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Green Practices, Green Employees: The Implications of Leaders and HR Practices on Employee Pro-Environmental Behavior in China's Petroleum industry

Chunyan LIU[1], Zhanfang SUN[2]

Abstract

Drawing on the theory of leader-member exchange and the theory of green human resource management, this study explores the stimulation of green behavior among employees in China's petroleum enterprises to promote sustainable development, and constructed an integrated model based on a questionnaire survey conducted among in-service employees from 18 Chinese petroleum enterprises to analyze the relationship between leader-member exchange, green human resource management, and employees' green behavior, as well as to examine the regulating role of psychological capital in this relationship. The research results show that there is a positive correlation between leader-member exchange, green human resource management, and employees' green behavior, which can be strengthened by psychological capital. Therefore, it is recommended in this paper that leaders establish a strong interactive relationship with employees, organize and improve internal green systems, cultures, and strategies, pay attention to the cultivation of employees' psychological capital, enhance employees' confidence and hope, and encourage and organize employee to participate in the activities such as green knowledge training and skill competition, in the hope to improve their level of green behavior.

Keywords: *Leader-Member Exchange; Green Human Resource Management; Psychological Capital; Employees' Green Behavior; Petroleum Enterprises*

1. Introduction

The Brundtland Report: Our Common Future released by the United Nations in the late 1980s marked a turning point in the discussion of sustainability, which has become a mainstream topic since then. This report proposes the importance for sustainable development, as stated in page 41, which refers the sustainable development to as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

[1] Chunyan LIU, PhD Candidate, Seoul School of Integrated Sciences & Technologies, Seoul, Korea.

[2] Corresponding Author: Zhanfang SUN, Distinguished Professor of Seoul School of Integrated Sciences & Technologies, Seoul, Korea.

This definition has consistently served as the foundation for the development of the concept of organizational sustainability. Organizational sustainability, also known as corporate sustainability, is a broad concept that involves not only ecological concerns, but also the integration of social responsibility and economic activities within the natural and social environment (Linnenluecke and Griffiths, 2010).

Environmental issues have emerged as a prominent concern worldwide, as they pose a threat to both the environment and human systems, potentially influencing human health. For example, the shipping industry contributes 2.8% of global emissions per year, equivalent to 1,036 metric tons of carbon monoxide 2e p.a per year (Gray et al., 2021), and the pollutants from motor vehicles account for 30% to 85% of all man-made air pollutants in metropolitan areas of developing countries (Faiz, 1993). These environmental issues pose a threat to environmental sustainability, forcing organizations worldwide to adapt their business strategies and embrace initiatives that promote environmental sustainability. Therefore, the construction of low-carbon cities has become the core strategy for countries to address the challenges posed by climate change (Feliciano and Prosperi, 2011; Watson et al., 2019). In recent years, there has been a persistent issue of high pollution levels in urban air quality. Amanda et al. (2010) believed that a large amount of pollutants, including greenhouse gases related to global warming, is being are released into the atmosphere during oil refining

Petroleum enterprises are energy-based enterprises that require high investments with high risk, high energy consumption, and high environmental pollution potential. Therefore, it is necessary to accelerate the development of a modern energy system to ensure national energy security and achieve the goals of carbon peak and carbon neutrality as scheduled, which serves as a crucial pillar for achieving high-quality economic and social development and is the only path towards the future sustainable development of the petroleum industry (Li and Shi, 2014). Emission reduction and energy management are important aspects in the pursuit of sustainable development for petroleum enterprises (Fernando and Hor, 2017). According to Fragkos et al. (2021), emission reduction can be achieved through the utilization of renewable energy, improvement of energy efficiency, and adoption of electrified energy services. However, in the context of energy management, the green management of petroleum enterprises necessitates improvement. Therefore, green management is becoming a new direction of development for petroleum enterprises, and scholars are placing more importance on the implementation of green management practices in human resources and employees (Shahab-Deljoo et al., 2023).

Islam et al. (2020) believed that green human resource management (GHRM) is a key challenge for organizations to implement effective sustainable development methods, which provides theoretical support for the green development of petroleum enterprises. Meanwhile, Renwick et al. (2013) believed that the implementation of green policies and practices within organizations through recruitment, selection, training, development, performance evaluation, rewards, salary management and exit policies, as well as the communication of values and corporate culture In line with the requirements of management time, green management practices of an organization further strengthen the commitment of both management and employees, which, in turn, influences the green behavior of employees and promotes the adoption and sustenance of green behavior among all members of the organization (Dubois and Dubois, 2012). Green behavior refers to a series of voluntary actions taken by employees in an organization to contribute to environmental sustainability and ecological environment protection, with an aim to reduce the negative impact of employees' activities on the natural environment (Ones and Dilchert, 2012; Kim et al., 2017).

The research framework has evolved from emission reduction of industry to green practice of organizations and now focuses on employees' green behavior. Further in-depth research is also being conducted on the factors influencing employees' green behavior. Previous studies have explored the

antecedent variables of employees' green behavior from contextual factors such as leadership behavior, the presence of a green atmosphere, green human resource management practices, and corporate social responsibility. For example, Graves et al. (2013) conducted a study that demonstrated how green transformational leadership, as a leadership behavior focusing on green goals, can establish a green vision for an organization and motivate members to actively strive for green goals. This further encourages the employees to implement green behavior; in other words, green transformational leadership has a positive influence on employees' green behavior. Tian and Robertson (2019) pointed out that employees are more likely to provide suggestions and participate in the company's overall social responsibility initiatives when they perceive the company as being concern of societal and environmental issues. Therefore, employees' perception of corporate social responsibility has a positive impact on their voluntary green behavior. Other studies have shown that personal factors and situational factors influencing employees' green behavior are often not mutually exclusive. Furthermore, they constitute both distal and proximal antecedents that influence employees' green behavior. For example, Norton et al. (2014) believed that a company's environmental strategy can create a green atmosphere that influences employees to adopt green behavior. Some studies suggest that the distal antecedent of leadership behavior can influence employees' green behavior through individual proximal antecedents, such as emotions and motivation. However, existing research still requires further investigation into the antecedent variables of employees' green behavior.

On the other hand, psychological capital is a newly developed field of research on human resource management from the perspective of positive organizational behavior (Luthans et al., 2010; Zheng and Kong, 2019). It is a significant factor in personal motivation, and its key components, self-efficacy and hope, play a crucial role in enhancing employees' confidence and willingness to engage in environmental behavior, thereby promoting employees' environmental behavior (Saeed et al., 2019). Existing studies, however, mainly focus on the intermediary role of psychological capital on employees' green behavior. A study conducted by Wang et al. in 2023 revealed that there is a positive correlation between responsible leadership and teachers' green behavior, and psychological capital plays an intermediary role in this relationship. As an individual's psychological resource, psychological capital should be regarded as a regulating factor (Yao et al., 2022).

Drawing on the aforementioned studies and based on 341 survey samples collected from 18 petroleum enterprises in China, this study introduced two independent variables, that is, green human resource management and leader-member exchange, and included psychological capital as a regulating variable to explore the mechanism through which these variables influence employees' green behavior. The investigations conducted encompass both practical and theoretical aspects, aiming to provide theoretical guidance for China's petroleum enterprises in formulating green management strategies, and to propose the corresponding improvement measures for petroleum enterprises.

2. Literature Review

The concept of green human resource management originates from discussions on sustainable practices. With the increasing focus on environmental issues, enterprises are beginning to recognize the importance of human resource management in greening of organizations, the economy, and society, which drives the development of green human resource management. According to the theory of green human resource management, the basic concepts, objectives, functions, processes, activities, and strategies of human resource management should be reevaluated with a focus on environmental sustainability, and the strategic importance of human resource management is emphasized (Arulrajah and Opatha, 2016). The new approach to human resource management closely related to environmental protection is a set of practices aimed at

understanding the relationship between natural environment, organizational activities, and the human resource management system. The primary objectives of green human resource management practice is to realize information sharing with employees (Clair et al., 1996), and to enhance employees' environmental awareness and behavior, increase their awareness of global environmental issues, and encourage them to adopt and participate in more environment-friendly practices (Renwick et al., 2013；Baumgartner and Winter, 2014).

The relationship between leaders and employees plays an important role in the successful implementation of green human resource management (Ahmad, 2015). The leader-member exchange (LMX) theory believes that there is a unique relationship between leaders and subordinates, which will influence the subordinates' performance in work, satisfaction with work, and commitment to the organization. This theory divides the relationship between leaders and subordinates into two types: high-quality and low-quality. Effective communication, trust, and support are crucial components of a high-quality LMX relationship. It has been revealed that high-quality LMX relationships are associated with better performance in work, higher satisfaction with work, and stronger commitment to the organization (Bauer and Erdogan, 2015). This theory also analyzes the quality of the relationship between managers and team members, emphasizing the influence of developing a communication relationship between leaders and subordinates on leadership (Schriesheim et al., 1999).

The leadership formed through leader-member exchange has been found to have an impact on organizational citizenship behavior (Ilies et al., 2007), and employees' green behavior has been determined to be a significant aspect of organizational citizenship behavior (Boiral and Paillé, 2012).

Psychological capital is a newly developed field of research on human resource management from the perspective of positive organizational behavior (Luthans et al., 2010), aiming to explore the influence of internal, malleable, and positive psychological resources on both individuals and organizations. According to the theory of psychological capital, psychological capital is comprised of self-efficacy, hope, optimism, and resilience, which can be developed and cultivated to improve individual performance (Youssef-Morgan and Luthans, 2013). It has been found that certain components or the overall structure of psychological capital have a positive impact on individual positive attitudes and behaviors, such as organizational commitment, organizational citizenship behavior, and retention intention. During personal growth and development, there exists a positive, measurable, usable, and manageable mental state or energy within an individual (Luthans et al., 2007).

Studies have shown the influence of green human resource management on organizational performance. Kim et al. (2019) pointed out that the implementation of green human resource management practices can improve employees' organizational commitment, pro-environmental behavior, and environmental performance. Other studies have also shown that green human resource management practices have a positive influence on employees' pro-environmental behavior (Saeed et al., 2019). The objective of the design and implementation of human resource management practices, policies, and concepts is to align with the organization's environmental goals and facilitate changes in employees' attitudes and behaviors, thereby improving the organization's environmental performance (Ren et al., 2022). Furthermore, the leader-member exchange has an influence on employees' well-being, satisfaction with work, civic behavior, and innovative behavior. Sagas and Cunningha (2004) found that employees engaged in high-quality LMX relationships tend to exhibig higher level of satisfaction with work compared to those engaged in low-quality LMX relationships. At the same time, Bhal et al. (2006) evaluated the influence of two dimensions of LMX (contribution and emotion) on citizen behavior, and the results show that the contribution dimension of LMX can predict citizen behavior better than emotion dimension. The leader-member exchange also has an

influence on innovation behavior. Effective communication leaders and members can enhance self-efficacy. There is a stronger impact of leader-member exchange on innovation behavior when employees perceive a high level of organizational support (Choi et al., 2021). Furthermore, in the context of the relationship between leaders and members, the consistent presence of a positive emotional tone influences the quality of LMX, whereas the consistent presence of a negative emotional tone does not (Gooty et al., 2019).

3. Theoretical Models and Research Hypotheses

3.1 Green Human Resource Management and Employees' Green Behavior

Green human resource management is a new model of human resource management that incorporates the environmental goals of an organization into its human resource management practices, policies, and concepts to facilitate changes in employees' attitudes and behaviors, ultimately improving the environmental performance of the organization (Renwick et al., 2013). Green human resource management practices, including green recruitment, green training, green performance management, and green salary and rewards, aim to communicate the organization's commitment for green practices, enhance employees' green awareness and understanding, and motivate employees to actively contribute towards achieving the organizations green goals (Ahmad, 2015). The influence of green human resource management has been extensively studied by scholars from macro and micro perspectives. The implementation of green human resource management practices can enhance the social responsibility of enterprises and improve the competitive advantage and reputation of organizations (Freitas et al., 2020), and improve employees' pro-environmental behavior, psychological ownership, and participation in work (Adriana et al., 2020). Furthermore, the environmental performance of organization is significantly influenced by individual-level variables. Therefore, on the basis that green human resource management plays a significant role in influencing employees' pro-environmental behavior, it can be hypothesized that:

H1: Green human resource management is positively correlated with employees' green behavior.

3.2 Leader-Member Exchange and Employees' Green Behavior

Liden and Maslyn (1998) categorized leader-member exchange into emotions, loyalty, contribution, and professional respect. Emotions are reflected in the attractiveness of the leader's personal charm to members, loyalty is the open support of members towards their leaders, contribution refers to the efforts that both parties are willing to make in cooperation, while professional respect refers to recognition of each other's reputation in the field of work. The leader-member exchange relationship emphasizes work-related communication and reflects the overall relationship between leaders and members (Graen anhd Uhl-Bien, 1995). On this basis, Graen and Dansereau (1972) first proposed the LMX theory, highlighting the different degrees of exchange relationships that exist between leaders and subordinates. Based on empirical research conducted by Graen and Ginsburgh (1977), it has been found that leaders are more likely to assign more responsibilities to subordinates who display loyalty. The reciprocity criterion is used to describe the degree of return. High return immediacy contributes to high-quality LMX relationships, while low return immediacy may lead to low-quality LMX relationships (Schriesheim et al., 1999). It has been demonstrated that a high-quality leader-member exchange relationship can promote high work performance (Graen and Schiemann, 1978), and subordinates who have a positive relationship with leaders and have higher LMX are more likely to show organizational citizenship behavior to maintain a balanced social exchange relationship (Ilies et al. 2017). Therefore, taking leader-member exchange as an independent variable, it can be hypothesized that:

H2: Leader-member exchange is positively correlated with employees' green behavior.

3.3 Regulating Role of Psychological Capital

Luthans et al. (2006) proposed the concept of psychological capital, which refers to the positive psychological state shown by individuals as they undergo personal and professional advancement. Psychological capital, as a core psychological element, has emerged as a key psychological resource for promoting personal growth and improving performance, and is regarded as more significant than both human capital and social capital (Luthans et al., 2006). Luthans et al. (2007) divided psychological capital into four dimensions: self-efficacy, hope, optimism, and resilience. It has been shown that individuals with high self-efficacy often perform better in leader-member exchange, which serves as a bridge to regulate the relationship between leaders and their subordinates (Kariuki, 2020). In addition, it has been observed that subordinates with a strong sense of work self-efficacy are more likely to be favored by their leaders, perceived as being more similar to their superiors, and rated as outstanding employees (Murphy and Ensher, 1999). Ababneh (2021) used the PO theory to examine the influence of certain personality traits on environmental initiatives. The study included a total of 376 employees from four-star and five-star hotels in Jordan, and the findings indicate that employee participation plays an intermediary role in relationship between green human resource management practices and employees' green behavior. Furthermore, organization-individual interaction is of great significance in encouraging employees to participate in environmental initiatives. Chen et al. (2014) found that the influence of green transformational leadership on green performance can be explained through the intermediary role of green mindfulness and green self-efficacy. This indicates that green transformational leadership not only have a direct positive influence on green performance, but also have an indirect positive influence on performance through green mindfulness and green self-efficacy. Accordingly, it can be hypothesized that:

H3: Psychological capital positively regulates the relationship between green human resource management and employees' green behavior.

H4: Psychological capital positively regulates the relationship between leader-member exchange and employees' green behavior.

Based on the forementioned research, a research model is constructed, as shown in Figure 1.

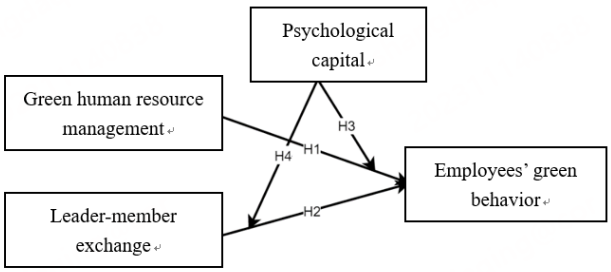

Figure 1. Theoretical model

4. Research Design

4.1 Research Process and Sample Sources

This study adopted two procedures: preliminary survey and formal research. In the preliminary survey, a total of 100 questionnaires were distributed. Out of these, 92 valid questionnaires were collected, resulting in an effective recovery rate of 92%. A total of 400 questionnaires were distributed during the formal survey. In terms of sampling method, employees from approximately 18 petroleum enterprises, including PCOC, Yanchang Petroleum, Sinopec Zhongyuan Oilfield, China Petroleum Engineering & Construction

Corporation, PetroChina Transportation Co., Ltd., and PetroChina Shaanxi Sales Co., Ltd., were selected as the research subjects for this study. The questionnaires were distributed online through the Internet with the support and assistance of the HR department. To minimize system errors and ensure the reliability and authenticity of data, the questionnaires were anonymously completed by employees across various levels and positions. Ultimately, a total of 341 valid questionnaires were collected, with an effective recovery rate of 85.25%. The descriptive statistics of the samples reveal that: Males make up the majority of employees, accounting for 71.85% of the sample; the majority of employees are between 36 and 45 years old (37.54%), followed by those over 45 years old (31.38%); the majority of employees have obtained a bachelor's degree (55.43%), followed by those with an associate's degree (29.03%) and a master's degree (14.66%); the majority of employees have worked for more than 10 years (83.28%). Therefore, as evidenced by their background, the selected samples in this study have, to a certain degree, universality and representativeness.

Table 1. Lists the descriptive statistical characteristics of the samples.

Feature	Category	Number of persons	Percentage
Sex	Female	96	28.15%
	Male	245	71.85%
Age	≤25	15	4.40%
	26~35	91	26.68%
	36~45	128	37.54%
	> 45	107	31.38%
Education level	Junior college	99	29.03%
	Undergraduate	189	55.43%
	Master	50	14.66%
	Doctor	3	0.88%
Working years	< 3	24	7.04%
	3~5	17	4.99%
	6~9	16	4.69%
	> 10	284	83.28%
Job rank	Ordinary	165	48.39%
	Basic level	99	29.03%
	Middle level	60	17.60%
	High level	6	1.76%
	Other	6	1.76%

4.2 Definition and Measurement of Variables

4.2.1 Leader-Member Exchange

The measurement of leader-member exchange is conducted using a scale developed by Graen and Uhl Bien (1995) consists of 7 questions, including "I have a clear understanding of whether my direct supervisor is satisfied with my work performance," "I believe that my direct supervisor knows a lot about my potential," and "I have a high level of trust in my direct supervisor and fully support their decisions."

4.2.2 Green Human Resource Management

The measurement of GHRM employed in this study is conducted using a scale developed by Dumont et al. (2017) with a total of 6 items, including "Enterprises establish work goals that are related to environmental protection for their employees," "Enterprises provide green training for employees to improve their environmental values," and "Enterprises take into account employees' green behavior at work when considering them for promotion."

4.2.3 Psychological Capital

The measurement of psychological capital is conducted using a scale developed by Luthans et al. (2007)

and translated by Li Chaoping, which consists of four dimensions: self-efficacy, hope, optimism, and resilience, with a total of 24 items, including "I am currently highly motivated to accomplish my work goals," "There are many solutions for any given problem," "At present, I consider myself to have achieved considerable success in my work," and "I can come up with many ways to achieve my current work goals."

4.2.4 Employees' Green Behavior

The measurement of employees' green behavior is conducted using a scale consisting of task-related green behavior and proactive green behavior. The task-related green behavior has been revised on the basis of the employees' task performance scale developed by Bachrach et al. (2007) (Bachrach et al., 2007), whereas the positive green behavior has been revised on the basis of the scale developed by Boiral and Paille (2012). The measurement of employees' green behavior has a total of 24 items across five factors: sustainable work, harm avoidance, resource conservation, individual-oriented green proactive behavior, and organization-oriented green proactive behavior, including "I reduce paper usage during work," "I engage in environmental protection projects," "I adhere to the company's guidelines for proper disposal of waste and harmful substances generated during work," "I actively acquire and expand my understanding of environmental knowledge," and "I provide suggestions on environmental protection to improve the company's work procedures."

4.2.5 Controlling Variables

Previous studies have proposed that employees' demographics characteristics (such as age, sex, and education level) will influence their green behavior (Zibarras and Coan, 2015; Dumont et al., 2017). To take into account the different perspectives of sample characteristics and ensure the objectivity and preciseness of empirical results, variables including sex, age, education background, working years, and job rank are controlled in this study.

The aforementioned scales are all 6-point Likert scale, with responses from strongly disagree to strongly agree.

5. Empirical Analysis and Research Results

In this study, the SPSS 26.0 software is used for the reliability and validity analysis, exploratory factor analysis, descriptive analysis, correlation analysis, and regression analysis of questionnaire data. Furthermore, AMOS 26.0 software is used for analysis of confirmatory factors, and multi-layer linear regression is used to verify the hypothesis. The following sections present the specific results obtained.

5.1 Reliability Analysis

In this study, SPSS 26.0 software is used to conduct reliability and validity tests on the research variables, and the results are shown in Table 2. Cronbach's α coefficient of leader-member exchange, green human resource management, psychological capital, and employees' green behavior is 0.955, 0.966, 0.939, and 0.984, respectively, all of which exceeds the research standard, indicating that the sample data has high internal consistency.

5.2 Validity Analysis

The validity indicators of the scale are assessed using the exploratory factor analysis process. The analysis results of exploratory factors show that the questionnaire is highly suitable for principal component analysis when KMO > 0.9 and Bartlett's sphericity test significance $p < 0.05$, suitable when $0.8 < KMO < 0.9$, generally suitable when $0.7 < KMO < 0.8$, not particularly suitable when $0.6 < KMO < 0.7$, and not suitable when $KMO < 0.5$. It can be seen from Table 3 that the factor analysis yielded $KMO = 0.977 > 0.6$, and Bartlett's sphericity test yielded $p < 0.001$, indicating that this scale is suitable for conducting principal

component analysis.

5.3 Convergent Validity

This confirmatory factor analysis was conducted on a total of 4 factors and 61 analysis items. Based on data listed in Table 4, the AVE values corresponding to the four factors are all greater than 0.5, and the CR values are all higher than 0.7, indicating that the data in this analysis has good convergent validity.

Table 2. Reliability analysis

	Cronbach	Questions	Total Cronbach
Leader-member exchange	0.955	7	0.986
Green human resource management	0.966	6	
Psychological capital	0.939	24	
Employees' green behavior	0.984	24	

Table 3. KMO and Bartlett's tests

KMO value		0.977
Bartlett's sphericity test	Approximate chi square	27261.920
	df	1830
	P	0.000

Table 4. Results of AVE and CR indexes of the model

Factor	AVE value extracted from mean variance	Combined reliability CR value
Leader-member exchange	0.762	0.957
Green human resource management	0.865	0.962
Psychological capital	0.840	0.963
Employees' green behavior	0.860	0.974

5.4 Discriminant Validity

Table 5 shows the discriminant validity of each variable. The AVE square root value of leader-member exchange is 0.873, which is greater than the maximum absolute value of the correlation coefficient between factors (0.805); that of green human resource management is 0.930, which is greater than the maximum absolute value of the correlation coefficient between factors (0.799); that of psychological capital is 0.917, which is greater than the maximum absolute value of the correlation coefficient between factors (0.895); that of employees' green behavior is 0.927, which is greater than the maximum absolute value of the correlation coefficient between factors (0.895). All aforementioned results indicate good discriminant validity.

5.5 Correlation Analysis

It can be seen from Table 6 that correlation analysis is used to study the correlation between leader-member exchange and green human resource management, psychological capital, and employees' green behavior, whereas the Pearson correlation coefficient is used to represent the strength of the correlation. The analysis shows that there is a significant correlation between leader-member exchange and green human resource management, psychological capital, and employees' green behavior, with correlation coefficient values of 0.799, 0.805, and 0.747, respectively. The correlation coefficient values are all greater than 0, indicating a positive correlation between leader-member exchange and green human resource management, psychological capital, and employees' green behavior.

5.6 Hypothesis Verification

5.6.1 Main Effect Test

The primary method used to test the hypotheses in this study is hierarchical regression analysis. It can

be seen from Table 7 that when controlling for sex, age, education background, working years, and job rank, the regression coefficient value of leader-member exchange is 0.578 (t = 16.712, p = 0.000 < 0.01), indicating that leader-member exchange has a significant positive influence on employees' green behavior. It can be seen from Table 8 that when controlling for sex, age, education background, working years, and job rank, the regression coefficient value of green human resource management is 0.523 (t = 16.919, p = 0.000 < 0.01), indicating that green human resource management has a significant positive influence on employees' green behavior. Therefore, H2 has been confirmed.

Table 5. Discriminant validity: Pearson correlation and AVE square root value

	Leader-member exchange	Green human resource management	Psychological capital	Employees' green behavior
Leader-member exchange	0.873			
Green human resource management	0.799	0.930		
Psychological capital	0.805	0.752	0.917	
Employees' green behavior	0.747	0.733	0.895	0.927

Note: Diagonal blue numbers represent the AVE square root value

Table 6. Standardized Pearson correlation

	Mean	Standard deviation	Leader-member exchange	Green human resource management	Psychological capital	Employees' green behavior
Leader-member exchange	3.902	1.195	1			
Green human resource management	3.783	1.298	0.799**	1		
Psychological capital	4.087	1.073	0.805**	0.752**	1	
Employees' green behavior	4.299	1.088	0.747**	0.733**	0.895**	1

* $p<0.05$ ** $p<0.01$

5.6.2 Regulating Effect Test

To verify H3, employees' green behavior is established as a dependent variable, and controlling variables, independent variables (leader-member exchange), and regulating variables (psychological capital) are introduced in sequence. It can be seen from Table 9 that Model 1 includes independent variables (leader-member exchange) and five controlling variables, including sex, age, education background, working years, and job rank. In Model 2, a regulating variable (psychological capital) is introduced in addition to the variables present in Model 1, and Model 3 further expands on Model 2 by including interaction terms (product term of independent variables and regulating variables). It can be seen from Table 9 that the independent variable (leader-member exchange) shows significance (t = 16.712, p = 0.000 < 0.05), indicating that the leader-member exchange has a significant influence on employees' green behavior, confirming H3. The regulating effect can be verified by two methods. The first method is to assess the significance of changes in the F-value from Model 2 to Model 3, and the second method is to examine the significance of the interaction terms in Model 3. In this study, the regulating effect is analyzed using the second method. It can be seen from Table 9 that the interaction between leader-member exchange and psychological capital shows statistical significance (t = -6.213, p = 0.000 < 0.05), indicating that the influence of the leader-member exchange varies significantly at different levels of the regulating variable (psychological capital), which can be observed in the simple slope in Figure 2.

Table 7. Results of linear regression analysis (n=341)

	Non-standardized coefficient		Standardized coefficient	*t*	*p*	Collinearity diagnosis	
	B	**Standard error**	***Beta***			**VIF**	**Tolerance**
Constant	1.120	0.155	-	7.206	0.000**	-	-
Sex	0.203	0.060	0.127	3.381	0.001**	1.219	0.820
Age	0.033	0.051	0.032	0.648	0.517	2.066	0.484
Education background	0.113	0.051	0.091	2.225	0.027*	1.432	0.698
Working years	0.107	0.049	0.107	2.167	0.031*	2.106	0.475
Job rank	0.001	0.045	0.001	0.017	0.986	1.513	0.661
Leader-member exchange	0.578	0.035	0.635	16.712	0.000**	1.244	0.804
R^2			0.612				
Adjusted R^2			0.605				
F			*F* (6,334)=87.797,*p*=0.000				
D-W value			1.844				

Dependent variable: employees' green behavior
* $p<0.05$ ** $p<0.01$

Table 8. Results of linear regression analysis (n=341)

	Non-standardized coefficient		Standardized coefficient	*t*	*p*	Collinearity diagnosis	
	B	**Standard error**	***Beta***			**VIF**	**Tolerance**
Constant	1.199	0.152	-	7.878	0.000**	-	-
Sex	0.123	0.061	0.077	2.030	0.043*	1.254	0.798
Age	0.067	0.050	0.065	1.338	0.182	2.059	0.486
Education background	0.187	0.050	0.150	3.724	0.000**	1.406	0.711
Working years	0.119	0.049	0.120	2.438	0.015*	2.095	0.477
Job rank	0.011	0.044	0.010	0.248	0.804	1.513	0.661
Green human resources management	0.523	0.031	0.624	16.919	0.000**	1.183	0.846
R^2			0.616				
Adjusted R^2			0.609				
F			*F* (6,334)=89.423,*p*=0.000				
D-W value			1.905				

Dependent variable: employees' green behavior
* $p<0.05$ ** $p<0.01$

To verify H4, employees' green behavior is established as a dependent variable, and controlling variables, independent variable (green human resource management), and regulating variable (psychological capital) are introduced in sequence. It can be seen from Table 10 that Model 1 includes independent variable (green human resource management) and five controlling variables, including sex, age, education background, working years, and job rank. In Model 2, a regulating variable (psychological capital) is introduced in addition to the variables present in Model 1, and Model 3 further expands on Model 2 by including interaction terms (product term of independent variables and regulating variables). It can be seen from Table 10 that the independent variable (green human resource management) shows significance (t = 16.919, p = 0.000 < 0.05), indicating that green human resource management has a significant influence on employees' green behavior. The regulating effect can be verified by two methods. The first method is to assess the significance of changes in the F-value from Model 2 to Model 3, and the second method is to examine the significance of the interaction terms in Model 3. In this study, the regulating effect is analyzed using the second method. It can be seen from the above table that the interaction between green human resource management and psychological capital shows statistical significance (t = -5.519, p = 0.000 < 0.05), indicating that the influence of green human resource management on employees' green behavior varies

significantly at different levels of the regulating variables (psychological capital), which can be observed in the simple slope in Figure 3.

Table 9. Analysis results of regulating effect

	Model 1	Model 2	Model 3
Constant	3.376** (22.195)	3.964** (35.892)	4.465** (33.776)
Sex	0.203** (3.381)	0.089* (2.112)	0.024 (0.587)
Age	0.033 (0.648)	0.047 (1.320)	0.017 (0.498)
Education background	0.113* (2.225)	0.068 (1.909)	-0.017 (-0.465)
Working years	0.107* (2.167)	0.002 (0.047)	-0.040 (-1.187)
Job rank	0.001 (0.017)	-0.019 (-0.608)	-0.002 (-0.083)
Leader-member exchange	0.578** (16.712)	0.061 (1.669)	0.056 (1.608)
Psychological capital		0.804** (18.855)	0.649** (13.659)
Leader-member exchange-psychological capital			-0.064** (-6.213)
Sample quantity	341	341	341
R^2	0.612	0.812	0.832
Adjusted R^2	0.605	0.808	0.828
F	F (6,334)=87.797,p=0.000	F (7,333)=205.924,p=0.000	F (8,332)=205.351,p=0.000
$\triangle R^2$	0.612	0.200	0.020
$\triangle F$ value	F (6,334)=87.797,p=0.000	F (1,333)=355.527,p=0.000	F (1,332)=38.596,p=0.000

Dependent variable: Employees' green behavior
* p<0.05 ** p<0.01
Inside the parentheses is the t-value

Table 10. Analysis results of regulating effect

	Model 1	Model 2	Model 3
Constant	3.177**(21.675)	3.943**(36.389)	4.390**(33.331)
Sex	0.123*(2.030)	0.071(1.694)	0.016(0.382)
Age	0.067(1.338)	0.050(1.455)	0.024(0.707)
Education background	0.187**(3.724)	0.080*(2.282)	0.006(0.156)
Working years	0.119*(2.438)	0.003(0.096)	-0.035(-1.042)
Job rank	0.011(0.248)	-0.016(-0.530)	-0.002(-0.060)
Leader-member exchange	0.523** (16.919)	0.116** (3.885)	0.118** (4.102)
psychological capital		0.751** (19.307)	0.610** (13.475)
Leader-member exchange-psychological capital			-0.057** (-5.519)
Sample quantity	341	341	341
R^2	0.616	0.819	0.834
Adjusted R^2	0.609	0.815	0.830
F	F (6,334)=89.423, p=0.000	F (7,333)=215.217, p=0.000	F (8,332)=208.786, p=0.000
$\triangle R^2$	0.616	0.203	0.015
$\triangle F$ value	F (6,334)=89.423, p=0.000	F (1,333)=372.772, p=0.000	F (1,332)=30.464, p=0.000

Dependent variable: Employees' green behavior
* p<0.05 ** p<0.01
Inside the parentheses is the t-value

5.6.3 Comparison of Regulating Role

A comparative analysis was made on the interaction between leader-member exchange, green human resource management, and psychological capital. The leader-member exchange * psychological capital has a higher influence, as shown in Table 11.

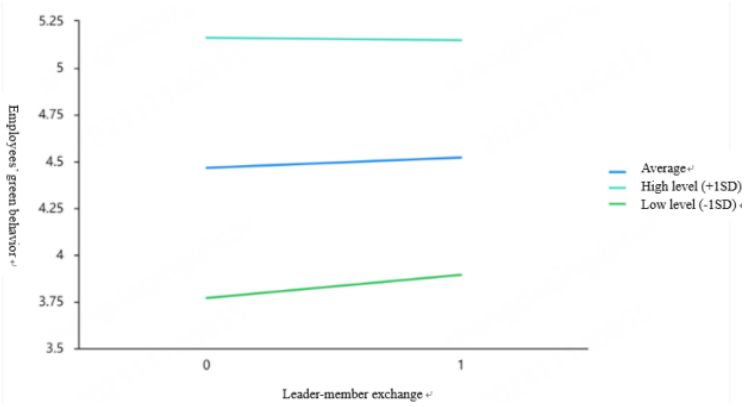

Figure 2. Regulating role of psychological capital (a)

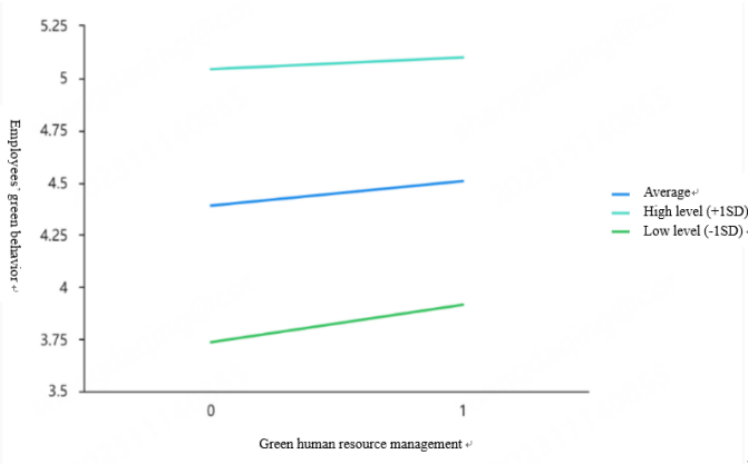

Figure 3. Regulating role of psychological capital

Table 11. Comparison of regulating role

Item	Interaction coefficient	Significance level	Ranking of degree of influence
Leader-member exchange * Psychological capital	-0.064**	0.02	1
Green human resource management * Psychological capital	-0.057**	0.015	2

5.7 Conclusion

Through a questionnaire survey conducted among China's petroleum enterprises in this study, it is found that leader-member exchange and green human resource management positively influence employees' green behavior. A positive relationship between leaders and employees facilitates the provision of support and resources by leaders to employees, and employees are more likely to exhibit green behavior. Green behavior is an important supplement to an organization's formal green management plan, which can improve the efficiency of its green management measures, ultimately contributing to the long-term sustainability of the

environment (Peng et al., 2019). By measures such as recruitment, training, performance management, assessment, and salary and benefits, green human resource management practices can enhance employees' environmental awareness and skills, and motivate them to show green behavior through rewards (Dumont et al., 2017). The aforementioned results align with previous studies at home and abroad (Zibarras and Coan, 2015; Yong et al., 2019). Zibararas and Coan (2015) confirmed the important role of human resource management practices in employees' green behavior in the UK, while Yong et al. (2019) took employees from hotels in Phuket, Thailand as a sample to provide evidence for the positive relationship between green human resource management practices and employees' environmental behavior.

In this study, it is found that the positive interaction between leader-member exchange and psychological capital influences employees' green behavior, which indicates that employees are more likely to exhibit green behavior when there is a positive relationship between leaders and employees and employees have a positive psychological state. It is also found that green human resource management and psychological capital positively interact with employees' green behavior, indicating that employees are more likely to exhibit green behavior when companies implement green human resource management measures and employees have a positive psychological state.

6.Theoretical Contribution and Practical Insights

6.1 Theoretical Contribution

Firstly, employees' green behavior is stimulated to rely on multiple and consistent contextual cues. This study expanded existing research on the antecedent factors of employees' green behavior is by proposing a conceptual framework for the relationship between leader-member exchange and employees' green behavior, providing the perspective of "relationship" in employees' green behavior research, introducing leader-member exchange and green human resource management as variables, expanding the explanatory mechanism for employees' green behavior, and enriching the theories of leader-member exchange relationship.

Secondly, from the perspective of positive organizational behavior, a regulating model is constructed. The leader-member exchange, green human resource management, employees' green behavior, and psychological capital are included in the same theoretical framework. Psychological capital is used to regulating variables to reveal the difference in the influence of different situational factors on individual behavior, which helps to comprehensively understand the boundary conditions of leaders and organizations influencing subordinates' green behavior and enriches research on employees' green behavior.

Finally, this study expanded on the characteristics of local culture, studied the green behavior of employees in China's petroleum enterprises, and based on the research subjects of China's petroleum enterprises, revealed how green human resource management practices influence employees' green behavior. These efforts provide standardized research examples for subsequent research samples based on high pollution enterprises and improve the representativeness of samples from China's enterprises.

6.2 Practical Insights

The insights for green management of China's petroleum enterprises are as follows.

Firstly, it can stimulate the protection of employees' green motivation through diversified incentive methods. Specifically, enterprises can develop performance and reward mechanisms related to green environmental protection as employees' external motivation. Through various policies and activities, employees can experience and understand the significance and value of green behavior, thereby stimulating their internal motivation. At the same time, China's petroleum enterprises are constantly innovating in green management and improving the green human resource management system. The management departments

of China's petroleum enterprises should develop scientific and reasonable green performance indicators to effectively assess policies such as green mining and efficient resource utilization. Due to the diversified psychological qualities of employees, their psychological capital is also key for the sustainable development of the organization. The formulation of policies and indicators should take into account employees' needs and situation, and people-oriented concept should be implemented to ensure that green human resource management yields good results and enterprises achieve healthy and sustainable development.

Secondly, leaders should strive to establish good interactive relationships with employees to fully leverage their guiding role. When promoting green behavior among employees, organizations should not only improve the internal green regulations, green corporate culture, and green strategic planning of petroleum enterprises, but also provide policy support for the establishment of relationships between leaders and subordinates, such as strengthening employee authorization and enhancing leaders' professional abilities. These measures help to promote harmonious internal relationships within the organization, stimulate employees' critical thinking, and lay the foundation for employees to implement green behavior.

Thirdly, China's petroleum enterprises should pay attention to the construction of employees' psychological capital. Psychological capital is an important resource for individuals, and prioritizing and cultivating employees' psychological capital in the management process is crucial for enterprises to cope with the intense market and maintain competitive edge. In particular, China's petroleum enterprises should maintain good communication in daily work, build a participatory labor relationship, encourage employees to participate in management, strengthen the connection between employees and the organization, improve employees' work enthusiasm, and bring promising prospect to employees for future career development. China's petroleum enterprises should also encourage and organize activities such as green knowledge training and skill competitions to extend employees' green knowledge reserve, so that they can better match the requirements of green responsibilities, perform better in their work, and improve their confidence in work. Finally, China's petroleum enterprises should regularly carry out psychological counseling activities for employees and promote methods to improve their psychological quality for employees to always maintain a resilient and optimistic psychological state, complete work efficiently, enhance green behavior, and ultimately improve organization's performance.

6.3 Shortcomings and Prospects

This study adopted the empirical method of questionnaire survey to demonstrate the influence of leader-member exchange and green human resource management on employees' green behavior, without considering other possible research methods, such as panel data and case study. Therefore, in the future, it is recommended that other research methods can be employed. Secondly, due to factors such as research conditions and feasibility, the samples of this paper are limited to 18 petroleum enterprises in China and do not include more types of enterprises from different regions. Therefore, in future studies, the scope of samples should be expanded to enhance the universality of the theory. Finally, this study only analyzed the regulating role of psychological capital. Therefore, future research is suggested to explore other possible intermediary mechanisms in leader-member exchange, green human resource management, and employees' green behavior.

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