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Research evolution and thematic breakthroughs in project leadership: A bibliometric analysis

Abstract

Purpose - The development of project managers and leadership has been highlighted as crucial for improving project success and performance, resulting in a rise of interest in project leadership research over the last two decades. While several qualitative reviews have been conducted, there have been limited quantitative and systematic reviews on project leadership. This study fills this gap by portraying the knowledge landscape and tracking the evolution of project leadership research from 1998 to 2022 through bibliometric approaches.

Design/methodology/approach - Based on 816 records, including 793 articles extracted and selected from the Web of Science database and specific journals, and 23 articles selected from three non-SCI/SSCI indexed journals, we used *CiteSpace* and *bibliometrix* R-package to depict visualizations of the trajectory of co-cited references, the landscape of co-occurred keywords, and emerging trends in project leadership via reference co-citation analysis, keyword co-occurrence analysis, and thematic mapping.

Findings - The bibliometric analyses enabled us to understand the conceptual aspects of project leadership and its theoretical background. Three stages of the intellectual bases were identified and tracked: the infancy phase (1998-2007), the growth phase (2008-2014) and the new development phase (2015-2022). The results of keyword co-occurrence analysis indicated that the research focus evolved from investigating traits and competences to examining the effects of traditional leadership behaviors, and then considering context-specific leadership. The findings

of thematic mapping and theoretical interpretation illustrate the potential directions of the competence comparison, new and appropriate leadership, and the interaction between leadership and context.

Originality/value - Our study advanced the field by providing a systematic review of project leadership, developing potential future directions for project leadership research, and providing practical implications for career development and training.

Keywords Project leadership, bibliometric review, scientific visualization, co-citation analysis, co-occurrence analysis

Paper type Literature review

Introduction

Leadership is mainly described as a process of interactions between leaders and followers in permanent organizations (Tyssen *et al.,* 2013). The concept of leadership gradually spread to different fields, and the definitions would vary considerably with the situation or context (Yukl, 2012), and have distinct meanings for the organizations. Leadership in project management (e.g., the personality, skills/competences, and behaviors of project managers), has been proven to significantly influence construction innovation (Chan *et al.,* 2014; Liu and Chan, 2017), construction safety (Wu *et al.*, 2016), and project performance (Lai *et al.*, 2018). Further, project leadership research has undergone a shift from traditional leadership theories (e.g., transformational leadership) to theories of dynamic leadership and its alignment with project context (e.g., balanced leadership) (Alonderiene *et al.,* 2022). Over the years, several leadership

paradigms have emerged in the project leadership literature (Tyssen *et al.*, 2013), such as person-oriented leadership (e.g., transformational and transactional leadership), and interaction-oriented

leadership (e.g., horizontal leadership), situation-oriented leadership (e.g., empowering leadership, and balanced leadership). The theories and leadership categories provided the theoretical basis and pluralism to characterize leadership in temporary organizations. Project leadership not only involved the utilization of the traits, skills, competences and situational behaviors, but encompassed the emergence of potential leaders through team member interactions, toward addressing the complex temporary context and facilitating project success.

The growing interests from academic circles and the desire to unravel the complexity of temporary projects have led to an increasing number of publications and a colorful project leadership research domain. The existing body of knowledge around project leadership provides the opportunity to explore this domain from different perspectives. Some of the studies focus on project leadership at the individual level from a micro perspective. More specifically, Turner and Muller (2005) conducted a review of leadership research in the project context based on the general management literature to identify the competences (profiles) of project managers. Graham *et al.* (2020) reviewed journal articles in the Scopus database (1997-2018) with a focus on the project managers' roles in construction projects, with regard to the vertical, horizontal, and balanced leadership approaches. Ahmed *et al.* (2021) synthetically explored and prioritized the project manager's leadership competencies through the method of systematic literature review. Besides, some studies shift the focus to the domain of project leadership at the organizational or

team level from a meso perspective. For example, Tyssen *et al.* (2013) evaluated the existing leadership theories as they apply to the temporary organizational context and provided a research agenda through the qualitative review approach. Scott-Young *et al.* (2019) developed a multi-level conceptual model around shared leadership in project teams to demonstrate how it might affect individual, team, project, and organizational performance based on a systematic review.

The above-mentioned review studies revealed the project leadership research on the specific leadership (e.g., competences, shared leadership) from the micro individual perspective or meso organization perspective, or on the leadership evolution from a period of time and concerning the specific projects (e.g., construction projects), primarily using qualitative or systematic approaches. Thus, the existing findings left room for studies from a broader vertical systematic perspective through a longer time span to comprehensively explore and interpret the project leadership domain and future development. Future knowledge can effectively detect and portray the mainstreams and trends of project leadership research using quantitative reviews. For example, recently developed approaches (e.g., bibliometric analysis) make it possible to track and assess the knowledge landscape and the evolution of the relevant literature (Zhu *et al.*, 2019b; Wu *et al.,* 2021). In this case, exploring the conceptual evolution and knowledge landscape, and tracing new trends in the project leadership field is important to help researchers systematically understand the details of project leadership and effectively focus on dynamic development. This review aims to depict the landscape, major topics, and emerging trends of the project leadership literature over time using quantitative visualization approaches. This study reviewed published journal articles from January 1998 to December 2022, collected from the Web of Science

database and non-SCI/SSCI indexed journals, and created visualizations of the cooperation network, intellectual bases, evolution of topics, and emerging frontiers of project leadership research using the tools of *CiteSpace, bibliometrix* R-package, and *Python.*

The paper is organized as follows. Section 2 introduced the concepts of project leadership from three viewpoints. Section 3 describes the methodology, including the sampling process and adopted tools of this study. Section 4, 5, 6, and 7 comprises and interprets the bibliometric results including descriptive statistics, reference co-citation analysis, keyword co-occurrence analysis, and thematic network mapping. Section 8 discusses the future directions of the project leadership domain combined with the theoretical interpretation and the results of bibliometric analyses, then illustrates the theoretical and practical implications of this project leadership review. Section 9 demonstrates the limitations and concludes this study.

The concepts and categorization of project leadership

There are different perspectives or schools conveying the leadership meaning or the evolution of leadership. According to leadership recognition in permanent and temporary organizations (Parry and Bryman, 2006; Tyssen *et al.,* 2013), the recognition of project leadership not only focuses on the leader-centered behavior, but relates to the followers and the organizations (Muller *et al.,* 2018a). The first is person-oriented leadership, distinguishing the successful leaders in projects from the traits, or competence perspectives. The viewpoints of trait and competence describe project leadership as the crucial personal traits, and social and emotional competences of leaders for facilitating project success or influencing project performance. In this view, project leadership is a kind of specific assignment requiring particular personality, competencies, qualifications,

strategies, and behaviors for project success. The examples are analyzing project managers' different competences, such as emotional, intellectual, and managerial competences (Dulewicz and Higgs, 2005; Muller and Turner, 2010), or personal traits (Gehring, 2007).

Another stream of leadership research advocated an interactional view, which claims project leadership as a series of interaction styles that imply different organizational climates, or interaction processes wherein managers inspire project members. Examples of specific leadership styles in projects encompass transformational and transactional leadership. The former is a social process wherein project leadership inspires followers by raising visions(Keegan and Hartog, 2004; Yang *etal.,* 2011) , and the latter is a contractual relationship (Tyssen *et al.,* 2014). Besides these vertical leadership styles, project team members might be acknowledged in the interaction of team members or the interaction with the formal leaders to emerge as potential leaders, such as shared leadership (Binci *et al.,* 2016; Hsu *et al.,* 2017) or horizontal leadership (Alonderiene *et al.,* 2022; Muller *et al.,* 2018c).

A situational perspective is another stream of leadership research, describing leadership as dynamic and effective when leaders' characteristics or behaviors match the project environment. Certain leadership behaviors should be performed in specific projects (Muller and Turner, 2010), and leadership can be selected and performed according to different contextual factors, including formal empowerment, task structure, project complexity, and uncertainty (Tyssen *et al.,* 2013). For example, participative leadership is appropriate for complex projects with skilled employees and a lack of formal authority, and this can be useful for projects in which new products are being developed (Akgun *et al.,* 2007). Balanced leadership in projects can be taken as the dynamics of

shifts in leadership between project manager and team members for the accomplishment of project goals (Pilkiene *et al.,* 2018; Alonderiene *et al.,* 2022; Drouin *et al.,* 2021).

Taken together, the competence-based view of project leadership mainly focuses on individual abilities and traits from a micro perspective. Considering the characteristics of a project or its temporary, contextual features, the paradigms of interaction-oriented and situation-oriented leadership focus on the team interaction process, and the matched and functioning conditions. Thus, project leadership can be characterized in this study as the integrative application of leaders' traits, competences, and situational behaviors that align with the complex temporary context. It also involves the emergence of outstanding horizontal leaders through interactions among formal leaders and team members, all aimed at affecting and enhancing project-related tasks and goals.

Methodology ***Research design***

The bibliometric mapping method applied in this study involves a set of scientometric analyses, such as the co-citation analysis, keyword occurrence analysis, and thematic network mapping to answer the questions, determining and quantitatively displaying research hotspots, research front terms, and topic development dynamics of the project leadership research field using knowledge domain visualization (Liu and Gui, 2016; Cobo *et al.,* 2011b; Borner *et al.,* 2003).

The SALSA framework (i.e., *Search, Appraisal, Synthesis,* and *Analysis)* developed by Papaioannou *et al.* (Papaioannou *et al.,* 2016) can be adopted as an unbiased approach to conduct

literature review, and the methodological procedure has also been used in the project management field (Rezende *et al.,* 2018). The methodological process involves four stages, and the overall research flowchart is described as follows and illustrated in Figure 1.

[Insert Figure 1 about here]

Bibliometric search and sample appraisal

Regarding the first stage, i.e., data search, illustrated the search strategy. In line with prior research (Zhu *et al.,* 2019b; Tao *et al.,* 2020), the Web of Science core citation database was used as the data source, and the data of project leadership research from 1998 to 2022 for this study was collected and updated to December 2022. The project leadership-related data from Scopus database has been analyzed by Graham *et al.* (2020). Further, in this study, is reviewed from the core citation database of Web of Science (WoS), and the publication data on project leadership research was exclusively collected in the areas of project management (PM) and construction engineering and management (CEM). The terms like "leadership" and "project leader*"' and additional leader-related terms like "manager", or "supervisor", and the main leadership types as "trans* leadership" in the title, abstract, or keywords were adopted in the selected PM and CEM journals. The leader-related terms with the term "project" were also searched in the four leadership journals. Specifically, the choice of these research areas was based on the analysis of three important PM journals (i.e., *International Journal of Project Management (IJPM), Project Management Journal (PMJ),* and *International Journal of Managing Projects in Business (IJMPB)* and ten important CEM-related journals (i.e.; *Journal of Management in Engineering (JME); Journal of Construction Engineering and Management (JCEM); IEEE Transactions on Engineering Management (IEEE-TEM); Journal of Civil Engineering and Management (SCEM);*

(ECAM); Building Research and Information (BRI); Journal of Computing in Civil Engineering (JCCE); Journal of Engineering and Technology Management (JET-M); Automation in Construction (AIC); and *Journal of Civil Engineering Education (EIENG)* (previously: *Journal of Professional Issues in Engineering Education and Practice*). We also added project leadership research from four leadership journals in management research areas (i.e., *The Leadership Quarterly (LQ), Journal of Leadership & Organizational Studies (JLOS), Leadership & Organization Development Journal (LODJ),* and *Leadership (LEA)).* Most of these selected important PM and CEM journals have been identified and used in prior studies (e.g., Bakhshi *et al.* (2016) and Luo *et al.* (2017)). Besides, some journals concerning project leadership and construction management, which are not in the SCI/SSCI database were also important (e.g., *Construction Management and Economics (CME),* and *International Journal of Construction Management (IJCMf)* or significantly related to the topic of project leadership (e.g., *Project Leadership and Society (PLS)),* were selected and manually checked.

During the appraisal stage, the title, abstract, and keywords of each record were scrutinized by two coders to remove any records that did not report on project leadership-related research. These steps produced a total of 2,409 original records between January 1st, 1998, and December 31st, 2022. After two rounds of checking and coding by two independent coders, 1,616 records were manually eliminated, so that the publications would not reference project leadership or used the word "leadership" to study other issues (e.g., Leadership in Energy and Environmental Design (LEED)). Finally, 816 project leadership-related records and 36,584 reference documents were obtained, including 793 project leadership-related records from these PM and CEM related

SCI/SSCI journals and 23 articles manually selected and coded from three journals not in the SCI/SSCI database.

Scientometric synthesis and analysis

In the synthesis stage, the extracted and checked articles as the input data were analyzed the intellectual base, research focus, and research front from the cited references and the citing articles using the analytic tools including *CiteSpace* version 6.25 (Chen, 2006), and *bibliometrix* R-package version 4.1.2 (Aria and Cuccurullo, 2017). Specifically, *CiteSpace* as a Java-based scientific visualization software developed by Chen (2006), is employed in this study to implement two functions: analyzing the intellectual bases from the cited references through the co-citation network analysis and exploring the topic clustering of the cited articles through the keyword co-occurrence analysis (Hou *et al.,* 2018). The *bibliometrix* R-package software is an open-source statistical R-tool for quantitative research in bibliometrics and scientometrics (Aria and Cuccurullo, 2017). This visualization tool is adopted to depict the thematic keywords map on the two axes of density and centrality to represent the advancement and relationship of themes to help infer the future directions of project leadership through the emerging and developed themes (Gholampour *et al.,* 2022; Mahi *et al.,* 2021). Additionally, due to the incompatibility of a few records originating from non-SCI/SSCI indexed journals with the aforementioned analytical tools, these records were converted to the WoS format and also analyzed using *CiteSpace* and *bibliometrix* R-package. For parsimony, some descriptive figures and Tables are demonstrated in online supplemental materials.

During the analysis stage, the results of co-citation analysis, keyword co-occurrence

analysis, and thematic mapping network were interpreted and revealed to help understand how the project leadership research mainstream developed and evolved over time, and what will primarily be the current focuses, then to infer the future directions of project leadership.

Results

Descriptive statistics

Descriptive statistics of publications

The 816 articles were summarized according to publication year from 1998 to 2022. As shown in Figure S1 in the supplementary materials, the distribution generally indicated an upward trend in the number of project leadership publications. Specifically, fewer than 10 articles per year concerning project leadership were published before 2008. However, the number of published articles increased in 2009, making up about 90% of the total literature, indicating the growth of academic interest in project leadership from that time on.

Besides the publication distribution over time, we also found that most of the studies were published in the top journals in the fields of project management and construction management (see Figure S2). These journals were *IJPM, PMJ, JCEM, JME, IJMPB,* and *ECAM*. They provided the fertile ground for the development of the topic of project leadership. Moreover, most project leadership studies adopted the following empirical research methods (71%, see Figure S3). More specifically, the empirical research consisted of surveys (55%), interview (10%), statistical analysis (3%), and experiments (2%), indicating the most commonly used data-collecting method of questionnaire survey. Case studies (12%) and theoretical descriptions (8%)

were the other two popular methods used to explore or explain the effects of project leadership. Additionally, the project types mentioned in these articles involve large-scale projects (e.g., megaprojects, infrastructure, and construction projects), information technology (IT) projects (including software projects and information system development projects), technology projects, research and development (R&D) projects, and innovation projects (e.g., cooperative innovation, open innovation).

Countries, institutions and authors co-authorship analysis

The contributions of different countries and institutions to project leadership domains were investigated and visualized using *bibliometrix* R-package. Co-authorship among different countries is indicated in Figure 2, and the top 10 productive countries and institutions during this period are listed in Table 1. As evident from Table 1, China (n = 366) was the most productive country with the largest number of publications on project leadership during this period, followed by USA (n = 327), Australia (n = 231), UK (n = 120), Pakistan (n = 71), Canada (n = 54), Netherlands (n = 45), Brazil (n = 40), Norway (n = 35), and Germany (n = 33). In the top 10 most productive institutions, Australian organizations ranked first, including Queensland University of Technology (n = 32), and RMIT University (n = 30). The institutions from China were also productive in the domain of project leadership, including Tongji University (n = 32), Tianjin University (n = 28), Tsinghua University (n = 20), and City University of Hong Kong (n = 14). Besides, as indicated in Figure 2, the blue color shade represents the publications and the red link depicts the cooperation relationships. Specifically, the darker the blue, the more productive the country is in terms of project leadership-related publications (Mahi *et al.,* 2021). Thus, the

country co-authorship map indicated that the USA, Australia, China, and UK were the collaborative countries in publishing research in project leadership.

[Insert Table 1 about here]

[Insert Figure 2 about here]

The 10 most prolific authors publishing on project leadership-related research are listed in Table 1. Ralf Muller, from BI Norwegian Business School (Norway), was the author with the highest number of project leadership-related articles (19 total, focusing on horizontal leadership). Helen Lingard from RMIT University (Australia, 11 articles, focusing on occupational health and safety) was the second most prolific author. Chinese scholars like D.P. Fang from Tsinghua University (focusing on safety leadership), L.Y. Zhang from Tianjin University (focusing on project performance management), and F.W. Zhu from Dalian University of Technology (focusing on project-based organization management) all published 8 articles on the topic of project leadership. Figure 3 presents the cooperation network of authors without the isolated authors. This network consists of 10 collaboration clusters. The largest cluster involves researchers such as Ralf Muller and F.W. Zhu, who collectively collaborated to publish the articles associated with vertical leadership, horizontal leadership, and balance leadership in projects.

[Insert Figure 3 about here]

Reference co-citation analysis: intellectual base development of project leadership literature

Reference co-citation maps display a network of co-citation links (Liu *et al.,* 2015). A reference co-citation network can be used to visualize the landscape and intellectual bases of a research domain (Ramos-Rodriguez and Ruiz-Navarro, 2004). Figure 4 depicts the co-citation timezone visualization of references using *CiteSpace.* For example, prior to 2008, few references emphasized the specific competencies or competency profiles of project managers. The literature between 2008-2014 has examined the correlation between the leadership styles (e.g., transformational and transactional leadership) and project outcomes. The subsequent references published after 2015 have delved into emerging subjects pertaining to project leadership, including but not limited to horizontal leadership, team issues, trust, and safety considerations. Combined with the fast-growing publication in 2008 from the descriptive statistics, and the above-mentioned conceptual perspective development from the person-oriental view (mainly focusing on traits and competencies), traditional style view (e.g., transformational and transactional leadership) to the interactional and situational view (e.g., horizontal and balanced leadership), then the development of intellectual bases for project leadership can be divided into three stages according to a period of about seven years: the infancy phase (1998-2007), the growth phase (2008-2014), and the new development phase (2015-2022). Besides, Table S1 (in the supplemental materials) lists the most influential co-cited articles in the reference co-citation map. It represents landmark works in the literature (Tsai and Wu, 2010).

[Insert Figure 4 about here]

The infancy phase: 1998-2007

Although there are not many co-cited articles in this stage, as shown in Figure 4, the literature laid the foundation for the development of theories of project leadership. Specifically, the methodology articles support the questionnaire survey and analysis for project leadership research (Bolger *et al.,* 2003; James *et al.,* 1984). The leadership style of the project manager has been identified as a critical factor for project success (Turner and Muller, 2005). The operation of team activity and product development provides the environment for leadership practice (Ancona and Caldwell, 1992; Brown and Eisenhardt, 1995). Moreover, scholars mainly focus on the competence of project managers, exploring how they can develop and evaluate their project management skills to improve their performance (Crawford, 2005). Intellectual, emotional, and managerial dimensions have been identified as areas of competence for project managers, and being skilled in these areas can ensure the success of a project (Muller and Turner, 2007; Sunindijo *et al.,* 2007). Besides the competence of managers, personality traits (e.g., managerial and entrepreneurial traits or vocational personality types) have also been identified as important for project success (Dvir *et al.,* 2006). Thus, traits and competences are the primary themes related to project leadership, providing the foundation for leadership development in projects.

The growth phase: 2008-2014

In this period, there were many classic references that were frequently cited. Leadership has been identified as an important "soft" skill that helps to ensure *esprit de corps* and teamwork (Bakker, 2010). The competence school of leadership has been explored and emphasized in projects (Clarke, 2010; Geoghegan and Dulewicz, 2008). The match between project management competence and project types has been highlighted in many projects, such as

projects relating to information systems (Skulmoski and Hartman, 2010), as well as projects relating to engineering and construction (Muller and Turner, 2010). Furthermore, the visionary or charismatic school of leadership emerges as important in this period. For example, Yang *et al.* (2011) identified the importance of transformational and transactional leadership for teamwork and the success of projects. Kissi *et al.* (2013) focused on the effect of transformational leadership on portfolio managers on project performance. Tyssen *et al.* (2014) proposed that transactional leadership might be effective under conditions with short durations or clear project goals. Third, scholars also developed the leadership styles combined with the competence profiles to deal with the complex, dynamic environment, such as communication, level of selfmonitoring, and conflict management style (Creasy and Anantatmula, 2013), goal-oriented leadership competency profiles (Muller and Turner, 2010), and project management leadership (Mir and Pinnington, 2014). Moreover, the abilities and practices of project managers are highlighted in mega-project management. They help leaders face distinctive challenges and dilemmas (e.g., when projects are over budget or over time) (Flyvbjerg, 2014). Additionally, the empirical methods are also the mainly used techniques in this period to investigate the behaviors of project managers, thus the methodology bias control cannot also be ignored (Podsakoff *et al.,* 2003).

The new development phase: 2015-2022

The discussion of project leadership in this period focuses on the types of leadership in projects and the associations with project outcomes. Different types of leadership styles are explored as ways of enhancing project performance or project success via team-building (Aga *et*

al., 2016), and regulatory focus (Lai *et al.,* 2018). As well as the traditional leadership schools, new leadership styles such as shared leadership (Binci *et al.,* 2016; Hsu *et al.,* 2017), horizontal leadership (Muller *et al.,* 2018a; Drouin *et al.,* 2018), and balanced leadership (Alonderiene *et al.*, 2020) are developed and investigated in terms of project governance and project performance. Also, project mangers' competences (e.g., emotional intelligence) are seen as a way of improving the likelihood of project success in combination with traditional leadership styles (Maqbool *et al.,* 2017), via trust and satisfaction (Rezvani *et al.,* 2016). Besides, the behavior of project managers besides leadership behaviors is emphasized when it comes to changing projects, such as voice behavior (Ekrot *et al.,* 2016). Moreover, leadership could be used to cope with the complexity and uncertainty of megaprojects (Sankaran, 2018), and construction safety (Fang *et al.,* 2015). Studies show that project managers and leaders should develop greater knowledge, skills, and competences in addition to the general responsibilities of decision-making (Hu *et al.,* 2015), and they assume responsibility when coordinating stakeholder management (Lehtinen *et al.,* 2019), and expressing passion and energy as an important governance approach for the megaproject (Zhai *et al.,* 2017).

Keyword co-occurrence analysis: research hotspots for the evolution of project leadership

The hot research topics related to project leadership can be determined using keyword co-occurrence analysis (Liu *et al.,* 2015). Table S2 presents the co-occurrence frequency of related high-frequency keywords from 1998 to 2022 in supplementary materials. Figure 5 presents the keyword co-occurrence clustering visualization graph for project leadership research from 1998

to 2022. Table 2 indicates the specific terms of the clusters over three periods. Figure S5 describes the high-frequency items extracted from titles, abstracts, and keywords through word cloud plots for three outside SCI/SSCI indexed journals. The results of the keyword cooccurrence analysis and clustering analysis indicate the research hotspots relating to project leadership.

[Insert Figure 5 about here]

[Insert Table 2 about here]

From individual personnel management to the development of leadership behaviors and competences (1998-2007)

As indicated in Figure 5, scholars first focused on the management styles of project managers or professionals in this period. As shown in Table 3, the following labels emerged as important labels and keywords such as "#0 innovation management", "#2 managing technical professionals", "#3 technology management", "#5 age differences" and "#7 cultural diversity". The following terms are critical labels in the clusters: "technical leadership", "knowledge", "top management team", "gender differences", and "project integration". At the early stage, scholars focused not only on personnel management but also on leadership development from the perspective of individuals. Specifically, the effective management and application of the technical and administrative skills of professionals are highlighted (Cordero *et al.,* 2004). Leadership behaviors are perceived as ways of enhancing the effectiveness of leaders and project performance (Chan and Chan, 2005; Skipper and Bell, 2006). Also, the competences of project managers, like self-control and flexibility, are identified as critical for construction management (Dainty *et al.,* 2005).

From the leadership development to the exploration of specific leadership competences and behaviors (2008-2014)

In this period, scholars observed the importance of specific leadership competences like emotional intelligence, the critical role of project manager, and the significance of personnel management. Specifically, "#0 emotional intelligence", "#6 project manager", "#7 personnel management", emerged as clustering term labels, as indicated in Table 3 and Figure 5. The following keywords occurred frequently: "transformational leadership", "transactional leadership", "temporary organizations", "manager-employee relationship", and "human factors", etc. Thus, emotional competence and the transformational and transactional schools of leadership are the main research focuses at this stage. Clarke (2010) identified the roles of emotional intelligence and transformational leadership in project management and identified the relationship between emotional intelligence and transformational leadership. Emotional intelligence is beneficial for leadership in groups or teams (Cote *et al.,* 2010). Transformational or transactional leadership can enhance project success (Yang *et al.,* 2011) and project performance (Kissi *et al.,* 2013). The positive roles are highlighted in the context of dynamic, temporary projects (Gundersen *et al.,* 2012; Tyssen *et al.,* 2013).

From the single leadership style to the contingency perspective of leadership (2015-2022)

During this period, the significant importance of leadership for project performance is emphasized. Also, the match for the specific or distinct conditions in projects is observed (Larsson *etal.,* 2015). As shown in Figure 5, the following emerged as the clustering terms: "#2 transformational leadership", "#3 project success", "#6 stakeholder relationships", and "#8 technological innovation". The roles of leadership are explored for their different outcomes rather

than the general success of projects. Outcomes such as safety (Fang *et al.,* 2015), knowledge sharing (Zhang and Cheng, 2015), team learning (Savelsbergh *et al.,* 2015), and relationship management (Meng and Boyd, 2017) are explored. Furthermore, the impact of leadership is examined from the perspective of contingency. Project managers' behaviors or competences must adapt depending on the unique characteristics of a project (Takey and Carvalho, 2015; Larsson *et al.,* 2015), such as pressure (Gallagher *et al.,* 2015), dynamics (Collyer, 2016), and complexity (Princes and Said, 2022). They must also adapt depending on the type of project, for example, mega-projects (Sankaran, 2018), multiple-projects (Patanakul *et al.,* 2016), and programs (Shao, 2018). Additionally, some new leadership types are explored in this period, including benevolent leadership (Gumusluoglu *et al.,* 2017), shared leadership (Hoegl and Muethel, 2016; Novoselich and Knight, 2018), horizontal leadership (Muller *et al.,* 2018a; Drouin *et al.,* 2018), ethical leadership (Wan *et al.,* 2020), and humble leadership (Ali *et al.,* 2020). Leadership emergence and followership are also examined (Li *et al.,* 2020a).

Besides, as indicated in Figure S5 plotted using the data from the non-SCI/SSCI indexed journals, some case examples draw scholars' attentions, such as Hong Kong (Wong *et al.,* 2007), and Turkey (Giritli and Oraz, 2004), and surveying is the widely used approach (Cheung *et al.,* 2007). Empower or power authority has been the primary practice of project leadership (Ahmed and Philbin, 2022; Fellows *et al.,* 2003), and the influencing outcomes involve occupational safety (Grill *et al.,* 2019), and commitment (Famakin and Abisuga, 2016). Some challenges in contemporary projects have been linked with project leadership, including digital innovation (Zulu and Khosrowshahi, 2021), and environment management (Urton and Murray, 2021).

Thematic network mapping: research orientations for project leadership

The thematic map can be used to depict the historical research orientations based on the detection of burst terms to reflect the thematic evaluation and infer future directions (Mahi *et al.,* 2021; Belfiore *et al.,* 2022). The thematic map of project leadership was developed using the *bibliometrix* R-package, as indicated in Figure 6. It is composed of four quadrants organized by centrality (X-axis) and density (Y-axis). Centrality reflects the correlation of distinct topics (Cobo *et al.,* 2011a), and density is the cohesiveness of these topics and can be taken as a measure of the topic's development degree (Belfiore *et al.,* 2022). The higher the centrality, the more important it is in the network. Similarly, the higher the density, the stronger the capability to develop and sustain the network (Agbo *et al.,* 2021).

[Insert Figure 6 about here]

The first quadrant in the upper right region represents the motor (or driving) topics with high centrality and high density. These include the themes of "technological innovation", "safety", "job burnout", "shared leadership", "project teams", and "vertical leadership". These themes are developed based on their importance and association, such as the relationship between horizontal leadership and team members' job burnout (Liu *et al.,* 2021a), the role of leadership for innovation (Strang, 2011; Lin and McDonough, 2011), and the safety-specific practices of supervisors or managers (Lingard *et al.,* 2012; Chen *et al.,* 2013).

The second quadrant in the upper left region represents specialized and isolated themes with high density but low centrality. These include the specialized topics of "organizational issues",

"behavior", and "authentic leadership". Scholars in this field mainly explore specific topics like the role of certain leadership (e.g., authentic leadership) in projects (Lloyd-Walker and Walker, 2011; Todt *et al.,* 2019), and the leadership practices for issues in construction companies (Lowstedt *et al.,* 2021; Nawaz Khan *et al.,* 2020), and the issues like risk management (Liu and Chiu, 2016).

The third quadrant in the lower left region contains the emerging or disappearing themes with low centrality and low density, including the topics of "competencies", "mega-projects", and "organizational learning". Specifically, the exploration of the appropriate leadership approaches associated with the current project type has resulted in the exploration of new attributes of leadership (Luo *et al.,* 2022), and the new leadership for megaproject management as emerging themes (Zaman *et al.,* 2022), as well as the identification of the individuals' competences or personality relating to contractors rather than the traditional project managers (Deep *et al.,* 2022).

The fourth quadrant in the lower right region includes the basic and transversal themes with high centrality but low density, indicating that some themes are basic and necessary for project leadership research. These include "project management", "construction workers", "project manager", "project success", and "project performance". These themes imply that productive research on the relationship between project manager's leadership and project outcomes such as proj ect success (Rezvani *et al*., 2016; Aga *et al*., 2016), and proj ect performance (Lai *et al.,* 2018; Chen and Lin, 2018), or construction safety-related consequences like construction workers' behavior (Liu *et al.,* 2021b; Xia *et al.,* 2021), which are fundamentally beneficial to the

development of project leadership.

Discussion

The theoretical interpretation and future directions for project leadership

Combined with the clustering terms listed in Table 2, some mainly used theories emerge as important terms in different clusters. Further, we manually conduct the statistics of the applied theory in the project leadership research. Then the theoretical application would be interpreted based on the existing studies, and the future directions can be inferred according to the theoretical interpretation and the above-mentioned bibliometric analyses.

Potential direction for extending the comparison of project managers ' competences and behaviors

The planned behavior theory states that behavioral intention can be affected by the individual attitude, subjective norms, and motivations, and it is the best way to predict and interpret the behavioral outcome (Ajzen, 1991). This theory provides evidence for the technology acceptance and adoption (Morris *et al.,* 2005), and other specific behaviors (e.g., relational behaviors (Zheng *et al.,* 2018), or waste reduction (Yuan *et al.,* 2018)) for managers and professionals. Although scholars have noticed the importance of behavioral intention, the intentions alone might not be the sufficient cause of behavior (Sutton, 1998), and there may be other variables (e.g., identity) to explain the intention (Rise *et al.,* 2010).

Social identity theory highlights self-categorization, demonstrating people's perception of belonging to a team or an organization (Brown, 2000). Transformational project managers can impact project members' work outcomes through project

identification (Ding *et al.,* 2017). Benevolent leadership can also inspire innovative behavior through team identification and department identification (Gumusluoglu *etal.,* 2017). The complex project context also provides the identifications for project managers to perform different tasks (Fang and Zhang, 2021). However, social identity may dynamically vary with the individual age and experience, and negative identities rather than positive identities are often overlooked (Miles, 2012).

Thus, future research could further refine the knowledge concerning project managers' competences and behaviors by comparing demographic differences (e.g., gender, age, working experience, etc.) (Ram and Ding, 2018), and exploring the relationship between project managers' competences and success in different contextual scenarios (e.g., cultures (Shao, 2018); power (Wynn *et al.,* 2021)). Researchers highlighted the validity, reliability, and generalization of the identified results of project managers' competences in light of the limited sample sizes used (Ram and Ding, 2018; Ballesteros-Sanchez *et al.,* 2019). Future research could consider extending the sample of project managers to cover different project types, departments (e.g., government and industry), or countries (e.g., developed countries and developing countries) to identify the differences of the competences and differentiate the multi-identities across these different situations (do Vale *et al.,* 2018; Floris and Cuganesan, 2019; Li *et al.,* 2020b).

Potential direction for enriching the mechanisms and paradigms ofproject managers' leadership

Social exchange theory and leader-member exchange theory are usually used to describe the mechanisms that influence project leadership or leadership-related variables. The main viewpoint in social exchange theory is that individuals tend to develop and maintain relationships with

people in the expectation that it will be rewarding (Blau, 2017). Leader-member exchange theory is a specific example of social exchange theory, mainly focusing on the social exchanges between leaders and members (Graen and Uhl-Bien, 1995). Liu *et al.* (2020) analyzed the impact of leader-member exchange relationships in work and non-work domains on the behavior of construction workers. Based on the idea that good leader-member exchange relationships facilitate beneficial outcomes, scholars have explored how leadership enhances project success, including transformation leadership (Kabore *et al.,* 2021) and inclusive leadership (Khan *et al.,* 2020). Further, project managers can also play a positive role as role models for learning. Social learning theory argues that team members observe, imitate, and learn from the behavior of leaders (Bandura, 1979). Ethical leadership can enhance project success by increasing trust in a leader and encouraging knowledge sharing (Bhatti *et al.,* 2021). Servant leadership can affect project team performance by encouraging knowledge sharing and creating a collaborative culture (Nauman *et al.,* 2022). However, it is also important to emphasize the clear description of the exchange relationship (Cropanzano and Mitchell, 2005), and the appropriate observable and learnable leadership behaviors of project managers (Fulmer and Ostroff, 2017).

Thus, suitable leadership for projects except for the traditional leadership and the influencing mechanisms should be explored in regard to their effectiveness in temporary organizations (Raziq *et al.,* 2018). For example, Latif *et al.* (2020) explored the impact of entrepreneurial leadership on project success based on the knowledge perspective. Ali *et al.* (2020) investigated the impact of humble leadership on team building and project success. Wan *et al.* (2020) examined the effects of paternalistic leadership on the behavioral integration of top management teams in the context of megaprojects. Moreover, the results of the keyword occurrence and thematic map also

revealed that keywords including “shared leadership” and “horizontal leadership” indicate rapidly emerging areas of project leadership research. These findings shed light on the emergence of leaders from team members and the transition of leadership between project managers and team members. To understand the transition between vertical and horizontal leadership in proj ects, we suggest that future studies focus on the transfer of leadership at different project-related levels, such as the task level, project level, and portfolio level (Pilkiene *et al.,* 2018). In addition, due to the complicated relationship between vertical leadership and shared or horizontal leadership, it would be valuable to investigate the possible ways in which different types of leadership interact with each other (Hsu *et al.,* 2017).

Potential direction for considering the interaction between project managers and the contexts

The social cognitive theory describes that human action would be caused by personal factors (e.g., cognition) and the environment (Bandura, 2001). Specifically, the impact of transformational leadership on project success could be transmitted by self-leadership and moderated by empowerment conditions (Ahmad *et al.,* 2022). Information processing theory also explains the mechanism of project leadership from the perspectives of information cues, suggesting that the environment or context can be read as different rules to regulate attitudes and behaviors (Salancik and Pfeffer, 1978). The presence of horizontal leadership provides information regarding equivocal opportunities for career development (Liu *et al.,* 2021a). The leaders’ job insecurity as an important cue would also influence project members’ job performance (Wan *et al.,* 2022). Besides, the uncertainty and complexity of the projects (Sakka *et al.*, 2016), and the characteristics of the top management team (Yi *et al.*, 2018) could also play

an important role in affecting performance consequences. Hence, the significance of the contextual factors, especially the environmental uncertainty, and complexity, are recommended to deeply highlight and explore in future research.

The topics of "mega-project", and "stress" have become emerging or developed keywords, as indicated by the thematic network in Figure 6. We suggest that future explorations of project leadership should be examined in combination with the specific characteristics of contexts. Furthermore, considering the importance and the increasing number of megaprojects globally, more studies are needed to explore the program management standard for megaproject management (Hu *et al.,* 2015). Moreover, comparing the management practices or approaches in subprojects within a large megaproject might be a fruitful avenue for future research (Zhai *et al.,* 2017). It is particularly valuable to understand both the similarities and differences in the management of mixed-nationality subprojects within international megaprojects.

Potential direction for applying new techniques for behavioral detection and investigation

The quantitative methods including the questionnaire survey and the statistical analysis have been mainly used to explore the effects of project leadership. The single-case study has also been the primary method of megaproject management research to date (Hu *et al.,* 2015; Lehtinen *et al.,* 2019). However, new methods like machine learning and different data collection such as the internet secondary data (e.g., LinkedIn) are recommended to extend and explore the career development of construction professionals (Hickey *et al.,* 2022).

Although most existing studies applied quantitative methods (e.g. large-scale surveys) to verify their empirical results, multi-source research design (Raziq *et al.,* 2018), multi-time points survey (Zhu *et al.,* 2019a), longitudinal studies (Lai *et al.,* 2018; Ding *et al.,* 2017), and experimental studies (Zaman, 2020) were recommended to reduce the issue of common method variance and explore causal inference. Besides, we also suggest more research or crossvalidation to ensure the generalization and validity of the results from single-case studies with other methods, such as qualitative methods or secondary archival data methods (Hu *et al.,* 2015; Sankaran, 2018; Lehtinen *et al.,* 2019; Zhai *et al.,* 2017). The exploration of quantitative methods (e.g., case studies) and qualitative methods (e.g., longitudinal studies or multi-wave data) would enhance the generalizability of the results and cross-validate the mechanisms and boundaries among leadership behaviors at different project stages (Binci *et al.,* 2016; Hsu *et al.,* 2017; Muller *et al.,* 2018a; Muller *et al.,* 2018c). Furthermore, the new method application like social network analysis is recommended as a way to study how leadership emerges from within the project team (Novoselich and Knight, 2018).

Theoretical and practical implications

This bibliometric review contributes to the project leadership literature in several ways. First, this study clarifies the conceptual viewpoints of leadership in projects and offers a systematic and comprehensive overview of the landscape, mainstreams, and frontiers of project leadership research from 1998 to 2022. Based on the data from the selected PM and CEM journals, and the crucial journals outside the WoS database, this broader and quantitative literature review reveals

the importance of project leadership, and the multiple influencing mechanisms for facilitating project success and project performance. Second, this review study depicts how the major topics of project leadership research change over time by tracing the evolution of different topics in project leadership literature. This study links the major topics and trending themes through the bibliometric findings, to assist readers in understanding the associations between mainstream research and emerging trends, and conduct the in-depth exploration and discussion for the intellectual structure and research transition path of project leadership. Third, combined with the bibliometric analyses, this study summarizes the widely used theoretical perspectives in project leadership research to potentially help infer future directions, and also provide the theoretical and methodological references for further exploration. Specifically, the theoretical utilization and topic transitions highlight the importance of contextualization. The cross-cutting challenges like technological innovation, complexity, and resilience provide urgent demands, new knowledge, and frontier issues for developing project leadership (Whyte *et al.,* 2022).

This review also provides practical implications for practitioners. First, the project manager could recognize their crucial role and regulate appropriate management measures based on the context to affect project members and project outcomes. Specifically, the right leadership could facilitate trust and knowledge sharing (Bhatti *et al.,* 2021), and cultivate collaborative culture (Nauman *et al.,* 2022). Second, the findings also could provide potential programs to train project managers and team members. For example, the leader's self-efficacy is beneficial to deal with environmental uncertainty and enhance project success (Zaman *et al.,* 2023). The abilities of risk tolerance and strategic management for managers are also conducive to innovation activities

(Mishra, 2021). The project member could be cultivated as the leader candidate like the horizontal leader through different strategies including empowerment, nomination, and identification (Muller *et al.,* 2018b; Yu *et al.,* 2018; Drouin *et al.,* 2018). Additionally, formal project leaders or potential horizontal leaders in projects should understand the broader responsibility and learn the new knowledge to address issues in contemporary projects, such as integrating the changing technologies into the innovation, degrading emerging complexity and uncertainty, and meeting the sustainable demands.

Conclusion and limitations

Limitations

This study has several limitations. First, the sample was restricted to specific journals. We restricted the selection boundaries to journals focusing on the areas of project management, construction and engineering management, and leadership in Web of Science since 1998, but there may be some project leadership studies to be found in other disciplines. For example, conference papers and books regarding project leadership were excluded from this study. Although three journals outside the Web of Science database are selected and separately analyzed using *Python,* due to the mainly concerned project type being construction projects, some journals concerning IT or R&D projects might be ignored.

Second, although a comprehensive landscape mapping of the development of project leadership from 1998 to 2022 was highlighted in this review, this literature search could be refined using different, critical subareas in project leadership in future studies. Moreover, the

visualization tools like *CiteSpace and bibliometrix* R-package were used to conduct the cocitation and co-occurrence analyses within the sample boundaries. Other mapping tools may be more suitable for conducting a different or more in-depth analysis. Comparison and optimization of the visualization results could be considered in future research. Moreover, while bibliometric approaches are quantitative, they do not capture the specific and exact relationships between project leadership variables and other related factors. Additional analyses like meta-analysis, or a combined bibliometric analysis and systematic review, could be Vsed to develop a comprehensive framework to portray the correlation between project leadership and key factors in the context of temporary projects.

Conclusion

Although leadership has been a critical factor for facilitating performance in the project context, until now there has not been a comprehensive bibliometric review to visualize the knowledge landscape and the research focuses of project leadership, and to trace the research trends of project leadership. To address these research gaps, the data of more than 700 journal articles from the WoS database were reviewed, and scientometric approaches and the visualization tools *CiteSpace* and *bibliometrix* R-package were applied to detect highly productive institutions, the co-authorship network, development of intellectual bases, research hotspot evolution, and research fronts within the project leadership literature. This study discussed and identified the conceptual viewpoints, and explored three stages of the development of intellectual bases and the evolution of research hotspots for project leadership based on co-citation and co-occurrence analyses. It also detected research fronts using thematic networks. Through the bibliometric analyses and theoretical interpretation, this review provides a

systematic understanding of the landscape and emerging topics in the project leadership literature and identifies important trends for future research, and also offers practical implications for the career development and training programs concerning project managers and members.

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