Playing the cards right: Exploring the way leadership influences organizational citizenship behavior for the environment in megaprojects

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Abstract

Purpose—Organizational citizenship behaviors for the environment (OCBEs) represent a crucial element of environmental sustainability for a wide range of organizations. However, the leadership mechanisms underlying OCBEs are as yet unexplored, particularly regarding the delivering megaprojects. This paper investigates how transformational and transactional leadership styles shape the environmental commitment of subordinates, motivating OCBEs in megaprojects.

Design/methodology/approach—Partial least squares modeling and hierarchical regression were performed on data obtained from 140 experts who have been involved in megaprojects.

Findings—Both transformational and transactional leadership styles are effective in motivating OCBEs, although the environmental commitment of subordinates partially mediates these relationships. The power distance orientation significantly moderates the relationship between transformational leadership and OCBEs, with the relationship being more positive when the power distance of subordinates is lower. Unexpectedly, a collectivist orientation was found to elevate the effect of transactional leadership, but weaken the effect of transformational leadership.

Originality/value—The mixed and contradictory findings regarding transformational and transactional leadership styles are reconciled in this study by integrating the contextual factors of power distance and collectivism. These findings shed new light on "*playing the cards right*" when using the leadership practices, that is, how leadership can be better leveraged to cultivate subordinates' OCBEs. They also provide targeted guidance for shaping contextual factors to increase the environmental sustainability of megaprojects.

Keywords: Megaproject; Leadership; Organizational citizenship behaviors for the environment; Environmental commitment; Power distance; Collectivism

1. Introduction

Megaprojects are temporary endeavors characterized by a huge investment commitment, extreme complexity, and far-reaching impacts on society, the economy, and the environment (Ma and Fu, 2020; Ma *et al*., 2019; Brookes and Locatelli, 2015; Van Marrewijk *et al*., 2008). In the engineering domain, the term "*megaprojects*" usually refers to large-scale and complex infrastructure projects with a budget of over $1 billion (Brookes *et al*., 2017; Davies *et al*., 2017; Flyvbjerg *et al*., 2003), which pose immense challenges for their managers and decision-makers (Pitsis *et al*., 2018; Le *et al*., 2020). Infrastructure megaprojects also change the local natural environment and even an area's ecological balance (Ansar *et al*., 2014; Zeng *et al*., 2015).

The environmental sustainability of megaprojects is usually a matter of grave management concern (Wang *et al*., 2020; Sabini *et al*., 2019). Disregarding the environmental sustainability can have relevant consequences on project performance, for instance, the Hong Kong–Zhuhai–Macao Bridge, the world's longest sea-crossing bridge, faced a one-year delay due to legal disputes regarding its environmental assessment procedure (Mok *et al*., 2015). California's high-speed rail construction currently faces a range of concerns by stakeholders about its environmental impacts (e.g., disruption, relocation of utilities, construction emissions, and water table impacts) (Deakin, 2017) along with a long environmental assessment process (Cummins, 2017). All across the world, improving environmental performance is becoming one of the most crucial objectives for the governance of megaprojects (Locatelli and Mancini, 2013; Wang *et al*., 2017a; Brunet and Aubry, 2016).

Previous studies of megaproject environmental governance have mostly focused on formal and project-level initiatives, such as the adoption of green technologies (European Union, 2013), the implementation of environmental permits, auditing, and assessment procedures (Daniel and Daniel, 2019; Flyvbjerg *et al*., 2003), and the development of environmental management systems (Giezen, 2012). However, environmental management measures involve various aspects (e.g., environmental awareness, behavioral customs, and the implicit knowledge gained from individual experiences) that cannot be reduced to formal and project-level practices (Wang *et al*., 2018). The complexity and diversity of environmental issues call for non-prescribed behaviors that are rarely comprised of formal programs and procedures (Boiral *et al*., 2018). Furthermore, the success of formal and project-level initiatives also depends on the individual, informal, and discretionary behaviors of project members (Lim and Loosemore, 2017). Without the support and voluntary engagement of project members (and stakeholders in general), the implementation of environmental management measures and standards is likely to be disconnected from routine tasks becoming more symbolical rather than substantial (Boiral *et al*., 2018; Wang *et al*., 2017a).

In the field of organizational environmental management, these aforementioned behaviors have been termed

"*organizational citizenship behaviors for the environment*" (OCBEs) (Boiral and Paillé, 2012). Specifically, OCBEs refer to discretionary and environmentally friendly behaviors not explicitly recognized by the formal reward system (Boiral, 2009), such as making suggestions regarding ways to prevent pollution, cooperating with environmental departments to promote green measures and technologies, and encouraging others to act in behalf of the environment (Wang *et al*., 2018). As such, OCBEs contributes to improving the environmental performance of projects and megaprojects while also filling gaps in the formal environmental management system (Alt and Spitzeck, 2016; Raineri and Paillé, 2016; Mi *et al*., 2019). Although OCBEs may appear to be secondary when taken individually, they are thought to have a multiplier effect on environmental performance when they accumulate over time and the number of individuals involved (Raineri and Paillé, 2016). Despite the relevance, OCBEs research in megaprojects remains at an early stage of development (Wang *et al*., 2018; Li *et al*., 2019). The study of OCBEs can make a relevant contribution to their theory and practice. For instance, it is uncertain as yet how a manager can best stimulate the emergence of OCBEs among project members.

Leadership, in particular transformational and transactional leadership styles, is a crucial determinant for the effective commitment of project members (Drouin *et al*., 2018; Tyssen *et al*., 2014) and hence has great potential for shaping their OCBEs (Graves and Sarkis, 2018; Mi *et al*., 2019). The environmental commitment of project members, i.e., their sense of attachment and responsibility regarding environmental concerns, can be a crucial factor in bridging the relationship between leadership and OCBEs in megaprojects. Leadership research is rooted in permanent corporate organizations where the leader–subordinate relationship is relatively stable. Transformational and transactional leadership styles within the context of a "*temporary project organization*" have rarely been investigated and, in principle, differ from those associated with permanent organizations (Ding *et al*., 2017; Tyssen *et al*., 2014). Therefore, exploring the relationship between different leadership styles and OCBEs contributes to better leveraging the leadership in greening megaprojects, that is, playing the cards right in improving the megaproject environmental governance.

Limited empirical evidence, especially in project settings, verifying the mediation effect of environmental commitment. Furthermore, leadership has certain explanatory power within specific cultural contexts, with mixed and even contradictory empirical findings for the effects of transformational and transactional leadership styles (Deichmann and Stam, 2015). A series of recent meta-analysis studies emphasized the need for more nuanced theorization regarding the moderating roles of cultural factors (Atwater *et al*., 2019; Lee *et al*., 2018; Zhang *et al*., 2019).

Following the call to extend leadership research and to consider the mechanism of environmental commitment

as well as the social-cultural context in organizational megaproject management research (Drouin *et al*., 2013; Lai *et al*., 2018; Vaagaasar *et al*., 2019), in this study, we investigated the effects of transformational and transactional leadership styles for OCBEs in megaproject addressing the following overarching research questions:

a) What are the relationships between transformational and transactional leadership styles and the OCBEs exhibited by subordinates in megaprojects?

b) Does the level of environmental commitment mediate these relationships?

c) How do cultural factors, including power distance and collectivism, shape these relationships?

The rest of this paper is structured as follows. In section 2, we discuss the theoretical foundations and the process by which the research hypotheses were developed. In section 3, we describe the research method and analytical procedures used, followed by a presentation of our data analysis in section 4. In section 5, we discuss the research findings and their implications for megaproject environmental management. Section 6 concludes this paper with a review of key points and an outline of the future research agenda.

2. Theoretical foundation and hypotheses development

2.1 Organizational Citizenship Behaviors for the Environment

Increasing studies make convincing cases to incorporate the workplace pro-environmental behaviors as portion of the ‘‘organizational citizenship behaviors’’ (OCBs) field (Boiral, 2009; Luu, 2019; Wang *et al*., 2017a; Mi *et al*., 2019). These discretionary behaviors toward the environment demonstrate a “*sense of citizenship*” as they are based on an innovative, spontaneous, and voluntary basis (Raineri and Paillé, 2016). This kind of behaviors are explicitly akin to OCBs and have been termed “organizational citizenship behaviors for the environment” (OCBEs) (Boiral, 2009). Furthermore, OCBEs manifest more than discretionary conservation behaviors (Luu, 2019). These behaviors also present a broad pattern of actions, such as as keeping abreast of the environmental issues of the organization (Raineri and Paillé, 2016), sharing environmental knowledge and making environmental suggestions (Wang *et al*., 2018), promoting environmental concerns to colleagues (Mi *et al*., 2019), and cooperating with the environmental department to facilitate green initiatives. Through the lens of OCBs, OCBEs can be defined as environmental extra-role behaviors neither formally required nor contractually rewarded by management systems in place (Boiral and Paillé, 2012).

2.2 Leadership styles and environmental commitment

Organizational commitment is defined as the psychological bond between individuals and their organizations (Chen *et al*., 2018). The manager’s leadership style is one of the most crucial factors influencing the organizational commitment and citizenship behaviors of subordinates (Nguni *et al*., 2006; Wang *et al*., 2017b). As the manager establishes goals for his/her subordinates, his/her leadership style ultimately shapes their behaviors in both mandatory and voluntary ways by affecting the attitudes and behaviors they exhibit while working to achieve those goals (Jung, 2001; Deichmann and Stam, 2015). Commitment, in this setting, has been defined as “*a sense of responsibility and attachment to a specific goal*” (Cohen, 2007) and provides direction to behaviors and facilitate the achievement of overarching goals beyond individual self-interests (Raineri and Paillé, 2016). In megaprojects, transformational and transactional leaders are expected to influence the willingness of their subordinates to engage in OCBEs by shaping their environmental commitment (Drouin *et al*., 2018; Tyssen *et al*., 2014; Graves and Sarkis, 2018; Mi *et al*., 2019; Wang *et al*., 2017a). In other words, environmental commitment is likely to serves as a bridge between transformational and transactional leadership styles and subordinates’ OCBEs.

2.2.1 Transformational leadership and environmental commitment

Transformational leadership emphasizes the symbolic behaviors exhibited by managers (Zheng *et al*., 2019), such the transfer of vision and values (Raziq *et al*., 2018), rather than the exchange of economic interests (Avolio *et al*., 2009). Transformational leadership is committed to guiding subordinates to focus on the long-term goals of the team or organization. The organization's members internalize the values conveyed by the leader as the goals and pursuits that drive their efforts (Zaman *et al*., 2019). For example, Buil *et al*. (2018) found transformational leadership to promote high-quality exchange relationships with subordinates by the direct expression of care, trust, and support. In consideration of reciprocity, subordinates increase their loyalty to the organization and voluntarily choose to take positive actions beyond their obligations. According to Robertson and Barling (2013), the concept of transformational leadership can be extended to the field of environmental management. Environmentally specific transformational leadership, when demonstrated by megaproject managers, transmits a clear environmental vision that enables project members to reach a consensus (Graves *et al*., 2019). Megaproject managers can set an example for subordinates by sharing their environmental values, emphasizing the importance of environmental sustainability, and taking the lead in addressing environmental issues (Robertson, 2017). As a result, project members develop a strong willingness and commitment to the environmentally responsible causes related to the megaproject (Graves *et al*., 2013). Given this background, we derived the following hypotheses:

H1a: Transformational leadership has a positive effect on environmental commitment.

H1b: Transformational leadership has a positive effect on OCBEs.

2.2.2 Transactional leadership and environmental commitment

Transactional leadership is characterized by clearly defined managerial responsibilities and tasks and the provision of returns to subordinates based on contractual requirements (Walumbwa *et al*., 2008), focusing on leading exchanges with subordinates (Deichmann and Stam, 2015; Zheng *et al*., 2019). The main difference between transformational and transactional leadership is that the former is committed to enabling subordinates to identify with the managers' goals and needs, whereas the latter involves an exchange of resources between managers and subordinates to satisfy their own needs. The essence of transactional leadership is to stimulate the enthusiasm of organizational members to achieve the desired goal through some forms of rewards (Breevaart *et al*., 2014). Transactional leadership is considered to be more prevalent in simple projects (Drouin *et al*., 2018), and has a more

significant impact on project member behaviors. For example, Jung (2001) found transactional leadership to have a positive effect on innovative behaviors. Nguni *et al*. (2006) indicated that transactional leadership yields a positive impact on citizenship behaviors. *Conversely*, studies have shown that transactional leadership harms the in-role and/or ex-role performances of subordinates (Afsar *et al*., 2017; Pieterse *et al*., 2010). In megaprojects, to cultivate the environmental commitment of project members, transactional leaders are expected to motivate project members to engage in the environmental cause via incentives. Transactional leadership also attaches importance to the problems and details of the work and takes timely and appropriate measures to correct the environmental misconceptions and behavioral attitudes of project members during the megaproject implementation process to promote OCBEs. Given this background, the following hypotheses are introduced:

H2a: Transactional leadership has a positive impact on environmental commitment.

H2b: Transactional leadership has a positive impact on OCBEs.

2.3 Environmental commitment and OCBEs

The importance of "*commitment*" has two aspects. On one hand, it clarifies the behavioral direction of individual organizational members, and on the other, it encourages them to strive toward goals, even to the extent of overlooking their own self-interests (Meyer and Herscovitch, 2001). Consequently, the concept of commitment has attracted widespread interest in the field of organizational behavior (Grego-Planer, 2019) and a series of related concepts has emerged, i.e., affective commitment (Iglesias *et al*., 2019), environmental commitment (Wang *et al*., 2017b), and career commitment (Huang *et al*., 2019). In essence, commitment refers to the attachment to and identity with organizational goals and values (Cohen, 2007) and is usually expressed as a sense of spontaneous responsibility (Klein *et al*., 2012). Raineri and Paillé (2016) further extended the concept of commitment to the field of environmental management and proposed that environmental commitment is "*a frame of mind denoting both a sense of attachment and responsibility to environmental concerns*" (p. 133). When the environmental values of individuals match those of the organization, the individuals will exhibit proactive environmental behaviors to help the organization achieving its environmental goals (Graves *et al*., 2013). As noted by Boiral *et al*. (2015), the leadership performance of managers provides a behavioral reference for subordinates. The manager's emphasis on environmental goals (whether the leadership style is transformational or transactional) affects the attitudes and perceptions of his/her subordinates regarding environmental issues, and hence OCBEs will emerge in daily work. Whether managers express their commitment to environmental issues, they build a shared team value system that

is committed to environmental sustainability, motivating the enthusiasm of project members to engage in OCBEs (Robertson and Barling, 2013; Afsar *et al*., 2017). As yet, the manner and extent to which OCBEs are affected by environmental commitment in project settings remain unclear. From this body of literature, we derived the following hypotheses:

H3a: Environmental commitment has a positive impact on OCBEs.

H3b: Environmental commitment mediates the relationship between transformational leadership and OCBEs.

H3c: Environmental commitment mediates the relationship between transactional leadership and OCBEs.

2.4 Moderating effect of a power distance and collectivism orientation

2.4.1 Moderating effect of power distance

The term power distance refers to the degree of personal acceptance by an individual of the unequal distribution of power between leaders and subordinates (Dorfman and Howell, 1988). Individuals with a low power-distance orientation believe that leaders and subordinates should occupy a close to equal position, have a strong sense of participation (Bochner and Hesketh, 1994), and expect to engage interpersonally with their leaders. Individuals with a high power-distance orientation tend to maintain formal hierarchical relations and follow the wishes and requirements of their leaders (Khatri, 2009). Project members with a low power-distance orientation have a strong sense of participation (Peltokorpi, 2018) could be prone to make suggestions regarding the sustainable delivery of megaprojects. Transformational leadership meets the needs of subordinates by granting them autonomy (Breevaart *et al*., 2014), which makes these project members willing to make extra effort to achieve the sustainable goals of megaprojects and to develop a strong willingness to perform OCBEs. That is, in megaprojects where project members demonstrate a low power-distance orientation, transformational leadership may have a positive impact on their OCBEs. *Conversely*, subordinates with a high power-distance orientation believe that leaders can benefit the most from decisions made independently (Tu and Lu, 2016). Hence, for subordinates with a high power-distance orientation, their sense of participation tends to be weak (Ahmad and Gao, 2018), which means they often consider only those tasks assigned by leaders to be sufficient and lack the willingness to implement extra-role behaviors (e.g., OCBEs). Therefore, for subordinates with a high power-distance orientation, the effect of transformational leadership can be diminished. Thus, the following hypothesis is presented:

H4a: Power distance negatively moderates the relationship between transformational leadership and OCBEs.

In megaprojects, if the project members have a low power-distance orientation, the positive effect of transactional leadership on their OCBEs may be diminished. Specifically, project members with a low power-distance orientation usually show a strong willingness to engage in daily management (Lin *et al*., 2019). In this case, there is limited room for transactional leaders to further promote subordinates' behaviors. Moreover, Transactional leadership emphasizes strict compliance with rules and regulations and has a clear framework of rewards and penalties, which can constrain the creativity of project members (Lin *et al*., 2018; Jin *et al*., 2018). As a result, project members may work routinely and lack any sense of project ownership (Bendoly *et al*., 2010). *Conversely*, subordinates with a high power-distance orientation readily accept the hierarchical difference and tend to identify with the values, attitudes, and decisions of the leader (Graves *et al*., 2019). Therefore, when megaproject managers emphasize the importance of environmental issues and offer material incentives, the project members may take concrete steps to implement the relevant environmental measures. This perspective leads to the following hypothesis:

H4b：Power distance positively moderates the relationship between transactional leadership and OCBEs.

2.4.2 Moderating effect of collectivism

Collectivism is another critical cultural dimension that reflects the degree of individual concern for the collective (Chen *et al*., 2016). Subordinates with different collectivist tendencies have different ways of reacting to leadership behaviors. For example, individuals with a highly collectivist orientation tend to focus on the overall goal of the "*inside circle*" and the constraints of norms and responsibilities (Hong *et al*., 2016). They hope to maintain cooperative relations within their circle (e.g., an organization), even when doing so means they must endure discomfort (Jin *et al*., 2018). In the case of conflicting personal and organizational goals, the overall goals of the organization are prioritized (Cohen and Avrahami, 2006). Transformational leadership aims to stimulate the high-level needs of subordinates by establishing a shared vision (Graves and Sarkis, 2018). In megaprojects, transformational leadership is, therefore, very persuasive for project members with a high collectivist orientation, because these members recognize the common goal of the project at a profound level (Lin *et al*., 2018; Mi *et al*., 2019). In contrast, if the collectivism orientation of the project members is low, their recognition of the value of the project is reduced. The appeal of transformational leaders may be less compelling, which makes it difficult to stimulate the OCBEs of subordinates. Thus, the following hypothesis is developed:

H4c: A collectivist orientation positively moderates the relationship between transformational leadership and OCBEs.

Similarly, if individuals have a highly collectivist orientation, the influence of transactional leaders on their environmental commitments may increase, because those with a high collectivist orientation are more likely to put collective interests and organizational goals at the forefront than those with a low collectivist orientation (Jin *et al*., 2018). In megaprojects, managers with a transactional leadership style promote the importance of environmental issues to their subordinates via contingency incentives or exception management (Zhang *et al*., 2018). Project members with high collectivist tendencies may actively respond and exhibit a higher level of environmental commitment in their daily work. *Conversely*, those with a low collectivist tendency tend to focus on the realization of their own interests (Stamkou *et al*., 2019; Kitirattarkarn *et al*., 2019) and disregard the sustainable vision of the project. As long as no severe environmental problem occurs, they prefer maintaining the status quo. Thus, the following hypothesis is proposed:

H4d：A collectivist orientation positively moderates the relationship between transactional leadership and OCBEs.

The proposed theoretical research model brings together the above discussion, as shown in Fig. 1.

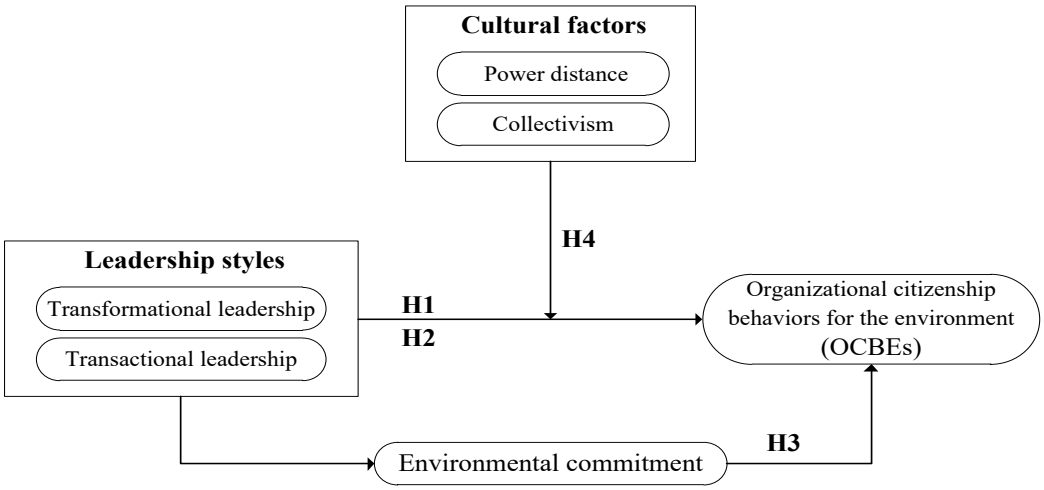

Fig.1. Theoretical research model

3. Research method

The research design consists of three key elements: the selection of participants, a questionnaire survey, and data analysis. The context of this study was China because of the increasing number of megaprojects it undertakes and delivers (e.g., Shanghai World Expo and Hong Kong-Zhuhai-Macao Bridge), which enables access to abundant amounts of culturally consistent primary and secondary data. Moreover, as Mi *et al*. (2019) suggested, the promotion of OCBEs calls for more nuanced empirical evidence within the Eastern cultural context (i.e., China). Furthermore, this study focuses on the effect of the leadership of managers, which can be objectively reflected in the attitude of their subordinates. To avoid deviation in the responses, the selected respondents were limited to middle managers (i.e., department managers and professional executives) and professionals working at the operational level (i.e., project engineers). Senior managers were excluded from the analysis because the research aims to examine the views and comments of subordinates on the leadership style of their superiors.

3.1 Questionnaire survey

The questionnaire is an effective instrument for the collection of primary data that is widely used in behavioral studies (Baruch, 1999). Leveraging the work of Elmes *et al*. (2011), this study applies the following steps to guarantee the validity and reliability of the questionnaire survey (Fig. 2). *First*, semi-structured explorative interviews were conducted with megaproject scholars and professionals to contextualize the measurement items properly. *Next*, a pre-test of 23 megaproject senior professionals was conducted to further assess the questionnaire design. *Thirdly*, an initial sample pool was established using the *Megaprojects Case Study and Data Center* (http://www.mpcsc.org/). A snowball-sampling approach was then employed to increase the number of samples, whereby the initial respondents were required to name three professionals who had worked on other megaprojects.

The initial version of the questionnaire was in English, which was then translated into Chinese to enable and facilitate the understanding of respondents. The back-translation approach was employed to ensure linguistic equivalence between the two versions (Paillé *et al*. 2014). Respondents were asked to fill out the questionnaire based on their most recent megaproject experience. The formal questionnaires were distributed and collected in China from November 2015 to March 2016. Of the 241 questionnaires that were returned (81.14% response rate), 43 were discarded because relevant data was missing and 58 were omitted because the respondents were senior managers who did not fit the target sample requirements. Eventually, a total of 140 valid questionnaires were

included in the study. Of these 140 respondents, 64 (45.71%) were middle managers and 76 (54.29%) worked at the operational level. Fig. 2 shows a flow chart of the key elements of the questionnaire design and implementation.

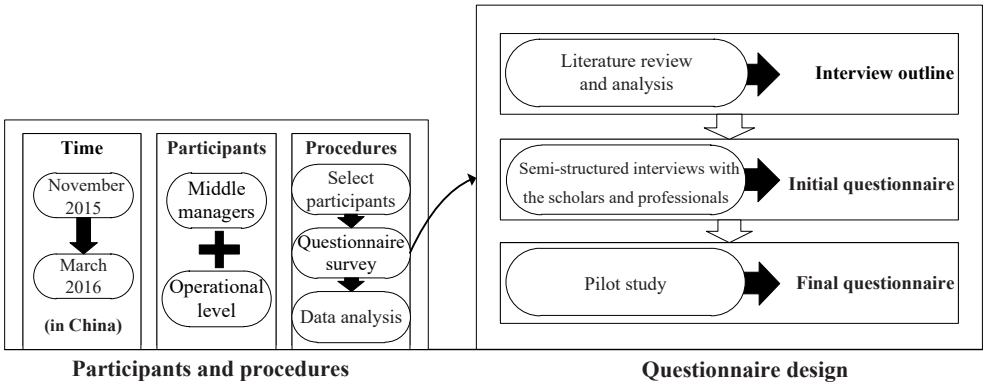

Fig.2. Flowchart of the questionnaire design

3.2 Variables and measurement

The six variables (i.e., transformational leadership, transactional leadership, environmental commitment, power distance, collectivism, and OCBEs) comprising the theoretical model were initially derived from the literature. The environmental commitment and OCBEs sections of the questionnaire were adapted from the measurement items reported by Raineri and Paillé (2016) and Wang *et al*. (2017a). With respect to transformational leadership, eight measurement items were adapted from the simplified scale in the paper by Barling *et al*. (2002) to reflect four dimensions of safety-specific transformational leadership: idealized influence, inspirational motivation, intellectual inspiration, and individualized consideration. With respect to transactional leadership, four measurement items were derived from the simplified scale developed by Den Hartog *et al*. (1997) to reflect two dimensions of transactional leadership: contingent reward and active management by exception. Regarding the research context, all the measurement items used for the two leadership styles were modified to better reflect environmental practices. For example, "*my supervisor talks about his/her values and beliefs about the importance of safety*" was reformulated to "*my manager talks about his/her values and beliefs regarding the importance of environmental protection*." Six measurement items developed by Dorfman and Howell (1988) were used to reflect power distance. Similarly, four measurement items developed by Wagner (1995) were adapted to reflect collectivism at work. Following Wang *et al*. (2017a) and Cao *et al*. (2017), four control variables, including project duration, project type, project role, and project size, were introduced to the empirical model to isolate any variations attributable to the project characteristics. The measurement items were evaluated using a 5-point Likert scale ranging from "*1–strongly disagree to 5–strongly agree*."

4. Data Analyses and Results

Factor analysis (FA) is a method widely used to identify individual factors that represent groups of interrelated variables (Hon *et al*., 2013). At first, exploratory factor analysis (EFA) was used to ascertain the potential dimensions of the constructs and to refine the questionnaire, followed by confirmatory factor analysis (CFA) to verify the results of the EFA (Cao *et al*., 2017; Wang *et al*., 2018). The partial least squares–structural equation model (PLS-SEM) and hierarchical regression modeling (HRM) were then applied to test the series of hypotheses proposed in section 2. Compared with the covariance-based approach, PLS-SEM is more suitable for predictive applications and fits well with the exploratory nature of this study (Lim and Loosemore, 2017). More importantly, PLS-SEM is adequate for the sample size of this research (Wang *et al*., 2018).

4.1 Factor analysis

In this study, EFA was used to investigate twelve items related to leadership styles. The Kaiser–Meyer–Olkin (KMO) value was 0.860, which is above the recommended threshold of 0.6, which means the sample adequacy was excellent (Field, 2013). The Bartlett test of sphericity (BTS) produced an approximation of $\chi 2 = 609.673$ ($df = 66$, $p = 0.000 < 0.001$), which indicates that the correlation coefficient between variables meets the FA requirements (George, 2011). Hair *et al*. (2011) noted that the loading of each item with respect to its corresponding construct should not be less than 0.5. Thus, the fourth item of transformational leadership (0.485) was deleted from the list of measurement items. Similarly, EFA was also applied to the analysis of environmental commitment (EC), OCBEs, power distance (PD), and collectivist orientation (CO). Finally, no measurement items were excluded.

Table I EFA of leadership style

Constructs	Measurement items	Factor loadings	
		Factor 1	Factor 2
TFL	TFL6	**0.774**	0.028
	TFL2	**0.771**	0.080
	TFL1	**0.733**	0.022
	TFL3	**0.726**	0.158
	TFL5	**0.723**	0.056
	TFL8	**0.709**	0.063
	TFL7	**0.703**	0.245
TSL	TSL2	0.156	**0.819**
	TSL1	0.108	**0.814**
	TSL3	0.080	**0.813**
	TSL4	0.032	**0.763**
Variance explained (%)		34.734	24.335
Variance cumulatively explained (%)		34.734	59.069

The remaining eleven items related to leadership styles were analyzed by FA a second time. The KMO value of 0.846 was again above the recommended threshold of 0.6. The BTS results also suggested their significance ($\chi 2$ = 551.685, df =55, p = 0.000 < 0.001). Finally, two factors were extracted from the eleven leadership items to represent transformational leadership (TFL) and transactional leadership (TSL). Table 1 shows that the rotated loadings of the manifest items with respect to their intended constructs are all above the recommended threshold of 0.5 and are also greater than the loadings of other constructs. These results validate the suitability of these listed eleven items for reflecting these two leadership styles. As shown in Table 2, the CFA analysis results indicate that the factor structure of the leadership constructs has excellent adaptability.

Table II CFA of leadership styles

Categories of indicators	Indicators	Fitness criteria	Leadership	
			Value	Fitness judgment
Absolute fit indicators	χ^2	p>0.05	57.713 p=0.066	Yes
	RMR	<0.05	0.027	Yes
	RMSEA	<0.08	0.050	Yes
	GFI	>0.90	0.928	Yes
Incremental fit indicators	NFI	>0.90	0.905	Yes
	IFI	>0.90	0.974	Yes
	TLI	>0.90	0.966	Yes
	CFI	>0.90	0.973	Yes
	PNFI	>0.50	0.708	Yes
	PCFI	>0.50	0.761	Yes
	χ^2/DF	<2.00	1.342	Yes
Parsimonious fit indicators	AIC	Values of the default model are lower than those of independent and saturated models	103.713<132.000 103.713<631.363	Yes
	CAIC	Values of the default model are lower than those of independent and saturated models	194.370<392.148 194.370<674.721	Yes

4.2 Evaluation of the measurement models

In this study, a comprehensive evaluation of the measurement items was conducted with respect to their internal consistency, convergent validity, and discriminant validity. Internal consistency was assessed by the composite reliability (CR) and Cronbach's α measures, and the average variance extracted (AVE) was used to indicate convergent validity.

Table III Measurement validity and construct correlations

Construct	CR	Cronbach's α	AVE	Correlation matrix					
				TFL	TSL	EC	OCBEs	PD	CO
TFL	0.894	0.863	0.548	**0.740**					
TSL	0.881	0.824	0.650	0.240	**0.806**				
EC	0.928	0.909	0.648	0.457	0.318	**0.805**			
OCBEs	0.923	0.902	0.632	0.557	0.348	0.670	**0.795**		
PD	0.880	0.837	0.551	0.174	0.102	0.228	0.511	**0.742**	
CO	0.847	0.759	0.581	0.359	0.226	0.339	0.420	0.208	**0.762**

As shown in Table 3, the CR and Cronbach's α values are greater than 0.7. Hence, the internal consistencies of the items included in each construct are good (Hair *et al*., 2011). The AVE values are all greater than 0.5, which indicates a satisfactory level of convergent validity. Also, the evaluation indicator of convergent validity includes the factor loadings of each item. As shown in Table 4, the standardized factor loadings of all the respective constructs of the items are all higher than the threshold of 0.7. Finally, the square roots of the AVE (the diagonal of the correlation matrix in Table 3) are all higher than the absolute value of the inter-construct correlations, which confirms that this measure has satisfactory discriminant validity.

Since all quantitative data was obtained from the questionnaire, there may be a risk of common method bias. To test for this possibility, Harman's single-factor test was conducted. The results revealed that there was no single dominant factor, and the most significant factor accounted for just 15.537% of the total measurement variance, which indicates that standard method bias had no significant impact on the data quality.

Table Ⅳ Measurement model evaluation

Code	Item loadings					
	TFL	TSL	EC	OCBE	PD	CO
TFL1	**0.712**	0.116	0.267	0.355	0.138	0.174
TFL2	**0.770**	0.171	0.322	0.421	0.173	0.193
TFL3	**0.751**	0.239	0.360	0.474	0.474	0.191
TFL5	**0.736**	0.146	0.425	0.413	0.146	0.304
TFL6	**0.766**	0.125	0.350	0.391	0.059	0.397
TFL7	**0.721**	0.297	0.288	0.345	0.097	0.299
TFL8	0.722	0.154	0.327	0.459	0.211	0.299
TSL1	0.202	**0.787**	0.203	0.217	0.019	0.225
TSL2	0.181	**0.782**	0.186	0.235	0.067	0.153
TSL3	0.134	**0.795**	0.294	0.303	0.150	0.107
TSL4	0.253	**0.859**	0.308	0.337	0.073	0.247
EC1	0.366	0.266	**0.839**	0.589	0.218	0.225
EC2	0.386	0.348	**0.834**	0.595	0.253	0.323
EC3	0.309	0.204	**0.718**	0.443	0.135	0.166
EC4	0.383	0.235	**0.764**	0.565	0.184	0.264
EC5	0.345	0.194	**0.794**	0.458	0.127	0.304
EC6	0.341	0.172	**0.808**	0.547	0.169	0.323
EC7	0.431	0.339	**0.867**	0.547	0.174	0.295
OCBEs1	0.443	0.225	0.493	**0.773**	0.466	0.263
OCBEs2	0.479	0.301	0.567	**0.854**	0.400	0.343
OCBEs3	0.401	0.244	0.500	**0.784**	0.391	0.309
OCBEs4	0.367	0.288	0.458	**0.728**	0.415	0.453
OCBEs5	0.512	0.294	0.592	**0.797**	0.430	0.342
OCBEs6	0.403	0.313	0.531	**0.808**	0.372	0.333
OCBEs7	0.478	0.269	0.569	**0.814**	0.370	0.301
PD1	0.214	0.056	0.251	0.442	**0.713**	0.079
PD2	0.096	0.081	0.181	0.401	**0.715**	0.262
PD3	0.038	0.019	0.137	0.317	**0.763**	0.097
PD4	0.177	0.154	0.170	0.385	**0.735**	0.230
PD5	0.102	0.089	0.156	0.346	**0.763**	0.110
PD6	0.111	0.046	0.0879	0.351	**0.761**	0.135
CO1	0.160	0.192	0.257	0.329	0.162	**0.746**
CO2	0.206	0.239	0.222	0.303	0.164	**0.748**
CO3	0.340	0.131	0.234	0.323	0.107	**0.747**
CO4	0.385	0.130	0.318	0.324	0.201	**0.806**

4.3 Hypotheses testing and analysis of results

The research hypotheses were analyzed using hierarchical regression modeling (HRM), with reference to

Garson (2013). Table 5 shows the results.

Table V Hierarchical regression results

Variables	OCBEs							
	Model 1		Model 2		Model 3		Model 4	
	β	VIF	β	VIF	β	VIF	β	VIF
Control variable								
Project duration	0.014	1.043	-0.001	1.055	-0.024	1.071	-0.028	1.117
Project type	0.138	1.024	0.044	1.074	0.028	1.099	0.032	1.111
Project role	0.001	1.143	0.051	1.163	0.049	1.168	0.003	1.222
Project size	0.086	1.121	0.056	1.124	0.079	1.131	0.071	1.173
Independent variable								
TFL			0.470***	1.123	0.365***	1.262	0.353***	1.281
TSL			0.224**	1.079	0.175**	1.107	0.152*	1.181
Moderator variable								
PD					0.378***	1.074	0.378***	1.096
CO					0.178**	1.229	0.220**	1.359
Intersection item								
TFL*PD							-0.189**	1.169
TFL*CO							-0.161**	1.200
TSL*PD							0.033	1.227
TSL*CO							0.101^{+}	1.186
F	0.912		11.292***		19.072***		16.785***	
R^2	0.026		0.337		0.538		0.613	
△F	0.912		31.233***		23.438***		6.178***	
$△R^2$	0.026		0.311		0.201		0.075	

Note: The regression coefficient is the standard coefficient; $^{+}$p<0.1[2]; *p<0.05; **p<0.01; ***p<0.001

First, Model 1 was used to examine the impact of the four control variables (project type, project duration, project role, and project size) on OCBEs. Subsequently, Models 2 and 3 were used to gradually incorporate the independent variables (TFL and TSL) and moderator variables (PD and CO), respectively. To examine the moderating effects of the cultural context elements, Model 4 was used to perform a regression analysis of the intersection of the independent and moderator variables.

The HRM results show that the R^2 value of the model gradually increases (from 0.026 to 0.613) with the addition of variables, which means that the interpretation of the models continuously improved. The variance

inflation factor (VIF) values for the regression models ranged between 1.055 and 1.359, which are much lower than the discriminant value of 3.0. This suggests that the regression estimates are not significantly influenced by multicollinearity (Cohen *et al*., 2013).

The effect of the control variables on OCBEs was not significant when not considering other variables (Model 1). After adding the independent variables in Model 2, both TFL ($\beta = 0.470$, $p < 0.001$) and TSL ($\beta = 0.224$, $p < 0.01$) were found to have significant positive impacts on OCBEs. Therefore, H1b and H2b are supported.

(1) Moderating effect analysis

The results of Model 4 reveal PD to have a negative moderating effect on the relationship between TFL and OCBE ($\beta = -0.189$, $p < 0.01$); thus H4a is supported. As shown in Figure 3, the lower the PD value of the project members, the stronger is the positive relationship between TFL and OCBEs.

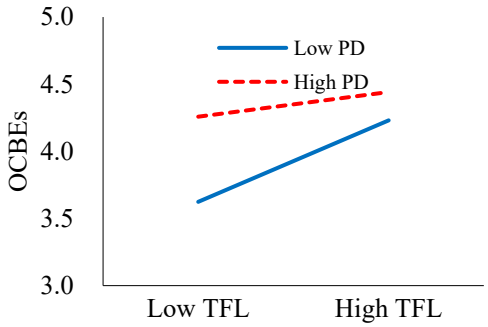

Fig.3. Moderating effect of PD on the relationship between TFL and OCBEs

As shown in Fig. 4, PD was found to have no significant effect on the relationship between TSL and OCBE ($\beta = 0.033$, $p>0.01$); hence H4b is not supported.

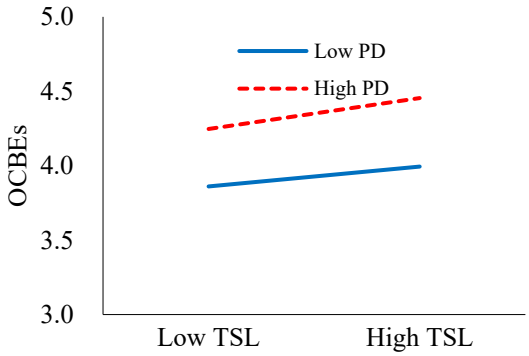

Fig.4. Moderating effect of PD on the relationship between TSL and OCBEs

As shown in Fig. 5, the lower the CO of the subordinates, the stronger is the positive relationship between TFL and OCBEs. Thus, CO was found to have a significant negative moderating effect on the relationship between TFL and OCBEs ($\beta = -0.161$, $p<0.01$), so H4c is not supported.

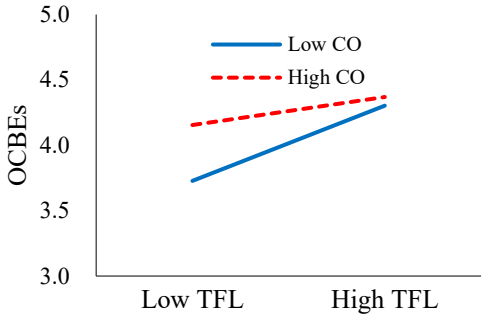

Fig.5. Moderating effect of CO on the relationship between TFL and OCBEs

As shown in Fig. 6, the lower the CO of the subordinates, the weaker is the positive relationship between TSL and OCBEs. Thus, CO was found to have a positive moderating effect on the relationship between TSL and OCBE ($\beta = 0.101$, $p < 0.1$), and H4d is supported. In summary, the hypotheses related to the moderating effects of PD and CO, i.e., H4a and H4d, are supported, whereas H4b and H4c are not.

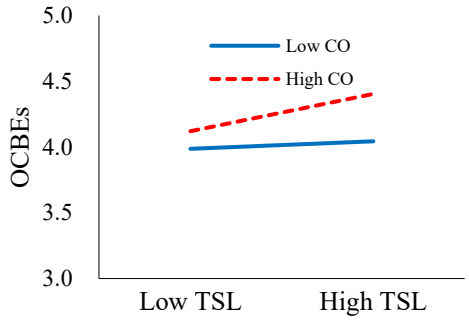

Fig.6. Moderating effect of CO on the relationship between TSL and OCBEs

(2) Mediation analysis

To compute the standard errors and test the statistical significance of the path coefficients, a bootstrapping approach with 5000 resamples was employed (Figs. 5 and 6 and Table 7). The R^2 value of the dependent variable (i.e., OCBEs) was calculated to be 0.542, which indicates that the research model is able to explain most of the variances in the construct. The TFL–OCBEs link ($b = 0.304$, $p < 0.001$) and the TSL–OCBEs link ($b = 0.118$, $p < 0.001$) are all significant, thus both H1b and H2b are supported. The TFL–EC link ($b = 0.404$, $p < 0.001$) and the TSL–EC link ($b = 0.221$, $p < 0.001$) are significant, so both H1a and H2a are supported as well. In addition, the influence of EC on OCBEs is significant ($b = 0.494$, $p < 0.001$), hence H3a is supported.

Regarding the relationships between TFL and OCBEs, the effect of TFL continues to be statistically significant ($\beta = 0.304$, $p < 0.001$) when EC is included. The path coefficient decreased (from $\beta = 0.505$ *** to $\beta = 0.304$***), which means EC has partial mediation effects on the TFL and OCBEs relationship. Similarly, regarding the relationships between TSL and OCBE, the influence of the TSL remains statistically significant when EC is considered ($\beta = 0.118$, $p < 0.05$). The path coefficient is significantly reduced (from $\beta = 0.226$ *** to $\beta = 0.118$*), hence EC also has a partial mediating effect on the TSL and OCBEs relationship. Both H3b and H3c are thus partially supported. Overall, TFL was found to have a stronger effect on OCBEs than TSL.

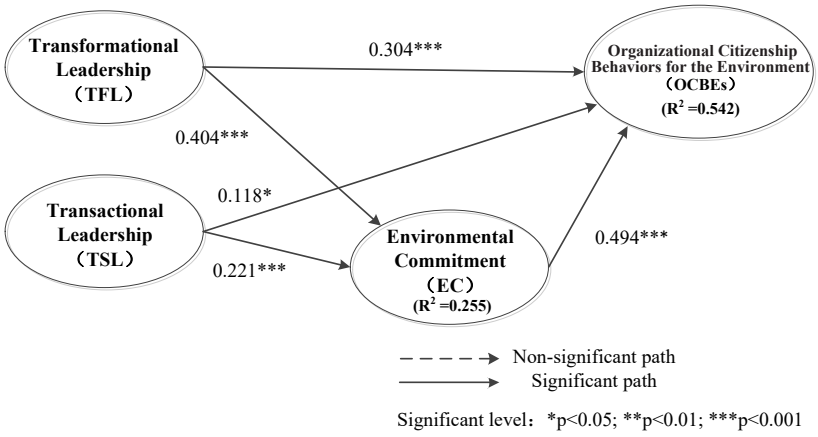

Fig.7. PLS analysis results for the research model

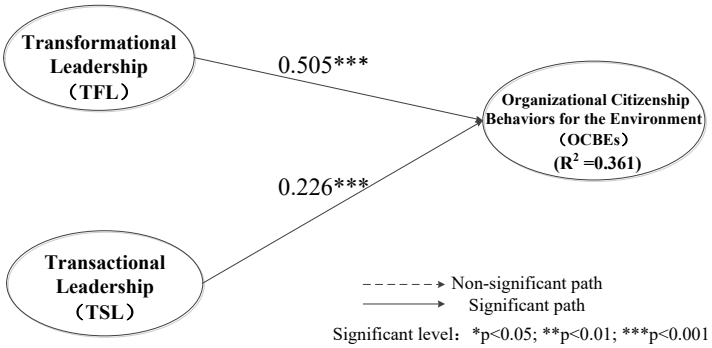

Fig.8. PLS analysis results for the alternative research model

As shown in Table 6, the mediation effect of EC on the TFL and OCBE relationship and the TSL and OCBEs relationship was further verified by the bootstrapping approach. The 95% confidence interval (after bias correction) does not contain 0, which means that the mediating effects are both statistically significant.

Table V Hierarchical regression results

Variables	OCBEs							
	Model 1		Model 2		Model 3		Model 4	
	β	VIF	β	VIF	β	VIF	β	VIF
Control variable								
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Project role	0.001	1.143	0.051	1.163	0.049	1.168	0.003	1.222
Project size	0.086	1.121	0.056	1.124	0.079	1.131	0.071	1.173
Independent variable								
TFL			0.470***	1.123	0.365***	1.262	0.353***	1.281
TSL			0.224**	1.079	0.175**	1.107	0.152*	1.181
Moderator variable								
PD					0.378***	1.074	0.378***	1.096
CO					0.178**	1.229	0.220**	1.359
Intersection item								
TFL*PD							-0.189**	1.169
TFL*CO							-0.161**	1.200
TSL*PD							0.033	1.227
TSL*CO							0.101^{+}	1.186
F	0.912		11.292***		19.072***		16.785***	
R^2	0.026		0.337		0.538		0.613	
△F	0.912		31.233***		23.438***		6.178***	
$△R^2$	0.026		0.311		0.201		0.075	

Note: The regression coefficient is the standard coefficient; $^{+}$p<0.1[2]; *p<0.05; **p<0.01; ***p<0.001

5. Discussion and implications

The environmental dimension of megaprojects is complex and diversified, calling for the active collaboration with environmental departments and the voluntary sharing of tacit knowledge, which is difficult to formalize via explicit and structured practices and policies (Boiral *et al*., 2015). The literature about OCBEs in projects vastly has disregarded the critical role played by leadership and has mainly focused on subordinate-level initiatives (Boiral et al., 2018). Given the relevance of leadership in fostering environmental sustainability (Sabini *et al*., 2019; Luu, 2019; Robertson and Barling, 2013), it is urgent to understand how to leverage leadership to increase and sustain the environmental commitment of megaproject members to motivate their engagement in OCBEs.

5.1 Theoretical contributions to theory

The results obtained in this study show that transformational leadership contributes to enhancing the environmental commitment of megaproject members and stimulating the emergence of OCBEs. This finding accords with those of Robertson and Barling (2013). Transactional leadership was also determined to be crucial in motivating OCBEs. Whereas most extant studies have focused on the unique role of transformational leadership (Ding *et al*., 2017; Graves *et al*., 2013; Muchiri *et al*., 2019), the results of this study reveal the positive impact of transactional leadership, which corroborates a relatively small number of empirical findings (Jung, 2001; Lai *et al*., 2018; Nguni *et al*., 2006). This study demonstrates the powerful effect of transactional leadership in driving subordinates to engage in pro-environmental behaviors in project settings. Interestingly, these empirical results conform to those obtained in studies by Deichmann and Stam (2015) and Tyssen *et al*. (2014), who, in different contexts, also emphasized the more significant potential of transactional leadership style than has been previously expected. Therefore, transactional leadership, in the context of our study, provides greater inspiration to subordinates as it establishes detailed task orientations as well as an appropriate reward and punishment mechanism. For example, the achievement of the environmental goal in Hong Kong–Zhuhai–Macao (HKZM) Bridge hinged on the effectiveness of the health, safety, and environment (HSE) management team. "*The smooth implementation of the HSE management system requires a powerful executive force and a meticulous approach. As for HSE managers, we need to be just and stern and work out every last detail. During the routine supervision and inspection process, project members usually received a series of rectification notices with detailed instructions*" (HKZM Bridge Authority, 2016). One of the HSE managers interviewed for this study offered an impressive observation: *Very strict environmental supervision initially makes contractors "uncomfortable." We employ a comprehensive training and*

testing system. All on-site contractors must pass this test and earn a certificate……in my opinion, the basic guarantee of environmental protection is to increase the costs of violation and establish powerful rules right from the very beginning. The improvement of environmental commitment as well as the emergence of OCBEs is based on the promotion of these "hard" measures.

Recent meta-analytic examinations of leadership highlight the role of culture-contextual factors in shaping the behavioral intentions of individuals and the need to consider these factors when examining the effect of leadership styles (Atwater *et al*., 2019; Lee *et al*., 2018; Zhang *et al*., 2019). This study echoes these calls and reveals that power distance and a collectivist orientation play a crucial role in unlocking the effects of the transformational and transactional leadership styles. Leadership is not a culturally neutral phenomenon (Kabasakal *et al*., 2012). The empirical results show that a low power-distance orientation amplifies the effect of transformational leadership, but unexpectedly, that power distance does not moderate the effect of transactional leadership (H4b is not verified). This finding confirms the difference between these two leadership styles. A low power-distance orientation of project members translates into the pursuit of "*equality for all*" in daily work, emphasizing a strong sense of participation, and expecting interpersonal interaction with managers. After being encouraged by their manager, project members are more likely to engage in extra-role behaviors and exhibit a willingness to cooperate with the project's call actively. A high power-distance orientation emphasizes the preference to remain in one's in-role sphere in the workplace. Even when encouraged and mobilized by their manager, it is difficult for project members to "exhibit *extraordinary focus on extra-role issues*."

The empirical results also reveal that a highly collectivist orientation amplifies the effect of transactional leadership, whereas a low collectivist orientation unexpectedly amplifies the effect of transformational leadership (the opposite of H4c). This finding confirms the significance of cultural factors prompting a further question: *Why does a collectivist orientation have contradictory moderating effects on these two leadership styles*? A reasonable explanation is that both transformational leadership and a high collectivist orientation emphasize organizational needs and shared visions (Deichmann and Stam, 2015). In other words, their effects greatly overlap. In a highly collectivist context, project members already demonstrate an exemplary commitment to project goals. Therefore, there is less available space for megaproject managers to greatly enhance the commitment of their subordinates.

In contrast, in transformational leadership, a crucial factor that enables improved collaborative working outcomes (Ding *et al*., 2017) is particularly valid within a low-level collectivist context and strengthening the

commitment of subordinates. Although studies have already analyzed the relationships between leadership styles (e.g., transformational leadership, servant leadership, and spiritual leadership) and pro-environmental behaviors (Afsar *et al*., 2016; Luu, 2019; Robertson and Barling, 2013), transactional leadership has received far less attention. Interestingly, the findings of this study are congruent with those of previous project management studies that show transactional leadership to be most effective in some cases (Tysse *et al*., 2014). Transactional leadership is, therefore, more likely to succeed with subordinates in a highly collectivist context who internalize their leader's values, and this effective internalization can be expected to foster feelings of shared environmental commitment and responsible behaviors.

5.2 Contributions to practice

This research has significant implications for megaproject managers and decision-makers who wish to improve the environmental performance of their projects. As such, managers can be challenged to implement a substantive and comprehensive environmental management system (EMS). Running an effective EMS hinges on the innovative and spontaneous behaviors of project members with respect to environmental improvement. Regarding the Hong Kong–Zhuhai–Macao Bridge, "*the most challenging task is not to facilitate reform of the management system or innovations in engineering technology, but to increase the environmental awareness of more than 100 contractors and 50,000 front-line builders*" (HKZM Bridge Authority, 2017). Our research shows that leadership is the key factor in coping with this challenge. Megaproject managers should focus not only on formal management practices but also on their leadership styles as they conduct their daily activities. The results of this study reveal the importance of both transformational and transactional leadership styles. OCBEs are neither self-starting nor self-sustaining but are based on the principle of reciprocity (Paillé *et al*., 2013). A transactional leadership style can engender high-quality reciprocity between leaders and their subordinates through a clear set of environmental goals that can stimulate the enthusiasm of project members to engage in OCBEs. This echoes the call of Tyssen *et al*. (2014) for the use of transactional leadership. Megaprojects management should, therefore, highlight and promote awareness of both transformational and transactional leadership styles and develop environmental management programs to train present and future leaders (Sabini *et al*., 2019).

In accordance with the work of Nguni *et al*. (2006) and Deichmann and Stam (2015), the results of this study confirm the positive influence of transformational leadership on project members' environmental commitment as being more significant than that of transactional leadership. Based on the environmental management practices of

the Shanghai Disney Resort construction project, Yang (2017) highlighted the significance of a comprehensive incentive program in megaprojects. Especially for transactional leaders, the environmental commitment of project members can be improved through this type of program, which can include environment suggestion awards, recognition of the eco-warrior of the month, and significant milestone achievement awards. Meanwhile, targeted environmental education is also an indispensable factor in motivating the environmental commitment of project members to ultimately create a supportive atmosphere for OCBEs (Wang *et al*., 2017a). For example, the Hong Kong–Zhuhai–Macao Bridge launched a series of activities, including a specialized training course on white dolphin protection and a month designated for the promotion of aquatic wildlife. In particular, the organizational complexity of megaprojects transforms project leaders from a leader of actors to a leader of leaders (Merrow 2018), which brings with it significant challenges to environmental management. Megaprojects management teams must be made aware of the importance of environmental commitment and cultivate an atmosphere of environmental protection.

Cultural values are also important factors in shaping the attitudes and behaviors of organizational members (Hofman and Newman, 2014). Therefore, it is necessary to consider the cultural characteristics of an organization to better understand the behavior of its members (Lee *et al*., 2000). The restraining effect of power distance suggests that, compared to transactional leaders, transformational leaders should empathic respect to their subordinates' cultural values (Lin *et al*. 2019). Specifically, leaders may need to take different actions based on the cultural values exhibited by individual subordinates rather than treating all subordinates the same. For subordinates with higher power-distance orientations, it would be more effective for transformational leaders to exhibit altruistic behaviors such as caring about the daily lives of their subordinates (Lin *et al*. 2018) or routinely engaging in high-quality leader-member exchanges (Tu and Lu 2016).

Meanwhile, megaproject managers need to adopt targeted approaches to better leverage the multiple moderating effects of a collectivist orientation as a significant catalyst for the effect of transactional leadership. As such, transactional leaders in megaprojects should recognize the importance of cultivating an exemplar collectivist environment. To do so, they can develop long-term training programs to improve collectivist attitudes and behaviors that benefit the environment (Chen *et al*. 2016). *Conversely*, a collectivist orientation was found to mitigate the effect of transformational leadership. Transformational leaders can use smaller project teams for their subordinates, as people tend to feel less peer pressure in smaller groups (Jin *et al*. 2018).

5.3 Limitations and future research

The generalizability of these study results is subject to certain limitations. First, the environmental commitment was considered to be a mediating variable in this exploration of the relationship between leadership styles and OCBEs. However, the empirical results show that environmental commitments play only a partial mediating role. Future research can explore other contextual variables that may mediate the "leader–subordinate exchange process," such as project identification, procedural justice, and trust in leaders. Secondly, this study was conducted in a specific geographic context (i.e., China). As such, there is an opportunity for future research to compare the influence of leadership styles in Eastern and Western cultural contexts.

6. Conclusions

Leveraging transformational and transactional leadership styles to cultivate OCBEs provides a crucial means for improving megaproject environmental governance. In this study, the mechanism influencing two types of leadership styles on OCBEs were compared, research hypotheses were tested using the HRM and PLS techniques, leading to the following conclusions. *First*, both transformational and transactional leadership styles were found to have a significant positive impact on environmental commitment and the OCBEs of megaproject members. Of the two, transformational leadership was found to be more influential. Secondly, environmental commitment positively predicts OCBEs but only partially mediates the relationship between transactional leadership and OCBEs. Thirdly, power distance plays a negative moderating role in the relationship between transformational leadership and OCBEs, and its moderating effect on the relationship between transactional leadership and OCBEs is not significant. Finally, a collectivist orientation has a negative moderating role in the relationship between transformational leadership and OCBEs, which is contrary to the original hypothesis. Moreover, a collectivist orientation has a positive moderating role in the relationship between transactional leadership and OCBEs.

Leadership has been reported to influence the OCBEs of subordinates (Luu, 2019; Mi *et al*., 2019). However, this line of research has tended to investigate specific leadership styles, such as spiritual leadership, transformational leadership, and ethical leadership, within permanent organizations. There has been scant research on the different mechanisms influencing leadership styles. Moreover, both transformational and transactional leadership styles within a temporary organization are expected to demonstrate differentiated power. This study echoes the call to extend leadership studies in project settings and highlights the effect of different leadership styles in cultivating environmental commitment and promoting OCBEs. The findings provide intriguing evidence toward the development of a better understanding of why, how, and under what circumstance transformational and transactional leadership styles predict OCBEs in the management of megaprojects. Megaproject managers must learn how to better leverage the effect of trust and commitment and shape the working context to motivate and inspire their subordinates regarding the environmental cause.

Notes

[1] As suggested by Hofstede (1980), when examining and extending leadership theory in organization studies, power distance orientation and collectivism are two important culture-contextual dimensions.

[2] According to Martins et al. (2002)，it is suggested to introduce the threshold of 0.1 for better interpretation of the empirical model.

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