

# KEY LEADERSHIP COMPETENCIES IN DIFFERENT MANAGEMENT LEVELS FOR DIGITAL TRANSFORMATION IN CONSTRUCTION ORGANISATIONS

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In recent years, the slow progress of digital transformation in construction organisations has received an increasing attention, and effective leadership is considered an important factor in driving transformation. Using China as the study context, this research aims to identify important leadership competencies for digital transformation across different management levels in construction. Data were collected using a questionnaire survey from 299 construction practitioners. The finding points out that interpersonal leadership competencies are considered important by construction practitioners at all levels. Conscientiousness, collaboration, and trust-building are particularly critical competencies in this domain. The research also found variances in what being considered important competencies in different management levels. For general staff, competencies, such as task decomposition and goal establishment, is the key. The competency of policy interpretation and implementation becomes important for the line managers and middle managers. For senior managers, the competencies of encouragement, persuasion, empowerment, and supervision have become key. This research provides practical guidance for leadership development for each management level in a construction organisation to support digital transformation.

Keywords: leadership; competencies; construction; China; digital transformation; information technology

## INTRODUCTION

The fourth industrial revolution have contributed to improvements in multiple traditional industries, such as manufacturing, agriculture, and banking (Ahmed *et al.*, 2022, Trivelli *et al.*, 2019, Zheng *et al.*, 2021). However, as one of the socio-economic pillar industries, the construction industry has faced persistent challenges, including poor cost management, delays, labour shortage, and health and safety risks (Ashraf *et al.*, 2023, Ghazal and Hammad, 2022, Xu *et al.*, 2023). Implementing

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digital and emerging technologies has a potential to address these challenges, improve the industry's overall performance, and support construction organisations' competitiveness in the digital age.

Digital transformation, therefore, has become an important research topic in the construction management discipline, and it has been realised that this is not a simple process of embedding technologies into the construction industry. Ezeokoli *et al.*, (2016) described digital transformation as a paradigm shift in both the internal and external aspects of a construction organisation. Samuelson and Stehn (2023) emphasize that digital transformation is a way to improve the strategic, business, operational, and project-level practices of the organisation. Adekunle *et al.*, (2024) illustrate the meaning of digital transformation is to improve construction output and productivity to achieve project outcomes and better client satisfaction through the adoption of information, computing, communication and connectivity technologies vertically, horizontally and longitudinally. Even though the literature emphasizes the different aspects of digital transformation, one common factor is mentioned, 'creative disruption', which requires a long-term change process and is empowered and driven by digital technologies (Zulu *et al.*, 2023).

Although the industry will benefit from digital transformation, construction organisations are struggling with the digital transformation process. Previous research puts diverse efforts into the feasibility of specific technologies, such as drone technology and visualisation technology, which points out the advantages of the adoption of emerging technologies in construction practice (Rohani *et al.*, 2014, Zaychenko *et al.*, 2018). However, such studies, which focus on the technological aspect, should be complemented with practical guidelines to digitally transform construction organisations. To survive in the new digital business environment, becoming agile and identifying the potential impact of new digital solutions should become a shared mindset and attitude within an organisation, and each employee should be engaged in this process (Schiuma *et al.*, 2022). Digital transformation, therefore, goes beyond traditional technological innovation and more about the creation of new knowledge and viewpoints (Tabrizi *et al.*, 2019).

In this case, effective leadership, is a social aspect that plays critical role in promoting this long-term transformation process in the construction industry (Bolpagni *et al.*, 2022, Woodhead *et al.*, 2018). Alade and Windapo (2020) demonstrated the positive influence of leadership traits, leadership styles, leadership intelligence and effective leadership in the digital age in the construction industry. Zulu and Khosrowshahi (2021) investigated how leaders influence digital transformation in construction organisations. Morgan and Papadonikolaki (2022) listed 10 'dos and don'ts' for leaders during the digital transformation process. Zulu *et al.*, (2023) identified 5 major barriers to effective leadership for digital transformation in the construction industry, including leader's characteristics, management and organisation, technological factors, resource constraints, and risk attitude and perception. Although past research has significantly contributed to the leadership body of knowledge, there is still a lack of understanding of which leadership competencies are critical for digital transformation in the construction industry and the differences of the critical leadership competencies requirement among the difference management levels. This understanding is important to recommend strategies to develop key leadership competencies needed to support such transformation. To fill the above research gap, this paper aims to identify the critical leadership competencies for digital transformation in the construction industry. The research also considers the influence

of management levels in construction organisations in its analysis, discussion, and recommendations.

### **Leadership competencies in the construction industry**

With the deepening of research on leadership, leadership theory is constantly developing, from the initial emphasis on the importance of individual agency to modern research emphasising that leadership is a phenomenon produced by complex interactions with society, environment, and culture. Leadership competency theory is one of the proposed leadership theories, originally derived from the term competency proposed by McClelland (1973). The leadership competency approach can facilitate a more dynamic interaction between leaders and followers than other theories, which improves leaders' performance and provides a strategic advantage to organisations in a competitive environment (Bernthal, 2004, Cardy and Selvarajan, 2006, Joon Yoon *et al.*, 2010). Leadership competency can be defined as the characteristics, mindsets, skills, and behaviours of a leader that contribute to superior performance in leading others (McClelland, 1973, Spencer, 1993, Hollenbeck *et al.*, 2006, Bolden and Gosling, 2006, Chow *et al.*, 2017).

Although the leadership competency approach has been studied broadly, research that focuses on leadership competency in the context of the construction industry in the digital age is limited. Yang *et al.*, (2022) first proposed a leadership competency framework for the construction industry aimed at supporting leadership development during the digital age. They identified 22 leadership competencies, which are further categorised into four domains, including cognitive, interpersonal, business, and strategic. However, this framework is a conceptual framework drawn from past research. Empirical research is needed to further update it and provide details for its application. Identifying the important leadership competencies and unveiling their differences across management levels are steps to progress on this endeavour.

### **METHOD**

A questionnaire survey was used in this research. The questionnaire consisted of two parts. The first part aimed to gather the demographic information of the respondents, and the second part was designed to rate the importance of the leadership competencies. The level of the importance was measured using a 5-point Likert scale (ranging from 1=Very unimportant, 2= Unimportant, 3= Neutral, 4=Important, and 5=Very important). The questionnaire was distributed online to construction practitioners in China using Qualtrics. China's construction industry is one of the world's leading construction industries in digital transformation (Forcael *et al.*, 2020), so collecting data from this context is logical to provide useful insights to advance efforts to promote digital transformation in the sector.

Before collecting data using the questionnaire, we engaged 13 senior-level managers in seven state-owned construction organisations in China to confirm the comprehensiveness of the identified leadership competencies. All interviewed managers have worked more than 20 years in the construction industry, and it is believed that their opinions can create more practical value for the original theoretical framework. The leadership competencies are presented in Table 1, and the questionnaire was developed based on this updated list. All 13 senior managers interviewed in the first phase of the project agreed to distribute the questionnaire to their contacts. This approach successfully attracted a high number of responses. .

IBM SPSS Statistics 27 was used to perform descriptive and inferential analyses of quantitative data software. Descriptive data in this study, including the mean and standard deviation, is applied to rank the importance of the leadership competencies. The inferential analysis, including Homogeneity of variances and one-way ANOVA, is employed to identify the statistical differences among the management levels. Both quantitative data analysis methods have been frequently applied for the similar research aims in the previous research (Toyin and Mewomo, 2022).

Table 1: Leadership competencies

Code	Leadership Competency	Code	Leadership Competency
Cognitive domain		Interpersonal domain	
C1	Open Mindedness and Tolerance of Failure	C9	Social Awareness
C2	Purpose Oriented	C10	Encouragement
C3	Critical Thinking	C11	Persuasion
C4	Gathering and Conveying Information	C12	Collaboration
C5	Learning Agility	C13	Trust-Building
C6	Acting Ethically		
C7	Innovative Thinking and Courage for Implementation		
C8	Conscientiousness		
Business domain		Strategic domain	
C14	Task Decomposition and Goal Establishment	C20	Visioning
C15	Financial Management	C21	Marketing Research and Evaluation
C16	Talent Management	C22	Strategic Planning and Appraisal
C17	Resource Allocation	C23	Digital Literacy
C18	Empowerment and Supervision	C24	Stakeholder Management
C19	Team Building and Coordination	C25	Policy Interpretation and Implementation

## FINDINGS

### Demographic information

A total of 360 responses were received, of which 299 are valid, accounting for 83.05% of the total. Of the 299 respondents, 239 (79.9%) were male, 54 (18.1%) were female and 6 (2.0%) did not state their gender. About 37.1% (111) of the respondents were younger than 35 years old. Respondents aged between 35 and 49, and older than 49 accounted for 33.8% (101) and 29.1% (87) respectively. Among them, 41.8% (128) of the respondents had been working in the construction industry for more than 15 years. In terms of management level, 112(37.5) were at the general staff level (refers to no direct report), 78 (26.1) were line managers (e.g., site supervisor and site engineer), 90 (30.1) were middle-level managers (e.g., project manager and department manager) and 19 (6.4) were senior managers (e.g., general manager and CEO).

### Analysis of Results

Cronbach’s Alpha values for the four competency domains are 0.909, 0.912, 0.904 and 0.924 for Cognitive domain, Interpersonal domain, Business domain and Strategic domain, respectively, indicating the reliability of the questionnaire. Table 2 shows the level of importance of the leadership competencies for digital transformation in the

construction industry. Overall, the mean values for the four domains are: Interpersonal domain (4.02), Cognitive domain (3.94), Business domain (3.91), and Strategic domain (3.83). The respondents considered that the most important leadership competency is interacting with people, which matches the labour-intensive characteristic of the industry (Toyin and Mewomo, 2022).

Table 2: Analysis summary

Code	Mean values for each level of management				Overall Mean N=299	Standard Deviation	Significance (p)
	Group 1 N=112	Group 2 N=78	Group 3 N=90	Group 4 N=19			
Cognitive Domain					3.94	0.606	
C1	3.69	3.85	3.86	4.05	3.80	0.826	0.212
C2	3.74	3.92	3.98	3.95	3.87	0.771	0.142
C3	3.74	4.08	4.00	3.89	3.92	0.697	0.005
C4	3.86	3.95	3.97	4.16	3.93	0.739	0.369
C5	3.85	3.86	3.99	4.05	3.91	0.784	0.467
C6	3.96	4.12	4.02	4.21	4.03	0.814	0.436
C7	3.78	3.88	3.97	3.95	3.87	0.758	0.338
C8	3.97	4.09	4.24	4.37	4.11	0.797	0.047
Interpersonal Domain					4.02	0.667	
C9	3.91	4.08	4.13	4.11	4.03	0.798	0.217
C10	3.83	3.95	4.07	4.32	3.96	0.752	0.024
C11	3.84	3.95	4.09	4.26	3.97	0.770	0.041
C12	3.97	4.10	4.14	4.26	4.08	0.771	0.272
C13	3.89	4.08	4.18	4.37	4.06	0.786	0.017
Business Domain					3.91	0.651	
C14	3.96	4.00	4.11	4.21	4.03	0.759	0.384
C15	3.74	3.91	3.90	4.16	3.86	0.856	0.177
C16	3.75	3.68	3.90	4.05	3.80	0.833	0.166
C17	3.81	3.91	3.94	4.05	3.89	0.761	0.470
C18	3.72	3.83	3.98	4.21	3.86	0.786	0.025
C19	3.92	4.04	4.13	4.16	4.03	0.743	0.189
Strategic Domain					3.83	0.692	
C20	3.59	3.71	3.84	4.11	3.73	0.813	0.025
C21	3.71	3.83	3.87	4.05	3.81	0.820	0.264
C22	3.79	3.76	3.82	4.16	3.81	0.834	0.292
C23	3.69	3.73	3.82	3.89	3.75	0.798	0.556
C24	3.74	3.92	4.00	4.16	3.89	0.812	0.054
C25	3.77	4.00	4.02	4.21	3.93	0.796	0.031

Group 1 =General staff level, Group 2= Line management level, Group 3= Middle management level, and Group 4= Senior management level

The mean values of the leadership competencies range from 3.73 to 4.11, which indicate that the respondents generally believed that all the leadership competencies are important for leading digital transformation in construction organisations. The three most essential competencies are: C8 (Conscientiousness), C12 (Collaboration), and C13 (Trust-Building), with mean values of 4.11, 4.08 and 4.06, respectively. These three leadership competencies suggest that accountability is important for leaders in the digital age, and that leaders should also demonstrate collaboration and

ability to build trust. This finding parallels the findings of Liikamaa (2015) regarding the crucial competencies of project managers. Nevertheless, our emphasis in this paper diverges as we underscore that these competencies hold significant relevance across various levels within construction organisations, extending beyond solely project managers.

Considering the influence of management levels (Group 1 = General staff level, Group 2 = Line management level, Group 3 = Middle management level, and Group 4 = Senior management level) on the results, an upward rating trend is noticeable, showing that as the organisational management level increases, the level of importance for each domain also increases. This aligns with the observation made by Dai *et al.*, (2011), indicating that the significance of leadership competencies escalates with the widening hierarchical distance. Some variations among the groups can also be observed when looking at each competency. For the general staff, and those at line management and middle management, C6 (Acting Ethically), C9 (Social Awareness) and C14 (Task Decomposition and Goal Establishment), are considered important. In addition, compared with the general staff, the line manager and middle manager generally believe the C25 (Policy Interpretation and Implementation) is one of the key competencies to their roles. On the other hand, for senior managers, leadership competencies in the strategic domain and C10 (Encouragement) from the Interpersonal domain are particularly important.

Upon further analysis with the one-way ANOVA test to examine the difference in the level of importance among the four management levels, it was found that there are significant differences in the following competencies: C3 (Critical thinking,  $p=0.005$ ), C8 (Conscientiousness,  $p=0.047$ ), C10 (Encouragement,  $p=0.024$ ), C11 (Persuasion,  $p=0.041$ ), C13 (Trust-Building,  $p=0.017$ ), C18 (Empowerment and supervision,  $p=0.025$ ), C20 (Visioning,  $p=0.025$ ) and C25 (Policy Interpretation and Implementation,  $p=0.031$ ). The post-hoc test was then performed to reveal the sources of the differences.

For C3, there are significant differences between the general staff and line management ( $p=0.011$ ), and the general staff and middle management ( $p=0.046$ ). The general staff did not consider this critical thinking competency as important as the other two groups. Given that the general staff are at the lowest management level in an organisation, they may feel that critical thinking is less important in most situations or tasks because their works tend to focus on performing day-to-day tasks as directed by those in the upper management levels. For C8, C11, C13, C18 and C20, the significant differences have been found between the general staff and middle management ( $p=0.016, 0.022, 0.010, 0.021$  and  $0.026$  respectively) and between the general staff and senior management ( $p=0.045, 0.026, 0.014, 0.012$  and  $0.010$  respectively). Management level again seems to have a strong influence on these differences. For example, demonstrating competency C13 (Trust-building) may be more important to higher-level managers than to general staff. Higher-level managers are required to engage and maintain relationships with more internal and external stakeholders. They need this trust-building competency to build effective interpersonal relationships, promote organisational or project structure stability, and facilitate collaboration (Singh, 2009, Long, 2018). For C10, the significant difference was found between the general staff and senior managers ( $P=0.005$ ). Due to the necessity to lead others to achieve common goals, senior managers are required to demonstrate the competency to encourage others.

## CONCLUSIONS

The study identifies the important leadership competencies for promoting digital transformation in the construction industry. Such investigation has been conducted in other industries, but it is the first time performed in the construction industry context.

The results suggest that all the identified leadership competencies are important for construction leaders in the digital age. Demonstrating these leadership competencies becoming more important the higher the management level is. Leaders' ability to interact with others is particularly important. In developing construction leaders in the digital era, construction organisations should focus on conscientiousness, collaboration, and trust-building for managers at all levels.

Variations among management levels have also been observed. For general staff, besides the above-mentioned competencies, task decomposition and goal establishment, acting ethically, and social awareness are key competencies. For those at the line management and middle management level, policy interpretation and implementation is key. For senior managers, encouragement, persuasion, and empowerment and supervision, are the key competencies.

This research has confirmed the importance of the listed leadership competencies for digital transformation in the construction industry. The findings contribute to the body of knowledge in the leadership competency model and provide guidance for construction organisations in providing effective leadership to facilitate digital transformation. For the incumbents, the results will enable them to identify their areas of strength and weakness. Additionally, the findings indicate differences in the importance of leadership between different levels of management. As the first study to investigate the gap in leadership requirements at different management levels in the construction industry, it provides a more targeted and efficient leadership development reference for practitioners at different management levels, addressing the need for empirical research on this, as argued by Yang *et al.*, (2022)..

Future research could focus on exploring the extent of leadership competency performance and developing a detailed leadership development plan for the construction industry.

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