

Empirical Research Paper

A framework for leadership practices and communication in the context of the construction sector

Ashok Rehan^{a,*}, David Thorpe^b, Amirhossein Heravi^c^a School of Surveying and Built Environment, University of Southern Queensland, Queensland, Australia^b Engineering and Construction Management, School of Surveying and Built Environment, University of Southern Queensland, Queensland, Australia^c Construction Programs, School of Surveying and Built Environment, University of Southern Queensland, Queensland, Australia

ARTICLE INFO

Keywords:

Leadership practices
 Communication
 Relationship management
 Conflict management
 Project success
 Success factors

ABSTRACT

An ongoing debate in the leadership domain underscores the prevalence of project failures globally, prompting project managers to refine leadership strategies and create innovative practices to navigate project complexities, emerging technologies, artificial intelligence, evolving stakeholder expectations, shifting construction landscape, and brittle, anxious, nonlinear and incompressible environment challenges in the construction industry. This study aims to provide insights into the relationship mechanisms between leadership practices, communication, and project success, introducing a framework for behavioral practices to address challenges in the Australian construction industry, such as project complexities, inefficiencies, cash flow disruptions, supply chain issues, communication barriers, cultural diversity, digitalization, and regulatory protocols compliance. Exploratory factors/multivariate regression analysis on collected responses on 66 projects have identified four critical success factors: relationship management, communication effectiveness, leading by example, and self-management that impact and improve project success significantly using relationship and conflict management as mediators, help formulate creative practices using stakeholder analysis, conflict resolution strategies, and promoting collaboration enhancing the decision-making process to overcome challenges. Researchers validated and confirmed results through in-depth interviews with independent practitioners, encouraging project managers to modify behavioral practices using an explicit model for enhancing project success.

1. Introduction

Globalization has introduced complexity and challenges in managing construction projects across developed and developing economies (Ngowi et al., 2005; Ofori, 2000). Project management professionals encounter design complexity, evolving stakeholder expectations, multilateral complexities leading to delays and inefficiencies, supply chain management, communication barriers with a multicultural workforce, regulatory and safety protocols implementation, infrastructure demands, skills shortages, sustainability issues, and new technology adoption in the construction industry. Despite employing modern project management techniques, a majority of project-based organizations in the construction industry report cost overruns, schedule delays, quality concerns, and stakeholder dissatisfaction (Ullah et al., 2018; Muneeswaran et al., 2020; Hasib and Al-Kilidar, 2021), underlining the importance of leadership and communication practices, building relationships, trust development, collaboration, managing stakeholders

and relationships/conflict management (PMBOK - v7, 2021).

Project failures are prevalent globally and also observed in the Australian construction sector (Aziz, 2013; Anantmula, 2010). The construction industry faces distinct challenges: infrastructure demands, geographical and environmental factors, climate issues, material supply disruptions, regulatory compliance, skills shortages, sustainability concerns, cost pressures, and technological advancements (Infrastructure Australia, 2022). Continuous technological advancement, nascent construction processes, and a digitalized, volatile, and uncertain environment demand re-evaluating traditional management models. This highlights the importance of critical success factors and compelling project professionals to refine leadership practices and strategies to constantly bolster project success. The intangible elements such as leadership practices, project communication, interpersonal relationships, and relationship and conflict management have emerged as critical dimensions in the literature review to achieve project success. Leadership practices refer to the specific techniques and actions project

* Corresponding author.

E-mail addresses: ashokrehan@gmail.com (A. Rehan), David.Thorpe@usq.edu.au (D. Thorpe), Amirhossein.heravi@usq.edu.au (A. Heravi).

managers/leaders use to influence and lead their teams, requiring interpersonal skills, integrated leadership behaviors, technical competencies, and cognitive aptitude (Strang, 2007). These practices include setting a clear vision, inspiring, motivating, goal setting, communicating effectively, providing feedback, coaching, mentoring, recognition, and creating a positive work environment.

Leadership in project management research has become vital for successful construction projects. For instance, Sampaio et al. (2022) emphasized leadership as a core competency (attribute underpinning a behavior (Moore et al., 2002) for project managers). Gruden and Stare (2018) identified influential behavioral characteristics like leadership, results orientation, assertiveness, reliability, and efficiency as crucial for project delivery. Moradi et al. (2020) noted that leadership and communication significantly impact project success, while (Alvarenga et al., 2019) highlighted the importance of soft skills. Managing relationships is also confirmed as another critical factor for project success (Meng, 2012; Le-Hoai et al., 2010; Acharya et al., 2006). Although previous studies have underscored the importance of leadership and communication in project performance (Turner and Muller, 2005; Müller and Turner, 2010; Anantatmula, 2010; Tabassi et al. 2016; Maqbool et al., 2017; Montenegro et al., 2021), there is also a call for more comprehensive empirical research to better understand the leadership practices and communication relationship mechanisms with project success (Raziq et al., 2018; Stevenson and Starkweather, 2010; Gruden and Stare, 2018).

Leadership research is evolving, exploring new perspectives and approaches to elucidate the impact of leadership practices and communication on project success. The VUCA environment (Volatility, Uncertainty, Complexity, and Ambiguity), multiplicity, technological advancement, and digitalization in the construction industry necessitate adaptive leadership in unpredictable situations (Froese, 2010; Sepasgozar et al., 2016). Emerging technologies, artificial intelligence, and the BANI (Brittle, Anxious, Nonlinear, and Incomprehensible) environment introduce new challenges (Ray, 2023). Traditional management models struggle with these complexities, making effective leadership and communication practices, relationship building, clear objectives, stakeholder engagement, knowledge sharing, risk management, teamwork, collaboration, emotional intelligence, and adaptability crucial for project success (Sampaio et al., 2022; Sang et al., 2018; Moradi et al., 2020; Muller and Jugdev, 2012; Anantatmula, 2010). To achieve sustained success in this unstable environment, project organizations need a new leadership practices and communication dimensions framework that addresses these complexities and manages digital technologies. This research probes leadership practices and communication's impact on project success, prompting project managers to showcase innovative instincts in devising creative strategies to navigate the emerging technologies and changing organization culture in the Australian construction industry while providing insights into the evolving construction landscape (Wang, 2014; cited in Xiao et al., 2019). The study also delves into the mediating role of relationship and conflict management in project success, aiming to deepen comprehension of underlying mechanisms, principles, and leadership theories.

To address existing gaps, the researchers conducted a factor analysis on randomly collected data from a broad spectrum of project managers to identify critical success factors and associated behavioral practices, guiding project professionals in developing success strategies. The study has three primary objectives: (1) explore and test the relationships between leadership practices, communication, relationship, and conflict management with project success (2) examine the mediating role of relationship management and conflict management within these relationships; and finally, (3) develop a framework for effective leadership practices and communication, ultimately improving project success in the construction sector.

The literature review is presented in the second section, and the results are discussed in the subsequent paragraphs, followed by concluding remarks.

2. Literature review

Leadership is viewed as influencing a group of followers to achieve predetermined goals and objectives using effective communication (Men, 2014, cited in Famakin and Abisuga, 2016). Project management literature has documented leadership as a vital skill of influential project leaders since the beginning of the 21st century (Odusami et al., 2003). However, globalization, changing demographics, digitalization, and technological advancements in the construction industry prompt project managers to adopt new innovative approaches and strategies for project success (Toor and Ofori, 2008).

Leadership is essential in construction, where success relies on meeting time, budget, and quality standards, satisfying stakeholders and end users, and benefiting organizations (Ika, 2015; Liphadzi et al., 2015). Project managers play a pivotal role in overseeing projects and managing teams and stakeholders, contending with a demanding external environment marked by stringent government regulations and intense competition among subcontractors and suppliers (Ofori and Toor, 2021) in influencing project success. Effective leaders inspire, create positive environments, guide teams through challenges, and steer toward objectives; organizations need them to achieve goals. The literature emphasizes leadership behaviors like inspiration, motivation, vision, emotional intelligence, collaboration, communication, trust, team empowerment, and conflict resolution as essential behaviors for project managers to attain construction project objectives (Emeré et al., 2018; Liphadzi et al., 2015; Price, 2009; Ogunlana, 2008; Toor and Ofori, 2008).

2.1. Leadership practices, communication, relationship, and conflict management linkages with project success

Leadership enhances project performance by emphasizing processes, clear communication, role definition, trust-building, and expectation-setting (Anantatmula, 2010). Project leadership refers to the ability of a project manager/leader to effectively lead in setting a clear direction, building trust, motivating and empowering team members, and creating an environment that prioritizes vision, creativity, enthusiasm, encouragement, and empathy to achieve pre-determined project objectives/goals (PMBOK - v7, 2021). It involves the knowledge, skills, and behaviors needed to guide, motivate, and direct a project team to achieve its objectives (PMBOK-v6, 2017). Studies have consistently shown a strong relationship between leadership and project success (Turner and Muller, 2005; Geoghegan and Dulewicz, 2008; Müller and Turner, 2010; Tabassi et al. 2016; Kissi et al., 2013; Liridon et al., 2017). Effective leadership practices, encompassing relationship management, stakeholder management, and conflict resolution, positively impact project success, particularly in the construction sector (Agyekum et al., 2022; Montenegro et al., 2021; Maqbool et al., 2017).

Leadership and communication are pivotal for overcoming project challenges and complexities (Muller and Jugdev, 2012). Alvarenga et al. (2019) found that leadership, communication, and commitment positively correlate with project success, recognizing leadership competencies such as communication skills, empowering, achieving, managing resources, strategic perspectives, self-awareness, results orientation, assertiveness, reliability, and efficiency (Sampaio et al., 2022; Ahmed et al., 2020; Moradi et al., 2020; Gruden and Stare, 2018). However, no ultimate leadership practices exist to achieve project success with many existing variables, a diverse workforce, and emerging technologies in a complex project environment (Tabassi et al., 2016).

Communication is another critical element in construction project management, enhancing collaboration, stakeholder engagement, and cost reduction (Zhang et al., 2022; Chowdhury et al., 2019). Project managers utilize communication competencies for effective communication in various contexts: team management, negotiation, developing stakeholders' relationships, and conflict management, ultimately impacting project success. Effective communication, the common thread

for any leadership model, can motivate, reduce non-productive efforts, avoid mistakes, manage uncertainties, encourage teamwork, and build confidence (Clarke, 1999). Clear and open communication fosters trust and understanding and is vital for leadership success. Nyandongo and Davids (2017) affirmed that communication effectiveness increases the project's success rate and overall performance.

In contemporary project management, as emphasized by (PMBOK - v7, 2021), interpersonal relationships are paramount (Meng and Boyd, 2017)—effective communication fosters relationship development, aiding project managers in achieving objectives. Building and maintaining relationships within project teams and stakeholders are crucial for performance (Bourne and Walker, 2008). Relationship management significantly impacts construction project performance (Meng, 2012), as emphasized by Davis and Walker (2004) and supported by (Ahadzie et al., 2009; Cheng and Li, 2004).

Conflict is pervasive in construction projects, leading to cost overruns, delays, disputes, and reduced productivity (Alazemi and Mohiuddin, 2019). Project managers spend 18%–26% of their time dealing with conflicts (Thomas, 2006). Effective conflict management is vital, as unresolved conflicts hinder project progress and team performance (Chen et al., 2014). Conflicts can impact an organization's business positively or negatively (Chandolia and Anastasiou, 2020), underscoring the need to investigate predictors affecting project success in today's complex environment.

2.2. Project success

The Project Management Institute has recently described project success as "based on adapting the unique project context, its objectives, stakeholders, governance, and the environment using the most appropriate processes to achieve the desired outcomes while maximizing value" (PMBOK - v7, 2021, p 44). The term 'success' is a highly complex measure and is interpreted differently by different individuals and organizations (Samset and Volden, 2012 cited in Williams and Samset, 2012) and measured depending on the type of projects and short-term benefits to the organizations. Pinto et al. (2022) recently described success in terms of benefits realization, stakeholder perceptions, timing, context, resource efficiency, and sustainability. Zwikael and Meredith (2021) focused on stakeholders' perspectives, including funding, delivering organizations, and project manager performance evaluation separately from project success.

Project success is a multifaceted concept intricately measured and interpreted differently by various individuals and organizations, focusing on satisfying project stakeholders, including end users. Jugdev and Müller (2005) highlighted its multidimensional nature, encompassing short-term project management success and long-term desired results. Ika (2015) emphasized determinants such as key stakeholders, team satisfaction, meeting organizational objectives, benefits, and commercialization opportunities. Ika and Pinto (2022) explore success through benefits realization, stakeholder perceptions, timing, and sustainability. Defining project success has been challenging due to differing viewpoints among stakeholders, as demonstrated by research. Thus, based on the above discussion, project success can be comprehensively defined as completing the project within specified time, cost, quality, and scope parameters, achieving organizational goals and objectives, generating benefits, and ensuring satisfaction, safety, and sustainability requirements.

2.3. Critical success factors

Project success analysis, based on critical success factors, Rockart (1982), enhances quality, efficiency, and effectiveness by pinpointing essential areas for project managers to focus on. Various studies have explored factors influencing project success, including technical aspects (Chan et al., 2004; Jha and Iyer, 2006; Leung et al., 2005) and project management techniques (Jha and Iyer, 2006; Munns and Bjeirmi, 1996).

Identifying critical success factors guides project managers in achieving predetermined goals, with industry-specific critical success factors widely applied in construction (Yong and Mustaffa, 2013), providing organizations with a competitive advantage in meeting stakeholders' expectations. Critical success factors serve as inputs to project management practices that directly or indirectly contribute to project success.

2.4. Leadership theories and frameworks

Various leadership theories and frameworks delineated in research literature facilitate project professionals in comprehending diverse styles and methodologies for attaining project success. These theories provide a foundation for exploring how leadership practices, communication, team dynamics, and project outcomes interact to achieve success and are widely adopted by project management practitioners (Raziq et al., 2018). Prominent theories such as Transformational (leaders inspire and motivate their followers to achieve exceptional performance and outcomes (Bass and Avolio, 2000), Transactional (focuses on the exchange between leaders and followers and encourage their followers through rewards and punishments based on performance as projects progress - (Burns, 1978), Servant (focuses on serving and supporting their followers, prioritizing their needs, and promoting their development and fostering a positive work environment (Greenleaf, 2007) and Situational (contingent upon the situation and the development of followers, and competence of their team members - (Hersey and Blanchard, 1982), provide a conceptual base for analyzing the relationship mechanisms between leadership practices, communication, team dynamics, and project success. These frameworks' common tenets encompass effective leadership, communication, vision, team cohesion, stakeholder management, and project performance. Drawing insights from these theories, project managers can devise innovative strategies to navigate the complexities and challenges of the construction industry (Van Marrewijk et al., 2023). This study explores project managers' perspectives on leadership and communication practices in construction, highlighting the positive impact of critical success factors on project outcomes and proposing a framework for leadership practices and communication dimensions conducive to project success.

2.5. Critical review of research studies

A critical review and synthesis of (35) research studies from an extensive literature review (Appendix A) have revealed the 30 most frequently occurring crucial leadership practice characteristics (essential attributes for effective leadership), used by project managers/leaders globally, namely, (1) Relationship, (2) Motivation, (3) Influence, (4) Vision, (5) Goal-Oriented, (6) Trust, (7) Encouragement, (8) Communication, (9) Inspire, (10) Task-Oriented, (11) Team Building, (12) Stakeholders, (13) Empowerment, (14) Commitment, (15) Emotional, (16) Effective Communication, (17) Conflict Management, (18) Flexibility, (19) Self-Management, (20) Coaching, (21) Goal Setting, (22) Share Information, (23) Self-Awareness, (24) Seeking Feedback, (25) Sensitivity, (26) Leading by Example, (27) Caring for Others, (28) Empathy, (29) Self-Development, and (30) Humility. These extracted behavioral practices from the literature review were utilized to create a survey questionnaire to collect data for further analysis to identify critical success factors and their associated leadership behavioral practices for project managers.

As discussed previously, project managers must comprehend and implement suitable leadership and communication practices consistently to achieve project objectives, particularly in the context of globalization, emerging technologies, evolving project complexities, the introduction of the digitalization of work culture, artificial intelligence, increased computing power, project impediments and continuously evolving organization culture in the construction industry. There is an imperative need for project professionals to examine leadership

practices and communication to enhance the understanding of the interrelationships among vital factors for devising creative strategies and leadership practices to counter the challenges arising from emerging innovative processes, artificial intelligence, and the BANI environment to achieve project success. This study seeks to fill the gaps identified in the literature review by investigating critical success factors and introducing a framework for addressing persistent issues and challenges in the Australian construction industry.

2.6. A conceptual model

The conceptual framework, comprising five constructs as depicted in (Fig. 1), is derived from a comprehensive review of the literature, leadership frameworks, and theories, supplemented by informal consultations with industry practitioners. It is designed to investigate the underlying relationship mechanisms between two independent variables, namely leadership practices and communication, and their impact on project success, the dependent variable. Moreover, the model delves deeper into these relationship mechanisms by employing relationship and conflict management as mediators. The interrelations among different variables will be analyzed utilizing Pearson’s correlation coefficient (r) analysis, and the relationship mechanisms will be explored using multivariate regression analysis to examine the influence of leadership practices and communication on project success—the relationships between various constructs are as follows.

- 1 Leadership Practices - > Project Success
- 2 Communication - > Project Success
- 3 Leadership Practices - > Relationships Management- > Project Success
- 4 Leadership Practices -> Conflict Management- > Project Success
- 5. Communication ->Relationship Management - > Project Success
- 6. Communication -> Conflict Management- > Project Success

Additionally, the role of mediators will be explored using the Hayes Process Macro-Model 4 Technique, as outlined in (item 5). The mediation effect of relationship and conflict management will be scrutinized by assessing the direct and indirect effects of leadership practices and communication through these mediators on project success.

Finally, the conceptual model will be empirically tested and validated through face-to-face, in-depth interviews with independent practitioners to elucidate the underlying relationship mechanisms between independent and dependent constructs.

3. Research methodology

3.1. Research design

This research adopts a positivist design philosophy, focusing on a quantitative approach for statistical analysis (O’Leary, 2004; Fernando, 2019). An explanatory sequential mixed design was used, where qualitative in-depth interviews followed quantitative data collection and analysis to elaborate on the initial findings (Creswell et al., 2003). Its advantages include straightforwardness and opportunities to explore the quantitative results in more detail (Ivankova et al., 2006). The adopted quantitative methodology is used for its objectivity, aiming to explore relationships between variables (Curtis et al., 2016). According to Kumar (2015), such designs are specific, well-structured, and tested for validity and reliability, facilitating reliable data collection and analysis, thereby enhancing the generalizability and reliability of the results.

This study employed a random sampling technique to ensure that each individual in the target population had an equal chance of selection (Martinez-Mesa et al., 2016; Kothari, 2004). The target population comprised project managers/leaders in Australian construction.

3.2. Data collection process

With a population of 42,100 project managers in Australia (ABS, 2023), initial sample sizes of 396 and 100 were calculated for ±5% and ±10% precision levels, respectively, using Yamane (1967) formula. The researchers used Platforms like LinkedIn, Project Management Institute chapters, and Engineers Australia (Queensland) to reach project managers from diverse construction backgrounds. A sample size of 200 (~50% of the required sample at ±5% precision) was selected due to slow responses despite multiple reminders over six-month period. Ultimately, 98 responses (49%) were received, with 66 (33%) providing comprehensive and completed survey questionnaires, yielding data for 66 projects (a project manager/project basis). Incomplete responses were excluded. This response rate aligns with findings by Yong and Mustafa (2013) on success factors attributing low response rates in questionnaire surveys to industry fatigue, and the achieved response rate of 33% compares favorably with the industry norm of 20–30% (Akintoye, 2000). Additionally, (Hair et al., 2018, cited in Memon et al., 2020) suggested a minimum sample size of 50–100 for factor and regression analysis, contingent on various factors. MacCallum et al. (1999), cited in Henson and Roberts (2006), showed that with high communalities (>0.60) and multiple items per factor, smaller sample

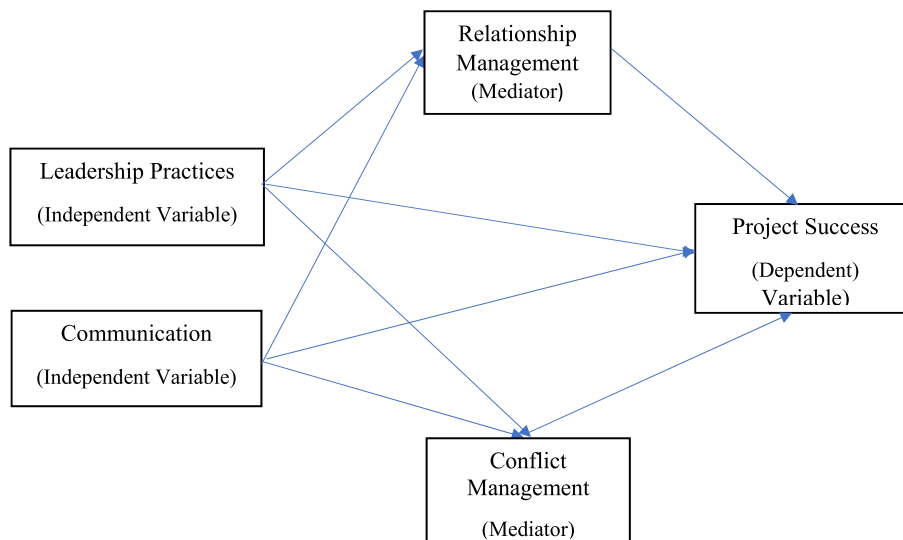


Fig. 1. Research conceptual model.

sizes can be sufficient.

3.3. Respondents demographics

Of the respondents (a mix of project managers/leaders from clients and main contractors from public and private sector project-based organizations), 50% fell into the 50+ age group and had a master's degree as their highest educational qualification. Furthermore, 31.8% of respondents had 20–30 years of professional experience in the construction industry. The respondents' demographic background is of mature professionals with high engineering degrees and 20–30 years of experience, which offered much credence to the collected data for this study. Respondent's demographics information is given (Appendix B - pie charts and tabular data)

3.4. Development of measuring questionnaire

Based on a literature review of global research studies, existing leadership frameworks and theories, and informal discussions with project professionals, the researchers used several leadership and communication attributes to develop a comprehensive 74-item survey questionnaire (Appendix C - survey questions) for a cross-sectional study. All items in the developed questionnaire were scored on a 5-point Likert scale (1–5) ranging from strongly disagree to strongly agree. Core variables were measured as follows: (1) Leadership Practices based on fourteen dimensions with a thirty-two-item scale; (2) Communication on four dimensions with sixteen items; (3) Relationship Management based on seven dimensions with a six-item scale; (4) Conflict Management seven with a nine-item scale; and (5) Project Success based on seven dimensions with eleven items. The questionnaire's content validity was evaluated by one PhD academic and four senior practitioners with master's degrees in engineering engaged in residential buildings, high-rise complexes, office and commercial complexes, tunnels, airports, and other construction projects. This led to refinements of four items to finalize the measuring instrument.

3.5. Data analysis process

Using Statistical Package for the Social Sciences (SPSS), data analysis involved exploratory factor analysis and multivariate/stepwise regression to identify latent factors/critical success factors and their associated leadership behavioral practices impacting project success. Data reliability, content, and construct validities were tested. Data processing steps included screening for missing values and outliers, normality checks (skewness and kurtosis), assessing data distribution (Appendix D - data distribution curves), multicollinearity, common method bias, and reliability and validity of questionnaire items and constructs followed by correlation and multivariate regression analyses. Normality checks for skewness and kurtosis fell within recommended ranges (+2 to -2) and (+3 to -3), respectively (George and Mallery, 2010). Next, the data were checked for missing values randomness (Tabachnick and Fidell, 2001). Missing values fell within the 0.4–10% range, so these were imputed using the Expectation maximization technique (Hair et al. 2010). Harman's single-factor analysis addressed potential common method bias, with variance in squared loadings at 33.18%, below the 50% threshold (Podsakoff et al., 2003). Internal consistency was assessed using Cronbach's alpha, and values above 0.7 were considered acceptable (Anderson and Gerbing, 1988). Cronbach's alpha values indicated adequate internal consistency for all constructs: leadership practices (0.936), communication (0.877), relationship management (0.758), conflict management (0.774), and project success (0.804) (Appendix E - a graphical representation). Principal components analysis was conducted to measure the construct validity. Before conducting factor analysis to extract latent factors, tests such as the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity are performed. The Kaiser-Meyer-Olkin test, relationship

strength correlation matrix (equal or >0.3), and Bartlett's tests of sphericity ($p < 0.05$) measures were performed to verify the suitability of sample data for factor analysis. Kaiser-Meyer-Olkin is particularly relevant when the cases-to-variables ratio is less than 1:5 (Williams et al., 2010). Optimal sample sizes for factor analysis vary, and Williams et al. (2010) cautioned against relying solely on rules of thumb due to the complexity of factor analysis dynamics (Fernando, 2019).

3.6. Face-to-face independent interviews with practitioners to validate the research results

Independent semi-structured interviews with five construction industry practitioners validated the research model and empirical results and gathered insights on leadership and communication practices for project success. Face-to-face in-depth interviews were chosen to ensure unbiased perspectives and minimize the influence of group dynamics. The sample size of five to twenty-five is consistent with established guidelines (Rudolph et al., 2015). The interviewees, with 30–40 years of experience and advanced engineering degrees, discussed leadership practices, success factors, and industry challenges. Lasting 45–60 min, the interviews used open-ended questions to explore perspectives on project success and critical factors. Data saturation was achieved after five interviews, ensuring diverse viewpoints were captured. Practitioners discussed leadership practices, project success, critical success factors, industry challenges, and adopting new technologies. Detailed findings are presented later in the article and in (Table 4).

4. Analysis and results

4.1. Exploratory factor analysis – Identifying underlying factors

Exploratory factor analysis revealed the underlying interrelationships among variables. Varimax rotation on the 74-item questionnaire, meeting all necessary conditions for convergence and discriminant validity and reliability testing, identified thirteen latent/underlying factors using principal components analysis (Appendix F). The Kaiser-Meyer-Olkin test values were 0.792 for (communication, relationship, and conflict management) and 0.750 for leadership practices, respectively, falling within the acceptable range (0.5–1.0) (Malhotra, 2008), indicating sampling adequacy. The relationship strength (>0.3) and Bartlett's sphericity test were also found significant, indicating the appropriateness of sample data for the factor analysis. Latent/underlying factors with loadings >0.5 (Hair et al., 1995) and eigenvalues >1.0 were retained, showing high internal consistency and acceptable convergent validity. For leadership practices, nine factors (LBSF1 to LBSF9) explained 72.36% of the variance, while four factors (CMSF1 to CMSF4) for communication, relationship, and conflict management explained 64.21% of the variance. Principal component analysis reduced the questionnaire from 74 to 42 items.

Discriminant validity was also tested for all extracted factors as per Fornell-Larcker's Conditions (1981); i.e., the square root of "Average Variance Extracted" should be > inter-constructs correlation values, satisfying this condition for all constructs except conflict management (Table 1). Convergent validity was tested by calculating composite reliability; composite reliability values for all the factors shown in BOLD were >0.60 (Table 1); hence, convergent and discriminant validity requirements were met. Descriptive statistics indicate minimal variation across constructs, with mean values ranging from 4.04 to 4.22 for this study.

4.2. Correlation

Five construct variables were tested for correlations using Pearson's (r) coefficient (Table 1). The analysis revealed statistically significant positive relationships between predictors (leadership practices, communication, relationship management, and conflict management)

Table 1
Pearson's Correlations Matrix (r-coefficient) and Descriptive Statistics for different Constructs N = 66.

Correlations						Descriptive Statistics		
Construct	Project Success	Leadership Practices	Communication	Relationship Management	Conflicts Management	N	Mean	SD
Project Success	(0.704)					66	4.09	0.397
Leadership Practices	0.576 ^a	(0.707)				66	4.22	0.406
Communication	0.638 ^a	0.569 ^a	(0.734)			66	4.16	0.411
Relationship Management	0.628 ^a	0.466 ^a	0.629 ^a	(0.748)		66	4.14	0.470
Conflicts Management	0.629 ^a	0.601 ^a	0.617 ^a	0.798 ^a	(0.739)	66	4.04	0.408
Construct	Cronbach's alpha	"Average Variance Extracted"	Composite Reliability	Square Root of "Average Variance Extracted"				
Leadership Practices	0.936	0.501	0.688	0.707				
Communication	0.877	0.539	0.793	0.734				
Relationship Management	0.758	0.560	0.792	0.748				
Conflict Management	0.774	0.547	0.782	0.739				
Project Success	0.804	0.496	0.803	0.704				

The square root of "Average Variance Extracted" values shown in BOLD > Inter-constructs correlation values in (Table -I), justifying discriminant validity except conflict management.

All Composite Reliability values lie between 0.688 and 0.803, satisfying the value requirement >0.6, justifying convergent validity.

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

and project success. (Table 1). These results align with (Geoghegan and Dulewicz, 2008) findings of a moderate relationship between leadership and communication practices. However, a strong correlation (r = 0.798) is observed between relationship management and conflict management, suspecting multicollinearity. Despite this, all four core variables have been retained to uphold data integrity with an explanation provided in item 6.

4.3. Critical success factors – multivariate/stepwise regression

Multivariate regression was used to understand relationships among variables in the dataset. Multiple stepwise regression explored the relative influence of factors extracted from factor analysis. A backward stepwise regression technique identified critical success factors, using latent factors as predictors and project success as the dependent variable. This method, similar to that used by Chan et al. (2004) for partnering construction projects in Hong Kong, offers simplicity and ease of implementation. The regression analysis identified four critical success factors in the fourth iteration: (1) Communication Effectiveness (CMSF1), (2) Relationship Management (CMSF2), (3) Leading by Example (LBSF2), and (4) Self-Management (LBSF7), explaining 60.20% of the total variance. Factors not meeting the entry/removal (Probability-of-F value-to-enter ≤ 0.050, Probability-of-F value-to-remove ≥ 0.10) criteria were excluded.

The multiple regression analysis showed an adjusted R-squared value of 0.531 and a significance value of <0.001, indicating the model's fitness and demonstrating a positive and statistically significant impact on project success. These four factors account for 53.1% of the variance in project success (Table 2).

Table 2
Critical success factors and their impact on project success.

Critical Success Factors	Standardized Coefficient (β)	R Square	Adjusted R Square	p-value
CMSF1– (Communication Effectiveness)	0.237	0.392	0.382	0.05
CMSF2 - (Relationship Management)	0.252	0.313	0.302	0.01
LBSF2 - (Leading by Example)	0.286	0.285	0.274	0.01
LBSF7 - (Self-Management)	0.246	0.227	0.215	0.01

p-value is <0.05.

Multiple Regression Analysis

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	0.748 ^a	0.560	0.531	0.27211		
ANOVA ^a		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.751	4	1.438	19.419	<0.001b
	Residual	4.517	61	0.074		
	Total	10.268	65			

a. Predictors: (Constant), Effective Communication, Relationship management, Leadership by Example, Self-Awareness.

a. Dependent Variable: Project Success.

b. Predictors: (Constant) Communication Effectiveness, Relationship Management, Leading by Example, Self-Management.

Coefficients.

Coefficients

Model		Unstandardized Coefficients	Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	
1	(Constant)	0.929	0.394		2.356 0.02
	Communication Effectiveness	0.189	0.095	0.237	1.983 0.05
	Relationship Management	0.178	0.067	0.286	2.638 0.01
	Leading by Example	0.240	0.092	0.252	2.608 0.01
	Self-Management	0.134	0.053	0.246	2.545 0.01

a. Dependent Variable: Project Success.

p-value is <0.05.

The identified four critical project success factors and their seventeen contributing leadership behavioral practices items (from a 74-item survey questionnaire) are explained below.

4.4. Critical success factors and their associated leadership behavioural practices

1. **Communication Effectiveness:** This factor includes eight items focusing on clear, purposeful, and appropriate communication with the project team and stakeholders. This is crucial for maintaining relationships and effectively addressing project management issues, disputes, and conflicts.

2. *Relationship Management*: This factor comprises three items emphasizing effective communication and collaborative teamwork to address project issues and conflicts utilizing effective communication and persuasion techniques to resolve disagreements.
3. *Self-Management*: This factor consists of two items: receiving feedback for self-improvement and managing emotions to enhance project outcomes through continuous self-improvement.
4. *Leading by example*: This success factor encompasses four items emphasizing exemplary behavior, effective communication, setting high standards, and honoring commitments to build trust within and outside the project team.

5. Mediation effects of relationship and conflict management on project success

The mediation roles of relationship and conflict management through leadership practices and communication relationships with project success were investigated using the process macro-model 4 technique. Preacher and Hayes (2008) criticized Baron and Kenny’s procedure for inaccurate p-value estimates in smaller samples, recommending the bootstrapping method instead. Bootstrapping is a nonparametric resampling procedure that tests mediation without assuming normality and is suitable for smaller samples (~100) (Preacher and Hayes, 2008; Pardo and Roman, 2013). This study used 5000 bootstrapped resamples with 95% confidence intervals to determine the significance of mediation relationships (Table 3). Indirect effects were considered significant if the confidence intervals did not include zero (Preacher and Hayes, 2008).

The analysis output for the relationships (Leadership Practices → Relationship and Conflict Management → Project Success) is summarized in (Table 3). Mediation analysis shows positive indirect effects, indicating that leadership practices and communication impact project success through these mediators. The total direct effect of mediation on leadership practices and communication is statistically significant (p = 0.000). However, zero within the 95% confidence interval range suggests some evidence of mediation effects, though the exact magnitude and direction are uncertain due to the small sample size responses. While a larger sample size is recommended for future investigations to obtain more accurate estimates of mediation effects, limitations related to time and resources are acknowledged in this study.

Table 3
Mediation role of relationship and conflict management on project success.

Total Effect (Leadership practices - > Project Success)	Direct Effect (Leadership practices - > Project Success)	Relationship	Indirect Effect	Confidence Interval		Significance (p)	Conclusion
				Lower Bound (LL95CI)	Upper Bound (UL95CI)		
0.562 (0.000)	0.309 (0.006)	(Leadership practices - > Relationships Management- > Project Success)	0.163	0.029	0.311	0.018	Partial Mediation
		(Leadership Practices → Conflict Management- > Project Success)	0.089	-0.118	0.287	0.360	Evidence of Partial Mediation
Total Effect (Communication - > Project Success)	Direct Effect (Communication - > Project Success)	Relationship	Indirect Effect	Confidence Interval		Significance (p)	Conclusion
0.616 (0.000)	0.344(0.003)	(Communication →Relationship Management - > Project Success)	0.129	Lower Bound (LL95CL)	Upper Bound (UL95CL)	0.170	Evidence of Partial Mediation
		(Communication →> Conflict Management- > Project Success)	0.142	-0.093	0.323	0.121	Evidence of Partial Mediation

The data analysis confirms that relationship management and conflict management mediate the relationship between leadership practices and communication with project success, both partially and complementarily, by significant direct effects and positive indirect effects, leading to improved project success.

6. Testing and validation of empirical results

The empirical results were tested and validated using an explanatory sequential mixed design approach by comparing insights from interviews with independent project practitioners. Discussions revealed convergence and divergence in perspectives on the study’s results (Appendix G). Broadly, critical success factors identified by practitioners closely align with empirical findings, ranked as follows: (1) leading by example, (2) inspiring motivation and vision, (3) relationship management, (4) communication effectiveness, (5) team encouragement and empowerment, (6) self-management, and (7) interpersonal sensitivity, all crucial for achieving project success (Table 4).

6.1. Divergent view

One interviewed project manager suggested separating the roles of project management and leadership to avoid clash of interest.

6.2. Challenges in the construction sector

Practitioners highlighted challenges like safety and regulatory compliance, skill shortages, high project costs, emerging technologies, digitalization, and navigating Australian rules and labor unions. These align with the study’s findings, underscoring the importance of critical success factors and affirming the significance of leadership and communication practices and the concluded framework in addressing industry issues.

The research data primarily relies on project managers’ self-assessments. Despite employing a robust methodology, potential over-estimation of the impact of leadership practices and communication on project success may exist. Future investigations should include other project professionals or external evaluators to offer critical assessment. External evaluators were not included in this study and are acknowledged as a limitation due to time and cost constraints, which prevented

Table 4
Identified Critical success factors from semi-structured interviews.

Success Factors	Project Manager (A)	Project Manager (B)	Project Manager (C)	Project Manager (D)	Project Manager (E)	Total
Team Encouragement and Empowerment	-	✓	✓	✓	✓	4
Leading By Example	✓	✓	✓	✓	✓	5
Interpersonal Sensitivity	-	✓	✓	-	✓	3
Relationship Management	✓	-	✓	✓	✓	4
Self-Management	✓	-	✓	✓	-	3
Mentoring Relationships and Empowerment	✓	-	-	-	-	1
Motivation-Visionary and Promote Relationships	✓	-	-	✓	-	1
Inspire Motivation and Visionary	✓	✓	✓	✓	✓	5
Coaching and Team Empowerment	-	-	-	-	✓	1
Promote Relationships	-	-	-	-	-	-
Communication Effectiveness	✓	-	✓	✓	✓	4
Mentoring Relationships and Empowerment	-	-	-	-	-	-
Conflict Management	-	-	✓	✓	✓	3
Communication Willingness	-	✓	✓	-	-	2

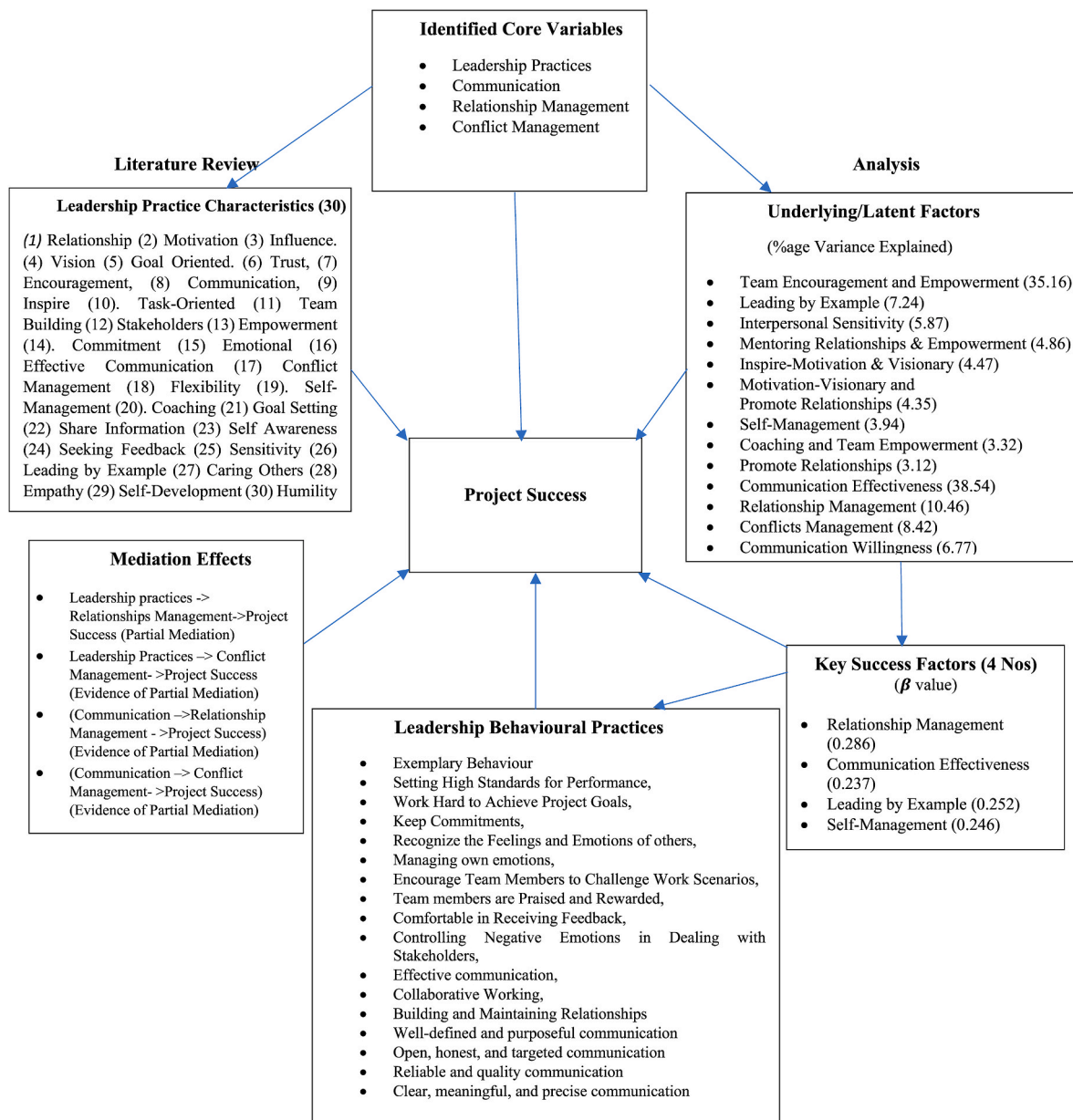


Fig. 2. Leadership practices and communication dimensions framework model.

further exploration.

Explicit Model for Project Professionals (framework explained)

The study and analysis work culminated in developing a framework model (Fig. 2). An explicit proposal for leadership practices and a communication model is suggested to enhance project success for construction professionals. Effective leadership, communication, and project management practices are critical for success. Identified leadership characteristics, behavioral clusters, critical success factors, and leadership behavioral practices can assist project managers in adopting the proposed explicit model for developing effective project management strategies. The following steps can be used to implement the proposed explicit model.

Identify Core Variables.

- Leadership Practices: Actions and strategies employed by project leaders to guide and motivate team members toward project goals.
- Communication: Exchange and sharing of information, ideas, and feedback among project stakeholders.
- Relationship Management: Building and nurturing positive relationships with stakeholders to foster trust and collaboration.
- Conflict Management: Identifying and resolving conflicts among project stakeholders to ensure project progress.

Leadership Practice Characteristics (Attributes). The leadership practice characteristics (attributes) identified in the presented framework can further be grouped into four clusters: (1) Interpersonal Practices Characteristics, (2) Emotional Practices Characteristics, (3) Tasks Oriented Practices Characteristics, and (4) Intellectual Practices Characteristics as described below. Project managers can leverage these clusters within their teams and engage stakeholders at various stages to achieve successful projects.

- 1 **Interpersonal Practices Characteristics:** (relationships, empowerment, conflict management, effective communication, stakeholders, team building, sharing information, seeking feedback, trust building, and coaching)
 - Cultivate a culture of trust, respect, and collaboration among team members.
 - Implementing conflict resolution mechanisms effectively.
- 2 **Emotional Practices Characteristics:** (motivation, inspiration, influence, emotions, sensitivity, encouragement, empathy, self-awareness, humility, caring for others)
 - Provide training to develop team members' emotional intelligence.
 - Encourage open dialogue and create a supportive and positive environment.
- 3 **Task-Oriented Practices Characteristics:** (goal setting, leading by example, commitment, flexibility, task, and goal-oriented)
 - Define clear project objectives and milestones.
 - Implement project management tools for effective control and monitoring.
- 4 **Intellectual Practice Characteristics:** (self-development, self-management, and vision)
 - Promote critical thinking and problem-solving skills.
 - Encourage innovation and creativity through recognition and rewards.

Furthermore, by incorporating the identified leadership behavioral practices into project management strategies, construction industry practitioners can enhance team performance and stakeholders'

satisfaction and ultimately achieve project success. The proposed explicit proposal and framework will assist project professionals in enhancing collaboration, communication, cohesive team building, trust building, creating a positive working environment, managing conflicts, tackling the industry's challenges, and improving project outcomes and success.

7. Discussion

The primary objective of this study was to investigate the project managers' insights, perspectives, and viewpoints on leadership practices and communication, focusing on their relationship with project success and addressing challenges within the Australian construction sector. It found a moderate correlation between these constructs, highlighting the mediating role of relationship and conflict management in enhancing project outcomes. Four critical success factors emerged: relationship management, leading by example, self-management, and communication effectiveness, rooted in leadership theories and principles.

(1) Relationship Management: Rooted in trust and rapport with project stakeholders, this factor echoes transformational and servant leadership theories, emphasizing open communication, active listening, and support for team members (Cheng and Li, 2004). Additionally, the importance of relationship management in project success, as demonstrated by earlier studies (Davis and Love, 2011; Meng, 2012), was reaffirmed. Similarly, sentiments echoed by the study's survey feedback indicating project managers' prioritization of relationship management in resolving project issues, which aligns with the unique relationship-focused culture in the Australian construction industry (Davis and Walker, 2004). (2) Leading by Example: This factor, aligns with behavioral and authentic leadership theories, involves leaders demonstrating consistent behaviors and setting expectations for others to follow. Leading by example means a leader's behaviors and commitment to work diligently (setting high standards) for themselves and motivate their team members to work harder to achieve project objectives. These findings are consistent with a study on empowered leadership (Arnold et al., 2000), where exemplary leadership behaviors (communication and listening skills) with the project team and internal and external stakeholders were confirmed to achieve project objectives. (3) Self-Management: Involving emotional regulation and effective responses to situations, this aligns with situational theory, emphasizing self-reflection, mindfulness, and emotional intelligence. The study aligns with Argyris's (1999) focus on self-improvement and learning from past failures rather than defensively reacting to feelings of failure. (4) Communication Effectiveness: Aligns with studies advocating effective communication, this factor supports decision-making, relationship-building, and conflict resolution (Adeleke et al., 2017; Davis and Walker, 2004). Highly skilled and effective communicators can manage stakeholder expectations and create positive organizational culture change (Weaver, 2007).

The research emphasizes a preference for people-oriented and relationship-driven leadership practices over task-oriented approaches, highlighting the significance of interpersonal sensitivity and self-management in managing emotions and improving outcomes. These findings resonate with Goleman's (2003) emotional intelligence framework and corroborate relationship management's impact on project performance in the Australian context.

The findings present a few divergences from the existing research: (1) The study differs from prior research by analyzing relationship and conflict management alongside leadership practices and communication. A high correlation coefficient ($r = 0.798$) between relationship and conflict management raises concerns about multicollinearity and potential skewing of the regression results. To address suspected multicollinearity, considered removing the conflict management variable and or inserting a single variable with an average of the two suspecting variables (relationship and conflict management) in the model, resulting in moderate correlation coefficients ($r < 0.700$) among all variables.

Despite these adjustments, regression analysis showed no significant variation in the original R-squared value, leading to the retention of all four core variables in data analysis to maintain data integrity. (2) the study's findings on conflict management contradict previous research studies; for example, (Maqbool et al., 2017) found a positive impact of effective leadership practices and conflict management on project success. (Chandolia and Anastasiou, 2020) suggest an association between leadership style and conflict management effectiveness. (3) Interviews with project managers revealed a divergence regarding a project manager's dual roles, suggesting a potential conflict of interest in performing leadership and project management roles together. This perspective contrasts with existing literature on this subject (Sampaio et al., 2022; Sang et al., 2018; Skulmoski and Hartman, 2010; Anantatmula, 2010).

Furthermore, the study performed within the Australian context contrasts its findings on success factors and leadership practices with research from other countries like Singapore, Denmark, Nigeria, and Malaysia (Ekung and Ujene, 2014; Lindhard and Larsen, 2016; Yong and Mustafa, 2013; Zhao et al., 2016), attributing differences to unique construction landscapes. For example, Singapore emphasizes directive and relationship-oriented leadership styles for green building projects (Zhao et al., 2016), while Denmark focuses on knowledge-sharing and communication (Lindhard and Larsen, 2016).

Another notable finding was the significance of 'leading by example.' This aspect highlights how a leader's commitment and exemplary behaviors inspire team members to excel; thirteen component factors with high mean scores ranging from 4.3 to 4.7 on the Likert scale (1–5) were extracted in exploratory factor analysis, showcasing Australian leaders' emphasis on team behaviors, empathy, self-improvement, and fostering better performance. These results align with Argyris's (1999) suggestion that managers embrace self-improvement rather than defending failures.

Survey feedback indicates that project professionals in the Australian construction industry exhibited practices indicative of authentic, transformational, and transactional leadership. These practices offered insights for navigating project complexities amidst evolving technology, infrastructure demands, supply chain disruptions, regulatory compliance, skill shortages, sustainability concerns, cost pressures, and technological advancements. Project managers exhibited strengths in self-awareness, emotional recognition, self-control, establishing trustful relationships, working towards shared goals, and fostering group synergy, emphasizing the importance of exemplary behaviors and self-feedback for continuous improvement and improved project outcomes.

8. Implications and limitations

8.1. Theoretical Implications

This study addresses the challenges of poor leadership practices, ineffective communication in relationships, and insufficient conflict management in project delivery, impacting dimensions such as time, cost, quality, and stakeholder expectations. The theoretical contribution lies in understanding relationship mechanisms, linkages, and principles/theories for leadership practices and communication for project professionals to achieve project success in the Australian construction sectors. The study affirms critical success factors' positive and significant impact on project success, including relationship and conflict management mediation effects. These findings are expected to encourage project managers/leaders to modify their behavioral practices, ultimately enhancing project outcomes.

This study stands out in the leadership domain as a unique investigation into leadership behavioral practices within the Australian construction sector. Its originality lies in introducing a comprehensive leadership practices and communication dimensions framework model based on the empirical research study. It illustrates underlying relationship interactions and mechanisms among various variables to achieve successful projects.

8.1.1. Innovative practices

The identified critical success factors can inspire the development of innovative practices to address specific challenges in the construction sector. These innovations include relationship management techniques such as stakeholder analysis, communication plans, conflict resolution strategies, and proactive relationship management. For example, "leading by example," innovative practices might involve integrating safety leadership into daily routines, safety inspections, feedback mechanisms, and recognition of safety behaviors. "Interpersonal sensitivity" could lead to cultural awareness training and coaching to bridge cultural gaps. "Self-management" practices might include mindfulness and resilience training for stress management, focus enhancement, and overall team well-being.

8.1.2. Positive mediation effects

The mediation analysis reveals positive and significant effects on leadership practices and communication relationships with project success using relationship management and conflict management as mediators, indicating improvement in project success.

8.2. Practical Implications

8.2.1. Training programs

Project-based organizations can arrange training programs and seminars to enhance their project management professionals' leadership practices and behavioral skills before project assignments. This study's approach and investigations of leadership practices and communication will add value to the existing body of knowledge in the leadership and project management domain, providing project professionals with an opportunity to enhance and upskill their ability to achieve success project in a challenging project environment.

9. Limitations and future directions

1. Based on a sample of 66 responses, the study's findings are indicative rather than conclusive. While focused on the Australian context, exploring its applicability internationally across construction sectors warrants consideration.
2. Future research could delve into relationship mechanisms involving various mediators, such as trust, teamwork, emotional intelligence, cultural diversity, and digital technology, in diverse construction contexts through longitudinal studies with larger sample sizes.
3. Future researchers can broaden the investigation beyond project managers to include professionals in engineering practice, quality assurance, safety, and followers (team members) for comprehensive insights. Qualitative analysis can delve into nuanced relationship mechanisms in leadership and communication behaviors.
4. Action Research methodology holds promise for investigating the impact of different leadership practices on project success. While beyond this paper's scope, such methods could substantially benefit businesses, project organizations, stakeholders, and society by enhancing project management efficiency and economy.
5. Future project leaders can investigate harnessing the study's findings on behavioral practices to enhance team competence in achieving project goals, drawing from emotional intelligence principles.

10. Conclusions

The study unveils and presents a Leadership Practices and Communication Dimensions framework, elucidating the intricate relationships, interactions, links, and underlying mechanisms among various constructs in the construction industry.

- This framework aligns project professionals with successful project management methodologies to address the complex challenges in the construction sector.

- Six significant groups emerged from the analysis, forming the basis for the framework, including core variables, leadership practice characteristics, critical success factors, mediators, and leadership behavior practices.
- Emphasis is placed on developing relationships and fostering group synergy for project success, with relationship and conflict management playing key roles.
- Analysis of project success responses reveals project managers' focus on key performance indicators in the Australian construction industry, including project purpose, safety protocols, quality standards, end-user satisfaction, and team satisfaction.
- A low sustainability score underscores the need for its awareness among project managers, suggesting training initiatives to address social, environmental, and economic concerns.
- Survey responses indicate a preference among project professionals for inspiring team members, exchanging information, setting high standards, working diligently, and acknowledging team contributions, reflecting a blend of authentic, behavioral, situational, and transformational leadership styles in the industry.

Enhanced leadership and communication practices are essential to realizing benefits in the construction sector amid evolving digital technologies, cultural diversity, virtual teams, and changing project complexities.

Disclosure statement

There is no potential conflict of interest.

CRedit authorship contribution statement

Ashok Rehan: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **David Thorpe:** Supervision. **Amirhossein Heravi:** Supervision.

Declaration of competing interest

The authors declare that they have no personal or financial interests that could have influence the research work in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.plas.2024.100142>.

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Dr. David Thorpe, Brief Biography – Presently engaged in teaching and researching at University of Southern Queensland, Australia

Dr. Amirhossein Heravi, Presently engaged in teaching and researching at University of Southern Queensland, Australia