

CASE STUDY **OPEN ACCESS**

# Sustainability in Energy Companies Under the Lens of Cultural Pressures: When Do We Talk of Greenwashing?

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## ABSTRACT

Listed companies allocate resources to various renewable energy and green innovation initiatives driven by economic and environmental, social, and governance (ESG) objectives. Corporations experience increased pressure from stakeholders, potentially hindering the concurrent achievement of economic and ESG goals and leading to phenomena such as greenwashing. This study examines whether these investments and practices represent an authentic transformation in corporate strategy or a mere rebranding attempt. Moreover, it investigates whether cultural dimensions can serve as predictors of greenwashing. The investigation progresses through three stages. First, a homogenous dataset of 59 companies listed in EU countries between 2011 and 2022 is identified. Second, the data envelopment analysis methodology is employed in the second stage to determine the energy companies' efficiency. An effective energy enterprise must simultaneously achieve social, environmental, and economic objectives. The study calculates a greenwashing proxy, creating a binary variable assigning a value of 1 to energy companies not impacted by greenwashing and 0 to those that are. Finally, logistic regression is utilized to investigate the correlation between the variable that denotes energy companies subjected to greenwashing and Hofstede's cultural dimensions. The study reveals that firms operating in countries with high levels of masculinity are more likely to participate in deceptive environmental practices known as “greenwashing.” This outcome has implications for academic and practical purposes, notably regarding stakeholder involvement and the re-evaluation of strategic and decision-making procedures impacted by the interplay of cultural values and green technology. To the best of our knowledge, this study represents the sole investigation that applies this approach to examining non-financial reporting, focusing on the interplay between cultural values, ESG, and their interaction effects.

## 1 | Introduction

Since environmental degradation has worsened, many enterprises are paying more attention to environmental concerns worldwide (Guo, Tao, and Gao 2014; Guo et al. 2018; Zhang et al. 2018; Tao and Chao 2024).

Due to increased public awareness, many stakeholders are more aware of environmental considerations (Chen and Chang 2012). In the last 10 years, investors, customers,

governments, as well as business clients have asked for more information disclosure from companies regarding their environmental performance (Marquis, Toffel, and Zhou 2016; Khan et al. 2023). Vollero et al. (2016) state that the energy sector companies create value for their stakeholders with clean and sustainable energy services. However, Talbot and Boiral (2018) reveal that stakeholders will encounter considerable difficulties, if not insurmountable obstacles, in accurately assessing, monitoring, and comparing companies' climate performance due to the inherent limitations of existing

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reporting frameworks. Social awareness of the environment has increased, especially among consumers (Porter and Kramer 2006; Wolniak 2015). After Porter and Kramer (2006), many studies show that most consumers would pay more for environmentally friendly products. The CSR concept defines the role of business rather broadly, emphasizing the need to encompass financial and social performance, that aims at integrating social and environmental goals into business management (Agudelo, Johannsdottir, and Davidsdottir 2020). The growing demand “leads businesses to adopt additional green marketing strategies to present to the customers what the business has to offer their customers, the value, level of social responsibility and the company’s image” (Zhang et al. 2018, 740). As pointed by Delmas and Burbano (2011), the green market is developing and so is the greenwashing process that comes along with it. Greenwashing is a consequence of two actions taken by companies: inadequate environmental stewardship and successful marketing of environmental initiatives; these two practices can affect the purchasing behavior of users (Delmas and Burbano 2011).

There may be many ways of defining greenwashing from numerous angles of view. Among others, a literature review by de Freitas Netto et al. (2020) points out the following types of greenwashing: greenwashing because of selective disclosure, greenwashing because of decoupling, and greenwashing as a consequence of corporate legitimacy theory. de Freitas Netto et al. (2020) raise the point that, for example, Seele and Gatti (2015) and Guo et al. (2018) state that greenwashing is, above all, a consequence of pragmatic corporate legitimacy. This kind of corporate legitimacy theory is the representation of the egoistic drives of managers and/or shareholders to their stakeholders (Suchman 1995). According to legitimacy theory, managers may refrain from pursuing environmental and social investments or actions if such initiatives threaten shareholder interests. Building on prior research, including Veltri et al. (2023), the authors hypothesize that this rationale for greenwashing is particularly applicable to the energy sector (Ceglia et al. 2020). The systematic literature review by Agudelo, Johannsdottir, and Davidsdottir (2020) demonstrates that energy companies face significant pressure from stakeholders to disclose non-financial information, rendering traditional accounting practices increasingly irrelevant in today’s global business environment.

The stakeholders of a commercial organisation typically assign this view (Gurok and Lagasio 2021). Instead, they are now expecting businesses to release greater detail and a higher level of comparability that Mewett describes as “more meaningfully complete” environmental, social and governance (ESG) data. In this new scenario, energy companies—in particular, private utilities (Boffo, Marshall, and Patalano 2020) are under and the focus is remarkably intense on ESG. By their very nature, energy companies are public utilities which seek to promote specific social objectives and provide benefits accessible to the general community; however, through different activities, they can produce negative externalities (Venturelli, Ligorio, and de Nuccio 2023). Based on this, energy companies must provide detailed and comparable information on their ESG performance not only to ensure the persecution of sustainable and inclusive development but also to increase their credibility towards stakeholders (Xie et al. 2019; Ceglia et al. 2022). In fact, the management of these

companies prepares impressive communication strategies to disseminate the results of their projects preparatory to the sustainable development goals (SDG) (Nishitani, Nguyen, et al. 2021; Nishitani, Unerman, and Kokubu 2021). However, if certain circumstances occur, revealing your ESG performance could result in a great loss of credibility.

To control reputational risk, evidence from empirical literature shows that greenwashing is a widespread practice (Zhang and Liu 2020). Moreover, the empirical literature has not yet provided an unambiguous result on the causal relationship between ESG performance and the effectiveness of service provision and between ESG performance and economic-financial performance (Xie et al. 2019). Empirical evidence tends to confirm this relationship, as financial institutions require companies to integrate financial reporting with ESG reporting as a factor in reducing credit risk (Brogi, Lagasio, and Porretta 2022). Instead, the relationship between ESG performance and the effectiveness of the provision of services is less evident and little studied (Veltri et al. 2023). The study by Veltri et al. (2023) is one of the few studies that analyses whether ESG factors are relevant for the efficiency of utilities and whether they are relevant for their capital-raising capacity. Starting from this study, our research analyses the role that cultural dimensions play in these relationships.

Our article is original in that it focuses on the association between ESG and cultural dimensions in the energy sector (Vollero et al. 2021; Esposito, Doronzo, and Dicorato 2023). In addition, it follows the innovative approach of Veltri et al. (2023), which measures the business performance of energy companies in terms of efficient use of inputs through data envelopment analysis (DEA). The authors use the score obtained through the DEA method to estimate the dichotomous “greenwashing” variable, which takes the value 1 when DEA-score is less than 1 and 0 otherwise. At this point, we verify the relationship between the greenwashing variable and cultural dimensions. The theoretical model was built on legitimacy theory. Indeed, literature analysis has shown a connection between cultural dimensions and managerial choices (Vastola, Russo, and Vurro 2017; Esposito, Doronzo, and Dicorato 2023). We will empirically test our hypothesis through the 2SLS regression logit (Wooldridge 2010). This type of regression allows us to mitigate endogeneity and obtain robust estimates even when the model of interest is not linear, such as LR (Wooldridge 2010). The results elucidate that 33 out of 59 energy companies are fully efficient. In addition, the 2SLS regression logit shows that cultural dimensions determine greenwashing. Specifically, energy companies based in countries with high power distance and masculinity values are more likely to use greenwashing.

## 2 | Theoretical Framework and Literature Background

### 2.1 | ESG Behavior Under Legitimacy Theory lens

In academic debate, firstly, Dowling and Pfeffer (1975) posited that effective communication enhances perceived legitimacy. Applying the definition of legitimacy by Suchman (1995), companies want to “legitimize” themselves with the various stakeholders through environmental and social practices but, above

all, by communicating these activities (Guo et al. 2018). The legitimacy theory that explains the relationship between ESG performance and financial performance is partly linked to the Voluntary disclosure theory (Hahn and Kühnen 2013). The more extensive definition of legitimacy theory by Hahn and Kühnen (2013) argues that companies will only provide favorable voluntary information. Mio et al. (2020) argued that the capacity of legitimacy theory to predict non-financial information (NFI) disclosure maintains its ability under the mandatory implementation of the EU Directive.

Legitimacy theory is one of the theories that best explain why ESG factors are relevant to businesses (de Villiers, La Torre, and Molinari 2022). Stakeholders expect that a company's ESG practices and performance are connected to its financial success, prompting an examination of the legitimate practices that support effective ESG performance through the lens of legitimacy theory (Lee and Raschke 2023). In contemporary settings, adopting sustainable strategies and transparent CSR disclosure policies is essential for organizations to navigate legitimacy challenges (Bachmann and Ingenhoff 2016; Castellò and Galang 2014; Talbot and Boiral 2013; L'Abate et al. 2023). Based on this reasoning, companies should improve their financial performance and business efficiency, as this would meet the wishes of stakeholders (Forgione, Laguir, and Staglianò 2020; Eposito et al. 2025). According to this theory, organizations gain stakeholder support by demonstrating legitimacy through credible communication (Choi and Shepherd 2005). For instance, Gómez-Carrasco, Guillamón-Saorín, and García Osma (2020) and Magness (2006) propose joining legitimacy theory into the writing to address why directors address certain issues in their communications with managers. Recent studies emphasize that CSR communication not only predicts but also enhances organizational credibility (Lock and Schulz-Knappe 2019). Integrated reporting practices have emerged as a vital strategy for corporations aiming to improve their legitimacy with key stakeholders (Camilleri 2018). The quality and extent of annual reports significantly impact perceptions of organizational legitimacy (Aerts and Cormier 2009). Crossley, Elmagrhi, and Ntim (2021) underscore the significance of social engagement, reputation, environmental integration, industry differentiation, and educational support, indicating that legitimizing strategies can simultaneously serve symbolic and substantive legitimacy purposes. However, such a construct is challenged by greenwashing. In fact, companies could strengthen their reputation as "sustainable enterprises" through communication campaigns that provide incomplete, unreliable, or even misleading information (Esposito and Witkowska 2024). Ching and Gerab (2017) extend the applicability of stakeholder, legitimacy, and signaling theories by investigating the interrelation of proactive corporate social responsibility disclosures in the context of gaining and maintaining legitimacy, securing stakeholder support, and reducing information asymmetry. Such practices would be more advantageous if sustainability actions reduced production efficiency (Godil et al. 2021). Based on this, Seele and Gatti (2015) and Guo et al. (2018) identify the link between greenwashing and legitimacy theory. Investors regard the limited dissemination of information as a negative signal (Buertey and Pae 2021), which is why companies provide voluntary information. However, they only communicate positive events that

can have a positive effect on the value of their shares (Saha and Kabra 2020). The ESG performance information asymmetry is known as greenwashing (Geng et al. 2022). Indeed, if companies do not meet stakeholders' expectations regarding economic and environmental performance, they could be delegitimized by the community and would be subjected to unsustainable social and political pressure, which would entail huge costs for the company itself (Thomas and Lamm 2012). On the other hand, integrating legitimacy theory and media agenda-setting theory, it is anticipated that companies subjected to heightened negative media scrutiny due to poor sustainability performance will experience greater societal attention and an increased loss of legitimacy (Emma, Emiliano, and Jennifer 2024).

Notably, the opportunity cost to deviate from sustainable practices and implement strategies aimed at achieving greenwashing is closely related to the sector to which it belongs (Zeqiraj, Sohag, and Soytaş 2020; Zhu et al. 2021; Zhu and Xu 2021; Peng et al. 2024). Zhu et al. (2021) argue that energy companies have a great incentive to implement actions that lead to greenwashing, as their activity often generates negative externalities. Hummel and Schlick (2016) contend that these companies tend to disclose low-quality information—characterized by opacity, incompleteness, or superficiality—to obscure their inadequate sustainability performance while simultaneously striving to uphold their legitimacy. Recent studies have shown that managers of energy companies, on the one hand, want to implement innovative standards, such as task force on climate-related financial disclosures (TCFD) and Sustainability Accounting Standards Board (SASB), to communicate their environmental and social performance, while on the other hand, they adopt communication strategies aimed at strengthening their legitimacy that can be configured as greenwashing (Yang et al. 2020; Yu, van Luu, and Chen 2020; Karaman et al. 2021; Zharfpeykan 2021; Zhang 2022).

## 2.2 | Cultural Dimensions and Greenwashing

In greenwashing, cultural dimensions play a significant role. In this context, this research incorporates Hofstede's cultural dimensions framework (Hofstede 2001), a widely accepted tool for conducting cross-cultural comparisons. Hofstede's cultural dimensions are six dimensions that represent the cultural differences of each country (Hofstede 2001). Although, some scholar (Shenkar 2001; Brock 2005; Tung and Verbeke 2010; Beugelsdijk, Kostova, and Roth 2017) criticize this framework, we denote energy companies subjected to greenwashing because cultural dimensions influence organizational behavior.

Table 1 summarizes the main concepts related to the six cultural dimensions identified by Hofstede.

Recent studies have shown the link between Hofstede's cultural dimensions (de Mooij and Hofstede 2010) and the environmental performance of a country (Dangelico, Fraccascia, and Nastasi 2020; Ardito, Dangelico, and Messeni Petruzzelli 2021). These studies have shown that masculinity is particularly relevant. Countries characterized by high values of femininity pay greater attention to environmental variables (Ardito, Dangelico, and Messeni Petruzzelli 2021). According to Klietnikova and

**TABLE 1** | Six cultural Hofstede's dimensions.

Cultural dimensions	Concepts
Power Distance Index (high vs. low)	Power distance is the extent to which less powerful members of a society accept and expect power to be distributed unequally
Individualism versus Collectivism	Individualism contrasts with Collectivism in terms of prioritizing personal goals over those of the group
Masculinity versus Femininity	Masculinity dimension explores the distribution of roles between the sexes within a society, with high scores favoring competitiveness, assertiveness, and material success
Uncertainty Avoidance index (high vs. low)	Uncertainty Avoidance measures the degree to which a society tolerates ambiguity and uncertainty, often relying on established rules and protocols to manage unpredictability
Long versus Short-term orientation	Long-term orientation denotes the value placed on future rewards, emphasizing perseverance and thrift over immediate results
Indulgence versus Restraint	Indulgence versus Restraint contrasts a society's openness to gratification with its regulation by strict norms

Nadanyiova (2017), it is precisely in these contexts that the risk of greenwashing is higher because communication on sustainable activity is considered more important.

One should not forget the role and cultural background of the manager/entrepreneur. A recent study by Cai, Hussain, and Zhang (2022) shows that while managers with a deep knowledge of the issues and opportunities offered by green investments have a greater chance of achieving high economic and environmental performance, others implement instrumental green activities to ensure their legitimacy and consequently have a greater propensity to implement greenwashing strategies. Moreover, it reveals that board experiential diversity improves internal monitoring, fostering the development of environmentally friendly technologies and reducing ESG greenwashing. At the same time, media attention enhances corporate transparency and accountability, promoting substantive environmental practices to sustain legitimacy (Huang, Xiong, and Liu 2024).

However, studies about the association between greenwashing and cultural dimensions in a specific sector are limited (Yang et al. 2020). Based on the theoretical and empirical literature, we posit our research question:

RQ. *Do cultural dimensions explain the occurrence of greenwashing?*

### 3 | Methodology

Our work analyses the relationship between cultural dimensions and greenwashing through a two-step approach. In the first step, we calculate a proxy for greenwashing, and in the second step, we test the relationship between cultural dimensions and greenwashing.

We decided to use a synthetic measure of company performance for energy companies, specifically the DEA (Charnes, Cooper, and Rhodes 1978). DEA uses input and output measurements

simultaneously to calculate a business efficiency score. DEA is a non-parametric methodology in which the input–output data entered in the mathematical model allows the calculation of the score. Following the methodology already applied by Veltri et al. (2023), we calculate the score of energy companies with input-oriented DEA because, as indicated by Capece, Costa, and Di Pillo (2021), Veltri et al. (2023) and Leopizzi, Palmi, and di Cagno 2023, the energy sector is a sector where the outputs are difficult to modify because of their public utility.

There is vast empirical literature that uses DEA to measure a company's overall efficiency. For example, Esposito, Doronzo, and Dicorato (2023) used the DEA method to calculate a synthetic score of social enterprises' economic and social performance. In addition, as already mentioned, Veltri et al. (2023) applied this methodology to calculate the efficiency of utility companies. For these reasons, the DEA method seems to be the most suitable method for building the greenwashing variable. To effectively measure greenwashing, DEA offers a robust and non-parametric approach that can handle multiple inputs and outputs without assuming a predefined functional form between them. This method is particularly suited for capturing discrepancies between reported environmental, social, and governance (ESG) performance and actual environmental and economic outcomes.

DEA is a valuable tool for assessing corporate efficiency, particularly in the context of ESG reporting. DEA calculates an efficiency score by analysing the relationship between companies' resource inputs and output outcomes, making it effective for identifying discrepancies in reported ESG performance. Specifically, DEA can reveal firms that invest heavily in sustainability initiatives yet demonstrate limited environmental impact, suggesting potential greenwashing practices. By evaluating whether companies convert sustainability investments into actual environmental benefits, DEA can identify instances where high ESG scores may not correspond to real performance (Veltri et al. 2023; Puertas et al. 2022). DEA's capability to incorporate multiple input and output variables enables a nuanced

analysis of corporate efficiency, distinguishing between genuine and superficial ESG efforts. This method establishes an efficiency frontier that benchmarks firms, helping identify those whose reported ESG achievements may not align with actual resource efficiency. DEA thus supports transparency by exposing firms that might overstate their ESG impact relative to peers (Puertas et al. 2022). Unlike traditional single-metric approaches, DEA's holistic framework captures the multifaceted nature of ESG, providing a comprehensive assessment of corporate sustainability and highlighting inconsistencies that could indicate greenwashing. This comprehensive perspective is essential for accurately assessing whether a company's ESG disclosures are aligned with genuine environmental and social contributions or merely serve as a façade for greenwashing (Veltri et al. 2023).

Our methodology is based on that previously applied by Veltri et al. (2023) in a similar context. We calculate two different efficiency scores, including and excluding the ESG score provided by Bloomberg as an input variable. The absence of a discrepancy between the two calculated efficiency scores is considered an indicator of greenwashing (Veltri et al. 2023). This assertion is supported by the fact that the input data used is the value provided by Bloomberg, which is calculated based on voluntary information and communication campaigns of the companies (Fatemi, Glaum, and Kaiser 2018; Nirino, Miglietta, and Salvi 2019).

### 3.1 | Step 1: Proxy Greenwashing

The following section outlines the methodology used to calculate the proxy that estimates greenwashing. In the initial step, we determine the efficiency scores of energy companies both with and without ESG performance and subsequently compare the resulting estimates. As discussed in the literature review, greenwashing is characterized by a discrepancy between the actual outcomes achieved and the information disclosed regarding environmental sustainability activities. Thus, the efficiency scores for companies engaged in greenwashing practices should remain unchanged in both scenarios. The authors utilized the ESG performance scores provided by Bloomberg, as these scores are derived from voluntary information and corporate communication campaigns (Fatemi, Glaum, and Kaiser 2018; Nirino, Miglietta, and Salvi 2019). Consequently, ESG performance provided by Bloomberg enables the assessment of data that is considered suitable for assessing greenwashing behavior. Efficiency scores were computed both with and without ESG performance and the variations between them. Afterwards, these scores were analysed. A subsequent statistical test was performed to determine whether the variations between the calculated scores were significantly different from zero.

Finally, the analysis revealed statistically significant changes over the entire observation period and built, allowing the construction of a greenwashing proxy. This proxy assigns a value of 1 when the delta between efficiency scores is not significant throughout the period and 0 otherwise. This methodological approach enabled the estimation of a proxy to identify instances of greenwashing. We emphasize that the DEA methodology is particularly appropriate for this research, as it facilitates the detection of greenwashing by examining the relationship between

ESG performance and economic performance without imposing assumptions about the causal connections between these variables (Bresciani et al. 2021; Iazzolino et al. 2023; Liu, Luo, and Lu 2023).

### 3.2 | Step 2: 2SLS Logistic Regression

We use a two-stage least squares linear regression (2SLS LR) approach to examine the relationship between the greenwashing variable and Hofstede's cultural dimensions. We have operationalized the dependent variable through a proxy derived from the DEA analysis detailed in the previous section. It is dichotomous: it takes the value of 1 if the difference between the efficiency scores calculated using the DEA methodology is statistically significant, indicating potential greenwashing, and 0 otherwise.

Hofstede's cultural dimensions (Hofstede 2001) serve as the independent variables in this analysis. The 2SLS LR methodology is deemed the most appropriate for testing the relationship between greenwashing and cultural dimensions due to the dichotomous nature of the dependent variable and the potential risk of endogeneity in the relationship (Angrist, Imbens, and Krueger 1999; Wooldridge 2010). Indeed, the relationship between greenwashing and cultural dimensions is exposed to the risk of endogeneity could arise from "reverse causality" a situation in which causes endogeneity (Angrist, Imbens, and Krueger 1999).

Nevertheless, the possibility of greenwashing behavior might influence or be influenced by cultural factors. However, this risk is relatively mitigated since cultural values are generally stable over time and not easily influenced by corporate behavior (Hofstede 2011). Therefore, we decided to address the endogeneity concern more rigorously. Indeed, we use instrumental variables for the cultural dimensions, as suggested by Nash and Patel (2019) and Boubakri et al. (2021). These instrumental variables are specifically chosen to ensure a robust analysis by minimizing the risk of biased estimates. Table 2 presents the measures proposed by Nash and Patel (2019) as instrumental variables for Hofstede's cultural dimensions. This approach allows for a nuanced exploration of how cultural values, as defined by Hofstede, influence or are associated with corporate greenwashing practices. By incorporating cultural dimensions such as Power Distance, Individualism versus Collectivism, Uncertainty Avoidance, Masculinity versus Femininity, Long-term versus Short-term Orientation, and Indulgence versus Restraint, the study examines whether certain cultural contexts are more prone to greenwashing behaviors. This examination provides valuable insights into the interplay between corporate sustainability practices and underlying cultural frameworks, contributing to the broader understanding of how cultural factors shape corporate behavior and ethical standards in different regions.

### 3.3 | Data Sample and Data Collection

We focused our research on energy companies listed on the European stock market because the EU has launched a regulatory process to institutionalizing ESG performance (Manes-Rossi

**TABLE 2** | Instrumental variables.

Cultural dimension	Instrumental variable	Operationalization
Individualism	Frost	Dichotomic variable that equals 1 if frost is likely to occur, and 0 otherwise.
Uncertainty Avoidance	Hieratical	Percentage of a country's population following Hierarchical religions. Religions classified as Hierarchical are: Catholic, Muslim, Orthodox.
Power Distance	CommHist	Dichotomic variable that equals 1 if the country's government is communist or has been communist, and 0 otherwise.
Masculinity	GenDist	GEN_DIST, measure the distance of each country from Italy, the country with the highest masculinity score in our sample.
Indulgence	TempAvg	Country's 30-year average temperature (in Celsius).
Short-term versus Long-term orientation	Protestant	Percentage of a country's population following a Protestant religion.

Source: This table is an elaboration from Nash and Patel (2019).

and Nicolò 2022). Indeed, on 5 January 2023, the Corporate Sustainability Reporting Directive (CSRD) entered into force. It identifies ESG information which must be provided by companies, but above all, it extends the breadth of companies involved (Michalak, Staszkiwicz, and Waniak-Michalak 2023). For these reasons, we considered the European context adequate and employed. The authors employ Bloomberg ESG performance to measure the ESG performance of energy enterprises.

Bloomberg is one of the world's leading data providers of business and financial data providers and ESG data for 11,700 companies in 102 countries. It aims to provide comparable data that enables informed investment choices analyzing. Bloomberg analyses a wide variety of public documents and sources through which companies disclose ESG information, sustainability reports, corporate websites, and surveys sent directly to companies. The ESG information Bloomberg seeks is grouped into 120 ESG key performance qualitative and quantitative indicators and updated annually. Bloomberg uses this information to calculate the ESG performance score (Clementino and Perkins 2021; Eng, Fikru, and Vichitsarawong 2022). The final sample consists of 59 European listed companies with all financial and ESG data for the period 2011–2022. According to the methodology of Veltri et al. (2023), we employ two input variables (EV/EBITDA and MktCap/TA) and three output variables (ROE, FCF/Revenue and ESG scores). We preferred to use ratios instead of absolute measures to avoid scale factors that could impact the calculation of DEA scores, unlike Veltri et al. (2023). Tables 2, 3 and 4 show the descriptive statistics of the sample.

#### 4 | Findings and Discussion

Tables 5 and 6 present the DEA scores calculated both with and without ESG performance, the delta scores, and the subsequent calculation of the greenwashing proxy. This methodology allows us methodological approach enables the authors to estimate whether ESG performance influences the overall efficiency of

energy companies. Specifically, the DEA scores, as shown in Tables 5 and 6, were computed to examine efficiency both including and excluding ESG performance.

The analysis reveals that 33 companies achieve full efficiency when ESG performance is incorporated, compared to only three companies that are fully efficient without considering the ESG factor. This finding indicates that managers perceive ESG performance as a crucial element in evaluating overall efficiency. The subsequent focus is on detecting greenwashing behavior. The greenwashing proxy assigns a value of 1–40 companies where the difference between the DEA scores, with and without ESG performance, is statistically significant, indicating potential greenwashing.

The relationship between cultural dimensions and the greenwashing proxy is examined using a two-stage least squares (2SLS) logarithmic regression model with instrumental variables. Table 7 presents the estimated results from the 2SLS regression analysis, noting that the greenwashing proxy takes a value of 1 if the delta between the scores is statistically significant throughout the entire period and 0 otherwise. As outlined in the methodology section, specific instrumental variables for cultural dimensions, as suggested by Nash and Patel (2019), were utilized.

The objective of the empirical analysis is to determine whether cultural dimensions can predict greenwashing behavior. Column 1 of Table 5 shows the direct relationship between greenwashing and cultural dimensions, while the subsequent columns explore the relationship using instrumental variables.

Only the “Masculinity” dimension-associated estimator to address potential endogeneity concerns. In both analyses, only the estimator associated with the “Masculinity” dimension is positive and statistically significant. This result implies that companies in highly masculine countries characterized by high masculinity are more prone to engage in greenwashing practices. Finally, the model's goodness predictive accuracy of

**TABLE 3** | Cultural dimensions.

Country	Power distance	Individualism	Masculinity	Uncertainty avoidance	Short-term versus long-term orientation	Indulgence
Austria	11	55	79	70	60	63
Belgium	65	75	54	94	82	57
Denmark	18	74	16	23	35	70
Finland	33	63	26	59	38	57
France	68	71	43	86	63	48
Germany	35	67	66	65	83	40
Greece	60	35	57	112	45	50
Hungary	46	80	88	82	58	31
Ireland	28	70	68	35	24	65
Italy	50	76	70	75	61	30
Luxembourg	40	60	50	70	64	56
Netherlands	38	80	14	53	67	68
Norway	31	69	8	50	35	55
Poland	68	60	64	93	38	29
Portugal	63	27	31	104	28	33
Romania	90	30	42	90	52	20
Spain	57	51	42	86	48	44
Sweden	31	71	5	29	53	78

Source: Data are provided by Hofstede (2011).

**TABLE 4** | Descriptive statistics.

	N	Mean	St. Dev	ESG_P	EV EBITDA	ROE	FCFSales	MktCap
ESG_P	781	70.93	19.05	1.00				
EVEBITDA	781	12.23	4.05	0.33***	1.00			
ROE	781	18.20	3.53	0.23**	0.38***	1.00		
FCFSales	781	4.48	1.29	0.31***	0.16***	0.10***	1.00	
MktCapTA	781	5.22	3.71	0.21***	0.02	0.10***	0.23***	1.00

\*\*Significant at the 5% level.

\*\*\*Significant at the 1% level.

Source: Data are provided by Bloomberg.

measurement the model was assessed by comparing expected outcomes with actual results. The model demonstrated a correct prediction rate of 77%, indicating strong predictive performance (Cameron and Trivedi 2010). Guo et al. (2017) offered a viewpoint on energy policy research, that is, from the institutional perspective. They introduced decoupling and legitimacy from institutional theory and green energy management in energy policy theory to examine the route from DEBG to GEBT.

The empirical findings from the 2SLS LR analysis confirm the theoretical connection between cultural values and greenwashing. Specifically, the “Masculinity” dimension is the only cultural variable found to be positively and significantly

associated with greenwashing behavior. This suggests that companies operating in cultures that value competitiveness and assertiveness may be more likely to engage in greenwashing as a means of maintaining legitimacy and public trust. The result aligns with previous research indicating that in high-masculinity cultures, firms may prioritize economic success and image management over substantive environmental commitments (Nash and Patel 2019). This finding has important implications for understanding how cultural contexts influence corporate strategies related to ESG. It supports the notion that cultural values can shape organizational behavior, particularly in how firms choose to communicate and implement sustainability practices. The use of instrumental variables in

**TABLE 5** | DEA score calculated without ESG performance.

	Energy companies	Country	DEA score calculated without ESG performance												
			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
1	Austria		0.78	0.765	0.63	0.81	0.75	0.645	0.705	0.78	0.78	0.645	0.81	0.78	
2	Austria		0.675	0.795	0.675	0.735	0.75	0.72	0.81	0.81	0.81	0.66	0.735	0.81	
3	Belgium		0.765	0.81	0.675	0.735	0.69	0.6	0.81	0.645	0.66	0.735	0.735	0.645	
4	Belgium		0.69	0.66	0.69	0.735	0.765	0.795	0.705	0.81	0.765	0.78	0.735	0.81	
5	Denmark		0.78	0.66	0.72	0.645	0.795	0.78	0.615	0.66	0.6	0.81	0.645	0.66	
6	Denmark		0.795	0.72	0.615	0.63	0.765	0.81	0.69	0.645	0.78	0.795	0.63	0.645	
7	Finland		0.72	0.66	0.75	0.735	0.78	0.735	0.615	0.645	0.66	0.615	0.735	0.645	
8	France		0.72	0.735	0.69	0.66	0.675	0.675	0.81	0.675	0.645	0.72	0.66	0.675	
9	France		1	0.99	1	1	1	1	1	1	0.99	1	1	1	
10	France		1	1	0.945	1	1	1	0.99	1	1	1	1	1	
11	France		1	0.9675	1	0.99	1	0.99	1	1	1	1	0.99	1	
12	France		1	1	1	0.9675	1	1	1	0.9	1	1	0.9675	0.9	
13	France		1	1	1	1	1	0.9225	1	1	1	1	1	1	
14	Germany		0.945	1	1	1	1	1	1	1	1	0.945	1	1	
15	Germany		1	0.945	0.99	1	1	0.9675	1	1	1	1	1	1	
16	Germany		1	1	1	1	1	1	1	1	1	1	1	1	
17	Germany		1	0.9225	1	1	0.9675	1	1	1	1	1	1	1	
18	Germany		1	1	1	1	0.99	1	1	1	1	0.945	1	1	
19	Germany		1	1	1	0.945	1	1	1	1	1	0.945	0.945	1	
20	Germany		1	0.945	1	1	1	1	1	1	1	1	1	1	
21	Greece		1	1	1	1	1	0.9	1	1	1	1	1	1	
22	Greece		1	1	0.99	1	1	1	1	1	1	1	1	1	
23	Hungary		1	1	1	1	1	1	1	1	1	1	1	1	
24	Ireland		1	1	1	1	1	0.93	1	1	1	1	1	1	
25	Italy		1	1	1	1	0.96	1	1	1	1	1	1	1	

(Continues)



TABLE 5 | (Continued)

	Energy companies	Country	DEA score calculated without ESG performance													
			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022		
26		Italy	1	1	0.99	0.96	1	1	1	1	1	0.93	1	0.99	0.96	0.93
27		Italy	1	0.99	0.9	1	1	1	1	1	1	0.93	1	1	1	1
28		Italy	1	1	1	1	1	1	0.96	0.9	1	1	0.93	1	1	1
29		Italy	0.99	0.9	0.93	1	1	1	0.99	1	1	1	0.9	1	1	0.9
30		Luxembourg	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31		Netherlands	1	1	1	1	1	1	1	0.9	1	1	1	1	1	1
32		Netherlands	1	1	1	1	1	1	0.96	0.96	1	1	1	1	1	1
33		Netherlands	1	1	0.93	1	1	1	1	1	1	1	1	0.99	1	1
34		Netherlands	1	1	1	0.93	1	1	1	0.96	1	0.93	1	1	0.93	1
35		Netherlands	0.93	1	1	1	1	1	0.93	0.99	1	1	0.9	1	1	1
36		Netherlands	0.735	0.72	0.81	0.615	0.63	0.75	0.75	0.72	0.795	0.765	0.66	0.615	0.795	
37		Netherlands	0.705	0.645	0.78	0.6	0.615	0.765	0.765	0.765	0.675	0.75	0.69	0.6	0.675	
38		Norway	0.795	0.765	0.63	0.69	0.705	0.705	0.705	0.6	0.795	0.675	0.75	0.69	0.795	
39		Norway	0.765	0.78	0.75	0.81	0.69	0.675	0.675	0.645	0.765	0.615	0.63	0.81	0.765	
40		Norway	0.735	0.69	0.645	0.69	0.69	0.765	0.765	0.765	0.765	0.75	0.705	0.69	0.765	
41		Norway	0.765	0.75	0.765	0.645	0.735	0.63	0.63	0.69	0.705	0.795	0.69	0.645	0.705	
42		Norway	0.69	0.705	0.75	0.795	0.705	0.78	0.78	0.78	0.615	0.735	0.675	0.795	0.615	
43		Norway	0.825	0.615	0.765	0.69	0.615	0.615	0.615	0.615	0.795	0.66	0.705	0.69	0.795	
44		Norway	0.825	0.705	0.72	0.63	0.615	0.615	0.615	0.81	0.705	0.825	0.66	0.63	0.705	
45		Norway	0.765	0.615	0.825	0.765	0.66	0.6	0.6	0.72	0.765	0.705	0.6	0.765	0.765	
46		Norway	0.72	0.72	0.75	0.81	0.795	0.615	0.615	0.63	0.795	0.705	0.63	0.81	0.795	
47		Poland	1	1	1	1	1	1	1	0.96	0.96	0.93	1	1	0.96	
48		Poland	1	1	0.93	1	1	1	1	1	1	0.93	1	1	1	
49		Portugal	1	1	1	0.93	1	1	1	1	0.99	1	1	0.93	0.99	
50		Portugal	1	0.93	0.9	1	1	1	1	1	1	1	1	1	1	

(Continues)

TABLE 5 | (Continued)

Energy companies	Country	DEA score calculated without ESG performance											
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
51	Romania	1	1	1	0.99	1	1	1	0.99	1	0.93	0.99	0.99
52	Spain	1	1	1	0.96	1	1	1	1	1	1	0.96	1
53	Spain	1	1	0.99	1	1	1	1	1	1	1	1	1
54	Spain	1	1	1	1	0.99	1	1	1	1	1	1	1
55	Spain	1	1	0.99	1	1	1	1	1	1	0.96	1	1
56	Sweden	0.93	1	1	1	0.99	1	1	1	1	1	1	1
57	Sweden	1	1	1	0.93	1	1	0.93	0.99	0.9	0.99	0.93	0.99
58	Sweden	1	0.96	0.99	1	1	1	1	0.99	1	1	1	0.99
59	Sweden	1	0.99	1	1	1	1	1	1	1	0.99	1	1

the analysis further strengthens the robustness of these findings by addressing potential endogeneity concerns, such as reverse causality, which is a common challenge in studies of this nature (Angrist, Imbens, and Krueger 1999; Wooldridge 2010).

The relationship between greenwashing and cultural values can be understood within the context of how cultural norms and values influence corporate behavior and decision-making. Hofstede's cultural dimensions theory provides a framework for analysing these variations. Specifically, the "Masculinity" dimension, which reflects a culture's emphasis on competition, achievement, and material success, has been shown to influence how companies approach sustainability practices. In cultures with high masculinity scores, there is often greater pressure to display financial and economic success, potentially at the expense of genuine environmental and social responsibility. This cultural emphasis may encourage companies to engage in greenwashing to maintain a positive public image while prioritizing economic outcomes (Hofstede 2001; Boubakri et al. 2021). The positive association between masculinity and greenwashing raises questions about the role of cultural values in shaping not only corporate communication strategies but also the actual implementation of sustainable practices. It suggests that regulatory frameworks and stakeholder pressures may need to be adapted to account for cultural influences. For instance, stronger regulatory oversight and accountability measures may be necessary in high-masculinity cultures to ensure that ESG commitments are genuine and not merely symbolic (Fatemi, Glaum, and Kaiser 2018). Furthermore, these findings contribute to the broader discourse on institutional theory, as discussed by Guo et al. (2017), by highlighting how cultural and institutional contexts can affect the legitimacy of corporate actions. The results underscore the importance of considering cultural dimensions when evaluating the effectiveness and authenticity of corporate sustainability efforts. This perspective provides a deeper understanding of why certain regions or sectors may be more susceptible to greenwashing and suggests avenues for future research and policy development.

## 5 | Conclusions

### 5.1 | Theoretical Contributions

The study allows us to contribute to the literature by showing how the use of the DEA tool and the methodology proposed by Veltri et al. (2023) can be useful for the analysis of the greenwashing phenomenon, in our case in the energy sector. In particular, the DEA has allowed us to create a dichotomous variable capable of showing where there are significant differences between performance with and without ESG elements, highlighting any discrepancies.

Even with the limitations present in this example, the result should not be interpreted as a judgment towards the companies analysed, but rather as a tool to verify when and how we can talk about greenwashing. Specifically, the results show that where the greenwashing proxy assigns a value of 1 is present in 40 companies. In these companies, the difference between the DEA scores, with and without ESG performance, is statistically significant, indicating potential greenwashing. To answer the

**TABLE 6** | DEA scores calculated with ESG performance and Greenwashing proxy.

Energy companies	Country	DEA score calculated with ESG performance														Greenwashing proxy
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022			
1	Austria	1	0.8415	0.693	0.891	0.825	0.7095	0.7755	0.858	0.858	1	0.891	0.858	0		
2	Austria	0.7425	0.8745	1	0.8085	0.825	1	0.891	0.891	1	0.726	0.8085	1	0		
3	Belgium	0.8415	0.891	1	0.8085	1	1	1	0.7095	0.726	0.8085	0.8085	0.7095	0		
4	Belgium	0.759	0.726	0.759	0.8085	0.8415	1	0.7755	0.891	0.8415	0.858	1	0.891	0		
5	Denmark	0.858	1	0.792	0.7095	1	1	0.6765	0.726	0.66	0.891	0.7095	0.726	0		
6	Denmark	1	0.792	1	0.693	0.8415	1	0.759	1	0.858	1	0.693	0.7095	0		
7	Finland	1	1	0.825	0.8085	0.858	0.8085	0.6765	0.7095	0.726	0.6765	0.8085	0.7095	0		
8	France	0.792	0.8085	1	0.726	0.7425	0.7425	0.891	0.7425	0.7095	0.792	0.726	0.7425	0		
9	France	1	1	1	1	1	1	1	1	1	1	1	1	1		
10	France	1	1	1	1	1	1	1	1	1	1	1	1	1		
11	France	1	1	1	1	1	1	1	1	1	1	1	1	1		
12	France	1	1	1	1	1	1	1	0.99	1	1	1	0.99	1		
13	France	1	1	1	1	1	1	1	1	1	1	1	1	1		
14	Germany	1.0395	1	1	1	1	1	1	1	1	1	1	1	1		
15	Germany	1	1	1	1	1	1	1	1	1	1	1	1	1		
16	Germany	1	1	1	1	1	1	1	1	1	1	1	1	1		
17	Germany	1	1	1	1	1	1	1	1	1	1	1	1	1		
18	Germany	1	1	1	1	1	1	1	1	1	1	1	1	1		
19	Germany	1	1	1	1	1	1	1	1	1	1	1	1	1		
20	Germany	1	1	1	1	1	1	1	1	1	1	1	1	1		
21	Greece	1	1	1	1	1	1	1	1	1	1	1	1	1		
22	Greece	1	1	1	1	1	1	1	1	1	1	1	1	1		
23	Hungary	1	1	1	1	1	1	1	1	1	1	1	1	1		
24	Ireland	1	1	1	1	1	1	1	1	1	1	1	1	1		
25	Italy	1	1	1	1	1	1	1	1	1	1	1	1	1		

(Continues)

TABLE 6 | (Continued)

Energy companies	Country	DEA score calculated with ESG performance														Greenwashing proxy		
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022					
26	Italy	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
27	Italy	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
28	Italy	1	1	1	1	1	1	0.99	1	1	1	1	1	1	1	1	1	1
29	Italy	1	1	1	1	1	1	1	0.99	1	1	1	1	1	1	1	0.99	1
30	Luxembourg	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31	Netherlands	1	1	1	1	1	1	0.99	1	1	1	1	1	1	1	1	1	1
32	Netherlands	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
33	Netherlands	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
34	Netherlands	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	Netherlands	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
36	Netherlands	0.8085	1	0.891	1	0.693	1	0.792	0.8745	0.8415	0.726	0.6765	0.8745	0.726	0.6765	0.8745	0	
37	Netherlands	1	0.7095	0.858	0.66	0.6765	0.8415	0.8415	0.7425	0.825	1	1	0.7425	1	1	0.7425	0	
38	Norway	0.8745	0.8415	0.693	0.759	0.7755	1	0.66	0.8745	0.7425	0.825	1	0.8745	0.825	1	0.8745	0	
39	Norway	0.8415	0.858	0.825	1	0.759	0.7425	0.7095	0.8415	1	0.693	0.891	0.8415	1	0.891	0.8415	0	
40	Norway	1	1	0.7095	0.759	0.759	0.8415	0.8415	0.8415	0.825	0.7755	0.759	0.8415	0.825	0.759	0.8415	0	
41	Norway	0.8415	1	0.8415	1	0.8085	0.693	0.759	1	0.8745	1	0.7095	0.7755	1	0.7095	0.7755	0	
42	Norway	0.759	0.7755	0.825	1	1	0.858	0.858	0.6765	0.8085	1	0.8745	0.6765	1	0.8745	0.6765	0	
43	Norway	0.9075	0.6765	0.8415	1	0.6765	1	0.6765	0.8745	1	0.7755	0.759	0.8745	1	0.759	0.8745	0	
44	Norway	0.9075	0.7755	1	0.693	0.6765	0.6765	0.891	1	0.9075	1	0.693	0.7755	1	0.693	0.7755	0	
45	Norway	1	0.6765	0.9075	0.8415	0.726	0.66	0.792	0.8415	1	1	0.8415	0.8415	1	0.8415	0.8415	0	
46	Norway	0.792	0.792	1	1	0.8745	1	0.693	0.8745	0.7755	0.693	0.891	0.8745	0.693	0.891	0.8745	0	
47	Poland	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
48	Poland	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
49	Portugal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
50	Portugal	1	1	0.99	1	1	1	1	1	1	1	1	1	1	1	1	1	

(Continues)

TABLE 6 | (Continued)

Energy companies	Country	DEA score calculated with ESG performance											Greenwashing proxy				
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		2022			
51	Romania	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
52	Spain	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
53	Spain	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
54	Spain	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
55	Spain	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
56	Sweden	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
57	Sweden	1	1	1	1	1	1	1	1	1	1	1	1	0.99	1	1	1
58	Sweden	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
59	Sweden	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

research question, among the significant cultural factors, there is “masculinity.” These results help to highlight what could be useful factors to analyse in corporate communication in the energy sector to understand whether there are dangers of greenwashing or not.

This opportunistic behavior could be explained by the need of energy companies to legitimize themselves in front of stakeholders (Choi and Shepherd 2005), also due to the pressures they receive regarding the sustainable transition. It could be hypothesized that forms of greenwashing can support corporate legitimacy in the absence of performances not adequate to stakeholders' expectations.

## 5.2 | Policy Implications

In recent years, research has shown the importance that management gives to achieving high ESG performance, as this has a significant impact on investors' choices.

As highlighted by Veltri et al. (2023) the energy sector is characterized by both positive and negative externalities. It provides a necessary public service, which can generate costs for the community, as demonstrated by the recent war-related energy crisis in Ukraine. This study aims to assess whether, over a 12-year time horizon, energy companies have considered ESG performance as a primary objective, such as economic performance. Following Drori and Honig's (2013) finding that legitimacy is a product of action in concert with external legitimization activities, the greenwashing accusation distorts the emergence, validation, diffusion and consensus. The results underscore the importance of considering cultural dimensions when evaluating the effectiveness and authenticity of corporate sustainability efforts. This perspective provides a deeper understanding of why certain regions or sectors may be more susceptible to greenwashing and suggests avenues for future research and policy development.

## 5.3 | Managerial Implications

In recent years, some researchers have exhibited the importance that management gives to the achievement of high ESG performance, as this has a significant impact on the choices of investors (de Vries et al. 2015). For this reason, managers could be tempted to implement greenwashing policies, especially in complex sectors such as the energy sector (Puertas et al. 2022; Veltri et al. 2023). The analysis demonstrates that fully efficient companies with the introduction of the ESG factor are 33, while fully efficient companies without considering the ESG factor are only 3. This implies that managers consider ESG performance relevant. The authors argue that companies that have not achieved economic and environmental efficiency over the entire period may have implemented behaviors related to greenwashing. In our study, 40 companies are included in the scenario described. Finally, the authors hypothesized the existence of a relationship between cultural variables and greenwashing based on legitimate theory. First, from Hofstede's (2001) cultural dimensions, adopted as the theoretical framework, the results of the logistic regression show that companies located in countries characterized

TABLE 7 | 2SLS logistic regression.

Model	IV 2SLS		IV 2SLS first stage		IV 2SLS		IV 2SLS first stage		IV 2SLS		IV 2SLS	
	Logistic regression	Greenwashing	First stage	Individualism	First stage	Power distance	First stage	Masculinity	First stage	Indulgence	First stage	Short-term versus long-term orientation
Dependent variable												
Independent variables												
Individualism		-0.21										
Uncertainty avoidance		-0.11										
Power distance		0.18										
Masculinity		0.31***										
Indulgence		0.22										
Short-term versus long-term orientation		-0.35										
Frost			2.01***									-0.11
Hieratical												-0.17
CommHist							3.01***					0.21
GenDist								2.03***				0.17***
TempAvg									1.75**			0.22
Protestant										2.01**		-0.35
N. Obs		781		781		781		781		781		781
N. Group		59		59		59		59		59		59
Pseudo R <sup>2</sup>		0.173										0.412
Wald test		0.000***										0.000***
F test		0.000***		0.000***		0.000***		0.000***		0.000***		0.000***

(Continues)

TABLE 7 | (Continued)

Model	Logistic regression	IV 2SLS		IV 2SLS first stage		IV 2SLS		IV 2SLS first stage		IV 2SLS		IV 2SLS	
				First stage		First stage			First stage		First stage		Second stage
Hausman specification value	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Anderson-Rubin weak instrument p value	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Wald weak instrument p value	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

\*\*\*Significant at the 5% level.  
 \*\*\*\*Significant at the 1% level.

by high values of “masculinity” are more inclined to implement greenwashing behaviors. These results are consistent with the literature that associates the implementation of ESG practices with female culture (Shin, Moon, and Kang 2023). Although, Hofstede’s cultural dimensions framework has been criticized (Shenkar 2001; Brock 2005) because it tends to oversimplify thought dichotomization (Tung and Verbeke 2010; Beugelsdijk, Kostova, and Roth 2017), the contribution of this study is relevant as it provides a solid empirical approach within the literature that analyses the factors contributing to the manifestation of behaviors attributable to greenwashing (de Freitas Netto et al. 2020).

### 5.4 | Limitations and Future Research

The study has some limitations: first, the use of the DEA tool could actually be too simplistic and the dichotomous variable created could not capture “shades of gray” present between possible greenwashing behaviors (white) and not (black). Furthermore, Hostfede’s cultural variables could not be fully representative of what influences these opportunistic behaviors. Future research could explore this phenomenon more specifically by considering other variables.

Moreover, further research will investigate cultural dimensions in renewable energy communities that play in the relationships mentioned above, according to Esposito et al. (2024). Possible research developments could be to execute multisectoral studies to assess whether the dynamics are attributable to elements typical of the sector or cultural variables.

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