

Research Paper

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Leadership practices and communication framework for project success – The construction sector

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Abstract: Globalisation has brought complexity to construction project management, with challenges like design complexity, evolving stakeholder expectations, and disruptions from the COVID-19 pandemic leading to uncertainties such as cash flow disruptions, schedule delays, and health-related issues. Despite modern management techniques, many project-based organisations face cost overruns, schedule delays, and client dissatisfaction. A literature review emphasises the importance of leadership and communication practices, trust development, collaboration, stakeholder management, and relationship and conflict management in addressing these challenges. This study aims to provide insights into the relationship mechanisms between leadership practices, communication, and project success, introducing a novel framework that encourages practitioners to adopt innovative behavioural practices, helping bridge the gap for empirical evidence-based studies. The methodology involves responses collected randomly from experienced project professionals, employing exploratory factors/multivariate regression to identify five key success factors: effective communication, relationship management, leading by example, self-management, and interpersonal sensitivity, along with 18 contributing behaviour practices that will help address challenges experienced in the Australian construction industry: delays and inefficiencies, supply chain

management, communication barriers with multicultural workforce and safety protocols implementation, regulatory and safety compliance, infrastructure demands, skills shortages, sustainability, and new technology adoption. The study identifies high-to-moderate levels of interpersonal and emotional behavioural practices, advocating for people-oriented and relationship-building practices to enhance project success, contributing to improved outcomes by adopting our developed framework. Two-fold implications include (1) categorising leadership dimensions into clusters, providing a practical tool for project managers and (2) the key success factors tailored to address sector-specific challenges, enhancing project outcomes.

Keywords: leadership practices, communication, relationship management, conflict management, project success

1 Introduction

Global growth contributes to not only expansion, including construction activities in developed economies, but has also led to complexity and challenges in managing projects in project-based organisations. In addition, despite using modern project management techniques and processes, a majority of project-based organisations reported cost overruns, schedule delays, quality concerns, and unsatisfied clients and stakeholders in the construction industry (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 (PMI 2021).

Continuous changes in technology and construction methods in the project environment have placed greater demands on traditional management models. In

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addition, the construction industry is fragmented, with multiple stakeholders and small businesses operating independently and generally resisting change (Froese 2010; Sepasgozar et al. 2016). The volatility, uncertainty, complexity and ambiguity (VUCA) environment, exacerbated by factors like COVID-19, has exposed the fragility of supply chains across the construction sector, emphasising the need for adaptive leadership in the face of unpredictability. Despite technological advancements enhancing project management, challenges arise from emerging technologies, artificial intelligence, and the brittle, anxious, non-linear, and incomprehensible (BANI) environment (Ray 2023). To achieve sustained success in this turbulent environment, construction organisations need new leadership practices and communication dimensions (LPCD) framework for project professionals that match the complexity and constant change and manage the application of digital technologies. Thus, project manager's effective leadership and communication practices, relationship building, clear objectives, stakeholder engagement, collaboration, and adaptability have become crucial to uplifting productivity in the construction sector.

An ongoing debate in the leadership domain underscores the prevalence of project failures globally (Anantatmula 2010; Aziz and Hafez 2013), prompting project managers to constantly refine leadership practices and strategies to bolster project success within the construction sector. Research in leadership continues to evolve, and new perspectives and approaches are being explored to elucidate leadership and communication behavioural practices in achieving project success. Emerging technologies in construction have heightened pressure on conventional managerial paradigms, necessitating an emphasis on key project success factors. Although nascent technological advancement strengthens and enhances project management, challenges arise from emerging innovative processes, artificial intelligence, and the BANI environment. Embracing agile and authentic leadership becomes crucial for construction leaders, fostering collaboration, creativity, adaptability, and resilience amid VUCA and BANI dynamics. Innovative project management practices are essential amid challenges like talent shortages, rising costs, disruptions, safety concerns, and technological advancements. Addressing these specific areas and gaps in the literature, this research probes leadership practices and communication's impact on project success, prompting project managers to devise creative strategies to navigate the evolving terrain of emerging technologies and equip practitioners with insights into the evolving construction landscape.

The success of projects has long been a topic of interest (Ika 2009; Pinto et al. 2021), and the focus has been on success criteria and success factors. Most past research studies have discussed success factors in project management in general terms (Ofori 2003; Yang et al. 2012; Alias et al. 2014 cited in Belassi and Tukel 1996; Butković 2021). A few researchers have focused their interest on project success/failures and success criteria and have suggested frameworks to deal with the success and failure of projects. For example, Belassi and Tukel (1996) grouped the success factors into four categories, which included (1) project-related factors, (2) project management factors, (3) human-related factors, and (4) external factors for determining the framework. Pinto and Slevin (1988) built their framework based on 10 factors: project mission, top management support, project schedule/plan, client consultation, personnel technical tasks, communication to recruitment/selection and training. Several studies have examined the multidimensional factors influencing project success and explored key factors considered critical for developing new frameworks for project success (Cooke-Davies 2002; Chan et al. 2004; Toor and Ogunlana 2009; Meng 2012; Dixit 2020).

The literature review underscores the lack of empirical evidence supporting studies on the impact of leadership behaviour practices and communication on project success. The industry's unique challenges necessitate innovative project management practices, especially amid continuously changing project environment. The literature gap prompts an investigation into leadership behaviours and communication on project success in addressing discussed challenges, emphasising the need for project managers to exhibit innovative instincts to formulate efficient project management practices in the evolving landscape of emerging technologies and multilateral complexities (Wang 2014, cited in Xiao et al. 2019). This study focuses on effective leadership practices and communication attributes and investigates to deepen understanding of the relationship mechanisms with project success and develop a framework for project professionals to meet the following objectives: (1) To identify key success factors for leadership practices and communication in the construction sector. (2) Examine the impact of project leadership practices and communication on project success. (3) Develop a framework for effective leadership practices and communication, ultimately improving project success in the construction sector.

Effective leadership practices and clear communication strategies are crucial for successful construction project management globally. The significance of

leadership and communication extends beyond the Australian construction industry, addressing challenges such as cultural diversity, complex supply chains, regulatory variations, sustainability considerations, technology adoption, and geopolitical factors. Leadership and communication effectiveness counters these challenges effectively by fostering inclusivity and collaboration among teams and stakeholders to overcome language and cultural barriers, managing complex supply chains and timely delivery of materials, minimising delays and disruptions spanning multiple regions, ensuring compliance of varying regulatory requirements across various regions, raising awareness of social, economic, and environmental factors to optimise resources utilisation, driving technology adoption and its smooth integration into workflows, fostering a culture of innovation and addressing the impact of geopolitical factors through risk assessment in construction projects.

Project management research has increasingly shifted its focus to leadership behaviours, recognising their crucial impact on project performance. Leadership, communication, organisation, target management and emotional intelligence are essential skills (Sang et al. 2018; Alvarenga et al. 2019). Previous studies, including Sampaio et al. (2021) and Gruden and Stare (2018), emphasise leadership and communication as top competencies contributing to project success. Moradi et al. (2020) affirm that leadership and communication significantly predict a project manager's successful performance. To understand leadership behavioural practices, communication, relationship, and conflict management's relationship mechanisms with project success, the researchers conducted an extensive factor analysis on randomly collected data from diverse project managers in the Australian construction sector, identifying five key success factors and their associated behavioural attributes.

Additionally, the key success factors and their associated behavioural attributes, identified through responses from project managers, were validated using 43 followers' (project engineers, supervisors, team members, and senior managers) feedback responses (dataset -2), employing relative index analysis. These key success factors and their contributing behavioural attributes are incorporated into our developed LPCD framework, serving as a valuable roadmap for project managers seeking strategies to achieve project success. The results are discussed in the subsequent sections, followed by concluding remarks.

The above discussion leads us to the central research question described below:

How can leadership practices, communication, relationship management and conflict management

interactions with project success contribute to improving success in the construction sector?

2 Literature review

2.1 Leadership theories and frameworks

Various leadership theories and frameworks in the literature assist project professionals in understanding diverse styles and practices for achieving project success. These theories and frameworks provide a foundation for exploring how leadership practices, communication, team dynamics and project outcomes interact to achieve success. These are valuable tools for evaluating leadership effectiveness and are widely adopted by project management practitioners (Raziq et al. 2018). These frameworks highlight the importance of effective leadership, communication, vision, collaboration, stakeholder management, and project performance. 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 motivate their followers through rewards and punishments based on performance as projects progress), Servant (focuses on serving and supporting their followers, prioritising their needs, and promoting their development and fostering a positive work environment) and Situational (contingent upon the situation and the development of followers, and competence of their team members) provide a conceptual base for analysing the relationship mechanisms between leadership practices, communication, team dynamics, and project success. Common themes across these frameworks include effective leadership, communication, vision, team cohesion, stakeholder management and project performance. Equipped with insights from these theories, project managers can develop innovative strategies to address challenges in the construction industry. This study delves into project managers' perspectives on leadership and communication practices within the construction sector, establishing the positive impact of key success factors on project outcomes. It creates the positive impact of key project success factors on project outcomes and introduces a nuanced LPCD framework. Additionally, the study's bivariate correlations analysis demonstrates significant positive relationships between predictors and project success, encouraging project managers to adopt identified leadership behaviours for improved outcomes.

The project manager is pivotal and responsible for driving the project forward to achieve success. The project manager's competencies and behavioural practices play a central role in overseeing the project and effectively managing the team and stakeholders in the context of influencing project success. Simultaneously, the project owner or sponsor is crucial in offering strategic guidance, decision-making authority, support and mutual understanding throughout the project. Muller and Jugdev (2012) identified leadership practices and communication as critical success factors (CSFs) motivating and inspiring team members toward achieving project success. Anantatmula (2010) emphasises project manager's leadership, role definition, people-related performance factors, clear communication, team building, and establishing trust as the key elements for improving performance. Studies consistently show a strong relationship between leadership characteristics and project success (Geoghegan and Dulewicz 2008; Müller and Turner 2010; Kissi et al. 2013; Tabassi et al. 2016).

2.2 Leadership

Leadership's increasing recognition in project management research underscores the significance of competencies such as leadership, results orientation, assertiveness, reliability, and efficiency, all linked to improved project delivery (Gruden and Stare 2018; Sampaio et al. 2021). Project managers' leadership and communication skills significantly influence project performance (Moradi et al. 2020), with behavioural practices like leadership, organisation, target management, and emotional intelligence identified as key factors (Sang et al. 2018). Soft skills like leadership and communication are essential for effective project management (Alvarenga et al. 2019). As discussed previously, various leadership theories and frameworks, e.g. transformational, transactional, servant, situational and strategic, exist in the literature, which empowers project managers with an understanding of various leadership styles and practices, enabling them to devise innovative strategies to address the challenges in the construction industry.

2.3 Communication

Effective communication is another vital factor in successful project management within the construction sector, enhancing collaboration and stakeholder engagement and reducing errors, rework and costs (Chowdhury et al. 2019; Zhang et al. 2022). Project managers utilise

communication competencies to communicate effectively in different contexts: team management, negotiation, developing stakeholders' relationships and conflict management, ultimately impacting project success (Ziek and Anderson 2015, pp. 788–803). Clarke (1999) stated that 'effective communication can motivate, reduce non-productive efforts, avoid mistakes, manage uncertainties, encourage teamwork, and build confidence'. Communication is a significant element in a project manager's behaviour, primarily when referring to the involvement of clients, customers or users (Munns and Bjeirmi 1996; Tukul and Rom 2001).

2.4 Relationship management

Project management institute PMI (2021) highlights the centrality of relationships built through effective communication for successful project objectives (Meng and Boyd 2017). Effective communication is fundamental to relationship development, aiding project managers in achieving project objectives. Project leaders need to develop and maintain inter-relationships within project network teams and external stakeholders/suppliers to achieve project performance. Meng (2012) demonstrated relationship management's significant effect on construction project performance.

2.5 Conflict management

Conflict, a common challenge in construction projects, can lead to increased costs, delays, reduced productivity and damage to relationships, ultimately impacting project success (Alazemi and Mohiuddin 2019). Conflict is inevitable in the presence of different parties and multidisciplinary teams working together with varying priorities in construction projects' unique and complex nature. Effective conflict management is essential, as unresolved conflicts can hinder project progress and negatively impact team performance (Chen et al. 2014). High levels of conflict reduce team performance in terms of schedules, costs, quality, specification and process satisfaction (Barki and Hartwick 2001; Leung et al. 2005), necessitating effective conflict management to control and reduce adverse impacts and enhance positive outcomes (Rahim 2002). Conflicts can positively or negatively impact an organisation's business (Chandolia and Anastasiou 2020), affecting project success.

Amid the complex construction environment, project professionals strive to mitigate project failures by adopting innovative leadership practices and strategies for

industry success. A critical review of significant empirical studies identifies varying leadership practices/behaviours employed by the practitioners to achieve success. These studies were carried out in specific contexts, indicating patterns and research landscape in the literature. For example, strategic leadership was identified as the most common and dominating style in promoting sustainability practices for inter-organisational leaders in the United Kingdom (Opoku et al. 2015). Higher transformational leadership behaviour was found to be a central aspect of safety-promoting leadership style at the construction sites in Sweden than in Denmark indicating national cultural context (Grill et al. 2019). Project managers' strong focus on monitoring and control, adequacy of planning and time management in a Chinese study was based on performance and maintenance (P-M) leadership theory. Less experienced managers were identified to be more task-oriented than more experienced managers who preferred relationship-oriented behaviour to achieve project objectives found in a study performed in South Florida, USA (Panthi et al. 2009). Democratic, transformational and transactional are the leading leadership styles in the South African construction industry found in an investigative study conducted on construction professionals (Emere et al. 2018). Behavioural characteristics/traits were identified based on investigating the project manager's behavioural competencies, e.g. trustworthiness, leadership, communication, emotional awareness, leveraging diversity, relationship building, assertiveness, reliability, ethics, creativity, team spirit, strong commitment, monitoring and control, conflict resolving ability, honestly, hard work and respect team members and other viewpoints (Yong and Mustaffa 2013; Liu and Fang 2014; Gruden and Stare et al. 2018; Sang et al. 2018; Moradi et al. 2020; Van Marrewijk et al. 2023).

Additionally, the review and synthesis of research studies from various countries/cultures found that the construction industry in most Western countries adopted transformational/transactional leadership practices focusing on relationships, team building, risk-taking and entrepreneurial behaviours (Opoku et al. 2015; Grill et al. 2019; Parson 2020) compared to task-oriented, autocratic, paternalistic and authoritative behaviours in countries such as Indonesia, Nigeria and some parts of China (Oke 2010; Liu and Fang 2014). A culture of acceptance, compassion and tolerance is prevalent in the South African construction industry, attributed to cultural influence (Emere et al. 2018). A specific country's socio-cultural and psychological mechanisms and environment often influence leadership behaviours, ultimately impacting project success dimensions.

2.6 Project success

Recently, the project management institute (PMI) has described project success as 'based on adapting to the unique context of the project, its objectives, stakeholders, governance, and the environment using the most appropriate processes to achieve the desired outcomes while maximising value, managing cost, and enhancing speed' (PMI 2021, p. 44). The term 'success' is a highly complex measure used as an indicator and is interpreted differently by different individuals and organisations (Samset and Volden 2012 cited in William and Samset 2012), and measured differently depending on the type of projects and targeting benefits (short or long terms). Project success is a complex, multidimensional construct that has evolved. Definitions vary across stakeholders and projects. Recently, Pinto et al. (2022) described 'success to capture a variety of perspectives considering factors like benefits realisation, stakeholder perceptions, timing, context, efficient use of resources and sustainability'. Zwikael and Meredith (2021) discussed stakeholders' contingent perspectives of success (e.g. in terms of the funding and the delivering organisations, evaluating the project manager's performance and project success separately). Jugdev and Müller (2005) concluded that project success is a multidimensional construct that includes short-term project management success (efficiency) and the longer-term achievement of desired results from the project (effectiveness and impact). PMI (2013) emphasises two aspects relevant to the project's success: completing the project within time, cost, quality and scope, and stakeholders' satisfaction. Ika (2015) advocated the success determinants to be the key stakeholders, the project team, customer satisfaction, meeting project organisation objectives, benefits to the project organisation and opportunities for commercialisation. Research on project success has demonstrated that defining it has been challenging for practitioners and scholars because stakeholders (internal and external) rarely agree on their viewpoints on its definition and on judging the project success criteria. For instance, meeting business expectations may have unintended consequences on society, highlighting the importance of sustainability (Ika and Pinto 2022). In addition, project ambiguity arising from internal and external stakeholders' changing demands, market turbulence and environmental instability makes defining and judging project success even more complicated (Wiewiora and O'Connor 2022).

Project success analysis is widely used to identify success factors and enhance project quality, efficiency and effectiveness. According to Rockart (1982), CSFs are

those few areas of activity in which the desired results are essential for a project manager to achieve their objectives. Therefore, determining success areas/factors will lead project managers to concentrate on achieving pre-determined goals. Determining the CSFs will give project organisations a competitive edge in fulfilling all stakeholders' aspirations. Our study has investigated and explored the importance of key success factors based on the following measurement dimensions: time, cost, quality, and scope, end users' satisfaction, team satisfaction, meeting organisation goals and objectives and customer and project stakeholders' satisfaction in this study.

While leadership traits and motivational factors for project success have been extensively studied, there needs to be more empirical evidence supporting studies investigating the impact of leadership behavioural practices and communication on project success in the Australian construction sector. Our study aims to bridge the knowledge gap found in the literature review by investigating the leadership practice behaviours and communication underlying relationship mechanisms with project success to address the ongoing issues and challenges with the introduction of the digital revolution, emergence of new technologies, artificial intelligence, increase in computing power and continuously changing organisation culture in the Australian construction industry.

3 Research methodology

Based on a comprehensive review of research studies, this study underscores the critical role of a project manager's leadership practices, communication, relationship management and conflict resolution as pivotal predictors of project performance in successful project management. The study employed a quantitative methodology with objectivity to explore the relationships between the variables (Curtis et al. 2016). A random sampling technique was selected for this study as it gives each individual in the target population an equal probability of being selected for the survey. A simple random sampling technique selected a subset of 200 participants from the population. The target population primarily was project managers/leaders from the Australian construction sector. The study questionnaire was distributed randomly using online business-oriented networking LinkedIn sites, the PMI chapters of New South Wales/Queensland/Victoria and the Engineers Australia, Queensland Division. Of 200 online questionnaires distributed, 98 (49%) responses were received within 6 months, of which 66 (33%) were sound and completed responses for 66 projects. Despite

the challenges associated with questionnaire surveys in the construction industry, the achieved% response rate of 33% compares favourably with the 20%–30% norm (Akintoye 2000). Dulaimi et al. (2003) reported a mere 5.91% response rate for their research survey due to the lack of participation from the construction industry. The reasons cited for this include work commitments and lethargy towards research (Dulaimi et al. 2003 Abdul-Aziz et al. 2012 cited in Kumar et al. 2023). The minimum sample size for factor analysis and regression analysis is 50–100, according to Hair et al. (2018; cited in Memon 2020) and is subject to some other factors. A few other tests are also considered before performing factor analysis to extract latent/underlying factors. These tests include Kaiser–Meyer–Olkin (KMO) – a measure of sampling adequacy, and Bartlett's test of sphericity. KMO is recommended, especially when the cases to variables are <1:5 (Williams et al. 2010). Based on the above discussion, 66 responses for this research were deemed adequate for our study's data analysis.

The researchers critically reviewed 35 global research studies, revealing (30) the most crucial leadership behaviour characteristic attributes (Table 1). The behaviour practice characteristics of leadership practices were grouped into four main clusters and categorised into high, moderate and low practising behaviours from our analysis. This study utilised a five-point Likert scale survey questionnaire to gather responses from a diverse group of professionals in the construction sector, capturing opinions from strongly disagree to strongly agree. The research focused on five constructs, encompassing a dependent variable (project success) and four independent variables measuring project success. These constructs formed the basis of a comprehensive survey questionnaire for data collection. Subsequently, data analysis was conducted using the statistical package for social sciences (SPSS), involving exploratory factor analysis (EFA) and multivariate/stepwise regression. This analytical approach aimed to identify key success factors, elucidate leadership behaviour practices and assess their impact on project success for construction projects.

3.1 Development of the measuring questionnaire

Based on our critical review of global research studies, existing leadership frameworks and theories and informal discussions with a number of project professionals, several attributes of leadership and communication practices (Table 1) were identified for our detailed analysis. These

Tab. 1: List of identified practice attributes for independent constructs from literature review.

1. Leadership practices	2. Communication	3. Relationship management	4. Conflict management
<ul style="list-style-type: none"> • Relationships • Motivation • Influence • Visionary • Goal oriented • Trust • Encouragement • Communication • Inspire • Task-oriented • Team building • Stakeholders • Empowerment • Commitment • Emotional • Effective communication • Conflict management • Flexibility • Self-management • Coaching • Goal setting • Share information • Self-awareness • Seeking feedback • Sensitivity • Leading by example • Caring others • Empathy • Self-development • Humility 	<ul style="list-style-type: none"> • Formal communication • Informal communication • Frequency of communication • Respect each other's viewpoints • Share events and changes willingly • Follow a trust communication mechanism • Defined communication purpose • Clear communication without any ambiguity • Understand communication with others • Knowledge of audience to communicate • Current & meaningful information • Proper methods/media/channels • Achieved the expected outcome • Open and honest communication • Tailor communication routines to the specific stakeholders • Communication barriers 	<ul style="list-style-type: none"> • Sense others' developmental needs • Inspire individuals and groups • Use effective communication/ tactics • Lead project network members • Manage change • Negotiate in resolving disagreements collaboratively • Work to build and maintain relationships with others 	<ul style="list-style-type: none"> • Respect others' perspectives • Recognise conflict in an early stage • Encourage all parties to communicate willingly • Resolve conflict amicably • Work effectively to resolve • Solve relationship issues • Build consensus • Manage ambiguous situations • Maintain self-control

attributes for constructs were used to create a comprehensive 74-item survey questionnaire for a cross-sectional study. Core variable measurements were operationalised through multiple dimensions: (1) leadership practices, assessed by a 32-item scale; (2) communication, measured through 16 items; (3) relationship management, assessed on a 6-item scale; (4) conflict management, measured using a 9-item scale; and (5) project success, comprising 11 items. The questionnaire underwent content validity evaluation by expert practitioners (one PhD academician and four experienced senior practitioners with master's degrees in engineering). This led to refinements on four items to finalise the measuring instrument. The data was tested for normality-skewness kurtosis indexes (George and Mallery 2010), parametric and non-parametric data distribution, randomness, multi-collinearity, common method bias, and reliability for internal consistency and found to fall within limits. Cronbach's alpha (α) was used to measure the different constructs' internal consistency (reliability). Cronbach's alpha (α) measured internal consistency. All constructs have Cronbach's alpha (α) value

>0.7, and the overall value is 0.926, indicating satisfactory internal consistency for the study (Anderson and Gerbing 1988; Hair et al. 2010). Principal components analysis was conducted to measure the construct validity. We used the KMO test, relationship strength correlation matrix (equal or >0.3) and Bartlett's tests of sphericity ($p < 0.05$) measures to verify the suitability of sample data for factor analysis. Latent factors were identified through factor analysis, with leadership practices, communication, relationship management and conflict management revealing 13 enabling success actors (Appendix 1). Multivariate regression analysis further examined these factors empirically to identify key success factors.

4 Results and discussion

4.1 Respondents' profiles

Of the (66) respondents (a mix of project managers/leaders from clients and main contractors from public and

private sectors project-based organisations) for this study, 50% were in the 50 + age group and had a master’s degree as their highest educational qualification, and 31.8% of the respondents had 20–30 years of professional experience in the construction industry. The respondents’ demographic background of mature professionals with high engineering degrees made them knowledgeable enough to answer questions posed in the questionnaire (Table 2).

4.2 Categorisation and gradings of leadership practice characteristics

A critical review of 35 research studies resulted in thirty (30) leadership practice characteristics (chronologically) used globally in achieving project success: (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 Others, (28) Empathy, (29) Self-Development, and(30) Humility (Table 1).

These behaviour practice characteristics identified above were grouped into four main clusters and categorised/graded based on our understanding and 35–40 years of practical experience in managing projects: (1) Interpersonal Practice Characteristics, (2) Emotional Practice Characteristics, (3) Tasks Oriented Practices Characteristics and (4) Intellectual Practices Characteristics (Table 3). The researchers collected frequency data for these (30) behavioural practice characteristics from each cited study and analysed them to grade these clusters. The clusters for a (set of characteristics) were graded based on (mean) average frequency occurrences in the cited studies: Interpersonal Practices characteristics (4.54), Emotional Leadership Practices characteristics (3.30), Intellectual Practices characteristics (2.71) and Tasks Oriented Practices characteristics (2.54), respectively (Table 3). The clusters on behaviour practices were examined, categorised, and graded from (high to low values) based on the following calculations (Rehan et al. 2024).

Tab. 2: Respondents (project managers) demographics respondent number = 66.

Characteristics	Category	Frequency	Percentage (%)
Age (years)	<30	Nil	Nil
	30–40	8	12.1
	40–50	25	37.9
	>50	33	50.0
Designation	Project manager	32	48.5
	Project leader	34	51.5
Education background	Diploma	1	1.5
	Bachelor’s degree	26	39.4
	Master’s degree	33	50.0
	PhD	3	4.5
	Job experience	5	4.5
Professional experience in construction industry (years)	10	7	10.6
	10–20	17	25.8
	20–30	21	31.8
	30–40	4	13.6
	>40	12	18.2
Professional experience as project manager/project leader (years)	10	18	27.3
	10–20	26	39.4
	20–30	14	21.2
	30–40	6	9.1
	>40	2	3
Project site location	Single site	21	31.8
	Multi-sites	45	45
Project complexity	Low	4	6.1
	Medium	31	47
	High	31	47

Average occurrence frequency (AOF) for a behaviour's characteristics = Total occurrences/cited journals

Mean (AOF) = Sum of (AOF) for a cluster/No. of behaviour characteristics in the cluster

1. Interpersonal Practices characteristics – High
2. Emotional Practices characteristics – Moderate
3. Task-Oriented Practices characteristics – Low
4. Intellectual Practices characteristics – Low

The analysis demonstrated high-to-moderate levels of managerial interpersonal and emotional behavioural practice characteristics to achieve project success compared to low levels of intellectual and task-oriented behavioural practices on construction projects. The analysis indicates the project manager's preferred choice of 'leadership practices' to achieve success in the construction industry.

The research emphasises 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.

4.3 EFA – identifying latent/underlying factors

Likert data underwent EFA to identify interrelationships among variables (Deng et al. 2014). Following Norusis (1993), the analysis utilised principal components factor analysis with varimax rotations on a 74-item questionnaire,

meeting all necessary conditions for convergence and discriminant validity and reliability testing. KMO tests yielded acceptable values (0.792 and 0.750) for communication, relationship conflict management, and leadership practices, respectively, falling within the acceptable range (0.5–1.0) (Malhotra 2008). The relationship strength (>0.3) and Bartlett's sphericity tests were significant, indicating the appropriateness of sample data for the factor analysis. The analysis retained factors with loadings >0.5 (Hair et al. 1995) and eigenvalues >1.0, and rotations were applied to eliminate cross-loadings. The leadership practices construct uncovered nine latent factors (LBSF1 to LBSF9) having a cumulative variance of 72.36%, while a group of (communication, relationship management and conflict management) construct produced four underlying factors (CMSF1 to CMSF4) with a cumulative variance of 64.21% (Rehan et al. 2024) (Appendix 1). Principal component extraction analysis reduced 74 items (original) to 42 items for success factors. All these extracted enabling success factors are important for project managers to concentrate on to achieve project success. All other extracted success factors were excluded during the iteration process because they failed to meet the system's entry/removal-level criteria (probability-of-F value-to-enter <= 0.050, probability-of-F value-to-remove >= 0.10).

4.4 Key success factors – stepwise regression

The latent factors identified in factor analysis were further examined empirically using multivariate regression analysis to identify the key success factors. A backward

Tab. 3: Categorisation and grading of leadership behaviour dimensions in the clusters.

Interpersonal Practice characteristics	Emotional Practice characteristics	Task-Oriented Practice characteristics	Intellectual Practice characteristics
(High)	(Moderate)	(Low)	(Low)
Relationship	Motivate/motivational	Team-building	Self-management
Empowerment	Influence	Goal-setting	Self-development
Conflict management	Inspire/inspirational	Goal-oriented	Vision
Stakeholders	Self-awareness	Leading by example	
Effective communication	Emotions/emotional	Flexibility	
Communication	Sensitivity	Commitment	
Share information	Empathy	Task-oriented	
Coaching	Humility		
Seeking feedback	Caring for others		
Trust building	Encouragement		

Tab. 4: Key success factors and their impact on project success.

Key success factors	Standardised coefficient (β)	R square	Adjusted R square	p-value
CMSF1 – (Effective Communication)	0.431	0.375	0.366	0.001
CMSF2 – (Relationship Management)	0.281	0.313	0.302	0.001
LBSF7 – (Self-Management)	0.300	0.227	0.215	0.000
LBSF2 – (Leading by Example)	0.366	0.285	0.274	0.000
LBSF3 – (Interpersonal Sensitivity and Encouragement)	0.242	0.188	0.175	0.000

Model summary				
Mode	R	R square	Adjusted R square	Standard error of the estimate
1	0.754 ^a	0.568	0.532	0.27179

ANOVA ^b						
		Sum of squares	Df	Mean square	F	Significance
1	Regression	5.781	4	1.445	19.648	<0.001 ^c
	Residual	4.487	61	0.074		
	Total	10.268	65			

^aPredictors: (Constant), Communication-Relationship Key Factors, Leadership Key Success Factors.

^bDependent Variable: Project Success.

^cPredictors: (Constant), Effective Communication, Leading by Example, Interpersonal Sensitivity, Self-Management, Relationship Management.

stepwise regression technique (Chan et al. 2004) between latent/underlying factors as predictors and project success as a dependent variable was used to identify key success factors (Table 4). The regression analysis resulted in five key success factors. The most dominating key factors identified are namely (1) CMSF1 (Effective Communication), (2) CMSF2 (Relationship Management), (3) LBSF2 (Leading by Example), (4) LBSF3 (Interpersonal sensitivity) and (5) LBSF7 (Self-Management). The variance explained by these five factors is 66.23% (Appendix 1).

A multiple regression was used to investigate the impact of these key success factors on project success (Table 4). The adjusted Pearson’s R-squared value of 0.532 and significance value of <0.001 show the fitness of the model, demonstrating a positive and statistically significant impact on project success and are consistent with the theoretical arguments. A variance of 53.2% for project success is explained and accounted for by these five key success factors (Table 4). The identified key success factors positively and statistically significantly impacted project success.

Further, Pearson’s correlation coefficient (*r*) for core variables revealed statistically significant and positive relationships between predictors and project success: leadership practices ($r = 0.576^{**}$, $p < 0.000$), communication ($r = 0.638^{**}$, $p < 0.000$), relationship management ($r = 0.628^{**}$, $p < 0.000$) and conflict management ($r = 0.629^{**}$, $p < 0.000$). The empirical findings support

positive relationships among leadership practices, communication, relationship and conflict management with project success, affirming the theoretical base. Such insights motivate project managers to modify their behaviours, fostering improved project results.

4.5 Key success factors and contributing behaviour practices

4.5.1 Relationship management

This factor consists of three items, primarily *effective communication, collaborative working and building and maintaining relationships*, focusing on relationship management. Australian project managers prioritised relationship management to resolve most issues in a complex project environment. This finding stems from Australian project leaders’ pragmatic approach to building and cultivating trustful relationships with all stakeholders, fostering collaboration, working towards shared goals, creating group synergy and resolving challenges through interpersonal connections with communities, indigenous groups, government bodies and environmental organisations. The outcome aligns with Davis and Walker’s (2004) illustrated view on how a construction project can be delivered by developing social relationships.

4.5.2 Effective communication

This factor consists of eight items: *open and honest communication, well-defined & purposeful, clear, meaningful, precise communication and targeted communication* appropriately to convey the message across the audience. Reliable, frequent and quality communication with the project team and all stakeholders is essential to a successful project. Effective and strong communication is vital in initiating, building and maintaining strong stakeholder relationships to address project issues/disputes/conflicts early on in the project management. This factor aligns with Adeleke et al. (2017) advocating communication effectiveness in improving decision-making and lessening conflicts.

4.5.3 Self-management

This factor comprises *self-feedback objectivity and controlling negative emotions*. These actions will encourage project managers to work on self-learning and improving their behaviours, ultimately contributing to better project

outcomes. The survey's results demonstrate project managers scoring high on self-awareness and the ability to recognise the emotions of others and control their own emotions, indicating influence and encouragement for team members to achieve project objectives. Self-feedback objectivity for behaviour improvement was another high marker in survey responses, thus encouraging the team to perform better. The study aligns with Argyris's (1991) recommendation that managers focus on self-improvement and learning from past failures rather than defending feelings of failure. Project professionals in the Australian building construction industry exhibited behaviour practices indicative of authentic, transformational and transactional leadership.

4.5.4 Leading by example

This factor encompasses four items concerning *exemplary leadership behaviour (communication and listening skills), setting high-performance standards, working hard to achieve the project objectives and keeping commitments and promises* to develop trust within and outside

Tab. 5: Identified leadership behavioural practices for project managers and followers

Leadership behavioural practices	Item	Mean	SD	Ranking
<i>Project managers – (self-perception)</i>				
Work hard to achieve Goals	LB14	4.71	0.46	1
Keep commitments & promises	LB16	4.53	0.53	2
Setting a high standard for performance	LB11	4.48	0.56	3
Set a good example of behaviours	LB8	4.32	0.59	4
Build and maintain relationships to work towards shared goals	RM6	4.48	0.53	5
Negotiate to resolve disagreements and create a collaborative environment	RM5	4.24	0.70	6
Comfortable to receive feedback	LB23	4.21	0.85	7
Recognise my feelings & emotions	LB25	4.17	0.67	8
Use effective communication for persuasion	RM3	4.12	0.85	9
Awareness to recognise the feelings of others	LB24	4.11	0.75	10
<i>Followers – (feedback assessment)</i>				
Work hard to achieve goals	LB14	4.47	0.70	1
Keep emotions and feelings in check	LB27	4.42	0.70	2
Setting a high standard for performance	LB11	4.33	0.93	3
Keep commitments & promises	LB16	4.28	0.72	4
Set a good example of behaviours	LB8	4.16	0.84	5
Build and maintain relationships to work towards shared goals	RM6	4.00	0.76	6
Negotiate to resolve disagreements and create a collaborative environment	RM5	4.00	0.72	7
Comfortable receiving feedback	LB23	3.98	0.99	8
Team members are rewarded for their creative work	LB31	3.98	1.08	9
Awareness to recognise the feelings of others	LB24	3.95	0.84	10

the project team network. The significance of ‘leading by example’ emerged, showcasing Australian leaders’ emphasis on team behaviour, empathy, self-improvement and performance enhancement.

4.5.5 Interpersonal sensitivity and encouragement

This factor comprises four items, primarily concerned with *recognising the feelings and emotions of others, managing one’s own emotions when dealing with stakeholders, encouraging team members to challenge work scenarios and praising and rewarding team members* for extraordinary performance.

Five crucial success factors derived from underlying principles, mechanisms and leadership theories and grounded in trust and open communication, exemplary leadership, and emotional intelligence, empowering project managers to navigate project complexity and technological advancements will help address challenges such as infrastructure demands, geographical and climatic factors, supply chain disruptions, regulatory compliance requirements, skills shortage, sustainability etc., faced by the Australian construction sector.

In addition, the study found distinctions between the top 10 contributing leadership behaviour practices for key success factors and those extracted leadership practice characteristics from 35 global research studies (Figure 1), suggesting future investigation.

4.6 Followers’ evaluation of project managers

The research data in this study primarily comes from project managers (self-assessment). To mitigate bias, questionnaire items were randomised, and Harman’s single one-factor analysis found a variance in squared loading of 33.18% against the threshold value of 50%, indicating no significant bias in the data. Additionally, the findings on key success factors and their practice attributes based on dataset-1 were subsequently validated by a second dataset-2 feedback response collected from 43 followers (project engineers, project supervisors, team members and senior managers who worked with project managers) using relative index analysis (mean and ranking) on evaluating their project managers leadership behavioural practices, revealing congruence in behavioural practices broadly (Table 5). The limited number of followers’ responses prevents broad generalisation and poses one of the limitations of our study. However, including a wide range of professionals in future research, such as those

in engineering practice, quality assurance, safety and external evaluators, would provide more comprehensive insights into leadership and communication behaviours. Due to time constraints, this aspect was not part of this study, which is acknowledged as a limitation.

Based on the preceding discussions, the researchers have developed a new LPCD framework (Figure 1). The framework is made up of four groups interrelated and linked to project success. The various interactive relationships with project success are represented more systematically (Figure 1), helping project leaders identify performance drivers to achieve success. An explicit model has been proposed for practitioners to manage projects to achieve success.

4.7 Explicit model for project professionals

The study suggests an explicit proposal for leadership practices and communication, based on the developed LPCD framework model, to enhance project success for construction professionals. Effective leadership, communication and project management practices are critical for project success. Identifying leadership characteristics, behavioural clusters, key project success factors and leadership behavioural practices can help project managers adopt our explicit model for developing effective project management strategies.

4.7.1 Identify core variables

- Leadership Practices: Actions and strategies employed by project leaders to guide and motivate team members towards 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.

4.7.2 Leadership behaviour clusters

- Interpersonal Practices Dimensions: Cultivate a culture of trust, respect and collaboration among team members. Implementing conflict-resolution mechanisms effectively.

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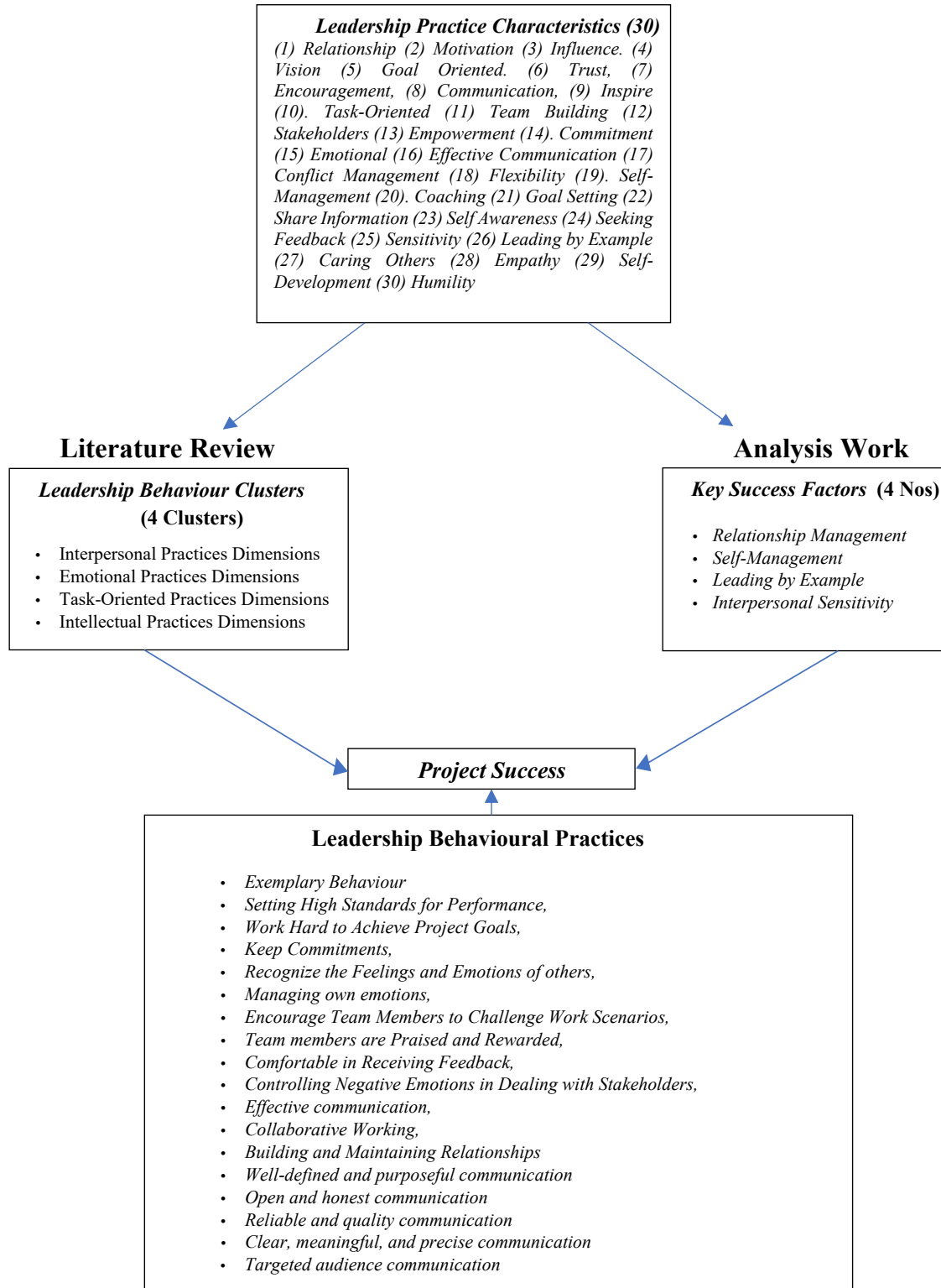


Fig. 1: LPCD framework. LPCD, leadership practices and communication dimensions.

- Emotional practices dimensions:
Provide training to develop team members on emotional intelligence.
Encourage open dialogue and create a supportive and positive environment.
- Task-Oriented Practices Dimensions:
Define clear project objectives and milestones.
Implement project management tools for effective control and monitoring.
- Intellectual Practice Dimensions:
Promote critical thinking and problem-solving skills.
Encourage innovation and creativity through recognition and rewards.

4.7.3 Leadership behavioural practices

These are specific techniques, actions or behaviours that project managers/leaders use to influence and lead their teams to achieve project objectives/goals. These practices help set clear visions, inspire, and motivate, provide effective communication, ensure objectivity in feedback and create a positive work environment to achieve project objectives.

By incorporating the identified leadership behavioural practices into project management strategies, construction industry practitioners can enhance team performance and stakeholders' satisfaction and ultimately achieve project success. Our proposed explicit proposal and framework will assist project professionals in enhancing collaboration, communication and conflict resolution, improving project outcomes and success.

The study focused on addressing gaps in comprehending the link between leadership behavioural practices and project outcomes to interject digital era challenges; the findings on human-related factors have the potential for supporting leadership behaviour practices in adopting technological advancements (building information model [BIM], frameworks, solutions, etc.) in the construction sector. Despite improving cost, quality and productivity through emerging digital technologies like BIM, global positioning systems (GPS), global information systems (GISs) and cloud computing, the study acknowledged various barriers, such as cultural, organisational, institutional, technological and financial factors, to their effective adoption (Ramilo and Embi 2014).

Digital technological advancements significantly influence leadership and communication practices in the construction industry. These advancements have revolutionised project planning, management and execution, leading to changes in leadership practices and

communication strategies. Emerging technologies, such as BIM, GPS and GIS, enhance and facilitate collaboration among project stakeholders and integration, monitoring, communication, coordination and safety practices in construction projects (Zhou et al. 2012; Zhang and Arditi 2013), enable real-time communication and teamwork, coordination irrespective of physical location and offer extensive project-related data, empowering leaders to make informed decisions, optimise resource allocation and mitigate risks. For instance, leaders use BIM for collaborative design reviews and feedback, improving planning and design quality while streamlining construction processes and minimising rework; GIS and GPS technologies enable accurate mapping and geospatial analysis, optimising site layout, logistics and resource management and overall efficiency and productivity. Digital technologies facilitate transparent communication and engagement with project stakeholders, encompassing clients, regulatory authorities and empowering field teams. Some of these innovations significantly impact project organisations in achieving productivity improvements up to 40% (Guo et al. 2017). By adopting digital technologies, leaders drive organisational success and continue to overcome the challenges of multilateral project complexity and diverse workforce, achieving superior project outcomes.

5 Implications and limitations

In the project management domain, ineffective leadership, communication, project complexity, digital environments, technological advancements and other challenges often hinder success across various dimensions such as time, cost, quality, stakeholder satisfaction and the realisation of benefits to the organisation. This study establishes key success factors' positive and significant impact on project success. The quantification of findings, employing an innovative approach, underscores the distinctive nature of this study with a novel framework of behavioural practices for the Australian construction sector. Two-fold implications include categorising leadership characteristic attributes into clusters, offering a practical tool for project managers that can be used at different stages in project management. Organisations can leverage these insights for targeted training programmes and recruitment criteria for project professionals. Secondly, the identified key success factors are tailored to address sector-specific challenges, contributing to improved project outcomes.

5.1 Limitations and future research

1. The findings are indicative rather than conclusive because only 66 completed responses were used for analysis purposes, confined to the Australian construction sector, suggesting extending research to the international setting for generalisation.
2. Future researchers can investigate relationship mechanisms to explore new perspectives and understand behaviour patterns, principles, and paradigms and approaches using sets of mediators (e.g. trust, teamwork, team building, virtual teams, emotional intelligence, digital technology, cultural diversity and others) on projects by conducting longitudinal studies.
3. This study has primarily investigated project managers' perceptions of leadership behaviour practices in the Australian construction sector; however, future research can involve a wider range of professionals beyond project managers, including engineering practice, quality assurance, safety and occupation, and followers (team members), for more comprehensive insights and delve into qualitative analysis.
4. Future project leaders can investigate harnessing our findings on behavioural practices to enhance team competence in achieving project goals.
5. 'Action Research' methodology on practitioners in a longitudinal study can be employed to investigate the impact of different leadership practices on project success. Action Research is a method used to study their practices in project management, reflect on them and make changes where required to produce the best results.

6 Conclusion

Successful project management usually involves a framework as a part of the methodology. The concept of key success factors has become popular with the project-oriented construction industry to address project complexity and other multilateral issues experienced by the industry's project leaders. The key success factors and their contributing leadership behavioural practices were identified using dataset-1 (project managers' responses) and validated by feedback data set-2 (followers), indicating similarities in behavioural practices in both cases (Table 4). Four significant groups of leadership practice characteristics, leadership behaviour clusters, key success factors and leadership behaviour practices have been used in

this study to develop novel LPCD framework. These identified behavioural practices are essential for building strong and motivated teams, promoting innovative practices and collaboration and achieving project success. A thorough and critical literature review revealed four leadership practice characteristics clusters, highlighting the prevalence of interpersonal and emotional behavioural practices in successful construction projects. The empirical findings support positive relationships among leadership practices, communication, relationship, and conflict management, affirming theoretical arguments. The research provides practical insights for addressing specific challenges (delays and inefficiencies), disrupted supply chain, communication barriers in a multicultural workforce, facilitating coordination with ancillary businesses and encourage project professionals to implement building regulations and safety protocols in the Australian construction industry. Contextualising the results within the Australian setting, the study notes variances from international studies (Yong and Mustaffa 2013; Lindhard and Larsen 2016; Zhao et al. 2016), attributing them to the unique construction landscapes of each country.

The analysis and framework contribute substantial evidence, advocating for a shift towards people-centric practices in the construction sector. The evolving landscape of digital technologies, cultural diversity, virtual teams and changing project complexities necessitates enhanced leadership and communication practices in projects to realise benefits due to technological advancement in the construction sector.

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Appendix 1: Summary of extracted latent/underlying factors (EFA).

Extracted factors	Factor loading	%age of variance explained	Cumulative %age variance explained
LBSF1: (Team encouragement and empowerment)			
10. I show concern & care about our team member's well-being & show empathy and compassion.	0.722		
17. I encourage my team members to express new ideas/opinions/suggestions for continuous improvement.	0.717		
20. I am conscious of my project team's contribution and appreciate their efforts to the project's success.	0.620		
28. I praise and appreciate team members' contributions individually for the job well done.	0.629		
29. I am aware of my limitations and appreciate my team members' strengths and contributions in helping me to engage with them.	0.561	35.161	35.161
LBSF2: (Leading by example)			
8. I set a good example of my behaviour (communication and listening skills) with my project team and stakeholders.	0.567		
11. I set high standards for performance for myself and adhere to the agreed-upon standards.	0.641		
14. I work hard to achieve the project goals.	0.640		
16. I keep my commitments and promises to those I work with.	0.676	7.242	42.408
LBSF3: (Interpersonal sensitivity)			
24. I have an awareness and ability to recognise the feelings and emotions of others and use these abilities to make decisions while interacting with them.	0.712		
25. I recognise my own emotions and feelings and can manage them.	0.695		
26. I encourage my team members to look for 'out-of-box solutions' and take risky approaches in challenging work scenarios/situations.	0.638		
31. I ensure the team members are well rewarded for their creative work in our project.	0.643	5.874	48.282
LBSF4: (Mentoring relationships & empowerment)			
3. I provide support, training & opportunities for my team members to adapt to the new project environment and mentor relationships to grow to perform better.	0.698		
22. I encourage & support my project team to adopt change management when required.	0.698	4.869	53.151
LBSF5: (Inspire-motivation & visionary)			
1. I inspire and motivate the project team to work together to achieve project goal/s.	0.727		
4. I discuss the big picture and describe what we aspire to achieve as a team.	0.562		
32. I have the flexibility in making decisions	0.691	4.475	57.626
LBSF6: (Motivation -- visionary and promote relationships)			
5. I encourage & motivate team members to achieve more than the agreed project goal/s.	0.550		
9. I encourage team members to solve problems together.	0.647		
12. I encourage team members to share their thoughts/dreams for the future.	0.762	4.351	61.977
LBSF7: (Self-management)			
23. I am comfortable & self-confident in receiving feedback and learning from it.	0.824		
27. I keep my negative emotions and feelings in check.	0.781	3.943	65.920
LBSF8: (Coaching and team empowerment)			
15. I suggest ways to improve team performance.	0.717		
19. I always look for new ways to do the job and challenge my project team members to look into how we work.	0.645	3.321	69.241
LBSF9: (Promote relationships)			
7. I encourage team members to exchange information with one another.	0.711	3.126	72.367

(Continued)

Appendix 1: Continued

Extracted factors	Factor loading	%age of variance explained	Cumulative %age variance explained
CMSF1: (Effective communication)			
1. I keep the purpose of communication well-defined & meaningful.	0.680		
2. I communicate clearly, and precisely without any ambiguity.	0.816		
3. I understand the communication from others involved in the project.	0.784		
4. I communicate appropriately with different audiences.	0.613		
5. I ensure the information is current, relevant, correct, meaningful, and straightforward.	0.579		
6. I use proper methods/media/channels for communicating the information to project team members and internal/external stakeholders.	0.714		
7. I achieved the expected outcome/s from our communication in general.	0.655		
8. I keep open and honest communication with all project teams and stakeholders.	0.507	38.548	38.548
CMSF2: (Relationship management)			
9. I use effective communication/tactics for persuasion.	0.713		
10. I negotiate in resolving disagreements and collaboratively develop a resolution.	0.722		
11. I build and maintain relationships with others, work toward shared goals, and create group synergy in pursuing collective goals.	0.808	10.467	49.014
CMSF3: (Conflicts management)			
12. I strive to encourage all parties to communicate willingly.	0.730		
13. I resolve conflict amicably.	0.815		
14. I helped solve relationship issues and problems that emerged on the project.	0.667	8.429	57.444
CMSF4: (Communication willingness)			
15. I encourage project team members to share events and changes willingly that may affect the project.	0.788		
16. I follow a trust mechanism in the process of communication.	0.721	6.772	64.216

EFA, exploratory factor analysis.