International Journal of Innovation and Business Strategy

Full paper

DOI: https://doi.org/10.11113/ijibs.v21.209

THE INFLUENCE OF TRANSFORMATIONAL LEADERSHIP ON GREEN PERFORMANCE: EMPIRICAL EVIDENCE FROM CHINA'S CONSTRUCTION SECTOR

Jing He[a], Bee Wah Tan*[b], Chor Foon Tang[c], Nor Fadzlin Mohammad Bahar[a]

[a] *School of Economics, Finance and Banking, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia.*
[b] *Graduate School of Business, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia.*
[c] *Centre for Policy Research, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia.*

*Corresponding author: beewahtan@usm.my

Article history: Received: 27 April 2026 Revised: 25 May 2026 Accepted: 05 June 2026 Published: 29 June 2026

Article type: Empirical article

Abstract

This study examines the relationship between transformational leadership and green performance in China's construction sector, with particular attention to how leadership influences environmental outcomes. Drawing on cross-sectional survey responses from 380 employees in construction firms, the study employs correlation analysis and multiple regression to evaluate both direct and indirect effects linking the dimensions of transformational leadership with employee green behavior, green performance, and green innovation capability. Results show that the influence of transformational leadership is not uniform across its dimensions. Idealized influence and inspirational motivation demonstrate a significant positive association with green performance, whereas intellectual stimulation does not exhibit significant direct effects. Individualized consideration is negatively related to green performance. The mediation analysis further indicates that employee green behavior does not significantly transmit the effect of transformational leadership to green performance, while green innovation capability serves as an important mediating mechanism. These findings suggest that leadership contributes to environmental outcomes in construction firms primarily through strengthening innovation-related capability rather than through direct changes in employee green behavior.

Keywords: Transformational leadership, Green performance, Green innovation capability, Construction industry, Environmental sustainability

1.0 INTRODUCTION

Over the past forty years, the construction sector in China has remained an important pillar of economic development, generating around 8 percent of gross domestic product and creating annual employment for over 100 million individuals (Kam et al., 2025). However, rapid urbanization and infrastructure expansion have also made it one of the country's most environmentally intensive industries (Sun et al., 2025). Globally, construction consumes nearly 40 percent of raw materials and produces about 36 percent of carbon dioxide emissions (Ahmed Ali et al., 2020). These pressures are particularly significant in China, given its carbon neutrality target for 2060, which requires substantial reductions in embodied and operational emissions across the construction value chain (Deng et al., 2024). Carbon-intensive materials such as cement and steel account for more than 15 percent of global CO_2 emissions, with China as the largest contributor (Zhang et al., 2025). Despite policy support and technological progress, major challenges remain, including low recycling rates, limited technological efficiency, and weak financial incentives for sustainable construction (Deng et al., 2024; Xiao et al., 2025).

Previous research has largely explained environmental performance in construction through technological innovation, regulatory enforcement, and material efficiency (Bakker et al., 2023; Shurrab et al., 2019). Although important, these explanations do not fully account for why firms operating under similar external conditions often achieve different environmental outcomes. This suggests that internal organizational factors, particularly leadership, may also matter by shaping strategy, resource allocation, and employee engagement in sustainability initiatives (Reza, 2019).

Transformational leadership has gained growing attention as a leadership approach associated with sustainability-related organizational outcomes. Transformational leaders articulate vision, act as role models, stimulate innovation, and provide individualized support (Bass, 2015; Bass & Riggio, 2006). In environmental settings, such behaviors may strengthen pro-environmental values, support experimentation with green technologies, and align organizational culture with sustainability goals (Robertson & Barling, 2013; Zhou, 2024). Studies across the manufacturing, service, and energy industries commonly find that transformational leadership is positively related to green innovation, broader sustainability performance, and the execution of environmental strategies (Ghasabeh et al., 2015).

However, these effects are not consistent across contexts. Prior studies show that leadership outcomes vary across industries, organizational arrangements, and institutional settings (Ystaas et al., 2023). In some cases, transformational leadership affects sustainability indirectly through employee behavior, organizational culture, or innovation capability rather than through direct managerial

influence (Bagga et al., 2023). Other studies suggest that an excessive focus on vision and inspiration may weaken attention to operational discipline or regulatory compliance, limiting immediate gains (Bakker et al., 2023). The variation in prior findings indicates that the link between transformational leadership and green performance is unlikely to be uniform.

This issue is especially relevant in construction, where organizational and environmental management conditions differ substantially from conventional manufacturing or service settings. Construction firms typically operate through project-based structures, temporary multi-organizational teams, fragmented subcontracting arrangements, and decentralized execution across project sites. Environmental performance therefore depends not only on leadership vision, but also on coordination across contractors, compliance with technical standards, resource management, and adherence to regulatory requirements (Zhang et al., 2025). In such environments, leadership influence may be less direct and more contingent on organizational systems and capability development. Leadership processes in Chinese firms are further shaped by institutional and cultural conditions, including collectivism and hierarchical governance structures, which may influence how leadership behaviors translate into environmental outcomes (Zhu & Huang, 2023).

Despite growing interest in sustainable leadership, several gaps remain in the literature. First, studies on environmental performance in construction continue to emphasize technological innovation, regulatory enforcement, and material efficiency, with comparatively limited attention to internal organizational drivers such as leadership and managerial decision-making (Shurrab et al., 2019). Second, existing studies often treat transformational leadership as a unified construct, providing limited insight into whether its individual dimensions exert differentiated effects on environmental performance (Robertson & Barling, 2013; Sun et al., 2022). Third, while prior studies frequently propose employee pro-environmental behavior as an indirect mechanism linking leadership and environmental outcomes, less attention has been given to organizational capability-based pathways, particularly green innovation capability. These gaps are especially relevant in China's construction sector, where project-based operations, fragmented supply chains, and strong regulatory dependence may shape how leadership translates into sustainability outcomes (Zhang et al., 2025; Zhu & Huang, 2023).

To fill these gaps, the study explores the relationship between transformational leadership and green performance in China's construction industry. Specifically, it analyzes the distinct effects of the four dimensions of transformational leadership and evaluates two potential pathways through which leadership may influence environmental performance, namely employee green innovation capability and green behavior. By examining these two mechanisms comparatively, the study advances a more integrative explanation of how leadership contributes to sustainability outcomes in complex industrial contexts.

This study makes three main contributions. First, it extends the sustainable leadership literature by providing evidence from China's construction industry, a context characterized by project-based operations, high carbon intensity, and strong environmental regulation, yet still underrepresented in leadership research. Second, rather than treating transformational leadership as a single aggregate construct, the study examines the differentiated effects of its four dimensions on green performance, allowing a more refined understanding of leadership effectiveness. Third, the study comparatively evaluates two mediating mechanisms, namely employee green behavior and green innovation capability, thereby offering deeper insight into the organizational processes through which leadership may influence environmental sustainability outcomes.

The following section reviews the relevant literature and presents the hypotheses. The methodology is then outlined, after which the empirical findings are reported. The subsequent section discusses the main results, and the final section concludes by highlighting the study's theoretical and practical implications.

■ 2.0 LITERATURE REVIEW

2.1 Concept of Transformational Leadership

Burns (2004) first conceptualized transformational leadership, and Bass (2015) later extended this perspective by describing it as a leadership approach that encourages followers to transcend personal interests in pursuit of shared goals. Bass and Riggio (2006) identify four dimensions: idealized influence, individualized consideration, inspirational motivation, and intellectual stimulation. Collectively, these dimensions represent leaders' ability to function as moral role models, articulate a clear and inspiring vision, encourage innovative thinking, and address the developmental needs of their followers.

In sustainability research, transformational leadership is increasingly viewed as a means of aligning organizational objectives with environmental responsibility (Robertson & Barling, 2013). Leaders who support environmental values may legitimize sustainability initiatives, strengthen organizational commitment, and encourage employees to internalize pro-environmental norms (Zhou, 2024). Intellectual stimulation may foster creative responses to environmental challenges, whereas idealized influence may reinforce trust and moral commitment to long-term sustainability goals (Bass, 2015).

Studies across manufacturing, service, and energy sectors generally found a positive relationship between transformational leadership and outcomes like green innovation, environmental strategy execution, and sustainability performance (Ghasabeh et al., 2015; Sun et al., 2022). However, these effects are not uniform. Their strength may vary with organizational structure, task requirements, and institutional conditions, and leadership may operate through intermediate processes rather than direct operational control (Bagga et al., 2023; Bakker et al., 2023).

From a sustainability perspective, transformational leadership is particularly relevant because environmental performance often requires more than formal compliance or technical implementation alone. Achieving sustainability objectives frequently depends on organizational learning, cross-functional coordination, employee value alignment, and the ability to adapt operational practices in response to environmental challenges. In this regard, transformational leadership may contribute not only through direct motivational influence on employees, but also by strengthening organizational capabilities that support environmental innovation and long-term sustainability performance.

2.2 Concept of Green Performance

Green performance is a multidimensional construct that reflects an organization's capacity to minimize environmental impacts and contribute to broader sustainable development goals (Onubi et al., 2020). In construction, it includes environmentally responsible design, efficient resource use, technological advancement, and regulatory compliance, not merely emission reduction (Shurrab et al., 2019).

Literature usually identifies several related dimensions. Environmental performance concerns lower pollution, waste, and carbon emissions. Green innovation refers to the adoption and development of environmentally friendly materials, construction methods, and technologies (Sun et al., 2022). Resource efficiency captures effective use of energy, water, and materials throughout the project lifecycle, whereas regulatory compliance concerns conformity with environmental laws, standards, and green building requirements (Ngo et al., 2023). In China, these dimensions are closely linked to policy instruments such as the Green Building Evaluation Standard and national carbon reduction targets (Zhang et al., 2025).

Most studies on green performance in construction emphasize technical and regulatory drivers such as process improvement, material efficiency, and policy enforcement (Deng et al., 2024; Shurrab et al., 2019). While valuable, this literature gives less attention to internal organizational conditions, especially leadership and employee engagement, that may shape how environmental strategies are implemented and sustained.

While technical systems and regulatory compliance remain important determinants of green performance, their effectiveness often depends on internal organizational conditions that influence implementation quality and strategic commitment. This suggests that green performance should not be viewed solely as a technical or compliance-based outcome, but also as an organizational outcome potentially shaped by leadership behavior, employee engagement, and innovation capability.

2.3 Review of Transformational Leadership and Green Performance

An increasing number of studies have investigated the link between transformational leadership and green-related outcomes. Bass and Stogdill (1990) suggest that leaders who exhibit strong ethical standards, clear vision, and personal support for followers are better positioned to promote pro-environmental behavior. Empirical studies similarly suggest that transformational leadership can strengthen organizational learning, support green innovation, and increase employees' environmental involvement (Cetin & Kinik, 2015; Reza, 2019). Through these channels, leaders may integrate sustainability into strategic decision-making and encourage green initiatives.

However, the relationship is not consistently positive. Leadership effectiveness may vary across industries, organizational structures, and cultural settings. It may also operate indirectly through employee green behavior, organizational culture, or innovation capability (Bagga et al., 2023). In some cases, strong emphasis on vision and creativity may weaken attention to operational discipline and regulatory compliance (Bakker et al., 2023). The evidence indicates that transformational leadership is not a universal or unconditional source of sustainability performance.

This suggests that transformational leadership may influence green performance through multiple mechanisms. At the behavioral level, leadership may shape employee environmental engagement through value internalization and motivational influence. At the organizational level, transformational leadership may strengthen innovation capability by encouraging experimentation, knowledge sharing, and adaptive problem-solving. Thus, leadership and sustainability performance should not be viewed as independent constructs, but as conceptually linked through behavioral and capability-based organizational processes.

2.4 Research Gap

Despite growing interest in leadership and sustainability, evidence from China's construction industry remains limited. Prior research has primarily emphasized the technological and regulatory aspects of green building while paying less attention to the behavioral and managerial mechanisms shaping environmental performance (Shurrab et al., 2019). Yet the sector's fragmented supply chains, project-based operations, and hierarchical governance structures may condition how leadership affects green outcomes (Zhang et al., 2025). In addition, cultural features such as collectivism, power distance, and relational harmony may shape the effectiveness of transformational leadership in promoting environmental goals (Zhu & Huang, 2023).

Against this backdrop, the present study explores how transformational leadership is associated with green performance in China's construction sector. The differentiated effects of the four leadership dimensions are examined, while employee green behavior and green innovation capability are considered as potential mediating mechanisms, thereby contributing to both theoretical development and practical understanding of sustainable leadership in an emerging-economy setting.

■ 3.0 CONCEPTUAL FRAMEWORK AND HYPOTHESES

3.1 Transformational Leadership and Green Performance

Transformational leadership is commonly associated with favorable organizational outcomes because it helps align vision, stimulate employee commitment, and encourage innovative thinking (Bass, 2015; Bass & Riggio, 2006). In environmental management, such leadership may influence organizational priorities by emphasizing sustainability values, directing resources toward environmental initiatives, and encouraging environmentally responsible practices among employees (Robertson & Barling, 2013; Zhou, 2024).

Prior studies have generally reported a positive relationship between transformational leadership and outcomes such as green innovation, sustainability performance, and environmental management practices (Ghasabeh et al., 2015; Sun et al., 2022; Ystaas et al., 2023). However, these effects are not necessarily uniform across leadership dimensions or industrial settings. In highly regulated sectors such as construction, environmental outcomes are often shaped by technological requirements, regulatory standards, and supply-chain coordination, all of which may constrain the direct effect of leadership on operational performance (Bakker et al., 2023; Zhang et al., 2025).

Accordingly, the contribution of transformational leadership to green performance may vary depending on the specific dimension involved. Some dimensions may exert a stronger direct influence by reinforcing sustainability values and strategic commitment, whereas others exert weaker or indirect effects. Accordingly, the following hypotheses are advanced:

H1: Idealized influence is positively associated with green performance.
H2: Inspirational motivation is associated with green performance.
H3: Intellectual stimulation is associated with green performance.
H4: Individualized consideration is associated with green performance.

3.2 Transformational Leadership and Employee Green Behavior

Employee green behavior refers to actions undertaken by employees that support environmental sustainability, including both voluntary and required behaviors such as participating in reducing waste, environmental initiatives, and conserving resources (Martins et al., 2021). These behaviors are especially important in contexts where environmental performance depends on many decentralized decisions rather than central control.

Transformational leadership may encourage employee green behavior by shaping values, strengthening moral responsibility, and motivating employees to act proactively (Bass & Stogdill, 1990; Robertson & Barling, 2013). Leaders who communicate a clear environmental vision and model environmentally responsible conduct may increase employees' willingness to internalize environmental goals and engage in discretionary green behavior. Previous studies also suggest that transformational leadership has a positive relationship with environmental engagement and employees' willingness to go beyond formal requirements (Sun et al., 2022). In construction settings, where employees often work with considerable operational autonomy at project sites, such behaviors may be important for translating leadership into environmental outcomes. Therefore, the following hypothesis is proposed:

H5: Transformational leadership is associated with employee green behavior.

3.3 Employee Green Behavior and Green Performance

Employee green behavior serves as a key behavioral foundation of organizational green performance. While individual actions may seem limited in isolation, their collective influence can improve environmental outcomes through lower waste, greater resource efficiency, and stronger compliance with environmental procedures (Martins et al., 2021).

In construction firms, project-level environmental outcomes depend heavily on daily employee practices, including material handling, energy use, and adherence to site procedures. Previous evidence indicates that firms with stronger employee environmental engagement tend to achieve better green performance (Onubi et al., 2020; Sun et al., 2022). Therefore, employee green behavior may represent an important pathway through which leadership contributes to sustainability outcomes. Accordingly, the following hypothesis is proposed:

H6: Employee green behavior is positively associated with green performance.

3.4 Transformational Leadership and Green Innovation Capability

A firm's green innovation capability reflects its ability to develop and implement environmentally sustainable processes, practices, and sustainable technologies (Ahmed Ali et al., 2020). In the construction sector, environmental improvement is often achieved through technological upgrading, process redesign, and coordination across functions, making this capability particularly important.

Transformational leadership may enhance green innovation capability by encouraging creativity, experimentation, and intellectual stimulation (Bass, 2015). Leaders who promote new ideas and challenge existing routines can strengthen the organization's capacity for green innovation. Prior studies report that transformational leadership is positively related to innovation-related outcomes, including green technology adoption and sustainable process improvement (Ghasabeh et al., 2015; Yu et al., 2024). In light of this, the following hypothesis is proposed:

H7: Transformational leadership is positively associated with green innovation capability.

3.5 Green Innovation Capability and Green Performance

By facilitating the adoption of eco-efficient solutions, green innovation allows firms to overcome technological and operational barriers to sustainability. Firms with stronger green innovation capability are typically more effective in improving resource efficiency, meeting environmental requirements, and maintaining environmental performance over time (Sun et al., 2025; Zhang et al., 2025). In the construction sector, where environmental outcomes are closely tied to materials, construction techniques, and project design, innovation capability is likely to be a key determinant of green performance. Accordingly, the following hypothesis is proposed:

H8: Green innovation capability is positively associated with green performance.

3.6 Mediating Role of Employee Green Behavior and Green Innovation Capability

The preceding hypotheses imply that transformational leadership may affect green performance through both direct and indirect pathways. In this study, the concept is represented by four dimensions: idealized influence, intellectual stimulation, inspirational motivation, and individualized consideration (Bass, 2015; Bass & Riggio, 2006). One possible indirect mechanism is employee green behavior. Leaders who model environmental values, encourage new ideas, articulate a clear vision, and provide individual support may strengthen environmentally responsible employee actions (Robertson & Barling, 2013; Tang et al., 2023). Such behavior may, in turn, improve organizational environmental performance (Martins et al., 2021; Sun et al., 2022). Nevertheless, this relationship may differ across leadership dimensions and organizational settings. On this basis, the following mediation hypotheses are proposed:

H9a: Employee green behavior mediates the relationship between idealized influence and green performance.
H9b: Employee green behavior mediates the relationship between inspirational motivation and green performance.
H9c: Employee green behavior mediates the relationship between intellectual stimulation and green performance.
H9d: Employee green behavior mediates the relationship between individualized consideration and green performance.

The second indirect pathway involves green innovation capability. Transformational leadership may enhance environmental performance by fostering innovation, learning, and experimentation within the organization. Green innovation capability denotes an organization's ability to create and apply environmentally sustainable technologies, managerial practices, and processes (Ahmed Ali et al., 2020; Borah et al., 2023). This mechanism is important in construction, where environmental progress often relies on technological innovation, material substitution, and process improvement (Shurrab et al., 2019; Yu et al., 2024).

The four dimensions of transformational leadership may exert different effects on this capability. Idealized influence may strengthen ethical commitment, inspirational motivation may reinforce shared goals, intellectual stimulation may promote creativity, and individualized consideration may enhance learning and knowledge development (Bass & Riggio, 2006; Sun et al., 2022). Greater green innovation capability increases the likelihood that firms will adopt environmentally friendly technologies, improve resource efficiency, and achieve superior environmental performance (Ahmed Ali et al., 2020; Yu et al., 2024). Therefore, the following mediation hypotheses are proposed:

H10a: Green innovation capability mediates the relationship between idealized influence and green performance.
H10b: Green innovation capability mediates the relationship between inspirational motivation and green performance.
H10c: Green innovation capability mediates the relationship between intellectual stimulation and green performance.
H10d: Green innovation capability mediates the relationship between individualized consideration and green performance.

■ 4.0 METHODOLOGY

4.1 Research Design

A quantitative cross-sectional survey design is employed in this study to examine how transformational leadership relates to green performance in China's construction industry through behavioral and organizational capability mechanisms. The survey method is suitable because leadership behavior, employee actions, and organizational capabilities are perceptual constructs that are not directly observable using secondary data (Marsh, 2025; McKibben et al., 2025). In organizational and sustainability research, quantitative surveys are commonly employed as they facilitate the systematic measurement of latent constructs, the collection of large-scale data, and the application of multivariate analysis (Gul, 2023). A cross-sectional design is also suitable for examining relationships, mediation

mechanisms, and explanatory pathways within complex organizational settings (Das-Munshi et al., 2020). Accordingly, the analysis focuses on relationships among variables at one specific point in time instead of temporal variation.

4.2 Sampling and Data Collection

The data collection process involved a structured questionnaire administered to employees and managers in Chinese construction companies. Obtaining responses from multiple individuals within the same organization helps reduce single-source bias and improve construct validity (LeBreton & Senter, 2008). It also enables consistent measurement of transformational leadership and green performance, with the mediating variables across firms differing in size, ownership, and location. The sample includes construction firms operating in China, including state-owned enterprises, private firms, and foreign-invested enterprises. Respondents were drawn from residential, commercial, infrastructure, and specialized construction segments, reflecting sectoral diversity.

To ensure representation across factors that may influence the leadership-green performance relationship, the sampling strategy incorporated geographic and firm-size stratification (Kang, 2021). Geographic coverage included eastern China, where economic development and environmental regulation are relatively advanced, central China, where industrialization and environmental awareness are increasing, and western China, where economic growth is increasingly balanced with ecological protection goals (Liao & Li, 2022). Firm size was divided into three size categories: small firms with fewer than 100 employees, medium firms with 100 to 1,000 employees, and large firms with more than 1,000 employees. This distinction is relevant because organizational scale may affect leadership effectiveness and environmental capability (Abiad et al., 2025; Mak & Kusnadi, 2005; Trencansky & Tsaparlidis, 2014).

A stratified purposive sampling approach was adopted to improve representation across relevant organizational characteristics. Construction firms were first categorized according to geographic region (eastern, central, and western China) and firm size (small, medium, and large). Respondents were then approached through professional industry networks, construction associations, and organizational contacts within these strata. Given practical access constraints, the sampling approach remained non-probabilistic, although stratification was used to enhance diversity and sectoral representation.

The planned sample size ranged from 350 to 400 respondents, as indicated by the power analysis. A minimum statistical power of 0.80 was considered sufficient to identify moderate effect sizes between 0.30 and 0.50, consistent with prior studies on leadership and performance (Bagga et al., 2023; Dalton et al., 1998). This range also allowed for non-response and possible data quality issues. Primary data were gathered through an online questionnaire circulated through professional construction networks and industry associations. A multi-channel distribution approach was used to improve response rates and representativeness (Patten, 2016; Sharma, 2022). The survey was administered through a professional online platform to ensure accessibility and data security, and reminder messages were issued periodically to reduce attrition. Participants were offered a research summary and industry benchmarking report as an incentive, providing practical value while preserving research integrity (Edwards et al., 2002).

Participation in the survey was entirely voluntary. Before completing the questionnaire, respondents were informed about the purpose of the study and provided informed consent to participate. Anonymity and confidentiality were assured, and respondents were informed that the collected data would be used solely for academic research purposes. No personally identifiable information was disclosed in the analysis or reporting of the findings.

4.3 Measurement Instruments

The study measured all constructs with previously validated scales tailored to the context of construction and sustainability. Except for where noted, responses were captured on a seven-point Likert scale, with 1 representing strongly disagree and 7 denoting strongly agree (Jebb et al., 2021).

Transformational Leadership

To operationalize transformational leadership, the study drew on the Multifactor Leadership Questionnaire (MLQ-5X), an instrument extensively used in prior leadership studies (Bass, 2015). The scale was translated and back-translated, reviewed by subject experts, and pilot-tested with Chinese construction professionals to ensure contextual suitability. The instrument retained four dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Each dimension was measured with five items, giving a total of 20 items.

Green Performance

Green performance was measured as a multidimensional construct reflecting the environmental outcomes of construction firms. Following prior studies, it comprised environmental performance, green innovation, resource efficiency, and regulatory compliance (Shurrab et al., 2019). Environmental performance, measured with six items, covered pollution reduction, waste management, and resource conservation (Block et al., 2024). Green innovation, measured with five items, captured the adoption and development of environmentally friendly materials, technologies, and processes (Akhtar et al., 2024). Resource efficiency, measured with four items, assessed efficient use of energy, materials, and water across project lifecycles (Kanyilmaz et al., 2022). Regulatory compliance, measured with three items, captured adherence to environmental regulations and voluntary sustainability standards (Anita & Olajumoke, 2024).

Employee Green Behavior

Employee green behavior was assessed using a multidimensional instrument encompassing both mandatory environmental practices and voluntary behaviors beyond formal job requirements. The items addressed behaviors such as waste reduction, energy conservation, environmental problem-solving, and collective environmental responsibility (Robertson & Barling, 2013; Tang et al., 2023). This measure reflects the view that organizational environmental outcomes depend not only on formal systems but also on discretionary employee behavior (Tang et al., 2023).

Green Innovation Capability

Green innovation capability was measured using items that assess a firm's capacity to generate, adopt, and implement eco-efficient technologies and practices (Akhtar et al., 2024). The scale captures knowledge integration, problem-solving capability, the allocation of resources toward environmental innovation, and cross-functional collaboration (Borah et al., 2023). Higher scores indicate stronger green innovation capability.

4.4 Data Screening, Reliability and Validity Assessment

Before the main analysis, the data were screened for missing values, abnormal response patterns, and completion time (Statistical analysis of the development of the construction industry in 2024, 2025). Questionnaires with more than 20 percent missing data or excessively short completion times were removed. For cases with limited missing values below 10 percent, sequential mean imputation was used to preserve sample size (Kline, 2023).

To reduce the likelihood of common method bias, the study incorporated a number of procedural safeguards. These included protecting respondent anonymity and carefully wording the questionnaire items in a neutral manner. The assessment was further supported by Harman's single-factor test, which showed that the first factor explained less than 40 percent of the total variance. This result indicates that common method bias was unlikely to pose a serious problem.

Table 1 Measurement of reliability and validity indicators

Statistic	Value
Cronbach alpha	0.82–0.93
KMO	0.78
Bartlett p-value	<0.001
AVE (min–max)	0.52–0.71
CR (min–max)	0.81–0.89

The study subsequently assessed the quality of the measurement model in terms of reliability and validity. The results indicated adequate internal consistency across all constructs, as the Cronbach's alpha values were higher than the commonly accepted benchmark of 0.70. Evidence of convergent validity was also established, given that the average variance extracted values exceeded 0.50 and the standardized factor loadings were above 0.60. A summary of the main reliability and validity results is presented in Table 1.

4.5 Reliability and Construct Validation

The reliability and construct validity of the measurement instruments were assessed prior to hypothesis testing. Internal consistency was evaluated using Cronbach's alpha as reported in Table 2, with all constructs exceeding the commonly accepted threshold of 0.70, indicating satisfactory reliability. Sampling adequacy for factor analysis was assessed using the Kaiser-Meyer-Olkin statistic, while Bartlett's test of sphericity confirmed sufficient inter-item correlations for construct assessment. These results suggest that the measurement instruments were suitable for subsequent regression analysis.

Table 2 Summary of construct reliability and validity

Construct	Cronbach α
Transformational Leadership (TL)	0.93
Idealized Influence (II)	0.88
Inspirational Motivation (IM)	0.86
Intellectual Stimulation (IS)	0.85
Individualized Consideration (IC)	0.84
Employee Green Behavior (EGB)	0.88
Green Innovation Capability (GIC)	0.85
Green Performance (GP)	0.90

4.6 Data Analysis

The data were processed using SPSS. The analysis began with descriptive statistics to summarize the characteristics of the respondents and to inspect the distribution of the variables. The skewness and kurtosis values fell within acceptable limits, indicating approximate normality (Holcomb, 2016). Pearson correlation analysis was subsequently performed to examine the associations among the principal constructs, and all correlation coefficients remained below 0.80, suggesting that multicollinearity was not a serious issue (Cleophas & Zwinderman, 2018; Kline, 2023). The study then employed multiple regression analysis to test the direct and indirect relationships proposed in the conceptual framework (Aiken et al., 1991). The mediating roles of employee green behavior and green innovation capability were assessed using the causal-step procedure and further confirmed through bootstrapping (Syafiq & Purwoko, 2022; Che Haron et al., 2024). Diagnostic tests confirmed that the key regression assumptions were satisfied, and statistical significance was assessed at the 5 percent level.

5.0 RESULTS

5.1 Descriptive Statistics

The descriptive statistics for the main variables are reported in Table 3. The mean values for the four dimensions of transformational leadership range from 3.81 to 3.95 on a seven-point Likert scale, implying a moderate perceived level of transformational leadership across the sampled firms. Among these dimensions, inspirational motivation records the highest mean score at 3.95, whereas intellectual stimulation shows the lowest at 3.81, suggesting some variation in the salience of leadership behaviors across organizations.

The mean score for employee green behavior is 3.96, indicating a moderate level of environmentally responsible behavior among employees. Green performance indicators range from 3.87 to 4.17, with green innovation and resource efficiency showing relatively higher average values than regulatory compliance. This pattern suggests that firms may place greater emphasis on technological improvement and resource management in pursuing environmental objectives. Standard deviations indicate reasonable variation across observations, implying heterogeneity in both leadership practices and environmental performance among construction firms. Overall, the descriptive statistics provide an adequate basis for the subsequent multivariate analysis.

Table 3 Descriptive statistics

Variables	Count	Mean	SD	Min	Max
Idealized Influence (II)	380	3.82	0.93	2.20	6.40
Inspirational Motivation (IM)	380	3.95	1.01	1.60	6.40
Intellectual Stimulation (IS)	380	3.81	0.81	1.60	5.60
Individualized Consideration (IC)	380	3.88	0.67	2.20	5.40
Transformational Leadership (TL)	380	3.86	0.40	2.85	4.75
Employee Green Behavior (EGB)	380	3.96	0.80	2.33	6.00
Green Innovation Capability (GIC)	380	4.17	0.73	2.20	6.00
Green Performance (GP)	380	4.04	0.42	3.07	4.91

Note: Idealized Influence (II); Inspirational Motivation (IM); Intellectual Stimulation (IS); and Individualized Consideration (IC) represent the four dimensions of transformational leadership.

5.2 Correlation Analysis

The Pearson correlation matrix for the study's principal variables is reported in Table 4. The results reveal positive intercorrelations among the four dimensions of transformational leadership, with coefficients varying between 0.55 and 0.62. Such a pattern suggests that idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration commonly occur together in organizations, consistent with the multidimensional conceptualization of transformational leadership proposed by Bass and Riggio (2006) and reinforced by earlier empirical findings (Ghasabeh et al., 2015).

Green performance is positively associated with idealized influence, inspirational motivation, and intellectual stimulation, indicating that some dimensions of transformational leadership may support stronger environmental outcomes. This outcome is consistent with earlier studies that emphasize ethical role modelling and value articulation in environmental performance (Robertson & Barling, 2013; Sun et al., 2022). By comparison, individualized consideration shows a weak and statistically insignificant relationship with green performance, suggesting a limited direct role in environmental outcomes within the construction context.

Table 4 Correlation analysis

Variables	II	IM	IS	IC	EGB	GIC	GP
II	1						
IM	0.62***	1					
IS	0.58***	0.61***	1				
IC	0.55***	0.57***	0.59***	1			
EGB	0.09	0.07	0.11	0.08	1		
GIC	0.41***	0.38***	0.36***	0.21**	0.29***	1	
GP	0.34***	0.29***	0.27***	0.12	0.47***	0.53***	1

Note: ***, **, and * denote significance at the 1, 5, and 10 per cent levels; II = Idealized Influence; IM = Inspirational Motivation; IS = Intellectual Stimulation; IC = Individualized Consideration; EGB = Employee Green Behavior; GIC = Green Innovation Capability; GP = Green Performance.

A positive correlation is observed between employee green behavior and green performance ($r = 0.47$, $p < 0.01$), indicating that environmentally responsible employee actions are associated with stronger sustainability outcomes (Martins et al., 2021; Tang et al., 2023). Among the variables examined, green innovation capability exhibits the strongest correlation with green performance ($r = 0.53$, $p < 0.01$), underscoring the central role of innovation capability in shaping environmental performance (Ahmed Ali et al., 2020; Yu et al., 2024). As all coefficients remain below 0.80, multicollinearity is unlikely to pose a major concern in the regression analysis (Kline, 2023).

5.3 Direct Effects of Transformational Leadership Dimensions on Green Performance

The regression estimates for the direct relationships between the four dimensions of transformational leadership and green performance are presented in Table 5. The model is statistically significant overall ($F = 7.94$, $p < 0.001$) and accounts for 11.2 percent of the variance in green performance. While the explained variance is relatively limited, such a result is common in organizational research, where outcomes are often shaped by a wide range of institutional and organizational influences (Hair et al., 2019).

Table 5 Regression analysis

Variables	β	t-value	p-value
Idealized Influence (II)	0.058	2.530	0.012 **
Inspirational Motivation (IM)	0.038	1.800	0.072 *
Intellectual Stimulation (IS)	–0.001	–0.050	0.964
Individualized Consideration (IC)	–0.186	–4.010	0.000 ***
Firm Size (Control)	0.090	2.170	0.031 **
Ownership (SOE) (Control)	0.040	0.780	0.135
R^2	0.112		
F	7.94		0.000

Note: ***, **, and * denote significance at the 1, 5, and 10 per cent levels.

Among the four dimensions, idealized influence has a positive and statistically significant effect on green performance ($\beta = 0.058$, $p < 0.05$), suggesting that leaders who act as ethical role models and visibly support sustainability can strengthen environmental outcomes (Robertson & Barling, 2013; Zhou, 2024). Thus, H1 is supported. Inspirational motivation also exhibits a positive association with green performance ($\beta = 0.038$, $p = 0.072$), although the relationship is statistically significant only at the 10 percent level. This finding suggests that inspirational motivation may contribute modestly to environmental performance, but its effect is weaker than that of idealized influence. Therefore, H2 receives weak empirical support.

By contrast, intellectual stimulation does not exert significant direct effects on green performance. This implies that motivation and cognitive stimulation alone may be insufficient in construction firms, where environmental outcomes are heavily shaped by technical systems, regulations, and standardized procedures (Bakker et al., 2023; Zhang et al., 2025). Therefore, H3 is not supported.

Individualized consideration exhibits a statistically significant and negative effect on green performance ($\beta = -0.186$, $p < 0.001$), suggesting that excessive attention to individual needs may weaken focus on collective environmental goals in tightly regulated settings (Bakker et al., 2023; Yukl, 2012). Hence, H4 is rejected. Overall, the results show that the effects of transformational leadership on green performance vary across its dimensions.

5.4 Mediation Analysis: Employee Green Behavior

Tables 6 and 7 report on the mediation results for employee green behavior. Table 6 shows that none of the four transformational leadership dimensions significantly predicts employee green behavior. This suggests that, within the sampled construction firms, leadership behavior does not directly shape employees' environmentally responsible actions. Although earlier studies suggest that transformational leadership can promote pro-environmental behavior through value shaping and empowerment (Bass & Stogdill, 1990;

Robertson & Barling, 2013; Sun et al., 2022), such effects are not evident in the present setting. In construction, employee actions are often governed by standardized procedures, safety rules, and environmental compliance requirements, which may reduce the direct influence of leadership.

Table 6 Effects of transformational leadership on employee green behavior

Variables	β	t-value	p-value
Idealized Influence (II)	–0.062	–0.91	0.364
Inspirational Motivation (IM)	–0.044	–0.73	0.467
Intellectual Stimulation (IS)	0.018	0.29	0.771
Individualized Consideration (IC)	–0.079	–1.12	0.264

Note: ***, **, and * denote significance at the 1, 5, and 10 per cent levels.

As shown in Table 7, employee green behavior has a positive and statistically significant relationship with green performance ($\beta = 0.223$, $p < 0.001$), which suggests that environmentally responsible employee actions contribute to organizational environmental outcomes (Martins et al., 2021; Tang et al., 2023). However, mediation cannot be established because transformational leadership is not significantly related to employee green behavior. Therefore, H9 is not supported. This result suggests that, in the construction industry, employee environmental behavior may be shaped more by formal systems and regulatory requirements than by leadership alone (Bakker et al., 2023; Zhang et al., 2025).

Table 7 Effect of employee green behavior on green performance

Variable	β	t-value	p-value
Employee Green Behavior (EGB)	0.223	3.72	0.000 ***

Note: ***, **, and * denote significance at the 1, 5, and 10 per cent levels.

5.5 Mediation Analysis: Green Innovation Capability

Tables 8 to 10 report the mediation results for green innovation capability. Table 8 shows that idealized influence, inspirational motivation, and intellectual stimulation all have significant positive effects on green innovation capability. This suggests that several dimensions of transformational leadership can strengthen a firm's ability to develop and implement environmentally sustainable practices and technologies. Leaders who model ethical values and encourage creative thinking may support organizational learning and innovation-oriented environmental strategies (Bass, 2015; Ghasabeh et al., 2015). These effects are especially important in industries in which environmental improvement depends heavily on technological innovation and process optimization.

Table 8 *Effects of transformational leadership on green innovation capability*

Variables	β	t-value	p-value
Idealized Influence (II)	0.134	2.68	0.008 ***
Inspirational Motivation (IM)	0.097	2.01	0.046 **
Intellectual Stimulation (IS)	0.119	2.41	0.017 **
Individualized Consideration (IC)	–0.052	–1.03	0.305

Note: ***, **, and * denote significance at the 1, 5, and 10 per cent levels.

As reported in Table 9, green innovation capability is positively related to green performance and the effect is statistically significant ($\beta = 0.097$, $p < 0.01$). This result implies that firms with greater innovation capability tend to perform better in terms of environmental sustainability. This result is in line with earlier evidence suggesting that environmental innovation supports the adoption of eco-efficient technologies, more efficient resource use, and stronger compliance with environmental requirements (Ahmed Ali et al., 2020; Yu et al., 2024).

Table 9 Effect of green innovation capability on green performance

Variable	β	t-value	p-value
Green Innovation Capability (GIC)	0.097	3.31	0.001 ***

Note: ***, **, and * denote significance at the 1, 5, and 10 per cent levels.

The findings reported in Table 10 indicate that green innovation capability serves as a significant mediator in the relationship between several dimensions of transformational leadership and green performance. This pattern implies that the contribution of transformational leadership to environmental performance operates mainly through its role in developing organizational innovation capability. Taken together, the results suggest that leadership contributes less directly to employee-level green behavior, but plays a more substantial role in fostering innovation capability, which in turn supports stronger environmental performance. This finding supports the argument that organizational capability is a central mechanism through which leadership affects sustainability outcomes in technologically intensive and project-based industries such as construction (Sun et al., 2022; Zhang et al., 2025).

Table 10 Mediation Effect Summary

Hypothesis	Indirect Effect	z-value	p-value
H10a (II → GIC → GP)	0.013	2.06	0.039**
H10b (IM → GIC → GP)	0.009	1.98	0.048**
H10c (IS → GIC → GP)	0.012	2.11	0.035**
H10d (IC → GIC → GP)	–0.005	–0.96	0.336

Note: ***, **, and * denote significance at the 1, 5, and 10 per cent levels; II = Idealized Influence; IM = Inspirational Motivation; IS = Intellectual Stimulation; IC = Individualized Consideration; GIC = Green Innovation Capability; GP = Green Performance.

■ 6.0 DISCUSSION

Among the four dimensions of transformational leadership, idealized influence emerged as the strongest positive predictor of green performance, suggesting that leaders who demonstrate ethical conduct and visibly support environmental responsibility are more effective in reinforcing sustainability priorities within construction firms. This finding is consistent with previous studies emphasizing the importance of value-based leadership in advancing environmental management practices (Robertson & Barling, 2013; Zhou, 2024). Inspirational motivation also exhibits a positive relationship with green performance, although the effect is relatively weak, indicating that articulating an environmental vision may contribute modestly to sustainability outcomes. By contrast, intellectual stimulation does not exert a significant direct effect on green performance. These findings suggest that, in the construction sector, environmental performance is influenced more by ethical leadership and organizational commitment than by motivational or cognitive leadership behaviors alone, as project specifications, engineering constraints, regulatory compliance, and standardized operational procedures often limit the immediate impact of leadership on environmental outcomes (Bakker et al., 2023; Zhang et al., 2025).

Another important finding is that individualized consideration is negatively associated with green performance. Although individualized consideration is generally regarded as a positive leadership behavior because it emphasizes employee support, mentoring, and developmental attention (Bass & Riggio, 2006), its effectiveness may depend on organizational context. In highly regulated and project-based construction environments, excessive emphasis on individual accommodation may reduce consistency in enforcing standardized environmental procedures, weaken collective coordination, or create implementation variability across teams. This interpretation aligns with contingency perspectives in leadership research, which suggest that leadership effectiveness depends on task structure and organizational demands rather than universally positive effects across all settings (Yukl, 2012).

The mediating role of employee green behavior in the relationship between transformational leadership and green performance is not supported. Although employee green behavior positively contributes to environmental performance, transformational leadership does not significantly explain this behavior in the sampled firms. This differs from earlier studies suggesting that transformational leadership can encourage voluntary environmental action among employees (Robertson & Barling, 2013; Sun et al., 2022). A plausible explanation is that construction employees operate within tightly structured project environments characterized by formal environmental protocols, safety procedures, and compliance-based controls. Under such conditions, employee environmental behavior may be shaped more strongly by institutionalized systems than by discretionary leadership influence. This suggests that leadership may have weaker behavioral transmission effects in operational settings where formal control mechanisms dominate.

The analysis also shows that the connection between transformational leadership and green performance operates primarily through green innovation capability. Specifically, leadership behaviors such as intellectual stimulation and ethical role modelling appear to enhance the firm's capacity to develop and apply environmentally sustainable technologies and practices. This result is in line with prior studies indicating that transformational leadership supports learning, innovation, and creative problem solving (Ghasabeh et al., 2015; Yu et al., 2024). In the construction industry, this capability is especially critical because environmental improvement often depends on advances in materials, design, and construction processes. The positive relationship between green innovation capability and green performance also reinforces the view that innovation is central to sustainability outcomes in this sector (Ahmed Ali et al., 2020; Yu et al., 2024). Overall, these findings indicate that the influence of leadership on sustainability is strongly shaped by context.

Overall, these findings suggest that the sustainability effects of transformational leadership are context-dependent rather than universally uniform. In industries where environmental performance depends heavily on technological capability, regulatory compliance, and operational coordination, leadership may exert greater influence through strengthening organizational capabilities than through directly shaping individual employee behavior. This extends the sustainable leadership literature by demonstrating that leadership effectiveness varies not only by leadership dimension, but also by the institutional and operational characteristics of the industry context.

■ 7.0 CONCLUSION, LIMITATIONS AND FUTURE DIRECTION

This study examined how transformational leadership relates to green performance in China's construction industry, with particular attention to the mediating roles of employee green behavior and green innovation capability. The findings show that the effects of transformational leadership differ across its dimensions and that its influence on environmental performance is transmitted primarily through organizational innovation capability rather than employee behavioral mechanisms.

More specifically, idealized influence emerged as the strongest positive predictor of green performance, while inspirational

motivation exhibited a weaker positive effect that was significant only at the 10 percent level. Intellectual stimulation does not produce significant direct effects, whereas individualized consideration shows a negative association with green performance. Although employee green behavior contributes positively to green performance, it does not serve as a mediating channel between transformational leadership and environmental outcomes. Green innovation capability, in contrast, emerges as the key mechanism connecting leadership with sustainability performance.

The study advances sustainable leadership research by showing that leadership does not affect environmental performance in a uniform manner, but rather through context-specific organizational mechanisms. In project-based and technologically intensive industries such as construction, leadership appears to contribute more through strengthening innovation capability than through directly shaping

employee behavior. From a practical perspective, construction firms should emphasize leadership practices that reinforce environmental values and support innovation-oriented cultures. Encouraging experimentation, knowledge sharing, and cross-functional collaboration may strengthen green innovation capability and improve long-term environmental performance. At the policy level, the findings support continued efforts to promote green technology adoption, strengthen environmental standards, and provide incentives for sustainable construction innovation.

This study is subject to several limitations. The reliance on cross-sectional data limits the extent to which causal relationships can be inferred. Future studies should consider longitudinal approaches and assess other moderating factors, such as institutional pressures, organizational culture, and digital transformation. Notwithstanding these limitations, the findings indicate that transformational leadership supports environmental sustainability in the construction sector mainly through the development of green innovation capability.

Acknowledgement

This research was supported by the Ministry of Higher Education, Malaysia (MoHE) under the Fundamental Research Grant Scheme (FRGS/1/2023/SS06/USM/02/1).

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics declaration

Formal ethical approval was not obtained for this study. However, the authors confirm that the research was conducted in accordance with established ethical principles and good research practices, with due consideration given to participant rights, informed consent, confidentiality, and responsible data handling.

References

Ahmed Ali, K., Ahmad, M. I., & Yusup, Y. (2020). Issues, impacts, and mitigations of carbon dioxide emissions in the building sector. *Sustainability*, *12*(18), 7427. https://doi.org/10.3390/su12187427

Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Sage.

Akhtar, S., Li, C., Sohu, J. M., Rasool, Y., Hassan, M. I. U., & Bilal, M. (2024). Unlocking green innovation and environmental performance: The mediated moderation of green absorptive capacity and green innovation climate. *Environmental Science and Pollution Research*, *31*(3), 4547–4562. https://doi.org/10.1007/s11356-023-31403-w

Bagga, S. K., Gera, S., & Haque, S. N. (2023). The mediating role of organizational culture: Transformational leadership and change management in virtual teams. *Asia Pacific Management Review*, *28*(2), 120–131. https://doi.org/10.1016/j.apmrv.2022.07.003

Bakker, A. B., Hetland, J., Olsen, O. K., & Espevik, R. (2023). Daily transformational leadership: A source of inspiration for follower performance? *European Management Journal*, *41*(5), 700–708. https://doi.org/10.1016/j.emj.2022.04.004

Bass, B. M. (2005). Transformational leadership theory. In J. B. Miner (Ed.), *Organizational behavior 1: Essential theories of motivation and leadership* (pp. 361–385). M. E. Sharpe.

Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership* (2nd ed.). Psychology Press. https://doi.org/10.4324/9781410617095

Bass, B. M., & Stogdill, R. M. (1990). *Bass & Stogdill's handbook of leadership: Theory, research, and managerial applications* (3rd ed.). Free Press.

Block, S., Emerson, J. W., Esty, D. C., de Sherbinin, A., & Wendling, Z. A. (2024). *2024 environmental performance index*. Yale Center for Environmental Law & Policy.

Borah, P. S., Dogbe, C. S. K., Pomegbe, W. W. K., Bamfo, B. A., & Hornuvo, L. K. (2023). Green market orientation, green innovation capability, green knowledge acquisition and green brand positioning as determinants of new product success. *European Journal of Innovation Management*, *26*(2), 364–385. https://doi.org/10.1108/EJIM-09-2020-0345

Burns, J. M. (2004). *Transforming leadership: A new pursuit of happiness*. Grove Press.

Cetin, M. O., & Kinik, F. S. F. (2015). An analysis of academic leadership behavior from the perspective of transformational leadership. *Procedia - Social and Behavioral Sciences*, *207*, 519–527. https://doi.org/10.1016/j.sbspro.2015.10.122

Cleophas, T. J., & Zwinderman, A. H. (2018). Bayesian Pearson correlation analysis. In *Modern Bayesian statistics in clinical research* (pp. 111–118). Springer. https://doi.org/10.1007/978-3-319-92747-3_11

Dalton, D. R., Daily, C. M., Ellstrand, A. E., & Johnson, J. L. (1998). Meta-analytic reviews of board composition, leadership structure, and financial

performance. *Strategic Management Journal*, *19*(3), 269–290. https://doi.org/10.1002/(SICI)1097-0266(199803)19:3<269::AID-SMJ950>3.0.CO;2-K

Das-Munshi, J., Ford, T., Hotopf, M., Prince, M., & Stewart, R. (Eds.). (2020). *Practical psychiatric epidemiology*. Oxford University Press. https://doi.org/10.1093/med/9780198735564.001.0001

Deng, X., Teng, F., Chen, M., Du, Z., Wang, B., Li, R., & Wang, P. (2024). Exploring negative emission potential of biochar to achieve carbon neutrality goal in China. *Nature Communications*, *15*, 1085. https://doi.org/10.1038/s41467-024-45314-y

Edwards, P., Roberts, I., Clarke, M., DiGuiseppi, C., Pratap, S., Wentz, R., & Kwan, I. (2002). Increasing response rates to postal questionnaires: Systematic review. *BMJ*, *324*(7347), 1183–1185. https://doi.org/10.1136/bmj.324.7347.1183

Ghasabeh, M. S., Soosay, C., & Reaiche, C. (2015). The emerging role of transformational leadership. *The Journal of Developing Areas*, *49*(6), 459–467. https://doi.org/10.1353/jda.2015.0090

Gul, Y. E. (2023). A theoretical perspective on survey method from quantitative research methods. *Universum: Psychology and Education*, *4*(106), 64–68.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Holcomb, Z. C. (2016). *Fundamentals of descriptive statistics*. Routledge.

Jebb, A. T., Ng, V., & Tay, L. (2021). A review of key Likert scale development advances: 1995–2019. *Frontiers in Psychology*, *12*, 637547. https://doi.org/10.3389/fpsyg.2021.637547

Kam, V., Li, J., & Tan, L. (2025). *Chinese construction companies' financial profile under pressure amid structural changes*. Fitch Ratings.

Kang, H. (2021). Sample size determination and power analysis using the G*Power software. *Journal of Educational Evaluation for Health Professions*, *18*, 17. https://doi.org/10.3352/jeehp.2021.18.17

Kanyilmaz, A., Demir, A. G., Chierici, M., Berto, F., Gardner, L., Kandukuri, S. Y., Kassabian, P., Kinoshita, T., Laurenti, A., Paoletti, I., du Plessis, A., & Razavi, S. M. J. (2022). Role of metal 3D printing to increase quality and resource-efficiency in the construction sector. *Additive Manufacturing*, *50*, 102541. https://doi.org/10.1016/j.addma.2021.102541

Kline, R. B. (2023). *Principles and practice of structural equation modeling*. Guilford Press.

LeBreton, J. M., & Senter, J. L. (2008). Answers to 20 questions about interrater reliability and interrater agreement. *Organizational Research Methods*, *11*(4), 815–852. https://doi.org/10.1177/1094428106296642

Liao, B., & Li, L. (2022). Spatial division of labor, specialization of green technology innovation process and urban coordinated green development: Evidence from China. *Sustainable Cities and Society*, *80*, 103778. https://doi.org/10.1016/j.scs.2022.103778

Mak, Y. T., & Kusnadi, Y. (2005). Size really matters: Further evidence on the negative relationship between board size and firm value. *Pacific-Basin Finance Journal*, *13*(3), 301–318. https://doi.org/10.1016/j.pacfin.2004.09.002

Marsh, C. (2025). *The survey method: The contribution of surveys to sociological explanation*. Taylor & Francis.

Martins, J. M., Aftab, H., Mata, M. N., Majeed, M. U., Aslam, S., Correia, A. B., & Mata, P. N. (2021). Assessing the impact of green hiring on sustainable performance: Mediating role of green performance management and compensation. *International Journal of Environmental Research and Public Health*, *18*(11), 5654. https://doi.org/10.3390/ijerph18115654

Ngo, M. T., Le, T. N., Nguyen, N. T., & Luu, T. T. T. (2023). Board independence and financial performance: Empirical evidence on mediating role of market competition from the Vietnamese market. *International Journal of Professional Business Review*, *8*(5), e01498. https://doi.org/10.26668/businessreview/2023.v8i5.1498

Onubi, H. O., Yusof, N. A., & Hassan, A. S. (2020). Effects of green construction on project's economic performance. *Journal of Financial Management of Property and Construction*, *25*(3), 331–346. https://doi.org/10.1108/JFMPC-09-2019-0076

Patten, M. L. (2016). *Questionnaire research: A practical guide* (4th ed.). Routledge.

Reza, M. H. (2019). Components of transformational leadership behavior. *EPRA International Journal of Multidisciplinary Research*, *5*(3), 119–124.

Robertson, J. L., & Barling, J. (2013). Greening organizations through leaders' influence on employees' pro-environmental behaviors. *Journal of Organizational Behavior*, *34*(2), 176–194. https://doi.org/10.1002/job.1820

Sharma, H. (2022). How short or long should be a questionnaire for any research? Researchers' dilemma in deciding the appropriate questionnaire length. *Saudi Journal of Anaesthesia*, *16*(1), 65–68. https://doi.org/10.4103/sja.sja_163_21

Shurrab, J., Hussain, M., & Khan, M. (2019). Green and sustainable practices in the construction industry: A confirmatory factor analysis approach. *Engineering, Construction and Architectural Management*, *26*(6), 1063–1086. https://doi.org/10.1108/ECAM-02-2018-0056

Sun, X., El Askary, A., Meo, M. S., Zafar, N. U. A., & Hussain, B. (2022). Green transformational leadership and environmental performance in small and medium enterprises. *Economic Research-Ekonomska Istraživanja*, *35*(1), 5273–5291. https://doi.org/10.1080/1331677X.2021.2025127

Tang, G., Ren, S., Wang, M., Li, Y., & Zhang, S. (2023). Employee green behaviour: A review and recommendations for future research. *International Journal of Management Reviews*, *25*(2), 297–317. https://doi.org/10.1111/ijmr.12328

Ystaas, L. M. K., Nikitara, M., Ghobrial, S., Latzourakis, E., Polychronis, G., & Constantinou, C. S. (2023). The impact of transformational leadership in the nursing work environment and patients' outcomes: A systematic review. *Nursing Reports*, *13*(3), 1271–1290. https://doi.org/10.3390/nursrep13030108

Yu, H., Wen, B., Zahidi, I., Fai, C. M., & Madsen, D. Ø. (2024). China's green building revolution: Path to sustainable urban futures. *Results in Engineering*, *23*, 102430. https://doi.org/10.1016/j.rineng.2024.102430

Yukl, G. (2012). Effective leadership behavior: What we know and what questions need more attention. *Academy of Management Perspectives*, *26*(4), 66–85. https://doi.org/10.5465/amp.2012.0088

Zhang, Q., Li, J., & Du, B. (2025). Carbon emission transfer and shared responsibility allocation in the supply chain: Evidence from the construction sector in China. *Sustainable Production and Consumption*, *55*, 285–296. https://doi.org/10.1016/j.spc.2025.02.027

Zhou, Y. (2024). The business leadership of the state-owned enterprises: Impact of the digital transformations. *Business Ethics and Leadership*, *8*(3), 253–289. https://doi.org/10.61093/bel.8(3).253-289.2024

Zhu, J., & Huang, F. (2023). Transformational leadership, organizational innovation, and ESG performance: Evidence from SMEs in China. *Sustainability*, *15*(7), 5756. https://doi.org/10.3390/su15075756