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The Impacts of Green Transformational Leadership on Pro-Environmental Behavior in the Chinese New Energy Automotive Sector

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Abstract: - Green transformational leadership is becoming an essential way for organizations to gain a competitive advantage. However, whether the goals of such practices can be achieved depends on how employees behave. Therefore, stimulating pro-environmental behaviors among employees through management activities is vital in the new energy automotive sector. In this study, based on Social Cognitive Theory, we examined the impact of green transformational leadership on employees' pro-environmental behaviors. A survey method was used to obtain data from employees working in new energy automotive companies in China, and a cross-sectional survey was conducted among 504 employees in China, which was analyzed through descriptive statistics, reliability analysis, EFA, CFA and path analysis. The results of the study show that green transformational leadership has a significant impact on employees' pro-environmental behaviors. The study's conclusions will offer a theoretical foundation and policy recommendations for decision-makers and managers in the new energy automotive sector.

***Keywords*:** Green transformational leadership, Pro-environmental behavior, Employee of new energy automotive sector, Social cognitive theory

1. INTRODUCTION

The present global challenges of climate change, energy scarcity, increasing environmental degradation, expanding population, and rapid urbanization provide substantial barriers to the sustainable progress of human society (Sharma, 2018). The pressure has notably intensified since the United Nations introduced sustainable development goals (SDGs) in 2015, mandating that global economies and business entities meet the outlined objectives for sustainable development by 2030 (Modgil et al., 2020). Banister (1998) and Abbass et al. (2022) identify the primary causes of environmental deterioration and harm in China as the swift population growth and GDP expansion.

In recent years, China has actively promoted the "dual-carbon" initiative, advocating for an energy revolution, advancing industrial transformation towards green and low-carbon practices, encouraging sustainable lifestyles, and facilitating the comprehensive green transformation of economic and social development (National Development and Reform Commission, 2023). The strategic plan for stabilizing the growth of the automotive sector clearly delineates the goal of

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attaining around 9 million units in new energy vehicle sales by 2023, as proclaimed by the NDRC in 2023. The report of the 20th CPC National Congress underscores the significance of a green and low-carbon economy and society in attaining high-quality development. The new energy vehicle sector, as emphasized in China's 14th Five-Year Plan, is a significant and strategic emerging industry. It is in accordance with the principle of sustainable development and has a crucial impact on the shift towards environmentally-friendly economic and social progress (Wang, 2023).

Electric vehicles are crucial in advancing sustainable economic and social progress by concurrently mitigating carbon emissions. According to a recent study, corporations are responsible for the continued release of carbon dioxide and other harmful contaminants into the atmosphere and water, which is contributing to the escalation of climate change (Robertson & Barling, 2013). Environmental activists and scientists anticipate that organizations will adopt ecologically friendly and sustainable strategies. Organizational leaders play a crucial role in executing these strategic practices(Peng et al., 2022). Comprehensive studies have illustrated the profound influence that organizational leaders exert on the outcomes of both employees and the organization as a whole.

Consequently, numerous experts have initiated an investigation into environmental leadership. Prior studies have pinpointed the specific traits that play a crucial role in the effectiveness of leaders within the environmental sector. Current scholars have placed increased emphasis on examining the effects of leadership behaviours (Afsar et al., 2016). The transformational leadership theory is hugely applicable for comprehending environmental management within the framework of various leadership models and concepts. Peng et al. (2021) contend that transformative leadership is superior in improving environmental performance. Robertson and Barling(2013) introduced the term "green transformational leadership" (GTL) to correspond with this concept. GTL, which stands for Green Transformational Leadership, denotes a leadership approach that prioritizes the promotion and implementation of ecologically sustainable practices. Previous studies indicate substantial evidence that Green Technology Literacy (GTL) has a vital role in promoting Pro-Environmental Behaviours (PEBs) (Peng et al., 2021). By recognizing the importance and seriousness of environmental issues, employees can successfully tackle these challenges by participating in environmentally friendly actions that decrease resource usage and lead to cost savings in operations. Given the substantial influence of this issue, it is not unexpected that many scholars have acknowledged and endorsed the necessity of conducting empirical investigations to study employees' PEBs in the workplace(Farrukh et al., 2022). Our understanding of the relationship between green revolutionary leadership and employee pro-environmental behaviours is limited (Islam et al., 2023). Moreover, there has been a scarcity of academic focus on the influence of green transformational leadership on pro-environmental behaviours, especially in developing nations.

2. LITERATURE REVIEW

2.1 Social Cognitive Theory

The Social Cognitive Theory (SCT) is a well-established paradigm that researchers use to investigate the complexities of employee behaviour. The SCT allows researchers to concentrate on the cognitive, motivational, and emotional processes that employees go through. Individuals' objectives and cognitions, as well as the external contextual circumstances that influence their motivated behaviours, are the foundation of Social Cognitive Theory (SCT), which is based on the interaction between these three factors (Bandura, 1991). Individual, behaviour, and environment are the three main parts. An individual's knowledge, attitude, and experiences contribute to the

development of constructive conduct.

Furthermore, the constructive interplay between an individual and their surroundings influences their behavior. The pro-environmental behaviour of employees refers to their readiness to participate in actions that promote environmental sustainability (Scherbaum et al., 2008). There are two main kinds of environmental actions taken by employees: those that are required of them by their jobs and those that are entirely optional. Workers who have access to both material and immaterial resources, including knowledge, expertise, and experience in the field of environmental protection, are more inclined to do their part to keep the planet habitable, according to Bandura's 1986 Social Cognitive Theory (Nisar et al., 2021). This entails accomplishing their assigned responsibilities and demonstrating pro-environmental conduct that aligns with environmental efforts.

2.2 The concept of Green transformational leadership

As a proactive leadership style, transformational leadership entails four interconnected behaviours: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration(Bass, 1999; Judge & Piccolo, 2004; Schmitt et al., 2016). Although traditional transformational leadership has received considerable attention, since 2000, an increasing number of scholars have acknowledged the significance of transformational leadership designed to achieve specific objectives. Barling et al. (2002) had an early understanding of the significance of transformative leadership with a focus on defined goals for predicting results. Their work focused on developing a model of transformative leadership that is exclusive to the field of occupational health and safety. Following this, classroom instruction was examined by Beauchamp et al. (2010), while parenting behaviours were examined by Morton et al. (2011). Both of which employed transformational leadership theory. Applying goal-specific transformational leadership to environmental contexts was further elaborated upon by Robertson and Barling (2013), who built on this research. Environmental concerns are the focal point of context-specific transformational leadership, which aims to promote specific management techniques that inspire members of the organization or their subordinates to take action in this area(Graves et al., 2013). Table 1 summarizes the definition of green transformational leadership that enterprises should have in previous studies.

Table 1 Definition of Green Transformational Leadership

Author	Definition of Green Transformational Leadership
Chen et al. (2006)	Green Transformational Leadership (GTL) is a strategic approach focused on advancing an organization's environmental objectives while enhancing employee understanding and motivation to attain Corporate Environmental Performance (CEP) targets.
Robertson and Barling (2013)	GTL is characterized as a form of transformational leadership that emphasizes the promotion of pro-environmental and green initiatives.
Chen and Chang (2013)	Green transformational leadership encompasses the actions of leaders who inspire followers to attain environmental objectives and encourage them to exceed anticipated standards of environmental performance.
Graves et al. (2013)	Green transformational leadership is a distinct management approach that emphasizes environmental concerns within

	transformational leadership, aimed at promoting the ecological initiatives of organizations or people.
Mittal and Dhar (2016)	Green transformational leadership (GTFL) is a leadership behaviour characterized by the primary objective of offering a clear vision, inspiration, and motivation to employees while also addressing their developmental needs to meet the organization's environmental goals.
Zhang et al. (2020)	Green transformational leadership denotes the conduct of leaders aimed at inspiring followers to attain environmental objectives and surpass anticipated standards of environmental performance.
Kusi, Zhao & Sukamani (2021)	Green transformational leadership is characterized by a leadership role that provides employees with inspiration, vision, and motivation while also addressing their learning and development requirements.

Green transformational leadership (GTL) represents a leadership approach that articulates a clear vision, energizes and encourages employees, and considers their growth requirements, all directed towards fulfilling the environmental goals of the organization. Experts agree that green transformational leadership is all about getting people to prioritize the organization's objectives over their own. Leadership encompasses the act of guiding individuals in any situation, providing assistance when needed, and fostering enthusiasm to generate innovative concepts within the professional setting (Mittal & Dhar, 2016). The majority of papers published in mainstream academic journals adhere to the framework of green transformational leadership proposed by Robertson and Barling (2013). Green transformational leadership is a form of transformational leadership that advocates explicitly for and facilitates pro-environmental and green initiatives. Additionally, this definition will be employed in our research.

2.3 The concept of Pro-environmental behavior

In recent years, environmental conservation and sustainability have become important goals for organizations. Companies are currently making efforts to ensure that their business operations are in accordance with policies and procedures that are friendly to the environment. Roy et al. (2001) Argue that participation in pro-environmental behaviour is crucial for the effective implementation of environmental management systems and the alignment of environmental policy with workplace practices. Consequently, the researchers condensed the concept of pro-environmental behavior from prior studies. Table 2 presents a precise and straightforward definition of pro-environmental activity.

Table 2 Definition of pro-environmental behavior.

Author	Definition of pro-environmental behavior
Kollmuss & Agyeman (2002)	A type of volunteer behaviour known as "pro-environmental behaviour" aims to reduce the adverse effects of one's actions on the built and natural environments and actively address environmental problems including climate change, global warming, and environmental degradation.
Scherbaum et	The pro-environmental behaviour of employees refers to their

al. (2008)	willingness to participate in activities that benefit the environment.
Ramus and Killmer (2007)	PEBs are typically unremunerated extra-role behaviours that employees manifest for the benefit of their organizations.
Ones and Dilchert (2012)	PEBs are defined as scalable actions and behaviours undertaken by employees that are associated with and contribute to environmental sustainability.
Paille & Boiral (2013)	Pro-environmental behaviour is intricate due to its pro-social aspect, making it exceedingly challenging for managers to persuade or motivate employees to exhibit such behaviour using conventional leadership styles or methods.
Bissing-Olson et al. (2013)	PEBs are characterized as sustainable behaviours that individuals engage in concerning the natural environment or actions aimed at mitigating the adverse effects of their activities on it.
Graves et al. (2013)	PEBs are defined as "a wide range of ecologically responsible actions, including increasing one's knowledge of environmental issues, brainstorming ways to lessen the company's influence on the environment, creating environmentally friendly goods and procedures, recycling and reusing materials, and challenging harmful practices."

Pro-environmental behaviors, are primarily the acts undertaken by employees in the workplace to foster environmental awareness. These actions include things like recycling paper, using less water and electricity, and other habits (Norton et al., 2017; Robertson & Barling, 2013). Essentially, pro-environmental behaviour (PEBs) in the workplace is defined as measures made by individuals to protect the environment. Employees have the autonomy to decide whether or not to engage in such behavior.

Current studies on the traits of pro-environmental behaviour have depended mainly on the contributions of Boiral and Paille (2012). Researchers have classified pro-environmental behaviour into three specific dimensions: eco-helping, eco-civic involvement, and eco-initiatives. Table 3 provides a summary of the criteria used in prior research to evaluate the degree of pro-environmental behaviour.

Table 3 Dimensions of pro-environmental behavior

Author	**Dimensional**		
	Eco-initiatives	**Eco-civic engagement**	**Eco-helping**
Boiral & Paillé (2012)	√	√	√
Wang et al. (2017)	√	√	√
Mi et al. (2019)		√	√
Anwar et al. (2020)	√	√	√
Zhao & Zhou (2021)	√	√	√
Gurmani et al. (2021)	√	√	√

Eco-initiatives are characterized as action-oriented and encompass actions such as providing suggestions. The organization may focus these behavioral activities on either improving

environmental performance or upgrading existing environmental practices (Boiral & Paillé, 2012). Eco-initiatives denote the actions undertaken by employees to reduce the negative environmental impacts associated with the workplace. Paper recycling, properly disposing of waste in approved containers, and avoiding resource waste are some of these initiatives.

Second, the voluntary participation of workers in environmentally friendly initiatives within a company is known as eco-civic engagement. An employee engages in eco-civic engagement when they actively support environmentally-focused organizational systems and demonstrate this through positive actions, such as voluntarily participating in company-organized environmental awareness events (Boiral & Paillé, 2012). Eco-civic engagement denotes the participation of employees in diverse organizational initiatives, including involvement in environmentally sustainable events and projects initiated by the organization, enhancing the organization's eco-conscious reputation, and voluntarily contributing to the organization's environmental activities.

Thirdly, eco-helping refers to an employee offering assistance to colleagues in resolving environmental-related issues. This dimension encompasses the actions taken by employees, such as educating new employees about environmentally friendly activities and promoting open discussions among colleagues regarding environmental issues (Boiral & Paillé, 2012). Eco-helping involves promoting environmental consciousness among colleagues. Employees within an organization root this behavior in their collaborative efforts to address environmental issues. It entails the voluntary exchange of ideas and knowledge, together with collaboration, to identify pollution sources and develop preventive measures.

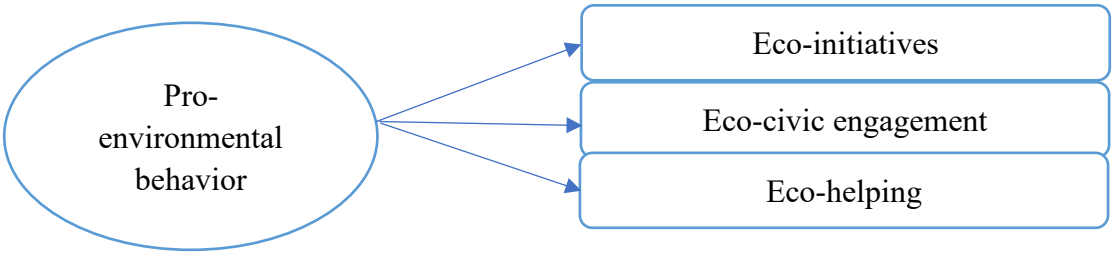

Figure 1 A model of pro-environmental behavior elements

3. RESEARCH METHOD

3.1 Population and Sampling

This study focuses on mainland China and examines the top ten enterprises in China's new energy vehicle independent brands. The selection of these enterprises is based on the "Automobile Industry Production and Sales Report 2023" by the China Association of Automobile Manufacturers (CAAM). The list is as stated below.

Table 4 Top 10 Chinese autonomous automakers in new energy vehicle sales in 2023.

Rank	Manufacturers	Sales (vehicles)
1	BYD	2389739
2	GAC Aion	442578
3	LEADING IDEAL	377251
4	GEELY	276109
5	Changan	246059

6	Great Wall Motor	206685
7	NIO NEXTEV LIMITED	159901
8	XPENG MOTORS	133568
9	LEAPMOTOR	130251
10	DEEPAL	118452

Source: China Association of Automobile Manufacturers (CAAM)

Consequently, the aforementioned Chinese mainland new energy vehicle manufacturers will serve as the survey population for this study, which will be considered an infinite aggregation since the total number of new energy vehicle manufacturers operating in mainland China cannot be precisely determined.

This study employed the Cochrane Systematic Evaluation approach, as outlined by W.G. Cochran in 1953, to investigate the wireless master sample. We maintained a confidence level of 95%. The following formula was employed to determine the sample size for the limitless master survey:

$$n = \frac{P(1-P)z^2}{e^2}$$

Where:

n is the sample size

Z is the quantile of the standard normal distribution that corresponds to the chosen confidence level. For example, while targeting a confidence level of 95%, the equivalent Z value is 1.96.

p represents the estimated ratio of specific characteristics within the limitless collection. When there is no prior knowledge available, a value of 0.5 can be used as a cautious estimate.

e is the acceptable level of sampling error.

This formula calculates the minimum sample size needed to achieve a desired level of confidence and an acceptable margin of error for the findings.

$$n = \frac{0.5(1-0.5)(1.96)^2}{(0.05)^2} = 385$$

Based on the computation, a minimum of 385 questionnaires is required as a sample. Bollen (1989, cited in Nonglak Wiratchai) states that in practical terms, if the response rate is low, the expected recovery rate in a single operation is 70%. This calculation yields a result of 550 (Kanlaya Vanichbuncha, 2006).

The "Automobile Industry Production and Sales Report 2023" of the China Association of Automobile Manufacturers (CAAM) is the basis for the random selection of samples, as illustrated in Table 5.

Table 5 Sample distribution

Manufacturers	**Sales (vehicles)**	**Proportion**	**Sample size**
BYD	2389739	53%	287
GAC Aion	442578	10%	55
LEADING IDEAL	377251	8%	44
GEELY	276109	6%	32
Changan	246059	5%	29
Great Wall Motor	206685	5%	29
NIO NEXTEV LIMITED	159901	4%	23

XPENG MOTORS	133568	3%	17
LEAPMOTOR	130251	3%	17
DEEPAL	118452	3%	17
Total	4480593	100%	550

This survey will disseminate a total of 550 questionnaires to 10 manufacturers.

4. RESEARCH RESULTS

We obtained the data from individuals currently working in China's new energy automobile business. We completed the data collection method over two months, specifically from January to March 2024. Following the data collection period, the survey had a total of 551 responses. We only included individuals who failed to meet the identification verification criterion (n = 47) from this total. In the end, we had 504 fully completed questionnaires available for data analysis, indicating a response rate of 91.47%.

4.2 Demographic Characteristics

This section presents the participants' demographic and work characteristics in terms of age, gender, degree of education, experience in the new energy automotive industry, type of work, and number of years in the firm. Table 6 presents the demographic and employment characteristics.

Table 6 Descriptive Statistics of Sample Group

Item	**Category**	**Number**	**Percentage in Total (n=504) (%)**
Gender	Male	289	57.34
	Female	215	42.66
Age	20~30 years old	226	44.84
	31~40 years old	147	29.17
	41~50 years old	80	15.87
	More than 50 years old	51	10.12
Education level	Technical secondary school and below	24	4.76
	Advance degree	160	31.75
	Bachelor	267	52.98
	Master	41	8.13
	Doctor	12	2.38
Working years	One year under	62	12.30
	1-5 years	263	52.18
	6-10 years	108	21.43
	11-15 years	42	8.33
	16-20 years	22	4.37
	21 years and above	7	1.39
Type of work	Managerial	27	5.36
	Administration/Finance	104	20.63

Item	Category	Number	Percentage in Total (n=504) (%)
	Marketing	167	33.13
	Product/Operation	120	23.81
	Professional	75	14.88
	General staff	11	2.18
	Five years and under	0	0
	6-10 years	163	32.34
Enterprise years	11-15 years	0	0
	16-20 years	0	0
	21 years and above	341	67.66

4.3 Basic Statistics of the Variables

In the formal questionnaire, 16 items are measured in this study, including six items as GTL1-GTL6 for Green Transformational Leadership (GTL), Pro-environmental Behaviors (PEBs) includes ten items as EI1-EI3, ECE1-ECE4 and EH1-EH3.

Table 7: Descriptive Statistics and normality test

Items	$\overline{X}$	$\overline{S.D}$	Skewness	Kurtosis
GTL1	3.347	1.116	-0.095	-0.984
GTL2	3.300	1.126	-0.022	-1.013
GTL3	3.335	1.158	-0.039	-1.206
GTL4	3.377	1.146	-0.058	-1.243
GTL5	3.383	1.148	-0.115	-1.101
GTL6	3.385	1.143	-0.072	-1.148
EI1	3.433	1.140	-0.112	-1.107
EI2	3.429	1.147	-0.138	-1.167
EI3	3.401	1.177	-0.209	-1.037
ECE1	3.369	1.227	-0.116	-1.200
ECE2	3.377	1.193	-0.105	-1.136
ECE3	3.421	1.192	-0.122	-1.165
ECE4	3.409	1.190	-0.113	-1.141
EH1	3.454	1.219	-0.281	-1.074
EH2	3.490	1.190	-0.222	-1.161
EH3	3.468	1.196	-0.194	-1.151

From Table 7, it can be seen that the overall distribution results of the sample data are more uniform, the average score of each item is between 3.30-3.50, which is in the range of general agreement to agreement, and the items are in the middle to upper level, the data distribution is more concentrated, and the standard deviation of each item is in the range of 1.10-1.50. The standard deviation reflects that the data are less discrete. The skewness and kurtosis values for each item are less than 3 and 5, respectively, indicating that the data in this sample closely follows a normal

distribution and is smooth.

4.4 Reliability Analysis

Reliability is a criterion employed to evaluate the consistency, stability, and dependability of a measurement instrument, such as a questionnaire or scale, during the measurement process. Reliability pertains to the extent of dependability in measuring outcomes, commonly evaluated through the utilization of the Cronbach alpha coefficient. A reliability level of 0.7 to 0.8 is considered adequate, whereas a better reliability level is indicated by a value of 0.8 to 0.9. A value exceeding 0.9 indicates a substantial degree of reliability. Table 8 shows the Cronbach α coefficients for various dimensions. The GTL dimension exhibits a coefficient of 0.889. Eco-initiatives has a coefficient of 0.839; Eco-civic engagement has a coefficient of 0.868; and Eco-helping has a coefficient of 0.840. To summarize, all the dimensions have reliability scores exceeding 0.8, suggesting that the questionnaire is very dependable.

Table 8 Reliability Analysis Results of Questionnaire

Variables	Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
Green Transformational Leadership	GTL1	0.689	0.872	0.889
	GTL2	0.688	0.872	
	GTL3	0.711	0.869	
	GTL4	0.726	0.866	
	GTL5	0.706	0.870	
	GTL6	0.711	0.869	
Eco-initiatives	EI1	0.693	0.785	0.839
	EI2	0.692	0.785	
	EI3	0.720	0.757	
Eco-civic engagement	ECE1	0.737	0.824	0.868
	ECE2	0.709	0.835	
	ECE3	0.713	0.834	
	ECE4	0.718	0.832	
Eco-helping	EH1	0.706	0.776	0.840
	EH2	0.706	0.776	
	EH3	0.699	0.782	

✳Coefficient of Cronbach's alpha > 0.8, good.

4.5 Validity Analysis

4.5.1 Exploratory Factor Analysis

In the process of conducting exploratory factor analysis on questionnaire data, the KMO test and Bartlett's sphericity test are frequently employed to assess validity. Research indicates that a KMO score exceeding 0.9 demonstrates a high level of appropriateness for factor analysis. A KMO value between 0.8 and 0.9 suggests that the data is suitable for factor analysis. A KMO rating between 0.7

and 0.8 indicates that the data is suitably aligned for factor analysis. A KMO value between 0.6 and 0.7 suggests that the data may not be particularly appropriate for factor analysis. A KMO value between 0.5 and 0.6 indicates that the data may not be appropriate for factor analysis. This inquiry will employ the method of maximum variance rotation. According to Kline (2011), a variable loading coefficient must be greater than 0.5 in order to be regarded as acceptable. This study employs exploratory factor analysis to analyze the survey findings obtained from the formal questionnaire. The findings are then shown in Table 9.

Table 9 KMO and Bartlett's Test of the Questionnaire (n=504)

Green Transformational Leadership （GTL)	Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.911
	Bartlett's Test of Sphericity	Approx. Chi-Square	1457.690
		df	15
		Sig.	0.000
Pro-environmental Behaviors (PEBs)	Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.894
	Bartlett's Test of Sphericity	Approx. Chi-Square	2542.243
		df	45
		Sig.	0.000

There is a clear and strong link between the variables in the data. The KMO values for the Green Transformational Leadership (GTL) scale and the coefficients for Pro-environmental Behaviours (PEBS) are 0.911 and 0.894, respectively. All scores exceeding 0.8 indicate that the data is credible and highly appropriate for factor analysis.

To evaluate the validity of a questionnaire, we utilize the KMO test and Bartlett's Test of Sphericity. The KMO statistic, ranging from 0 to 1, indicates the extent of connection among variables. A value nearing 1 signifies a stronger correlation. Moreover, we can infer that the data exhibits robust validity if the p-value of the Bartlett sphericity test is less than 0.05. The KMO statistic is 0.949. Bartlett's test of sphericity yielded a p-value of 0, signifying statistical significance at the 0.05 level. The questionnaire exhibits a substantial level of validity.

4.5.2 Confirmatory Factor Analysis

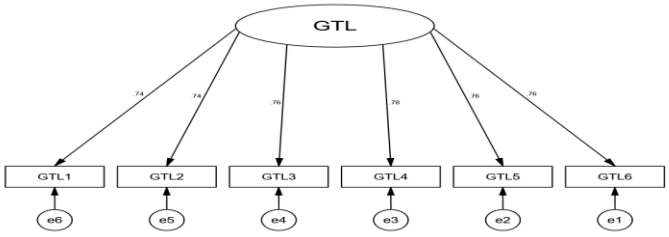

Figure 2 GTL normalized output for a CFA

Table 10 Results of confirmatory factor analysis for GTL

			Estimate	Standardized Estimate	S.E	C.R.	p	CR	AVE
GTL6	<---	GTL	1.000	0.764				0.889	0.572
GTL5	<---	GTL	0.994	0.756	0.058	17.017	***		
GTL4	<---	GTL	1.023	0.780	0.058	17.606	***		
GTL3	<---	GTL	1.011	0.762	0.059	17.176	***		
GTL2	<---	GTL	0.950	0.737	0.057	16.539	***		
GTL1	<---	GTL	0.942	0.738	0.057	16.560	***		

Note: * * * indicates p <0.001

Table 10 indicates that all standardized factor loadings of the measurement model are more significant than 0.5, except for paths designated as fixed parameters of 1. The C.R. values of the path coefficients in the model satisfy the necessary criteria, and the significant P-value indicates the model's quality for each item and its effective convergence. We generally use convergent validity to measure the correlation between the same latent variable and all measured items. The assessment of a model's degree of convergence is determined by the criteria that the combined reliability (CR) must exceed 0.7, and the average variance extracted (AVE) must be greater than 0.5. The AVE values exceed 0.5, and the CR values are above 0.7, which indicates that the data in this analysis exhibit strong convergent validity.

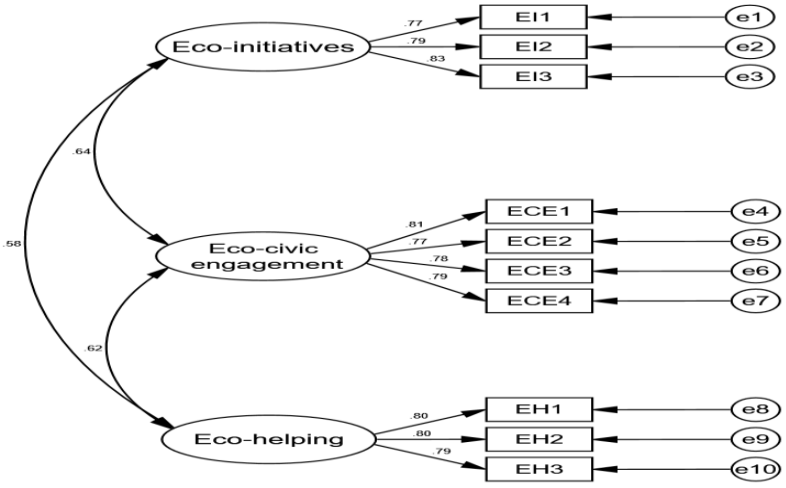

Figure 3 Model diagram of CFA of Pro-environmental Behaviors (PEBS)

Table 11 Results of CFA for Pro-environmental Behaviors (PEBs)

			Estimate	Standardized Estimate	S.E	C.R.	p	CR	AVE
EI1	<---	EI	1.000	.775					
EI2	<---	EI	1.025	.789	.060	17.132	***	0.839	0.635
EI3	<---	EI	1.100	.825	.062	17.703	***		
ECE1	<---	ECE	1.000	.811				0.868	0.622
ECE2	<---	ECE	.924	.770	.050	18.290	***		

ECE3	<---	ECE	.938	.783	.050	18.651	***		
ECE4	<---	ECE	.944	.789	.050	18.837	***		
EH1	<---	EH	1.000	.801					
EH2	<---	EH	.974	.799	.055	17.736	***	0.840	0.637
EH3	<---	EH	.972	.794	.055	17.636	***		

Note: * * * indicates p <0.001

Table 11 shows that all standardized factor loadings in the measurement model are more significant than 0.5, except for the fixed parameters set at 1. The model has good item quality and convergence impact since the path coefficients have large C.R. values and the P-value is substantial. We commonly employ convergent validity to evaluate the correlation between a latent variable and all its measured items. The model meets the convergence criteria when both the combined reliability (CR) and the average variance extracted (AVE) are more significant than 0.7. All AVE values for the three standard components listed in the table exceed 0.5, and all CR values are above 0.7. This signifies that the data utilized in this investigation exhibited strong aggregate validity.

4.6 Correlations between Variables

Verifying the connection among variables in the theoretical model is an essential and critical step in analyzing the relational framework of the variables and evaluating the model as a whole. The research will utilize the Pearson correlation coefficient to demonstrate the links among variables. The Pearson correlation coefficient quantifies the covariation patterns of variables, with a strong correlation signifying a distinct tendency in covariation.

Table 12 Pearson Correlation Coefficient between Variables

	Mean	Standard deviation	GTL	EI	ECE	EH
GTL	3.354	0.914	1			
EI	3.421	1.004	0.352**	1		
ECE	3.394	1.016	0.463**	0.548**	1	
EH	3.471	1.046	0.353**	0.492**	0.525**	1

* p<0.05 ** p<0.01

Table 12 presents a notable correlation among the five components of green transformational leadership (GTL), eco-initiatives, eco-civic engagement, and eco-helping. The correlation coefficients for these items are 0.352, 0.463, and 0.353, respectively. The statistics indicate a positive correlation between GTL and eco-initiatives, eco-civic participation, and eco-helping, as all these variables exhibited values greater than 0.

Table 13 Result of Path Analysis

Potential Variable		Observed Variable	Unstandardized Coefficient	Standardized Coefficient	S.E	t_value	p
PEBs	<---	GTL	0.277	0.276	0.059	4.726	***
EI	<---	PEBs	0.813	0.762	0.069	11.736	***
ECE	<---	PEBs	1.000	0.840			

EH	<---	PEBs	0.874	0.748	0.074	11.761	***

Note: * * * indicates p <0.001

The unstandardized path coefficient of 0.277 and the standardized path coefficient of 0.276 are unambiguous indications of the impact of GTL on PEBS. Statistical significance is indicated at a 1% confidence level by the p-value, which is less than 0.001. The data indicates that GTL has a substantial and advantageous effect on PEBs.

5. DISCUSSION AND CONCLUSION

5.1 Discussion

GTL positively influences various dimensions of PEB, indicating that effective green leadership is crucial for fostering environmentally responsible behaviors among employees. GTL encourages employees to take proactive measures such as implementing energy-saving practices, reducing waste, and adopting sustainable technologies within the workplace. The analysis revealed a significant correlation between GTL and eco-civic engagement, with a coefficient of 0.463. This suggests that green transformational leaders are particularly effective in motivating employees to participate in community-oriented environmental activities, such as local clean-up drives and environmental awareness campaigns. GTL also promotes eco-helping behaviors, where employees assist their colleagues in adopting green practices and share knowledge about sustainability, fostering a collaborative environment.

This study examines data from industrial employees of new energy firms in China to assess the impact of green transformational leadership on employees' pro-environmental behaviours. The organizational behaviour literature posits that employees' actions stem from their psychological affiliation with their employers (Van Knippenberg, Van Dick & Tavares 2007). Therefore, an evaluation of SCT (McCormick, 2001; Schunk & DiBenedetto, 2020; Stajkovic & Luthans, 1998) has formed the basis for supporting this basic theoretical perspectives underpinning this research. SCT posits that situational variables affect employees' cognitive abilities, resulting in varied emotional outcomes (Gundlach et al., 2003). Consequently, the theory facilitates the examination of the influence of both positive and negative dimensions on employee behavioural outcomes (Farooq et al., 2022). Recent studies have utilized Social Cognitive Theory (SCT) to investigate various behaviours, including compulsory citizenship behaviours and creativity (P. He et al., 2020), among others. Statistical analysis of the new energy automotive sector in China reveals a significant correlation between green transformational leadership and workplace environmental behaviours. Green transformational leaders' visionary motivation directly encourages employees to adopt pro-environmental behaviours.

Additionally, leaders' individualized consideration and ethical shaping indirectly foster these behaviours through the development of psychological ownership among employees (Mi et al., 2019). Therefore, leaders who value the planning and communication of their organization's vision will inspire their employees to engage in more eco-civic engagement. Timely communication of organizational trends and plans to employees can enhance their understanding of the importance and value of their contributions to both the organization's success and their personal development. This approach enhances employees' willingness to participate in pro-environmental behaviours that positively impact the organization's potential performance and long-term reputation. Studies have established a correlation between green transformational leadership and staff pro-environmental

behaviours (Gurmani et al., 2021). This study demonstrates that green transformational leadership fosters an environment conducive to environmentally friendly employee behaviour in the workplace. This theoretical framework posits that employees within China's new energy automotive sector will cultivate confidence in both the organization's future and their personal prospects through green transformational leadership exhibited by their managers, thereby establishing a foundation for pro-environmental behaviours.

The results indicate a substantial favourable impact of GTL on PEBS. Emphasizing green transformational leadership is essential for fostering pro-environmental behaviour among employees in the workplace. Based on transformational leadership theory, transformational leadership behaviours, such as articulating organizational values and vision, possess significant inspirational qualities (Bass, 1999), and this is especially true when leaders demonstrate behaviours that are consistent with the ideals of their organization. Employees can acquire behavioural patterns from leaders through careful observation, which promotes the internalization of environmental values and, as a result, motivates employees to engage in comparable environmental behaviours. This hypothesis was only proven in a few earlier investigations (Afsar et al., 2016; Graves et al., 2013; Robertson & Barling, 2013). Green transformational and spiritual leadership behaviours, characterized by inspiration, more effectively motivate employees' environmental behaviours.

Furthermore, employees' pro-environmental actions are more likely to receive support in the workplace when leaders adopt a proactive approach to environmental issues. Direct leader behaviours that emphasize environmental issues, including vision descriptions, motivation, intellectual incentives, individualized consideration, and support, can be interpreted as a sequence of affective events that promote positive affective experiences regarding the environment, subsequently activating employees' pro-environmental behaviours (Farrukh et al., 2022; Li et al., 2020; Tuan, 2021). According to the present research, leadership actions that address environmental challenges can effectively encourage employees to adopt pro-environmental behaviours.

The new energy vehicle sector is fundamentally environmentally focused, and leaders ought to promote green transformational leadership (GTL) to foster an eco-friendly corporate culture. Business leaders ought to embrace a leadership style focused on transformation that effectively articulates an environmental vision and encourages employee engagement in sustainable development efforts. Through regular communication and motivation, leaders can increase employee buy-in to the environmental mission. To inspire their teams to do the same, leaders should practise what they preach when it comes to environmental protection.

Despite the achievements of this study, three limitations should be mentioned. First, our study utilized a quantitative research approach. Future research should incorporate a mixed-methods approach, combining quantitative and qualitative methods to gain a deeper understanding of the factors influencing PEB. Qualitative methods, such as interviews or focus groups, could provide richer insights into the experiences and motivations of employees, complementing the quantitative findings. Second, we conducted this study in China. The potential impact of cultural differences should be considered in future studies to generalize our findings further. Third, this study did not utilize a longitudinal research design. Although solid theory and evidence generally support our model, future studies should adopt a longitudinal design to test the validity of our findings.

AUTHORS CONTRIBUTION

The study was conceptualized by [Author 1]; methodology was developed by [Author 1]; data curation and analysis were performed by [Author 2]; the original draft was written by [Author 1]; and review and editing were done by [Author 3]. All authors have read and approved the final manuscript.

DECLARATION OF INTEREST

The authors declare no conflict of interest.

The funders had no role in the design, execution, or writing of the study.

DATA AVAILABILITY

Data supporting the findings of this study are available from the corresponding author.

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