Environment, Development and Sustainability
https://doi.org/10.1007/s10668-024-04665-8

Unveiling greenwashing dynamics: exploring the nexus between transparent corporate practices, employee perspectives, and ethical leadership impact

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Received: 25 September 2023 / Accepted: 18 February 2024
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Abstract
This research delves into the complex dynamics of greenwashing communication (GC), organizational transparency (OT), employee perception of greenwashing (EPG), and ethical leadership (EL) within the Chinese manufacturing industry. The study encompasses 539 employees from manufacturing organizations in the Jiangsu region, with data analysis conducted through partial least square structural equation modeling (PLS-SME) using SmartPLS 4. The findings disclose that GC positively and significantly influences OT and EPG. Moreover, OT significantly influences EPG and mediates the relationship between GC and EPG. Furthermore, EL plays a vital role in intensifying the positive impacts of GC on OT, especially in organizations that place a strong emphasis on EL. Practically, this study guides how to enhance environmental communication strategies within companies by promoting authentic and transparent communication.

Keywords Greenwashing communication · Organizational transparency · Employees · Perception of greenwashing · Ethical leadership

1 Introduction

In recent times, there has been an increasing worry about the involvement of organizations in environmental issues (Awan et al., 2023). Governments, public institutions, and non-governmental organizations are urging organizations to adopt and implement eco-friendly

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Published online: 12 March 2024

initiatives (Huang et al., 2022; Ul-Durar et al., 2023). Consumers are actively seeking environmentally friendly products, and investors prefer companies prioritizing environmental sustainability (Alola et al., 2023; Fazli et al., 2023). Despite increasing investment in corporate social responsibilities (Karmani et al., 2023), companies face risks associated with environmental disasters and greenwashing, where actions do not align with their communications (Pizzetti et al., 2021).

The term "greenwashing" originates from the combination of "green" (associated with environmentalism) and "whitewashing" (covering up or glossing over negative information) (Xu et al., 2023). It is recognized as the act of deceiving stakeholders, including consumers, employees, government, suppliers, and trading partners, regarding the green practices implemented by a company, product, or service (Santos et al., 2023). In a comprehensive review study, Gatti et al. (2019) argued that three decades after the conceptualization of this term, it has recently demonstrated heightened refinement. Consequently, numerous studies have used this term to investigate the perception of greenwashing, particularly from the perspective of consumers and employees (Gatti et al., 2019; Santos et al., 2023). However, limited attention has been given to the significance of greenwashing communication (*hereafter referred to as GC*) (Torelli et al., 2020; Vollero et al., 2016). This research aims to fill this gap by exploring the impacts of GC on employees, shedding light on its role in shaping perceptions and attitudes towards eco-friendly practices.

As organizations face increasing scrutiny for their environmental practices, the prevalence of greenwashing poses a tangible risk to their credibility. The lack of clarity in corporate communications, as evidenced by a survey indicating that 45% of employees suspect their companies engage in some degree of greenwashing, highlights the urgency to address this issue (WE, 2023). GC, involving misleading communication practices to falsely appear environmentally responsible, can undermine trust within the workplace, weaken employees' belief in organizational dedication to sustainability, and cultivate skepticism about information authenticity (Naidoo & Gasparatos, 2018). GC is a marketing tactic employed to overstate its eco-friendly efforts, aiming to misguide environmentally conscious buyers (Edwards, 2023). Various forms of GC include exaggerated claims, false certification, misleading advertisements, and vague language, among others (de Freitas Netto et al., 2020). While prior studies focused on external stakeholders, it is crucial to examine its effects on internal stakeholders, particularly employees (Ren & Hussain, 2022). Employees are integral to the workforce and have their own expectations and values (Li et al., 2022). Despite existing literature on external stakeholders' reactions to greenwashing (Guerreiro & Pacheco, 2021; Okbagaber, 2023; Rahman & Nguyen-Viet, 2023), research on employees' viewpoints is limited (Pizzetti et al., 2021; Santos et al., 2023). Moreover, there is a clear lack of comprehension regarding the effects of GC on employees' viewpoints (Santos et al., 2023; Torelli et al., 2020). This research aims to investigate the influence of GC on employee perception of greenwashing (*hereafter referred to as EPG*) and organizational transparency (*hereafter referred to as OT*).

In this context, ethical leadership (referred to as *EL*) is suggested to act as a protective barrier against the consequences of greenwashing (Inês et al., 2023). EL, fosters openness, genuineness, and ethical principles in organizational communication, creating a culture of accountability and trust (Asamoah, 2023). Ethical leaders minimize greenwashing practices, resulting in more precise and truthful communication, enhanced credibility, and increased employee confidence (Blome et al., 2017; Jha & Singh, 2019). This study suggests employing EL as a moderator to assess its impact on the link between GC and OT, particularly in the context of Chinese manufacturing where ethical leadership is crucial for success (Bhatti et al., 2021; Le & Nguyen, 2023).

Leaders, who give priority to ethical considerations serve as a source of inspiration for employees to uphold elevated moral norms, thereby creating a professional milieu that prioritizes integrity and responsible behavior (Cheng et al., 2022; Dey et al., 2022; Yang et al., 2023). Furthermore, organizational behavior studies, which examine the actions of individuals and groups within a company, is profoundly impacted by EL (Al Halbusi et al., 2020; Dua et al., 2023; Ye et al., 2023). In the context of Chinese manufacturing, where collaboration and teamwork are highly valued, ethical organizational behavior becomes a fundamental pillar for achieving success (Sarwar et al., 2023). When employees are guided by ethical principles, they are more likely to participate in constructive behaviors, contribute effectively to team efforts, and demonstrate a strong work ethic (Al Halbusi et al., 2021). These behaviors not only strengthen internal unity but also cultivate positive relationships with stakeholders, thereby bolstering an organization's reputation in the market (Cabrera-Luján et al., 2023; Malik et al., 2023; Saha et al., 2020). Additionally, ethical leaders within manufacturing enterprises establish an environment that places importance on environmental sustainability, equitable labor practices and social responsibility (Chukwu et al., 2023; Hristov et al., 2022). This not only in line with the increasing global emphasis on ethical business behavior but also positions Chinese companies as responsible corporate entities, thereby augmenting their competitiveness and attractiveness to a wider client. Therefore, this study utilizes EL as a moderator and seeks to determine whether EL moderates the correlation between GC and OT.

2 Literature review and hypotheses formulation

2.1 Theoretical support

The social exchange theory (*SET*) initially proposed by Blau (1964) and further developed by Cropanzano and Mitchell (2005), has its roots in sociology and psychology. SET posits that individuals engage in social interactions through a rational assessment of associated advantages and disadvantages (Cropanzano et al., 2016). This influential conceptual framework aims to predict how individual actions within an organization are influenced by the anticipation of receiving rewarding reactions from others (Cook et al., 2013). According to SET, employees establish reciprocal relationships with their organization, exchanging socio-emotional benefits. The establishment of these social exchange connections depends on a strong basis of integrity and trust (Aryee et al., 2002), coupled with the recognition of valuable advantages and confidence in the fairness of the exchange (Cook et al., 2013). Additionally, employee feedback on corporate behavior, such as communication, aligns with the reciprocity principle (Li et al., 2022).

Building upon the social exchange theoretical arguments, SET was employed to construct a model (refer to Fig. 1). It is noteworthy that organizations engage in the practice of green communication as a means of communication aimed at fostering a positive perception and gaining advantages, often at the expense of complete veracity. Greenwashing communication can be viewed as an element of the exchange process where organizations seek benefits like an enhanced reputation and increased sales, potentially misleading stakeholders (Ioannou et al., 2023).

Furthermore, OT can be perceived as the embodiment of openness and clarity that organizations extend to their employees, constituting a fundamental aspect of the social exchange (Kurtessis et al., 2015). In this reciprocal relationship, employees dedicate their

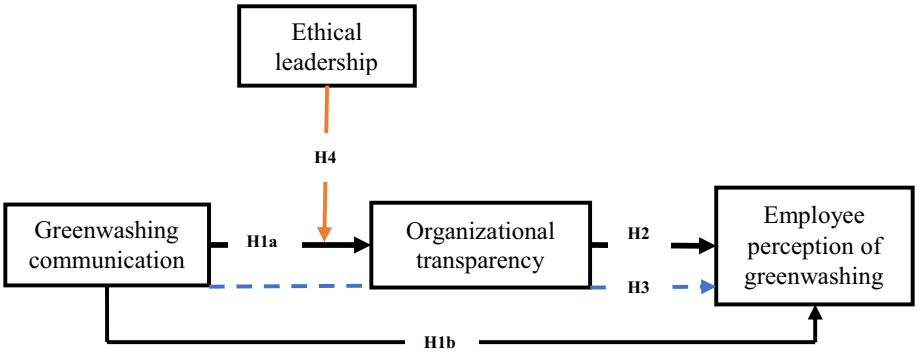

Fig. 1 Proposed model

efforts and unwavering allegiance to the organization in return for numerous desirable consequences, creating an environment characterized by transparency and trust (Schnackenberg & Tomlinson, 2014). The extent of OT significantly influences how employees perceive the inherent fairness in the exchange (O'Connor & Crowley-Henry, 2019).

Moreover, EPG, defined as "employees' perception about the organizational behaviors that mislead stakeholders by green communication" (Li et al., 2022, p. 1723), functions as a driver for assessing the degree to which the organization fulfills its obligations in the social exchange (Li & Chen, 2023). The perceived fairness of the exchange is paramount within the SET framework. If employees come to believe that the organization is misleading them through greenwashing, it not only violates their expectations of fairness and transparency but also jeopardizes the integrity of the social exchange. This perceived unfairness has significant implications, potentially leading to negative employee perceptions, decreased organizational commitment, and a potential decline in employee morale (Li et al., 2022). Moreover, when employees perceive instances of greenwashing, it disrupts the exchange, as it contradicts their expectations of the organization's ethical conduct and transparency (Maher et al., 2022). This disruption in the social exchange can create a ripple effect, negatively influencing employee trust and the overall quality of the employee-organization association.

EL is suggested as a significant determinant of social interaction within the organizational context (Mayer et al., 2009). Leaders who exhibit ethical behavior not only establish a foundation of trust and mutual exchange with subordinates but also contribute positively to the overall quality of social interaction (Hansen et al., 2013; Zou et al., 2015). This positive interaction is supported by trust, a crucial component of social exchange, fostering reciprocal relationships between leaders and employees, thereby aligning with the principles of SET (Newman et al., 2014; Oparaocha, 2016). In this respect, OT plays a crucial role in the establishment and maintenance of trust by providing openness and clarity. In doing so, it reinforces positive social exchange relationships within the organizational framework (Kurtessis et al., 2015).

Table 1 outlines recent literature, the utilized theories, and their contributions concerning greenwashing within the context of employee perspectives. In particular, a significant portion of the current literature has concentrated on the results stemming from employees' views on greenwashing. However, there is limited literature that explores the factors influencing EPG. In this regard, the present research makes a significant contribution to

Table 1 Literature on Greenwashing in the context of employees

Author	Title	Theory	Data collection	Analysis	Results
Miao et al. (2023)	"The effect of corporate greenwashing on employees' environmental performance: person–organization values fit perspective"	Person–organization fit theory	269 Chinese Employees working in 8 Gas companies	Path analysis and hierarchal regression using Mplus	Perceived organizational fit directly and indirectly influences employee environmental performance and environmental belief moderates greenwashing – perceived organizational fit link
Robertson et al. (2023)	"Employees' response to corporate greenwashing"	Social identity theory	205 American employees	Path analysis using SPSS	Greenwashing perception significantly influences perceived corporate hypocrisy. In addition, corporate hypocrisy influences turnover intention
Mu and Lee (2023)	"Greenwashing in corporate social responsibility: a dual-faceted analysis of its impact on employee trust and identification"	Stakeholder, social-identity, and social-exchange theory	314 Chinese employees working in different sector	Path analysis using PLS-SEM	Greenwashing within CSR directed at primary stakeholders has a negative impact on trust, while greenwashing within CSR targeting secondary stakeholders has a negative impact on employee-company identification. Furthermore, both trust and employee-company identification positively contribute to employee loyalty

Table 1 (continued)

Author	Title	Theory	Data collection	Analysis	Results
Li et al. (2022)	"How and when does perceived greenwashing affect employees' job performance? Evidence from China"	Attribution theory Social exchange theory	298 Chinese employees working in companies located in Guangdong, Jiangsu, and Hubei province	Path analysis using AMOS 24	The negative impact of perceived greenwashing on job performance is influenced by organizational cynicism, acting as a mediating factor. Additionally, the relationship between perceived greenwashing and organizational cynicism is moderated by employees' green values
Santos et al. (2022)	"Does greenwashing affect employee's career satisfaction? The mediating role of organizational pride, negative emotions, and affective commitment"	Appraisal theory of emotions and moral foundation theory	398 Portuguese employees working in different sectors in Portugal	Path analysis using AMOS	Employees perceived greenwashing negatively influences career satisfaction, affective commitment, and organizational pride, and positively influences negative emotions. In addition, the connection between employees' perception of greenwashing and career satisfaction is significantly mediated by organizational pride and affective commitment
Westerman et al. (2022)	"When sustainability managers greenwash: SDG fit and effects on job performance and attitudes"	Social identity theory	125 employees working in companies located in the USA	Path analysis using SPSS	Employees perceived greenwashing adversely influences job performance

Table 1 (continued)

Author	Title	Theory	Data collection	Analysis	Results
Iddagoda et al. (2021)	"Green work-life balance and greenwashing the construct of work-life balance: myth and reality"	Role behavior theory and system theory	170 Sri Lankan employees working in publicly listed banks	Path analysis using SPSS	Work-life balance positively and significantly influences employee engagement and job performance
Tahir et al. (2020)	"The impact of greenwashing practices on green employee behavior: Mediating role of employee value orientation and green psychological climate"	Value-basis, supplier-value-fit, and theory of normative conduct	520 Pakistani employees working in 10 agriculture companies, located in the Punjab province	Path analysis using PLS-SEM	Greenwashing has an adverse impact on employee green behavior. In addition, green psychological climate and employee value orientation adversely mediate the relationship
Blome et al. (2017)	"Antecedents of green supplier championing and greenwashing: An empirical study on leadership and ethical incentives"	Transactional leadership theory	118 employees working in procurement departments in different companies located in Germany	Path analysis using PLS-SEM	EL exerts a positive and noteworthy impact on advocating for green suppliers. Furthermore, compliance with authority significantly affects greenwashing

greenwashing literature on EPG by investigating the effects of GC and OT on EPG, along with the moderating effect of EL.

2.2 Hypotheses formulation

2.2.1 Relationship of GC with EPG and OT

GC refers to a strategic communication strategy that organizations adopt in order to present themselves as environmentally responsible, regardless of the actual sustainability practices they engage in. This approach employs various messaging techniques, such as environmental claims, advertisements, certifications, and public relations efforts, all aimed at projecting an eco-friendly image (Robertson et al., 2023). The primary objective of GC is to cultivate favorable perceptions among stakeholders including employees, establishing the organization as environmentally conscious (Nemes et al., 2022). Firms involved in GC often highlight their sustainability commitment, green initiatives, and practices (Nyilasy et al., 2014), crafting messages to spotlight efforts in reducing its ecological impact, conserving resources, and contributing to the planet's well-being (Ottman, 2017).

From an employee, these communicative efforts can significantly influence their perception. Employees being essential internal stakeholders, rely on information from their employer to shape their views (Robertson et al., 2023; Tahir et al., 2020). It is argued that consistent exposure to GC messages emphasizing environmental responsibility may lead employees to internalize these narratives (Brunton et al., 2017). Consequently, they may perceive their organization as genuinely dedicated to environmentally friendly practices and sustainability (Miao et al., 2023; Szabo & Webster, 2021). This favorable perception can generate pride among employees, fostering a sense of association with an eco-consciousness and social responsibility organization. The compelling nature of GC may lead internal stakeholders to disregard or diminish disparities between conveyed ecological endeavors and the actual green practices within the institution (Brunton et al., 2017; Santos et al., 2023; Vollero et al., 2016). Therefore, based on the above arguments, the hypothesis is formulated that.

H1a GC positively influences EPG by shaping employees' perception of their organization's commitment to environmental sustainability.

When organizations participate in the practice of greenwashing, there is often a perceived need to support their assertions with transparency (Kaner, 2021). Making environmental assertions without substantiating evidence poses a risk to their image if stakeholders become aware of the actual situation (Wu et al., 2020). In this context, the utilization of GC can potentially stimulate an increase in OT. To uphold their credibility and correspond with the communicated green image, firms may find it crucial to augment the transparency in their eco-friendly practices. This may involve disclosing information pertaining to their endeavors toward sustainability, assessments of environmental impact, endeavors for the conservation of resources, and adherence to eco-friendly certifications (Reck et al., 2022).

As an outcome, the implementation of GC can incentivize organizations to divulge their financial records and provide stakeholders with increased transparency pertaining to their green initiatives (Martin-Rios et al., 2022; Wilson, 2013). This heightened transparency may involve multiple aspects, including sustainability reports, data on environmental performance, and information regarding the firm's supply chain and sourcing practices

(Ahmad & Zhang, 2020; Yu et al., 2020). Moreover, the necessity to substantiate GC can motivate organizations to adopt more comprehensive sustainability measures and actively engage in authentic green practices. This transition towards genuineness has the potential to increase OT, as stakeholders perceive a closer alignment between the organization's green communication and its actual efforts. Hence, the hypothesis is formulated that.

H1b GC positively influences OT by compelling firms to become more transparent in their green initiative and practices.

2.2.2 Relationship of OT with EPG

OT refers to the practice of sharing information about a company's activities with its stakeholders to foster accountability, clarity, and trust (Alonso, 2022). In fostering stakeholders' perceptions of greenwashing, OT plays a crucial role (Uyar et al., 2020). Studies argue that when organizations prioritize transparency in their environmental practices, they cultivate an atmosphere of credibility and trustworthiness (Men & Stacks, 2014). This, instills confidence in employees, assuring that the organization operates openly and honestly in its eco-friendly endeavors, diminishing doubts or suspicions of greenwashing (Szabo & Webster, 2021).

Furthermore, transparent organizations provide employees with convenient access to information pertaining to their endeavors in the environmental domain, enhancing understanding and trust in the genuineness of these efforts (Rawlins, 2008). This accessibility empowers employees to formulate informed assessments, reinforcing their favorable notions regarding sustainability commitment. Hence, it is suggested that.

H2 OT positively influences EPG.

2.2.3 OT as a mediator

OT plays a critical role in influencing EPG in the context of GC. GC involves communication tactics by organizations to present themselves as environmentally accountable, irrespective of potential inadequacies in their sustainability practices (Nemes et al., 2022; Nyilasy et al., 2014). While seeking to cultivate a favorable impression, these communication efforts can create doubt among employees, particularly when disparities exist between communicated green initiatives and the actual implementation (Torelli et al., 2020).

SET suggests that individuals engage in social exchanges with the expectation of positive outcomes. In the workplace, these exchanges involve tangible rewards and socio-emotional benefits, relying on trust and honesty (Aryee et al., 2002; Cook et al., 2013). When organizations engage in GC, presenting potentially exaggerated or misleading environmentally friendly claims (Nemes et al., 2022; Nyilasy et al., 2014), it introduces a potential breach of trust within the social exchange. Employees may perceive the organization as violating their expectations of honesty and transparency, leading to negative perceptions, feelings of deception, and a decline in trust.

OT assumes a crucial mediating role in this context. SET posits that trust is foundational in social exchange, and transparency is essential for fostering and maintaining trust (Cropanzano et al., 2016). When organizations are transparent about their communication practices, environmental initiatives, and overall business conduct, it can mitigate the negative effects of greenwashing (Kang & Hustvedt, 2014; Rawlins, 2008). In this dual role, OT

not only serves as a mediator but simultaneously enables employees to actively contribute to the advancement of authentic sustainability within their professional environment.

H3 OT positively mediates the relationship between GC and EPG

2.2.4 EL as a moderator

EL, as defined by Demirtas (2015) encompasses action, behavior, and talks aligned with appropriate norms, reflecting leaders committed to maintaining ethical standards in both conduct and communication. In organizations with a robust leadership framework, leaders actively advocate for transparency and ethical behavior (Brown et al., 2005).

SET argues that individuals engage in social exchanges by rational assessment of fairness, reciprocity, and trust (Cropanzano et al., 2016). Ethical leaders, characterized by ethical decision-making, fairness, and integrity, play a crucial role in establishing a foundation of trust within the companies. When faced with GC, these ethical leaders act as a moderator, influencing how firms communicate their environmental initiatives. These leaders are more prone to promote transparency and promptly correct any discrepancies, moderating the impact of greenwashing on OT (Blome et al., 2017). Their influence fosters a more authentic exchange with employees. A prior study by Schultz and Seele (2020) concluded that ethical leaders cultivate a culture of honesty and accountability, fostering open and transparent communication.

H4 EL moderates GC–OT link such that the positive influence of GC on OT is stronger when EL is high.

Figure 1 illustrates the proposed hypotheses in pictorial form. Black arrows show the direct relationships, the blue dashed line represents mediation, and the orange moderation effects.

3 Method

3.1 Data collection and sampling

Given the limited availability of organizational-level environmental data in published sources (Wang, 2019), a questionnaire was chosen for data collection. To ensure the questionnaire's effectiveness, a pretest involving 10 participants from manufacturing companies was conducted. Minor adjustments were made, resulting in a final questionnaire with two main sections: demographics (seeking information on age, education, firm size, working experience, and industry) and constructs (covering GC, OT, EPG, and EL).

In line with the study's objectives, a quantitative approach was employed through a self-administered survey. The survey, conducted online over four months from March 1st to June 30th, 2023, targeted randomly selected employees in the Chinese manufacturing industry. The choice of the manufacturing sector was driven by its significant contribution in China relative to other sectors (Wang et al., 2017) and its frequent involvement in global greenwashing activities (Ioannou et al., 2023; Johnsson et al., 2020; Vollero et al., 2016). The decision to employ an online survey was motivated by various benefits such as quicker response times, cost efficiency, ease of data entry, flexibility, control over

format, technological advancements, acceptance by respondents, and the capacity to gather additional information on response sets (Granello & Wheaton, 2004; Qalati et al., 2023a, 2023b). Data collection occurred in four waves: GC in wave 1, EPG in wave 2, OT in wave 3, and EL in wave 4, each wave spanning one month.

Aligned with the recommendations of Pesämaa et al. (2021) and findings from a recent study by Qalati et al., (2023a, 2023b) in the context of manufacturing in China, a minimum sample size of 200 was suggested, considering the presence of 20 items for four constructs, each requiring 10 responses. To enhance generalizability, in the preliminary stage, one thousand questionnaires were distributed to randomly selected employees in manufacturing firms, resulting in 726 responses after one month. Subsequently, the second wave yielded 630 responses, the third wave 580, and the final wave 539, resulting in a total of 539 usable questionnaires in the ultimate sample. Table 2 provides a comprehensive overview of the sample's characteristics.

Table 2 results reflects that a significant majority (66.6%) were male. Notably, 39% (n = 210) of participants fell within the age bracket of 26 to 35 years. Furthermore, a substantial portion of the participants, amounting to 55.7%, held master's or doctoral degree. Additionally, the majority of them occupied middle-level positions (44.5%, n = 240), had 1 to 5 years of job experience (44.3%, n = 239), and were employed in companies with a workforce exceeding 500 employees (39%, n = 210).

3.2 Measurement

The study incorporated a total of 20 items, comprising five items to measure GC, adapted from McShane and Cunningham (2012) and Vollero et al. (2016); five items designed to

Table 2 Manufacturing firm participants' demographical information

		Frequency	Percentage
Gender	Male	359	66.6
	Female	180	33.4
Age	< 25	60	11.1
	26–35	210	39.0
	36–45	179	33.2
	> 45	90	16.7
Education (degree)	College	89	16.5
	Bachelor	150	27.8
	Master or doctoral	300	55.7
Experience (year)	< 1	150	27.8
	1–5	239	44.3
	> 5	150	27.8
Job level	Low	179	33.2
	Middle	240	44.5
	Top	120	22.3
Firm size	< 100	150	27.8
	100–200	119	22.1
	201–500	60	11.1
	> 500	210	39.0

evaluate OT, adapted from Rawlins (2008); five items for assessing EPG, adapted from Li et al. (2022); and five items to gauge EL, adapted from Khuntia and Suar (2004). All scale items are categorized under the Likert Scale, with a rating of 5 indicating strong agreement, and a rating of 1 representing strong disagreement.

3.3 Data analysis approach

This research employed SPSS statistics to analyze preliminary data, utilizing descriptive statistics such as means and frequencies. Additionally, the study executed PLS-SEM over covariance-based-structural-equation-modeling (CB-SEM) with SmartPLS 4.0 to evaluate the hypotheses.

3.3.1 PLS-SEM versus CB-SEM

The choice of this approach was driven by the limited sample size and the exploratory nature of the research (Hair et al., 2019). In comparison to alternative methodologies like CB-SEM, PLS-SEM offers enhanced flexibility for modeling complex structures and formative constructs, minimizing the amount of unexplained variance in the proposed model (Guenther et al., 2023), as well as accommodating data with specific requirements such as small sample sizes and non-normal distributions (Hair et al., 2019). Moreover, CB-SEM focuses on explanation, while PLS-SEM emphasizes both explanation and prediction (Hair, 2021). Consequently, PLS-SEM has gained significant popularity across various domains, including environment-related (Munerah et al., 2021), business studies (Guenther et al., 2023), health (Mutonyi et al., 2021), tourism research (Kock, 2018), education (Ghasemy et al., 2020), computer science (Alshurideh et al., 2023), and social science (Hair et al., 2019; Qalati et al., 2023a, 2023b). In line with the recommendations of Hair et al. (2019), this research aims to utilize a complex structural model, thus opting for the PLS-SEM approach facilitated by SmartPLS 4.0.

The research followed the two-step approach advocated by Hair et al. (2019) to examine and interpret the PLS-SEM findings in relation to the hypotheses. This approach includes (1) evaluating the reliability and validity of the measurements and (2) assessing the structural model. The reliability analysis involved both Cronbach's alpha (CA) and composite reliability (CR) coefficients, while the validity analysis encompassed convergent and discriminant validity. Mediation analysis was assessed using the bootstrapping results to derive the direct and indirect path coefficients.

3.3.2 Challenges and suggestions for using PLS-SEM

Researchers employing PLS-SEM encounter various difficulties. One particular hurdle involves determining an appropriate sample size, particularly in the context of intricate models. To tackle this issue, researchers are advised to incorporate bootstrapping techniques and evaluate effect sizes in conjunction with statistical significance. Another challenge arises from the complexity of the models themselves, especially those that involve first-order and second-order constructs, making interpretation difficult. In order to address this, researchers ought to prioritize theoretical relevance and simplicity, carefully considering whether each additional construct contributes significantly to the research question.

Ensuring the validity and reliability of a complex model that includes reflective variables is a persistent issue. Thorough evaluations of reliability and validity, the use of

established scales, and iterative refinement grounded in statistical and theoretical considerations can aid in overcoming this challenge. Additionally, the presence of multicollinearity among explained variables can have an impact on the dependability of path coefficients, demanding scholars to diagnose and deal with these concerns through measures such as examining variance inflation factors and judicious variable selection (Guenther et al., 2023; Richter et al., 2022; Zhao et al., 2020).

4 Results

Figure 2 illustrates the step-by-step guidelines for conducting analysis using the PLS-SEM approach through SmartPLS 4, along with the acceptable thresholds.

4.1 Measurement model evaluation

Hair et al. (2019) suggested a thorough evaluation of the measurement model, covering the examination of indicators, internal consistency reliability, and both convergent and discriminant validity.

Indicator reliability reflects how accurately and consistently observed indicators measure the underlying latent construct. Loadings of indicators measure the strength of the association between each indicator and its related latent variable. According to Hair et al. (2019), ideal indicator loadings should exceed 0.708 to indicate strong reliability, although values above 0.6 are often considered acceptable. As demonstrated in Table 3, the outer-loadings of the variables surpass the recommended threshold of 0.708 (Hair et al., 2019).

Internal consistency reliability, typically assessed using measures such as CA and CR, plays a critical role in evaluating the quality of latent constructs. This evaluation

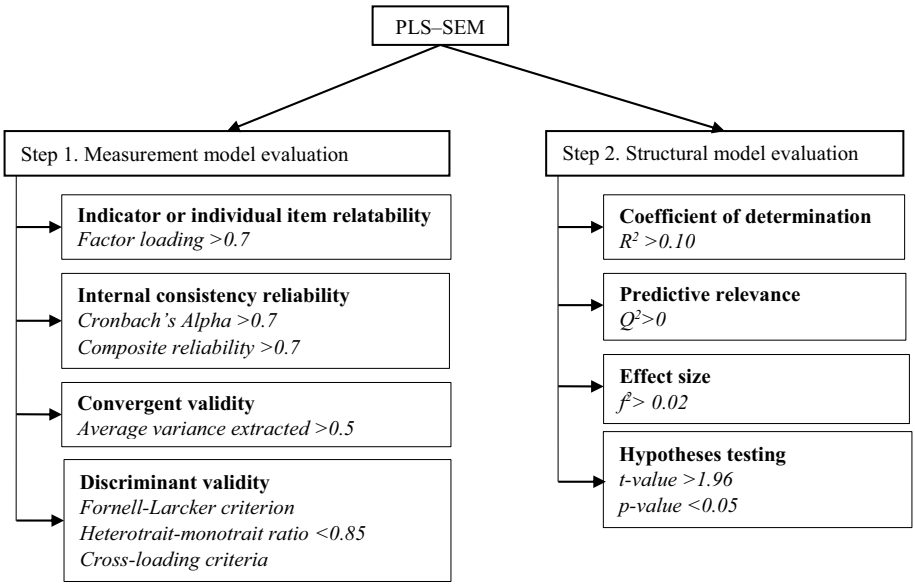

Fig. 2 PLS–SEM step by step process

Table 3 Constructs reliability and convergent validity

Construct	Items	Factor loadings	CA	CR	AVE	VIF
Greenwashing communication (GC)	GC1	0.84	0.939	0.954	0.804	1.743
	GC2	0.892				
	GC3	0.900				
	GC4	0.936				
	GC5	0.914				
Organizational transparency (OT)	OT1	0.906	0.903	0.927	0.719	1.740
	OT2	0.740				
	OT3	0.805				
	OT4	0.902				
	OT5	0.873				
Ethical leadership (EL)	EL1	0.935	0.928	0.946	0.78	1.648
	EL2	0.871				
	EL3	0.759				
	EL4	0.902				
	EL5	0.936				
Employees perception of greenwashing (EPG)	EPG1	0.940	0.936	0.948	0.786	
	EPG2	0.820				
	EPG3	0.864				
	EPG4	0.915				
	EPG5	0.887				

assesses whether the indicators used to measure a latent construct consistently exhibit relationships with each other. CA quantifies the degree of correlation among a set of items measuring the same underlying construct, while CR measures the degree to which a set of items consistently measures an underlying construct. Both CA and CR values range between 0 and 1, with higher values indicating a superior level of consistency and reliability. For PLS-SEM, a value of 0.7 and above is often recommended (Hair et al., 2019). Table 3 indicates that both measures exceed the suggested threshold of 0.7 (Hair et al., 2019), implying a commendable level of measurement reliability.

Furthermore, we employed convergent and discriminant validity to further evaluate the robustness of the measurement model. Both validity measures are used to ensure the validity of measurement instruments and the clear differentiation of latent constructs. Convergent validity, evaluating how well a concept consolidates to elucidate the variability of its components, was scrutinized using the Average Variance Extracted (AVE), as proposed by Hair et al. (2019). As illustrated in Table 3, it is evident that the AVE exceeds the suggested threshold of 0.5 (Hair et al., 2019).

Before delving into the assessment of the structural framework, it is imperative to conduct a thorough examination of multicollinearity using the variance inflation factor (VIF) (Chen et al., 2023). As depicted in Table 3, all VIF figures fall within the range of 1.648–1.743, which is significantly below the threshold of 3.33 (Qalati et al.,

Table 4 Discriminant validity (Fornell-Larcker and HTMT ratio criterion)

Construct	EPG	EL	GC	OT
Employees perception of greenwashing (EPG)	*0.886*	**0.343**	**0.316**	**0.292**
Ethical leadership (EL)	0.366	*0.883*	**0.657**	**0.649**
Greenwashing communication (GC)	0.356	0.621	*0.897*	**0.666**
Organizational transparency (OT)	0.329	0.625	0.652	*0.848*

The highlighted italic values are the square-root of AVEs mentioned in Table 2, whereas bold values represent the HTMT values

Table 5 Cross-loading criterion

	EPG	EL	GC	OT
EL1	0.302	**0.935**	0.500	0.541
EL2	0.362	**0.871**	0.551	0.427
EL3	0.128	**0.759**	0.487	0.531
EL4	0.416	**0.902**	0.693	0.654
EL5	0.392	**0.936**	0.482	0.558
EPG1	**0.940**	0.380	0.416	0.422
EPG2	**0.820**	0.182	0.117	0.210
EPG3	**0.864**	0.202	0.197	0.084
EPG4	**0.915**	0.469	0.427	0.298
EPG5	**0.887**	0.188	0.183	0.261
GC1	0.234	0.377	**0.840**	0.626
GC2	0.270	0.552	**0.892**	0.446
GC3	0.347	0.673	**0.900**	0.599
GC4	0.361	0.535	**0.936**	0.584
GC5	0.365	0.636	**0.914**	0.634
OT1	0.350	0.648	0.674	**0.906**
OT2	0.090	0.374	0.358	**0.740**
OT3	0.220	0.430	0.366	**0.805**
OT4	0.265	0.526	0.580	**0.902**
OT5	0.368	0.585	0.654	**0.873**

The bold value represents the factor's outer loadings. *EPG* employees perception of greenwashing; *EL* ethical leadership; *GC* greenwashing communication; *OT* organizational transparency

2023a, 2023b). This outcome indicates the absence of discernible issues related to multicollinearity.

Discriminant validity, indicating how distinct a variable is from others, was evaluated through three criteria: the Fornell-Larcker, the heterotrait-monotrait (HTMT) ratio of correlations, and the cross-loadings criterion. The Fornell-Larcker criterion compares the square root of the AVE to the correlations between constructs (Fornell & Larcker, 1981). The cross-loadings criterion ensures that a construct's factor loading is surpass all cross-loadings. Moreover, the HTMT criterion mandates that the HTMT value is

notably below either 0.90 or 0.85 (Hair et al., 2019). As illustrated in Table 4 and 5, all these criteria confirm the discriminant validity of the constructs.

4.2 Structural model evaluation

The assessment of the structural framework involves evaluating several standard criteria, including the analysis of the coefficient of determination (R^2), the assessment of predictive relevance (Q^2), the consideration of effect sizes (f^2), as well as the examination of the significance and relevance of path coefficients (Hair et al., 2019).

In the context of PLS-SEM research, R^2, often used to evaluate the adequacy of fit in regression analysis, serves to quantify the extent to which the exogenous constructs within the model can account for the observed variance in endogenous latent constructs. Higher R^2 values suggest a better fit of the model. However, in PLS-SEM, which prioritizes prediction over explanation, lower R^2 values are often considered acceptable (Benitez et al., 2020; Hair et al., 2019). Figure 3, illustrates that GC accounts for 55.0% of the variation in the OT. In addition, GC and OT account for a 14.3% variance in EPG (Hair et al., 2019).

Q^2 is a crucial metric in PLS-SEM used to evaluate the predictive power of a structural model. It assists researchers in assessing the model's ability to accurately predict or anticipate the endogenous constructs based on the exogenous constructs. Q^2 values range from negative infinity to 1. A positive Q^2 value signifies that the structural model has predictive relevance, indicating that it can predict the endogenous construct more effectively than simply using its mean value. Generally, values exceeding 0 are considered meaningful. However, values above 0, 0.25, and 0.50 are classified as small, medium, and large predictive accuracy (Hair et al., 2019). Table 6 results reflect small and medium predictive accuracy for EPG and OT, respectively.

Additionally, f^2 plays a pivotal role in PLS-SEM by providing insights into the practical significance and strength of relationships within the model. Specifically, f^2 quantifies the effect size of an exogenous construct on an endogenous construct within the structural model. Effect sizes are categorized as small (<0.02), medium ($0.02 \leq f^2 < 0.15$), or large (≥ 0.15) (Hair et al., 2019). Table 6 exhibits that GC has a large effect on OT, whereas GC on EPG and OT on EPG has a medium effect. In addition, Table 6 furthers that all of the hypotheses were supported ($p < 0.05$ level of significance). The following section contains a detailed discussion of the proposed relationship.

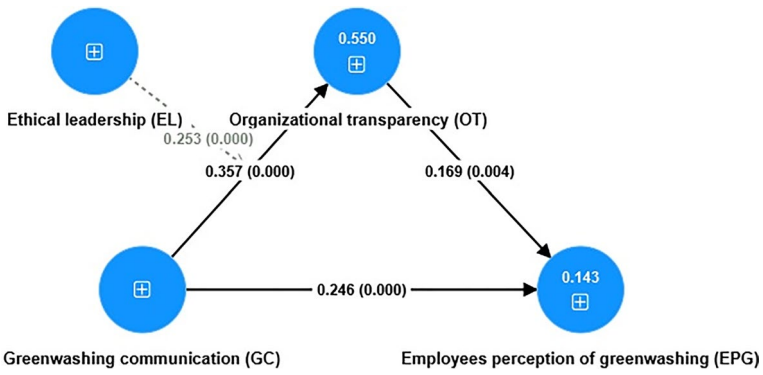

Fig. 3 Structural model assessment

Table 6 Structural model measurement using hypotheses testing, f^2, and Q^2

Hypothesis	Relationships	*β*eta	*t*-value	*p*-value	Decision	f^2
Direct effect						
H1a	GC → EPG	0.246	4.100***	0.000	Supported	0.040
H1b	GC → OT	0.357	8.325***	0.000	Supported	0.162
H2	OT → EPG	0.169	2.850**	0.004	Supported	0.020
Indirect effect						
H3	GC → OT → EPG	0.060	2.720**	0.007	Supported	
Moderation effect						
H4	GC x EL → OT	0.253	8.586***	0.000	Supported	

EPG employees perception of greenwashing; *EL* ethical leadership; *GC* greenwashing communication; *OT* organizational transparency

** $p < 0.05$; *** $p < 0.001$

Q^2 (EPG) = 0.086 and Q^2 (OT) = 0.354

4.3 Discussion of results

The study unveils several significant findings within the Chinese manufacturing sector. Regarding H1a, there is a noteworthy positive impact of GC on employee perceptions of their organization's dedication to environmental sustainability (Miao et al., 2023; Szabo & Webster, 2021). The observed positive and significant impact of GC on EPG (Beta = 0.246, *t*-value = 4.100, *p*-value = 0.000) supporting *H1a*. This implies that organizations engaging in honest and genuine sustainability communication are likely to cultivate a more favorable perception of their sustainability efforts among employees, aligning with prior work by Vollero et al. (2016).

Concerning H1b, the study observed that improved GC positively influences OT by compelling companies to increase transparency regarding their environmentally friendly initiatives and practices (Beta = 0.357, *t*-value = 8.325, *p*-value = 0.000), supporting *H1b*. This suggests that firms that communicate sustainability initiatives more genuinely and transparently tend to align their communication with their actual practices, in line with previous research by Kaner (2021), Ahmad and Zhang (2020) and Yu et al. (2020) who emphasize the importance of the GC and OT relationship.

Regarding H2, the research finds that OT has a favorable and significant impact on EPG (Beta = 0.169, *t*-value = 2.850, *p*-value = 0.004), supporting *H2*. This signifies that enterprises displaying higher transparency in their activities and environmentally friendly endeavors are likely to possess personnel who harbor fewer doubts about the genuineness of their dedication to sustainability, supporting prior work by Szabo and Webster (2021) and Rawlins (2008).

The research also explored the mediating and moderating impacts. Concerning H3 (mediation), OT was recognized as a noteworthy intermediary in the correlation between GC and EPG (Beta = 0.060, *t*-value = 2.720, *p*-value = 0.007), supporting *H3*. This suggests that the impact of GC on EPG is, to some extent, transmitted through its influence on OT. Enterprises effectively disclosing sustainability efforts have a positive effect on OT, subsequently leading to a more favorable employee perception of their ecological initiatives, aligning with the work of Lee and Li (2021). The supported work of Lee and Li (2021) observed that transparent communication, the substantiality of information, accountability,

and active participation have the potential to enhance the trust of the public in an organization, consequently fostering favorable perceptions and attitudes.

Finally, in relation to H4, the study observed a positive and significant moderation effect of EL in the association between GC and OT (Beta = 0.253, *t*-value = 8.586, *p*-value = 0.000), supporting *H4*. This indicates that in the presence of high EL within manufacturing companies, the constructive impact of GC on OT is intensified. This highlights the significance of EL in nurturing a culture of transparency within an organization, especially in the realm of GC and green practices within the Chinese manufacturing sector. This result is in line with previous research by Ilyas et al. (2020), suggesting that EL plays a pivotal moderating role in the relationship between GW and OT, achieved through the promotion of ethical behavior and transparency within an organizational context.

5 Conclusion

The study offers valuable insight into the complex relationship among GC, OT, EPG, and EL within the Chinese manufacturing industry. Utilizing PLS-SEM through SmartPLS 4, the analysis focused on a subset of 539 manufacturing companies in the Jiangsu region unraveling the dynamic that shapes EPG's commitment to environmental sustainability.

The findings support multiple hypotheses, revealing the interplay of these concepts in influencing the environmental perception within organizations. Initially, the study establishes that GC significantly and positively influences both EPG and OT. This indicates that enterprises that are involved in honest and authentic communication about their environmental practices not only foster a favorable perception of sustainability efforts among employees but also promote greater transparency in these efforts.

Furthermore, the research revealed that OT positively influences EPG, underscoring the importance of transparency in enhancing employees' confidence in their enterprise's commitment to sustainability. Additionally, the study uncovered the intermediary function of OT in the association between GC and EPG. This suggests that open and clear channels of communication enhance the constructive effect of GC on shaping EPG. Moreover, EL emerged as a noteworthy moderator, intensifying the beneficial influence of GC on OT, especially in circumstances where EL is prominent. This highlights the significance of EL in reinforcing the relationship between GC and OT within the Chinese manufacturing sector.

5.1 Theoretical implications

The results of this research provide a valuable contribution to the existing body of knowledge on the phenomenon of greenwashing (Schultz & Seele, 2020; Torelli et al., 2020; Vollero et al., 2016), the concept of OT (Rawlins, 2008; Schnackenberg & Tomlinson, 2014), and the concept of EL (Brown et al., 2005; Demirtas, 2015; Hansen et al., 2013). Specifically, it sheds light on the significance of considering the perspectives and interests of internal stakeholders, especially employees, in the realm of greenwashing research (Brunton et al., 2017; Torelli et al., 2020; Vollero et al., 2016).

Furthermore, the study furnishes empirical evidence supporting the notion that OT functions as a mediator, while EL serves as a moderator, in the relationship between GC and the way employees perceive greenwashing. These theoretical insights significantly deepen our comprehension of the intricate dynamics involved in effectively managing

perceptions of sustainability within organizational settings (Li & Chen, 2023; McShane & Cunningham, 2012; Miao et al., 2023).

5.2 Managerial implications

This research provides practitioners with valuable knowledge on how organizations can enhance their strategies for communicating sustainability. The study unfolds key managerial insights for organizations operating in the Chinese manufacturing sector. Firstly, the positive impact of GC on EPG underscores the importance of authentic sustainability communication. Companies engaging in honest and genuine communication about their environmental practices are likely to foster a positive perception among employees. This suggests that organizations should invest in transparent sustainability communication strategies to align employees' perceptions with the reality of their sustainability efforts.

Secondly, the study findings emphasize the role of GC in positively influencing OT. Improved GC encourages companies to enhance transparency regarding their environmentally friendly initiatives and practices. Organizations ought to acknowledge the significance of harmonizing communication with tangible operational procedures, giving utmost importance to the act of conveying ecologically sustainable endeavors in a transparent manner. This not only augments credibility but also fortifies the bond between the organization and its stakeholders, which encompasses employees. Managers must guarantee that communication precisely mirrors the organization's dedication to the concept of sustainability.

Thirdly, the study places great importance on the bidirectional correlation between organizational transparency (OT) and employee perceptions of greenwashing (EPG). It is probable that companies that demonstrate greater transparency in their eco-friendly undertakings will cultivate trust and alleviate any uncertainties employees may have regarding the genuineness of sustainability endeavors. Managers ought to assign priority to transparency as a strategic instrument for augmenting employee perceptions and attitudes towards the ecological initiatives of the organization.

Fourthly, as the study evidenced OT as a noteworthy intermediate factor in the correlation between GC and EPG. This indicates that companies ought to give precedence to transparent communication methodologies as a mechanism to favorably impact employee interpretations of greenwashing. Managers must concentrate on proactively revealing sustainability endeavors, validating information, ensuring responsibility, and promoting employee engagement in order to foster favorable perception and build trust.

Lastly, a significant function of EL as a moderator between GC and OT, emphasize that companies with robust EL enhance the favorable influence of GC on transparency. In this vein, managers ought to allocate resources towards cultivating ethical leadership within the organization, as it contributes to a culture of transparency and ethical conduct. This is especially crucial in the context of environmentally sustainable practices in the Chinese manufacturing industry, where teamwork and collaboration hold great importance.

5.3 Limitation and future research direction

While this study offers valuable perspectives, it is not devoid of limitations. The data collection exclusively centered on the manufacturing sector in China, therefore confining the applicability of the results to other circumstances. Subsequent research could investigate these connections in varied industries and cultural environments. Additionally, this research employed a cross-sectional design, which restricts the ability to establish

causation. Experimental or longitudinal research designs could provide additional insights into the dynamics of GC, OT, and EPG over an extended period. Lastly, this research relies on self-report measures which can introduce the potential for common method bias. Subsequent studies could include multiple data sources or objective measures to reduce this potential bias.

Author contributions All authors have an equal level of contributions.

Funding This work was supported by the Humanities and Social Sciences Foundation of MOE China (18YJA630119), the Humanities project of the National Bureau of Statistics (2015ly84), and Jiangsu Natural Science Foundation (BK20180852).

Data availability Data will be made available at the request of the authors.

Declarations

Conflict of interest The authors declare no conflict of interest.

Ethical approval This study was conducted following the recommendation of the Ethical Principles of Psychologists and Code of Conduct by the American Psychological Association (APA) and approved by the Ethics Committee of Jiangsu University.

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