Positive Leadership and Employees' Pro-Environmental Behavior: A Meta-Analysis

Abstract

Based on social learning and self-determination theory, this study empirically investigated 36 positive leadership and employees' pro-environmental behavior topics (N=15745). The meta-analytic structural equation modeling approach was used for a systematic review, resulting in the following phased conclusions. There is a significant positive correlation between positive leadership and employees' pro-environmental behavior, environmental motivation mediates the relationship between positive leadership and employees' pro-environmental behavior, and industry category and research design rigor significantly moderate the relationship between positive leadership and employees' pro-environmental behavior. This research clarifies the authentic relationship between positive leadership and employees' pro-environmental behavior, opens the black box between the two, and expands the boundary conditions between them.

Keywords: Positive leadership, Employees' pro-environmental behavior, Meta-analysis, Sustainable development

Introduction

With the continuous improvement of financial performance, the impact of businesses on the natural environment is also increasing daily. To achieve the strategic goal of sustainable development, organizations must constantly invest significant resources to empower the green development of enterprises (Andersson et al., 2013; Robertson & Barling, 2017). An organization's sustainable development relies on its employees' recognition and participation. Employees are the core resources for implementing environmental practices within the organization (Buysse & Verbeke, 2003). Therefore, the organization attaches significant importance to the crucial role of employees in promoting sustainable development and clean production (Singh et al., 2020). Pro-environmental behaviors are essential environmental practices for employees, such as waste recycling and reuse, green product development, and sustainable work methods (Kim et al., 2017; Jenny et al, 2017). Cultivating and shaping employees' pro-environmental behaviors contribute to improving corporate profits, establishing a positive social image, and gaining a competitive advantage. Therefore, it has become an essential topic of concern in management (Wesselink et al., 2017; Peng et al., 2020; Omarova & Jo, 2022).

Given the positive impact of pro-environmental behavior, it is relatively significant to understand the relevant factors of employees' pro-environmental behavior. Researchers have identified two major categories of related factors of pro-environmental behavior through a series of empirical studies: the first category is internal individual factors, such as demographic variables, cognitive and affective psychological variables, the Big Five personality traits and trait affective variables (Vicente-Molina et al., 2018; Li et al., 2019; Gifford & Nilsson, 2014; Kristofferson et al., 2014); The second category is external contextual factors, such as in-group identification, collective efficacy, group emotion, in-group norms, macroeconomic culture, and so on (Geiger et al., 2020; Chen, 2015; Greenaway et al., 2015; Harth et al., 2013; Fielding & Hornsey, 2016). Although these studies provide valuable evidence for the related factors of employees' pro-environmental behavior, leadership style may be closely related to employees' pro-environmental behavior (Robertson & Barling, 2013), relevant empirical research indicates that environmentally specific leadership, ethical leadership, green leadership, responsible leadership, and transformational leadership highly correlate with employees' pro-environmental behavior (Azhar & Yang, 2022; Hu et al., 2022; Zhou et al., 2022).

Unsurprisingly, the current literature fails to adequately address the relationship between leadership styles and employees' pro-environmental behavior. Firstly, previous empirical studies

have examined the connection between a particular leadership style and employees' pro-environmental behavior (Ahmed et al., 2023). However, the literature on individual pro-environmental behavior has yet to explore the relationship between macro leadership style and employees' pro-environmental behavior (Li et al., 2019; Ahmed et al., 2023). Categorizing and summarizing leadership styles can help better understand the factors influencing employees' pro-environmental behavior. Secondly, although research on the relationship between leadership styles and employees' pro-environmental behavior is growing, there are substantial discrepancies in effect sizes among existing studies. For example, after controlling for factors such as sampling tools, gender, and sampling region, some researchers found a correlation coefficient of 0.575 between ethical leadership and employees' pro-environmental behaviors, with a statistically significant level of less than 0.001. However, other researchers found that the correlation coefficient between the two was only 0.11 (Wood et al., 2021; Chreif & Farmanesh, 2022).

In addition to the difficulty in grasping the proper relationship between positive leadership and employees' pro-environmental behavior, there may be mediating mechanisms between leadership styles and employees' pro-environmental behavior. The existing literature on the mediating variables between the two is scattered, and the sample size limitations restrict the persuasiveness of research conclusions. Lastly, the discrepancies in existing research conclusions may be due to the need for more contextual variables that moderate the relationship between leadership styles and employees' pro-environmental behavior, namely the boundary conditions of their relationship. The characteristics of different samples, research designs, and measurement methods may lead to variations in research results, making it difficult to accurately estimate the overall effect of the studies (Shipton et al., 2017). Existing empirical research needs to explore the boundary conditions of the relationship between leadership styles and employees' pro-environmental behavior from a contextual perspective.

The method of meta-analytic structural equation modeling (MASEM) can integrate and statistically analyze the conclusions of multiple studies, combining effect sizes to provide a systematic evaluation and analysis of the differences in research findings. It also allows for testing the mediating effects and examining the moderating effects of different contextual variables through model fit tests (Borenstein et al., 2009). This study aims to analyze the relationship between positive leadership and employees' pro-environmental behavior using the MASEM method. We expect to make progress in the following three aspects: First, to clarify the strength of the relationship between positive leadership and employees' pro-environmental behavior to resolve any discrepancies found in previous studies. Second, to explore the mediating mechanisms between positive leadership and employees' pro-environmental behavior under maximum sample size conditions to unveil the "black box" of their interaction process. Third, to investigate the contextual factors that may constrain the relationship between positive leadership and employees' pro-environmental behavior, such as industry category and research design rigor. This study aims to clarify which situational variables can moderate the relationship between positive leadership and employees' pro-environmental behaviors and to improve the accuracy of research conclusions.

Literature Review and Hypotheses Development

Positive Leadership and Employees' Pro-Environmental Behavior

Positive leadership encompasses a leadership style and behaviors that result in employees and subordinates experiencing positive emotions (Kelloway et al., 2013). Employees observing positive leadership behavior can evoke positive emotional experiences such as joy, excitement, relaxation, and happiness. Positive leadership fosters employee trust, enhanced work engagement, task performance, and a higher perception of leadership effectiveness (Norman et al., 2020). (Norman et al., 2020).

Employees' pro-environmental behavior, also known as employees' green behavior or organizational citizenship behaviors, refers to employees' purposeful and conscious actions to

reduce or eliminate negative environmental impacts. This behavior not only effectively improves the natural environment but also has the potential to change individual and organizational attitudes toward environmental protection (Tian & Robertson, 2019). Employees' pro-environmental behavior is voluntary, and extra-role behavior is not included in the organization's performance incentive system. However, it improves the organization's environmental management level (Boiral & Paillé, 2012).

Social learning theory emphasizes that observing others' behavior is essential for individuals to acquire social behaviors (Bandura & Walters, 1977). When applied to the organizational context, the interaction between leaders and employees influences employee behaviors. In other words, mediated by social observation and modeling learning, employees acquire the behaviors of positive leadership and engage in pro-environmental behaviors (Robertson & Carleton, 2018).

This study expands on the interaction between leadership and members within the framework of social learning theory. Whether it is environmentally specific, ethical, or green leadership, positive leaders transmit their environmental preferences to employees through concrete actions such as protecting the environment, maintaining ecological balance, reducing environmental pollution, and adopting sustainable work methods. As observers of social learning, employees consciously identify the environmental orientation of leadership and learn about their leaders' concern for environmental protection. As a result, employees are expected to engage in behaviors with minimal or no negative environmental impact (Peng et al., 2022). Meanwhile, environmentally specific leadership, green leadership, responsible leadership, etc., encourage employees to broaden their perspectives, go beyond personal interests, and demonstrate behaviors that benefit their environment (Robertson & Barling, 2013). As, there is a high correlation between positive leadership and employees' environmental autonomy and pro-environmental behaviors (Robertson & Carleton, 2018). Thus, we propose the following hypothesis:

H1: *Positive leadership will be positively related to employees' pro-environmental behavior.*

Environmental Motivation as a Mediator

Environmental motivation is an individual's intrinsic drive towards pro-environmental behavior, manifested by sustained interest, enjoyment, and higher satisfaction levels (Li et al., 2020). Self-determination theory suggests that motivation is the core factor of individual behavior (Gagné & Deci, 2005). Moreover, situational factors are highly correlated with individuals' level of intrinsic motivation, such as leadership style or behavior (Ryan & Deci, 2000). Positive leadership styles such as environmentally specific, green, and responsibility-based leadership enthusiastically convey the importance of organizational sustainability in management practices. They clearly articulate the practical significance and real-world impact of environmental protection, establish clear and achievable environmental goals for employees, and encourage employees to solve problems related to environmental conservation creatively. This process of transmitting environmental values promotes the internalization of organizational environmental values at the employee level, enhancing employees' sense of self-fulfillment when engaging in pro-environmental behaviors (Daily et al., 2009). When employees embrace the transmission and internalization of environmental values from positive leadership, environmental consciousness becomes integrated into their self-identity construction, making pro-environmental behavior more meaningful (Turaga et al., 2010).

Self-determination theory suggests that individuals with high levels of intrinsic motivation exhibit strong initiative in exciting tasks and bring a sense of joy or satisfaction in the workplace (Ryan & Deci, 2000); there is a high correlation between intrinsic motivation and green behaviors in the occupational setting (Deci et al., 2017). There is a correlation between environmental motivation and employees' behavioral practices. The spontaneity of pro-environmental behavior indicates the intrinsic consistency between environmental motivation and pro-environmental behavior (Lu et al., 2017). At the same time, some scholars believe that individuals with high levels

of autonomous motivation will actively engage in environmental protection activities even without the influence of external factors (Gagné & Deci, 2005). Therefore, employees' environmental motivation is closely related to pro-environmental behavior. Therefore, we recommend the following hypothesis:

H2: *Environmental motivation mediates the relationship between positive leadership and employees' pro-environmental behavior.*

Potential Moderator Variables

Divergent findings in studies of the same variable may be attributed to contextual factors, such as industry category and the rigor of research design (Borenstein et al., 2009; Cooper, 2017). Due to variations in business processes and production nature, the manufacturing industry exhibits a greater need for and sensitivity to environmental protection than other industries (Zhai & An, 2020). The production objects and processes within the manufacturing industry are highly likely to cause damage to the natural environment. Therefore, the correlation between positive leadership and employees' pro-environmental behaviors may be stronger in the manufacturing industry.

In addition, the research design of questionnaire surveys primarily focuses on controlling common method biases. Common method bias is a systematic error that arises from the same data source within the questionnaire method, and homologous variance can result in inflated effect values (Podsakoff et al., 2003). In practice, it is expected to control common method biases by using multiple time points and different sampling sources to enhance the rigor of the research design. Studies using multi-source sampling tend to yield lower effect values than single-source sampling studies. Based on the above analysis, we suggest the following hypotheses:

H3: *Industry category will moderate the relationship between positive leadership and employees' pro-environmental behavior.*

H4: *The rigor of the research design will moderate the relationship between positive leadership and employees' pro-environmental behavior.*

In summary, the research model of this study is illustrated in Figure 1.

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Methodology

Research Methods

This study adopts the two-stage meta-analytic structural equation modeling approach to examine the relationship between positive leadership and employees' pro-environmental behaviors (Cheung, 2005).

Literature Retrieval

According to the suggestions of Moher et al. (2009), this study establishes a specific process for literature retrieval and screening, as shown in Figure 2. The study used keywords such as "leadership," "leadership style," "pro-environmental behavior," "green behavior," and "environmental, organizational citizenship behavior." It employed the "AND" search mode to retrieve literature from English core databases such as Web of Science and APA PsycINFO. The titles and abstracts of the downloaded literature were read and reviewed. Additionally, efforts were made to search for any missing references through critical academic journals in organizational behavior, significant academic conferences in international organizational behavior, and reaching out to critical scholars via email to minimize publication bias and enhance the accuracy of the meta-analysis results. The cutoff time for literature retrieval is noon on October 1st, 2023, Beijing time. In addition, there are no restrictions on the publication date of the literature.

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The specific criteria for literature selection are as follows: (1) The literature needs to report the Pearson correlation coefficient *r* between variables or other convertible correlation coefficients. (2) The literature must report at least one correlation coefficient to illustrate the relationship between positive leadership and employees' pro-environmental behavior. (3) Duplicate and redundant studies, as well as qualitative research, will be excluded. (4) According to the screening criteria proposed by Cooper (2017), studies that do not fall under the research topic of "positive leadership and employees' pro-environmental behavior" should also be excluded. A total of 36 publicly published journal papers were included in the sample for the meta-analysis.

Surprisingly, most studies included in the meta-analysis were conducted in developing countries such as Pakistan and China. At the same time, there were relatively few studies from the United States (only three), and there needed to be more exploration on this topic from European countries such as the UK, Germany, and France. We speculate that this research status may be because compared to developed European countries, the contradiction between environmental protection and economic development is more acute in developing countries. Therefore, researchers in these regions show more concern and enthusiasm for research topics related to environmental protection. We look forward to more samples from European countries to enrich the empirical research on proactive leadership and employees' pro-environmental behavior and further examine whether cultural background can significantly moderate the relationship between proactive leadership and employees' pro-environmental behavior through subgroup analysis.

Encoding

According to Cooper's recommendations (2017), the coding process consists of four stages. In the first stage, three researchers jointly develop a coding worksheet and coding scheme, and they code the literature included in the meta-analysis. This includes coding for mediator variables, effect sizes, sample sizes, sampling procedures, industry classifications, and other related factors. During the second phase, the three researchers individually analyzed a randomly chosen group of 12 articles and subsequently evaluated the findings' coherence, yielding a consistency coefficient of 0.88. Any inconsistencies in the coding are addressed, improved, and revised. During the third step, each of the three researchers individually analyzes a distinct collection of 10 articles chosen at random, resulting in an enhanced level of consistency (with a consistency coefficient of 0.94). Any remaining inconsistencies are resolved by deliberation. During the fourth stage, the three researchers finalize the coding process for all the articles and then do additional checks to confirm the absence of noticeable errors. The literature considered in the meta-analysis is summarized in Table 1. Positive leadership encompasses a range of different forms, which are specifically listed in depth in Table 1.

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Meta-analysis Program

According to the research paradigm recommended by scholars (Borenstein et al., 2009; Cooper, 2017), this study used CMA 3.0 software for main effect analysis and moderation effect testing and used AMOS 26.0 software for mediation effect testing. The two-stage meta-analytic structural equation modeling procedure consists of two stages: in the first stage, the correlation coefficients of the combined research findings are synthesized to generate a pooled correlation

matrix; in the second stage, the structural equation model is fitted based on the pooled correlation matrix for hypothesis testing (Cheung, 2005).

The first phase of analysis includes the following three steps:

First, correct measurement errors. The correction formula is as follows:

$$r_z = \frac{r_{xy}}{\sqrt{r_{xx}}\sqrt{r_{yy}}}$$

Among them, r_z is the correlation coefficient between the variables x and y after correction, r_{xy} is the correlation coefficient between variables x and y, and r_{xx} and r_{yy} are the reliability values (Cronbach's α coefficient) of variables x and y.

Second, the sample size is used as the calculation standard for the corresponding weight of the adjusted effect value. At the same time, conduct a heterogeneity test on the adjusted effect values. Use the I^2 index to assess the degree of heterogeneity, where an I^2 value greater than 0.75 indicates high heterogeneity.

Third, a comprehensive correlation matrix was formed using the correlation coefficients that have passed the heterogeneity test.

The second phase of analysis includes the following four steps:

Fourth, two methods were used to assess for publication bias. Firstly, the fail-safe factor was calculated, where a larger fail-safe factor indicates a lower possibility of publication bias. Then, the trim-and-fill method was used to estimate the number of missing studies (M). This method removes asymmetric studies from the funnel plot through an iterative process, forming a symmetric funnel plot and obtaining a new unbiased effect estimate. Using both methods to evaluate for publication bias can provide more robust research conclusions.

Fifth, a meta-analysis of the main effect will be conducted using the adjusted effect values and their corresponding weights, and the effect values will be converted into Fisher's Z scores. Simultaneously, the inverse variance weighting method was used to adjust for the distribution bias of the effect values, ensuring the accuracy of the effect value weights.

Sixth, import the comprehensive correlation matrix formed in Step 3 into AMOS software, use the maximum likelihood estimation method to conduct path analysis on the research model based on the comprehensive correlation matrix, and use the bootstrap method to evaluate the mediating effect. According to the principle setting of reliability in structural equation modeling, 1-α is set as the variance of measurement residuals (α is the average reliability value of variables), and $\sqrt{\alpha}$ is the non-standardized factor loading of the variables. The sample size for fitting the model is the harmonic mean of each study's sample size.

Seventh, use subgroup analysis to assess the moderating effect of moderating variables.

Results

Meta-Analysis Results of Bivariate Relationships

The meta-analysis results of the bivariate relationship are shown in Table 2. A significant positive correlation exists between positive leadership and employees' pro-environmental behavior (r=0.422, p<0.001). The I^2 values for all bivariate relationships are above 0.90, and the Q statistic is statistically significant, indicating the need for subsequent tests of moderating effects. The coefficients of insecurity are all greater than the critical value of 5k+10. The imputation method results show no missing values in the study of all bivariate relationships, indicating minimal impact from publication bias in this study.

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Meta-Analytic Structural Equation Modeling and Mediation Effect Testing

Following Cheung's (2015) recommendation, this study used AMOS for path analysis and hypothesis testing. The parameter estimates for the path analysis are shown in Figure 3, and the information for the mediation analysis is shown in Table 3. The relationship between positive leadership and employees' pro-environmental behavior is positively significant (r=0.24, p<0.001), supporting hypothesis 1. The relationship between positive leadership and environmental motivation (r=0.43, p<0.001) and the relationship between environmental motivation and employees' pro-environmental behavior (r=0.56, p<0.001) are both positively significant, indicating that environmental motivation mediates the relationship between positive leadership and employees' pro-environmental behavior, with an indirect effect accounting for 50.42% of the total effect. Hypothesis 2 is supported.

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Testing The Moderating Effect of Industry Category and Research Design Rigor

The results of the moderation analysis for the interaction effects are shown in Table 4. The table shows that the industry category significantly moderates the relationship between positive leadership and employees' pro-environmental behavior (Q_b=15.604, p<0.001). Compared with non-manufacturing industries, the correlation coefficient between positive leadership and employees' pro-environmental behavior is more significant in manufacturing, providing preliminary support for hypothesis 3. The rigor of the research design significantly moderates the relationship between positive leadership and employees' pro-environmental behavior (Q_b=13.035, p<0.001). Compared with single-source sampling, the correlation coefficient between positive leadership and employees' pro-environmental behavior is smaller when adopting a multi-source sampling research design, which provides preliminary validation for hypothesis 4.

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TABLE 4 ABOUT HERE

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This study conducted a meta-regression analysis to examine whether the relationship between positive leadership and employees' pro-environmental behavior is moderated by industry category and research design rigor. Industry category (β_1=-0.061, p<0.001) and research design rigor (β_1=0.059, p<0.001) significantly moderate the relationship between positive leadership and employees' pro-environmental behavior, providing further support for hypothesis 3 and hypothesis 4.

Discussion

This study utilizes meta-analytic structural equation modeling to understand better the correlation between positive leadership and employees' pro-environmental behavior. By aggregating leadership styles with underlying connections into one overarching term, namely

positive leadership, this study systematically integrates all relevant empirical studies at the current stage (k=36, N=15745), providing reliable estimates of the correlation between positive leadership and employees' pro-environmental behavior. The research findings consistently demonstrate a clear trend, indicating a significant positive correlation between positive leadership and employees' pro-environmental behavior. Additionally, environmental motivation mediates the relationship between positive leadership and employees' pro-environmental behavior. At the same time, industry category and research design rigor significantly moderate the relationship between positive leadership and employees' pro-environmental behavior.

Theoretical implications

The potential theoretical contributions of this study may manifest in the following aspects. Firstly, this study emphasizes the authentic relationship between positive leadership and employees' pro-environmental behavior within a comprehensive framework. Previous qualitative reviews on factors influencing individual pro-environmental behavior often overlooked the relevance of leadership (Li et al., 2019). Although a series of empirical studies have demonstrated a positive correlation between environmentally specific leadership, green leadership, responsible leadership, moral leadership, and other leadership styles and employees' pro-environmental behavior (Chreif & Farmanesh, 2022; Hu et al., 2022; Zhou et al., 2022), there is currently a lack of a comprehensive and aggregated perspective to evaluate the proper relationship between positive leadership and employees' pro-environmental behavior. As the first meta-analysis on leadership styles and employees' pro-environmental behavior, this study reveals a moderate positive relationship between positive leadership and employees' pro-environmental behavior. It expands the qualitative research on pro-environmental behavior and illustrates the intrinsic connection between leadership styles and employees' pro-environmental behavior (Li et al., 2019).

Secondly, this study employed the Meta-Analytic Structural Equation Modeling (MASEM) approach to construct a mediation model between positive leadership and employees' pro-environmental behavior. Environmental motivation mediates the relationship between positive leadership and employees' pro-environmental behavior, further clarifying the influence mechanism between the two (Li et al., 2020). This will help deepen the understanding of the relationship between positive leadership and employees' pro-environmental behavior.

Finally, this study explores the boundary conditions of the relationship between positive leadership and employees' pro-environmental behavior, contributing to expanding the research literature on leadership and employees' pro-environmental behavior. By examining whether industry category and research design rigor (homogeneous sampling or multiple-source sampling) can moderate the relationship between positive leadership and employees' pro-environmental behavior, the results show that compared to non-manufacturing industries, the positive correlation coefficient between positive leadership and employees' pro-environmental behavior is more significant in manufacturing industries. A possible explanation is that due to industry characteristics and production processes, manufacturing industries place more emphasis on green production and environmental protection (Zhai & An, 2020). Furthermore, compared to homogeneous sampling, the correlation coefficient between positive leadership and employees' pro-environmental behavior is smaller under multiple-source sampling. This could be attributed to the control of sampling errors and the avoidance of inflated effect sizes among variables, thus preventing an artificially high correlation coefficient (Podsakoff et al., 2003).

Practical implications

From this meta-analysis, we can gain a series of practical insights. On the one hand, organizations should emphasize the importance of leaders actively practicing pro-environmental behaviors. By adopting various methods such as green office practices, green official travel, and the formulation of green production plans, leaders should emphasize and implement green and environmentally friendly concepts in their leadership behaviors. Additionally, green management should be integrated into leadership and training programs to encourage leaders to contribute to the

green and sustainable development of the organization (Li et al., 2020).

On the other hand, in terms of employee recruitment and training, it is essential to strengthen the focus on environmental awareness and motivation. When recruiting new employees, organizations should use talent assessment tools to identify individuals with high levels of environmental motivation as much as possible. These employees are more likely to possess the concepts of clean production and green sustainable development. To train existing employees, organizations can utilize various methods such as salon workshops, green tourism and study programs, and lectures by environmental experts to make employees understand the importance of green production and sustainable development.

Limitations And Future Research Directions

Despite the contributions of this study, there are still certain limitations. Firstly, like most meta-analyses, the conclusions of this research are limited by the quality of the literature data included in the meta-analysis sample. Due to the limitations of cross-sectional research methods (44.44%), causal inferences cannot be accurately estimated (Antonakis et al., 2014). Additionally, the use of homogeneous sampling (47.22%) may affect the accuracy of the research results due to common method bias and perceptual biases (such as social desirability, personality biases, etc.) (Podsakoff et al., 2012).

Secondly, although the coding scheme was designed to account for moderating variables like the type of organization, it was discovered during the coding process that numerous studies needed to provide pertinent information regarding the type of organization. This oversight hindered the ability to examine the potential moderating effects of this contextual variable. In addition, many contextual variables (such as environmental rules and organizational policies) and individual variables (such as environmental motivation) cannot be examined for their possible moderating effects. Finally, only literature composed in the English language was incorporated, while literature in other languages was disregarded, potentially resulting in selection bias.

Therefore, future research can expand in the following areas: Firstly, future empirical studies should use more longitudinal designs, tracking studies, group studies, or experimental studies to avoid the interference of common method bias on the accuracy of research results. Secondly, when future empirical research becomes more abundant, further examination can be conducted to determine whether variables such as environmental regulations, organizational policies, and environmental motivation have moderating effects. Lastly, future meta-analyses should incorporate research findings from multiple languages to enhance the comprehensiveness and accuracy of research conclusions.

Conclusion

This study employed the meta-analytic structural equation modeling approach to investigate the genuine connection between positive leadership and employees' pro-environmental behavior. Additionally, the study examined the role of environmental motivation as a mediator between the two variables. Moreover, we examined the moderating effects of industry category and research design rigor on the relationship between the two. This study will help unravel the complex relationship between leadership style and employees' pro-environmental behavior, further achieving green and sustainable development of the organization.

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Table 1 Overview of primary studies included.

Author and year	N	Correlation	Types of positive leadership	Country	Industry
Robertson & Carleton,2018	125	0.58	environmentally specific transformational leadership	United States	not reported
Tuan,2019	161	0.29	environmentally specific charismatic leadership	Vietnam	Service and catering
Li et al.,2020	214	0.44	environmentally specific transformational leadership	China	Manufacturing
Yue et al.,2022	873	0.229	empowering leadership	China	Public institution
Ahmad et al.,2021	427	0.46	ethical leadership	Pakistan	not reported
Faraz et al.,2021	323	0.598	green servant leadership	Pakistan	Manufacturing
Tian & Suo,2021	561	0.48	responsible leadership	China	Service and catering
Zhou et al.,2022	319	0.553	responsible leadership	China	Manufacturing
Farrukh et al.,2022	280	0.791	green transformational leadership	Pakistan	Manufacturing
Omarova & Jo,2022	218	0.15	environmentally transformational leadership	Kazakhstan	Non-profit organization
Graves & Sarkis,2018	251	0.48	environmentally transformational leadership	United States	Manufacturing
Azhar & Yang,2022	202	0.15	transformational leadership	United States	Civil servant
Saleem et al.,2021	400	0.35	ethical leadership	Pakistan	University and hospital
Tu et al.,2022	344	0.47	environmentally specific transformational leadership	China	not reported
Thabet et al., 2022	254	0.623	green inclusive leadership	Palestine	Service and catering
Zafar et al.,2022	434	0.52	environmentally specific servant leadership	Pakistan	Manufacturing
Zheng et al.,2023	935	0.435	transformational leadership	China	Service and catering
Asante,2023	235	0.328	green leadership	Ghana	Service and catering
Luu,2018	1143	0.27	environmentally specific servant leadership	Vietnam	Service and catering
Graves et al.,2018	165	0.74	active leadership	Russia	not reported
Khan et al.,2019	447	0.19	ethical leadership	China	Manufacturing
Ying et al.,2020	315	0.712	servant leadership	Pakistan	Manufacturing
Wood et al.,2021	2284	0.11	ethical leadership	United Arab Emirates	Service and catering
Cheng et al.,2021	203	0.2	empowering leadership	China	not reported
Zhang et al.,2021	299	0.386	responsible leadership	China	not reported
Hu et al.,2022	422	0.32	green leadership	Pakistan	Manufacturing
Quan et al.,2022	372	0.263	green inclusive leadership	China	Manufacturing
Qu et al.,2022	461	0.38	self-sacrificial leadership	China	Manufacturing
Khan et al.,2022	224	0.534	environmentally specific ethical leadership	Pakistan	Service and catering
Peng et al.,2022	511	0.408	environmentally specific servant leadership	Pakistan	Healthcare industry
Mi et al.,2019	215	0.36	transformational leadership	China	not reported
Ahmed et al.,2023	357	0.44	responsible leadership	Pakistan	Manufacturing
Islam et al.,2021	589	0.41	ethical leadership	Pakistan	not reported
Islam et al.,2020	645	0.21	ethical leadership	Pakistan	Manufacturing
Chreif & Farmanesh,2022	200	0.575	ethical leadership	Lebanon	Non-profit organization
Anser et al.,2020	337	0.2	spiritual leadership	China	Manufacturing

Table 2 Results of bivariate element analysis

Variable relationship	*k*	*N*	Weighted average correlation coefficient		95% Confidence Interval		Homogeneity test			Publication Bias Test	
			ρ	*Z*	*Lower bound*	*Upper bound*	*Q*	I^2	*p*	*Fail-safe-N*	*M*
PL-EM	5	1460	0.382	3.968	0.201	0.537	50.833	92.131	0.000	291	0

EM-EPB	5	1460	0.577	6.503	0.430	0.695	82.315	95.141	0.000	817	0
PL-EPB	37	15745	0.422	11.646	0.336	0.562	697.709	95.270	0.000	10917	0

Note: PL is positive leadership, EM is environmental motivation, EPB is employees' pro-environmental behavior, *k* is the number of effect sizes, and *N* is the sample size.

Table 3 Mediation effect test information

Variable relationship	Point estimate	Standard error	95% Monte Carlo confidence interval
Total effect			
PL→EPB	0.478***	0.020	[0.439,0.517]
Direct effect			
PL→EPB	0.237***	0.022	[0.196,0.280]
Indirect effect			
PL→EM→EPB	0.241***	0.014	[0.212,0.269]

Note: PL is positive leadership, EM is environmental motivation, EPB is employees' pro-environmental behavior, ***denotes $p<0.001$.

Table 4 Test results of the moderating effect

	Category	*k*	*N*	*r*	95% Confidence Interval		*Z*	*p*	Homogeneity test		
					Lower bound	*Upper bound*			Q_b	*df*	*p*
Industry Category	Manufacturing industry	14	5056	0.394	0.370	0.418	28.221	0.000	15.604***	1	0.000
	Non-manufacturing industry	14	8210	0.313	0.293	0.332	26.464	0.000			
Rigorousness of research design	Single-source sampling	17	7216	0.386	0.366	0.405	34.452	0.000	13.035***	1	0.000
	multiple-source sampling	19	8529	0.335	0.315	0.354	30.905	0.000			

Note: ***denotes $p<0.001$.

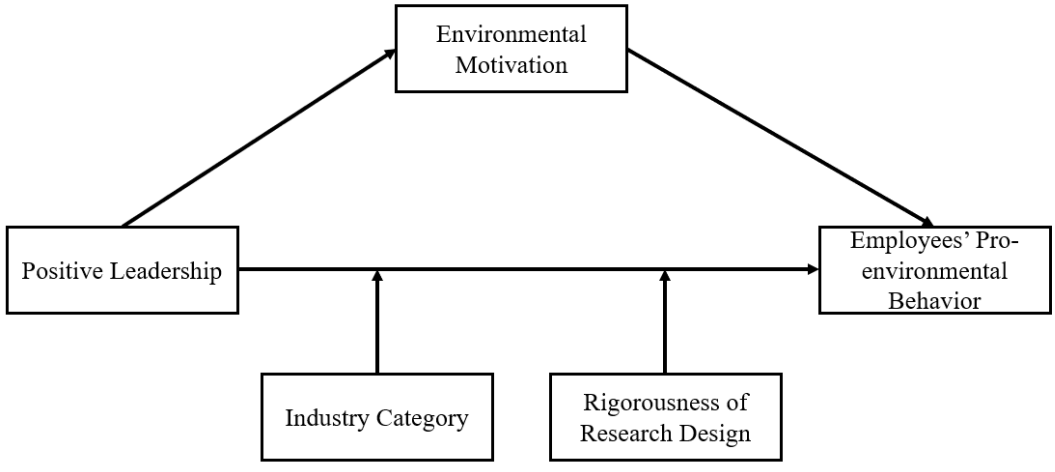

Fig. 1 Theoretical model

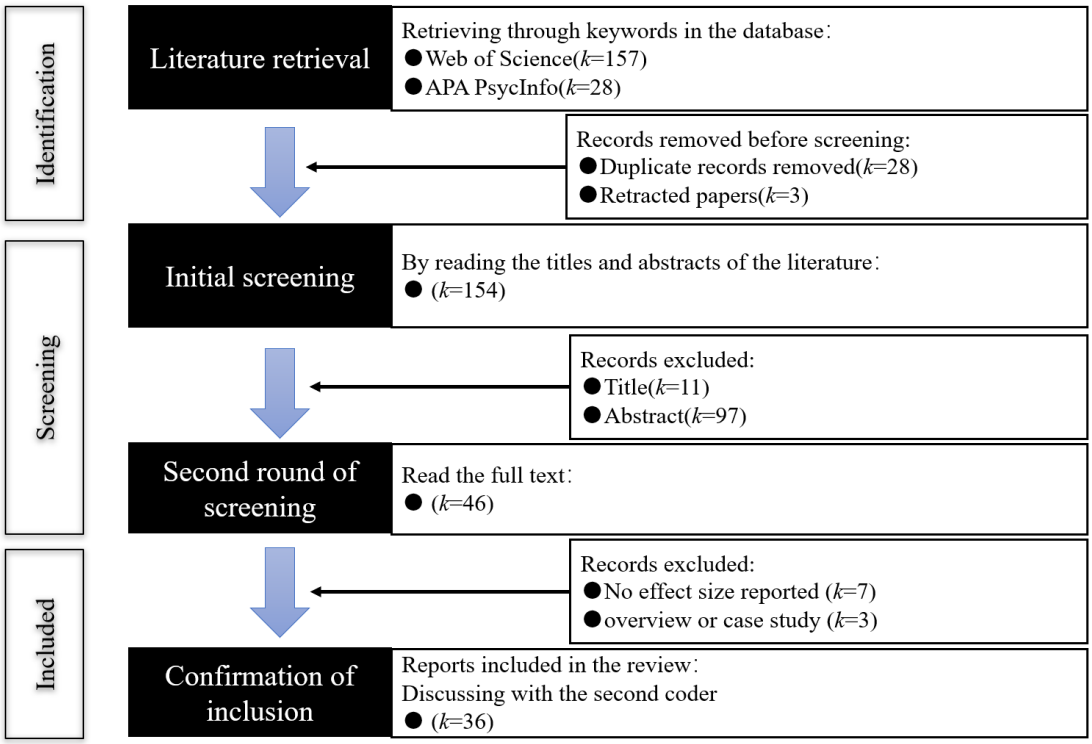

Fig.2 PRISMA flow chart of systematic literature search.

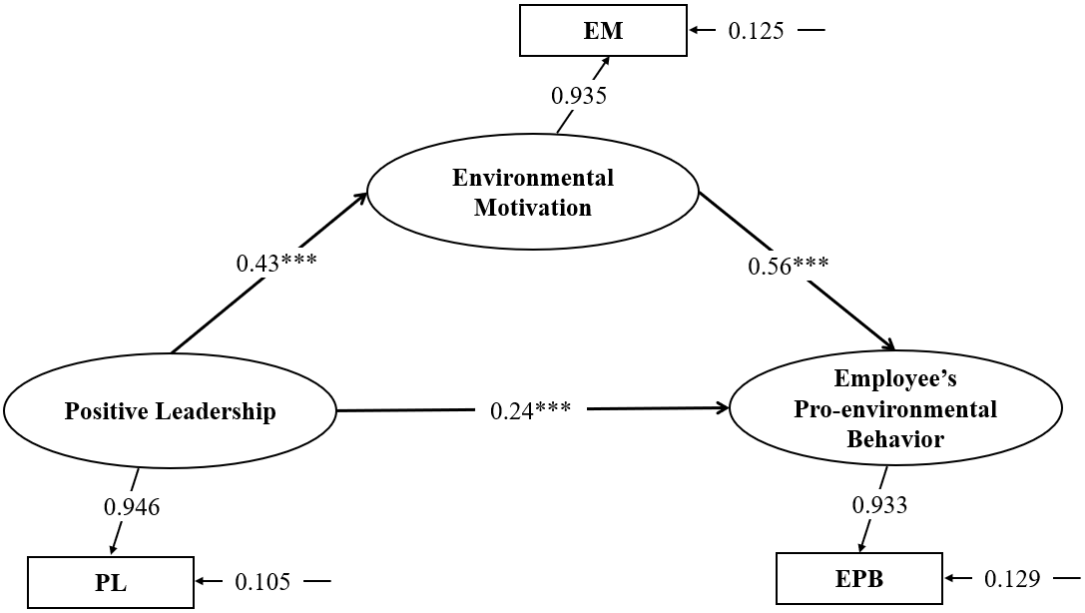

Fig.3 Model path coefficients