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Demographic Variables and the Link Between Environmental, Social, and Governance Criteria and Corporate Sustainability Performance: the Influence on Workers' Perception

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ABSTRACT

The integration of environmental, social, and governance (ESG) criteria into corporate practice depends in part on how employees of different demographic groups perceive ESG impacts. Therefore, the objective of this research is to identify which workforce demographic characteristics most strongly influence employees' perceptions of how ESG criteria affect corporate sustainability performance. Using a mixed quantitative approach— partial least squares structural equation modeling (PLS-SEM) combined with multicriteria decision analysis (MCDA) via PROMETHEE-RATIO—the analysis draws on responses from 2747 employees of two Brazilian electricity-sector firms. PLS-SEM confirmed a multidimensional ESG measurement model and revealed significant multigroup differences. PROMETHEE-RATIO rankings highlighted item Q3 as the highest-priority target for intervention across groups, while Q10 and Q13 were consistently least critical. Nonparametric testing showed significant demographic variance (Kruskal–Wallis $\chi^2 = 32.206$, df = 7, $p = 3.719 \times 10^{-5}$). Women in the Central-West (G8) displayed distinct factor loadings versus several groups. Gender and geographic region were the strongest demographic covariates associated with variation in ESG perceptions. Demographic heterogeneity (particularly gender and region) shapes employee ESG perceptions. Tailored, demographically sensitive ESG strategies are therefore recommended to enhance employee engagement and organizational sustainability. This study contributes a granular assessment to guide more inclusive ESG management.

1 | Introduction

Corporate sustainability has migrated from peripheral corporate philanthropy to a central strategic imperative (Tyan et al. 2024), driven by the need to address accelerating environmental degradation (Lim 2024), widening social inequality (Liu and Xin 2024), and persistent governance failures (Amarna et al. 2024). This shift has encouraged firms to adopt environmental, social, and governance (ESG) criteria as an integrated framework that both mitigates risk and fosters long-term value creation through improved resilience (Schimanski et al. 2024), resource efficiency (Abate et al. 2023), and stakeholder trust (Alessa et al. 2024).

Environmental actions—measuring and reducing ecological footprints (Udemba et al. 2024), improving resource efficiency (Moktadir and Ren 2023), minimizing waste (Jiang et al. 2023), and transitioning to renewable energy

(Phan 2024)—now form core strategic priorities. At the same time, social commitments to human rights (Tsang et al. 2023), diversity (Alawadi et al. 2023), equity (Romano et al. 2020b), and community engagement (Bax et al. 2024) enhance employee morale and stakeholder relations (Lin et al. 2024), yielding tangible benefits for organizational legitimacy and societal welfare (Ortas et al. 2019). Robust governance structures—transparent decision-making (Schimanski et al. 2024), ethical oversight (Baldini et al. 2018), and accountable boards (Amarna et al. 2024) -further consolidate internal cohesion and external credibility.

Together, these ESG dimensions reduce regulatory (Dai and Solangi 2023), operational (Islam et al. 2021), and reputational risks (Neven et al. 2015) and have been associated empirically with enhanced financial performance (Zahid et al. 2023) and sustainable growth (Bellandi 2023), contradicting the misconception of sustainability as mere philanthropy (Billedeau and Wilson 2024; Mattas et al. 2024)

Despite improvements in voluntary ESG disclosure, a persistent concern is the gap between reported commitments and enacted practices (Kim et al. 2022; Yu et al. 2018). Workers occupy a privileged position in closing this gap because they possess firsthand knowledge of operational realities (Zhang et al. 2024) and are both recipients and implementers of corporate sustainability measures (Barbosa et al. 2023). Stakeholder Theory frames employees as primary stakeholders whose perceptions influence legitimacy and the success of ESG implementation (Marcon et al. 2023).

Consulting employees therefore enhances the relevance (Saygili et al. 2023), credibility (Pulino et al. 2022), and verification of ESG reporting while fostering organizational buy-in and ownership for sustainability objectives (Allen 2023; Pulino et al. 2022)

However, employees do not interpret ESG uniformly: demographic heterogeneity—age, gender, education, tenure, ethnicity, and geographic location—shapes values, perceptions, and behaviors that determine how sustainability initiatives are received and enacted within firms (Fayyaz et al. 2023; Szabo et al. 2020). Social Identity Theory predicts that demographic groups develop group-specific interpretations of organizational actions (Soto-Simeone and Kautonen 2021). Thus, demographic affiliation can lead to systematic differences in how ESG initiatives are perceived (J. Li and Liu 2025).

Recent studies highlight the nuanced influence of factors such as gender (Effah et al. 2024), age (Abdi et al. 2022), tenure (Z. Li, Stamolampros, and Zhao 2025), and geographic location (Cao et al. 2024) on employees' perceptions and engagement with ESG practices. For example, gender differences have been shown to shape attitudes toward social (Issa and Hanaysha 2023) and environmental (Cambrea et al. 2023) dimensions, with women often prioritizing ethical and sustainability concerns more than men. Similarly, regional cultural norms and values influence how workers perceive and engage with ESG initiatives, making geographic location a critical variable in understanding sustainability practices across diverse contexts (Duque-Grisales and Aguilera-Caracuel 2021).

While existing literature recognizes the importance of demographic variables in shaping organizational dynamics, a comprehensive understanding of how these variables intersect with ESG integration and corporate sustainability remains underexplored. Barbosa et al. (2023) conducted a comprehensive study on the impacts of integrating ESG criteria on corporate sustainability performance from the perspective of workers. Their research employed a systematic literature review (SLR) to develop a questionnaire for qualitative measurement and used the Item Response Theory (IRT) method (Barbosa et al. 2024) to validate it. Additionally, they employed partial least squares structural equation modeling (PLS-SEM) to quantitatively assess impacts (Barbosa et al. 2025). Despite the meticulousness of the study by Barbosa et al. (2023), a relevant gap persists the following: empirical research has not systematically identified which workforce demographic characteristics—alone or in intersection—drive heterogeneity in perceived ESG impacts. This omission is consequential: without granular, subgroup-sensitive evidence, firms risk designing one-size-fits-all ESG policies that misalign with employees' values and impede implementation. Moreover, extant studies rarely combine robust multigroup inferential techniques with decision-prioritization tools to both explain and rank demographic-specific priorities.

Therefore, the gap that this study set out to fill consisted of identifying the demographic variables that most influence workers' perception of the impacts of ESG criteria on corporate sustainability performance. This analysis incorporates qualitative and quantitative analyses and considers the perspective of workers.

To date, there is a dearth of comprehensive studies in this specific direction. Utilizing statistical methods, such as PLS-SEM, is deemed advantageous for pinpointing the key demographic variables influencing workers' perceptions of ESG criteria's impact on corporate sustainability performance, considering the complexity of this phenomenon (Barbosa et al. 2025).

In this conception, the following research question was highlighted: Which are the demographic variables that most influence workers' perception of the impacts of ESG criteria on corporate sustainability performance? Therefore, the research aims to identify which workforce demographic characteristics most strongly influence employees' perceptions of how ESG criteria affect corporate sustainability performance. Specifically, the study aims to: (i) analyze the demographic characteristics—such as gender, age, tenure, education level, and geographic region—that shape workers' perceptions of ESG criteria and sustainability performance; (ii) investigate the differences in perceptions between demographic subgroups, emphasizing variations across gender and regional categories; (iii) develop a robust methodological framework, leveraging the PLS-SEM and PROMETHEE-RATIO methods, to quantitatively and qualitatively assess the interplay between demographic variables and ESG criteria; and (iv) provide actionable insights for organizations to tailor their ESG strategies in alignment with demographic diversities, ultimately enhancing corporate sustainability practices and employee engagement.

This research does not aim to challenge or dismiss the importance of personality and culture; rather, it seeks to complement

these perspectives by examining the underexplored yet significant role of demographic variables. It seeks to contribute to the growing literature on ESG integration by bridging the gap in understanding how workforce demographics influence perceptions of corporate sustainability performance.

This investigation contributes to ESG scholarship and practice by systematically identifying demographic determinants of worker perceptions, extending measurement-focused research to account for workforce heterogeneity; by integrating PLS-SEM with PROMETHEE-RATIO and mixture modeling to both explain and prioritize demographic influences; and by offering evidence-based guidance for managers and policymakers to design inclusive ESG policies that reflect demographic realities (Su and Xue 2024 a). Practically, our findings are intended to help firms target training, communication, and resource allocation to demographic groups whose perceptions may impede adoption, thereby improving the fidelity of ESG disclosure and the effectiveness of sustainability practices. In doing so, the study clarifies how disclosure, practice, and workforce diversity interact to shape credible and impactful corporate sustainability.

In addition to this introduction (Section 1), the structure of this paper is organized as follows: Section 2 (Literature Review) presents a critical analysis of the relevant literature on ESG criteria, corporate sustainability, and the PLS-SEM and PROMETHEE-RATIO methods; Section 3 (Methodological Procedures) details the methodological approach, including the application of the PLS-SEM and PROMETHEE-RATIO methods and the sample design of the study; Section 4 (Results) provides a detailed analysis of the data, presenting the main findings on the influence of demographic variables on workers' perceptions of ESG criteria and corporate sustainability performance; Section 5 (Discussion) interprets the results in light of the existing literature, elaborating the theoretical and practical implications of the findings, as well as the contribution of this study to the field of ESG research; and Section 6 (Conclusion) summarizes the main findings of the study, describes its contributions, and discusses its limitations. Recommendations for future research and practical applications are also provided.

2 | Theoretical Framework

2.1 | ESG Criteria

Environmental, social, and governance (ESG) criteria have matured into a dominant heuristic for assessing corporate sustainability (Hu et al. 2026), linking environmental risk management, social commitments, and governance structures to long-term value creation and stakeholder legitimacy (Nagriwum et al. 2025). The literature grounds ESG within stakeholder theory (which frames firms as accountable to multiple constituencies) (Lee and Isa 2025) and social identity theory (which explains how group memberships shape perception and engagement) (Zhu et al. 2025), providing normative and social-psychological pathways through which ESG affects organizational outcomes. While these frameworks explain why firms adopt ESG and why employees respond variably, they are often applied separately rather than integrated; consequently, theorizing rarely captures how social identities (e.g., gender, region) interact with stakeholder pressures to produce heterogeneous internal responses to ESG policies (Wang et al. 2025).

Conceptually, ESG is treated both as three discrete domains (E, S, G) and as a multidimensional latent construct, producing useful taxonomy and operational measures (Lin 2025). The field benefits from validated instruments and recent use of IRT (Barbosa et al. 2024) and PLS-SEM (Spanò et al. 2025) to capture latent structure and measurement properties, improving construct validity for worker-perception studies. However, conceptual heterogeneity persists: (i) indicator selection varies across studies, complicating comparability (Garefalakis et al. 2025); (ii) many measures rely on subjective self-reports rather than triangulating with objective firm metrics (Pinto-Gutiérrez et al. 2025); and (iii) criteria weighting and aggregation remain contested—making composite ESG scores sensitive to researcher choices (Mengyuan et al. 2025). The innovative coupling of PLS-SEM with MCDA (PROMETHEE-RATIO) in recent work offers a route to both explain latent relationships and prioritize policy-relevant items (Barbosa et al. 2025), yet it introduces subjectivity through weight elicitation and decision-maker framing that must be transparently reported and sensitivity tested.

Empirical studies increasingly document demographic heterogeneity in ESG perceptions: gender and geographic region emerge repeatedly as strong covariates, with women and employees in more regulated/activist regions showing stronger ESG salience (Antari, Sbai, and Ed-Dafali 2025; Antari, Sbai, and Girar 2025). Large survey samples and multigroup PLS-SEM analyses have revealed significant between-group differences and prioritized intervention items via PROMETHEE-RATIO rankings (Barbosa et al. 2025; Sklavos et al. 2025). These studies make two important contributions: They center employee perspectives (an underexplored stakeholder) and demonstrate feasible mixed-method pipelines to both explain and rank issues. However, empirical work is constrained by recurring limitations: reliance on cross-sectional, self-reported data (Chang et al. 2025), nonrepresentative samples (Feng and Nie 2024), and sector/geography concentration (Abu Afifa et al. 2025), which limits external validity. Moreover, although multigroup techniques detect average differences, few studies deploy intersectional or longitudinal designs to reveal how overlapping demographics and temporal dynamics shape ESG attitudes.

2.2 | Corporate Sustainability Theory

Corporate sustainability theory draws from several well-established but partially disconnected streams (Appiah et al. 2025). Stakeholder theory legitimizes corporate responsibility by positing that firms must respond to multiple constituencies, shaping sustainability choices and disclosure strategies (Trindade et al. 2025). The natural resource–based view extends resource-based logic to environmental constraints and capabilities, arguing that environmental investments can be strategic sources of competitive advantage (Singh et al. 2025). Institutional theory explains the diffusion of sustainability practices through coercive, normative, and mimetic pressures, while shared-value arguments reframe social needs as opportunities for competitive strategy (Milić et al. 2025). Collectively, these frameworks explain why firms pursue sustainability but rarely articulate how

firm-level capabilities, institutional pressures, and stakeholder identities interact to produce heterogeneous outcomes.

Conceptually, corporate sustainability is represented both as the classic triple bottom line (people, planet, profit) and—more recently—as ESG-aligned, multidimensional constructs (Cantele et al. 2024). This pluralism fosters rich theorizing but generates measurement heterogeneity: indicator sets differ across studies (Lei et al. 2025), composite scoring and weighting lack standardization (Elafify 2021), and materiality judgments vary with context and framers (Su et al. 2025). Reporting regimes increase disclosure uptake but also surface new tensions—most notably greenwashing and inconsistent coverage of nature/biodiversity issues—making cross-study comparability and inference difficult unless materiality and weighting choices are explicitly justified and sensitivity tested (Anathole et al. 2025). Hybrid approaches that combine latent-variable modeling with prioritization tools offer promise for linking explanation with decision support but introduce epistemic choices that must be transparently reported (da Cunha et al., 2025).

Empirical findings on corporate sustainability are substantive but uneven. Studies document strong growth in environmental-focused research (Fleck-Baustian et al. 2025) and proliferation of case and survey studies (Thompson et al. 2025), while evidence on the profitability or financial payoffs of sustainability strategies remains context-dependent and at times mixed (J. Li, Zhao, and Taghizadeh-Hesary 2025). Institutional pressures and stakeholder activism consistently predict adoption and reporting, yet studies often rely on cross-sectional designs, self-reported measures, single-country or sector-concentrated samples, and inconsistent operationalizations (Hafeez et al. 2024)—limiting causal claims and external validity. Recent studies call for multilevel (Krasodomska et al. 2025), longitudinal (Berntsen 2025), and mixed-methods designs (Keil et al. 2025) to better link sustainability initiatives with firm performance and societal outcomes, and empirical monitoring shows persistent underreporting of nature-related risks despite regulatory advances.

2.3 | Demographic Variables

Demographic variables are not merely background descriptors but function as social markers that structure identity, power, and stakeholder salience within and around organizations (Sadeghi et al. 2021). Classic social-identity (Shayo et al. 2025) and social-categorization (Gier 2019) perspectives explain how age, gender, ethnicity, tenure, and other demographic markers shape identification, attention, and behavioral proclivities—thereby mediating how employees perceive and respond to corporate policies. At the same time, stakeholder theory underscores that demographic groups constitute distinct stakeholder categories whose interests and legitimacy claims differ (Kanta Sharma et al. 2025). However, these theoretical streams have tended to operate in parallel rather than be integrated: researchers rarely model how demographic-based identities interact with stakeholder pressures, institutional logics, or organizational capabilities to produce heterogeneous outcomes. Intersectionality scholarship further challenges unidimensional treatments by showing that single-axis demographic analyses obscure the compounded, nonadditive effects of multiple social locations, a perspective increasingly advocated in organizational research but still underutilized in empirical ESG and sustainability studies (Ren et al. 2025; Slabbekoorn et al. 2024).

Conceptually, demographic variables occupy at least three roles in organizational research: (1) as control/background covariates that describe sample composition (Ezz El Deen et al. 2024); (2) as independent or moderating variables that explain heterogeneity in attitudes and outcomes (Pastor-Cisneros et al. 2025); and (3) as identity anchors that actively shape perception and behavior (Gelner et al. 2025). This multiplicity of roles calls for careful operational clarity—researchers must state whether a demographic marker is treated as a proxy for social identity, structural position, exposure to risk, or life-course stage. Measurement (Lingham et al. 2024) and harmonization (Smith et al. 2024) pose the following recurring challenges: indicator definitions, cross-national comparability, and aggregation rules vary widely, undermining replication and meta-analytic synthesis. Methodological advances are available to increase comparability but remain inconsistently applied.

Empirical studies consistently document that demographic markers correlate with organizational attitudes and behaviors, yet effect patterns are context contingent (Grigsby et al. 2024; Kuo 2025). Meta-analytic and large-sample evidence shows demographic moderators in ESG—employee outcome relationships, while newer studies reveal that perceived diversity and identity salience can condition whether demographic heterogeneity yields positive organizational outcomes (Hu et al. 2025). Nonetheless, the literature is limited by frequent reliance on cross-sectional surveys, self-reports, convenience samples, and single-country or single-industry settings—factors that weaken causal inference and external validity. Importantly, work that treats demographic variables only as controls misses substantive interaction effects and intersectional dynamics shown to matter in leadership, retention, and sustainable-behavior studies (Šerić et al. 2024). Recent empirical work thus calls for multigroup modeling, intersectional analytics, and triangulation with objective administrative or ecological data to better capture demographic heterogeneity.

2.4 | Stakeholder Theory and Social Identity Theory

Stakeholder Theory is a normative and analytical framework that posits firms ought to recognize (Valentinov 2025), account for (Hadwin 2025), and, where appropriate, balance (Cahyono et al. 2024) the legitimate interests of multiple groups and individuals—"stakeholders"—who can affect or are affected by the firm's goals and operations. Rather than treating shareholders as the sole rightful locus of firm responsibilities, Stakeholder Theory locates corporate purpose within a pluralistic set of moral and instrumental obligations toward employees (Yu 2024), customers (Gu et al. 2024), suppliers (Jum'a et al. 2024), creditors (Dagestani et al. 2024), communities (Guo et al. 2025), regulators (Hassan et al. 2024), and other parties whose interests are materially implicated in corporate activity.

Conceptually, the theory rests on three interrelated claims. First, it asserts that stakeholders are morally significant:

managers have duties that extend beyond maximizing shareholder wealth because corporate actions produce benefits and burdens distributed across a range of social actors (Marcoux 2003). Second, it describes and explains managerial behavior by identifying how firms interact with stakeholder groups and how those interactions shape organizational outcomes (Sarturi et al. 2025). Third, it advances instrumental propositions: attending to stakeholder interests can produce desirable organizational outcomes, although such outcomes are contingent rather than logically necessary (Arian et al. 2025).

Stakeholder Theory reframes the corporation as a nexus of social relationships with ethical and practical responsibilities to a plurality of constituencies—an orientation that invites both normative justification and rigorous empirical specification (Jiang and Fang 2024; Waheed and Zhang 2022)

Social Identity Theory (SIT) is a social-psychological framework that explains how individuals' self-concepts derive, in part, from their membership in social groups and the evaluative significance attached to those memberships (Magnus 2022). The theory proposes that people categorize themselves and others into social groups (Adam et al. 2025), cognitively adopt those group memberships as part of the self (social identification) (Huang et al. 2025), and then engage in intragroup and intergroup cognitive and behavioral processes aimed at maintaining or enhancing a positive social identity (Lonsdale 2021)

SIT predicts predictable patterns such as in-group bias (Scheepers and Derks 2016), outgroup derogation under threat (Dobbs and Crano 2001), conformity to in-group norms, and selective information processing favoring the in-group (Shipley 2008). In organizational contexts, social identities—professional (Stubbs and Tong 2025), departmental (Bartels et al. 2019), organizational (Shaw et al. 2025), or demographic (Soto-Simeone and Kautonen 2021)—shape cooperation, conflict, commitment, and turnover. Multiple and overlapping identities can either mitigate or exacerbate intergroup tensions depending on perceived compatibility and identity salience (Huang et al. 2025; Scheepers and Derks 2016).

SIT situates the self as partly social: group memberships provide meaning, motive, and standards that systematically shape cognition and behavior (Brousseau et al. 2020). By explaining how categorization (Sewell et al. 2022), identification (Stubbs and Tong 2025), and comparison (Chiang et al. 2017) produce predictable intergroup patterns, SIT supplies a robust explanatory and predictive framework widely applied across psychology, sociology, and organizational studies.

3 | Methodological Procedures

Understanding the influence of worker demographic variables on the relationship between ESG criteria and corporate sustainability practices holds significant importance for academia and practical applications (Park et al. 2012). This comprehension is crucial for elucidating the intricate interplay between ESG criteria and corporate sustainability practices (Jonwall et al. 2023). By examining factors such as gender, age, tenure within the company, educational attainment, and geographic location, companies can gain useful insights into the diverse perspectives and experiences that shape organizational sustainability engagement (Trivedi 2023). Hence, employing a comprehensive and scientifically validated methodology is imperative.

The study, approved by the Ethics Committee of the Federal University of Paraíba (CAAE: 37320620.8.0000.5185), outlines the methodological approach to achieve the research objective outlined in the Introduction (Section 1). The steps described in Figure 1 provide a clear roadmap for carrying out this research. The present study is based on a statistically validated questionnaire using IRT (Barbosa et al. 2024), which was built from a comprehensive and SLR (Barbosa et al. 2023)

This section details the investigated companies, sample population, research instruments, and the development of multivariate statistical models to quantitatively measure observable variables and identify demographic variables predominantly influencing workers' perceptions of ESG criteria impacts on corporate sustainability performance.

The study was conducted in two Brazilian electricity sector companies, Control and Engeselt, headquartered in João Pessoa (Paraíba), with regional branches in several states across four regions of Brazil. These companies, specializing in electrical projects, construction, processes, and services, have been in operation for approximately 26 and 17 years, respectively, and employ highly qualified technical teams. A total of 2747 respondents participated in the survey, representing 59.72% of the total employee population.

Given the potential influence of gender and region on workers' perceptions, the sample was categorized into the following eight

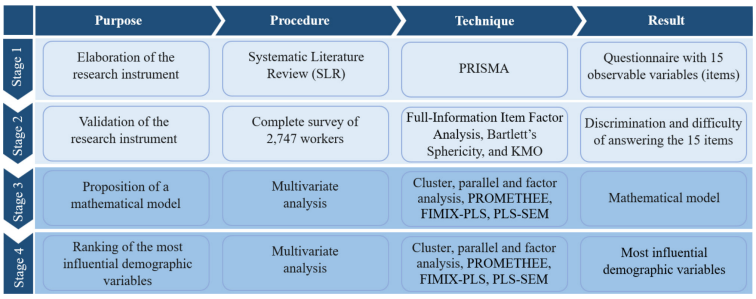

FIGURE 1 | Steps of the methodological procedure. *Source:* Adapted Barbosa et al. (2024).

subgroups (Table 1): Group 1 (G1): men from the Northeast region; Group 2 (G2): men from the Southeast region; Group 3 (G3): men from the North region; Group 4 (G4): men from the Central-West region; Group 5 (G5): Women from the Northeast region; Group 6 (G6): Women from the Southeast region; Group 7 (G7): Women from the North region; Group 8 (G8): Women from the Central-West region.

The sample primarily consisted of men ($n = 2121$) from the Northeast region ($n = 1420$) employed at Control ($n = 1345$). Most men have secondary education ($n = 1129$), while most women have higher education ($n = 211$). Both genders are predominantly aged between 31 and 40 years, with an average tenure of 4 years in their current roles. However, men are generally older, with 24.23% over 41 years old compared to 9.72% of women. Additionally, men have longer tenure in their roles, with 9.29% working in the same position for at least 5 years, compared to 3.85% of women.

This gender distribution reflects the reality of the Brazilian electricity sector, which is predominantly male (Boghossian et al. 2020). The sector has historically been associated with technical and operational roles that require engineering and field-based expertise, professions in which men have been traditionally overrepresented in Brazil (Schaan et al. 2009). While this gender imbalance presents challenges, it also highlights the

TABLE 1 | Descriptive statistics of the respondents.

	G1 ($n = 1420$)		G2 ($n = 237$)		G3 ($n = 150$)		G4 ($n = 389$)		G5 ($n = 352$)		G6 ($n = 82$)		G7 ($n = 21$)		G8 ($n = 90$)	
Variable	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Company																
Engeselt	75	5.3	81	34.2	64	42.7	40	10.3	65	18.5	52	63.4	12	57.1	26	28.9
Control	1345	94.7	156	65.8	86	57.3	349	89.7	287	81.5	30	36.6	9	42.9	64	71.1
Education level																
Medium	785	55.3	88	37.1	83	55.3	173	44.5	119	33.8	27	32.9	7	33.3	21	23.3
Medium technical	352	24.8	88	37.1	45	30.0	135	34.7	64	18.2	13	15.9	9	42.9	20	22.2
Superior	228	16.1	51	21.5	20	13.3	68	17.5	129	36.6	35	42.7	5	23.8	42	46.7
Postgraduation	55	3.9	10	4.2	2	1.3	13	3.3	40	11.4	7	8.5	0	0.0	7	7.8
Company time (years)																
Less than 1	390	27.5	165	69.6	76	50.7	88	22.6	105	29.8	51	62.2	13	61.9	23	25.6
From 1 to 4	893	62.9	58	24.5	48	32.0	282	72.5	211	59.9	27	32.9	6	28.6	65	72.2
From 5 to 9	88	6.2	9	3.8	13	8.7	17	4.4	27	7.7	4	4.9	2	9.5	2	2.2
Above 10	49	3.5	5	2.1	13	8.7	2	0.5	9	2.6	0	0.0	0	0.0	0	0.0
Current position time (years)																
Less than 1	490	34.5	167	70.5	81	54.0	101	26.0	165	46.9	61	74.4	14	66.7	34	37.8
From 1 to 4	804	56.6	43	18.1	46	30.7	260	66.8	169	48.0	19	23.2	7	33.3	55	61.1
From 5 to 9	70	4.9	10	4.2	13	8.7	19	4.9	15	4.3	2	2.4	0	0.0	1	1.1
Above 10	56	3.9	17	7.2	10	6.7	9	2.3	3	0.9	0	0.0	0	0.0	0	0.0
Age (years)																
From 16 to 18	5	0.4	4	1.7	2	1.3	0	0.0	5	1.4	1	1.2	4	19.0	2	2.2
From 19 to 21	84	5.9	30	12.7	22	14.7	9	2.3	38	10.8	13	15.9	2	9.5	12	13.3
From 22 to 25	168	11.8	26	11.0	32	21.3	41	10.5	81	23.0	20	24.4	7	33.3	22	24.4
From 26 to 30	306	21.5	37	15.6	32	21.3	81	20.8	84	23.9	20	24.4	3	14.3	24	26.7
From 31 to 40	507	35.7	76	32.1	45	30.0	157	40.4	108	30.7	19	23.2	5	23.8	22	24.4
From 41 to 50	283	19.9	39	16.5	17	11.3	89	22.9	31	8.8	7	8.5	0	0.0	7	7.8
Above 50	67	4.7	25	10.5	0	0.0	12	3.1	5	1.4	2	2.4	0	0.0	1	1.1

importance of studies like ours in identifying demographic nuances and their implications for ESG practices.

The decision to use a Likert scale of 1–5 in this study, as validated by Barbosa et al. (2024), was guided by both methodological and practical considerations. A 5-point scale provides a balanced and straightforward range of options for respondents, making it easier for them to assess their perceptions without overwhelming them with too many choices (Adelson and McCoach 2010). This is particularly important in large-scale surveys, where cognitive fatigue may influence response quality.

Studies have shown that 5-point scales are highly effective in capturing the central tendencies of respondents' opinions while maintaining reliability and validity (Barbosa et al. 2024; Barbosa et al. 2021). While 7-point or 9-point scales may offer greater granularity, they do not necessarily yield more precise results and can complicate data analysis without significantly enhancing measurement accuracy. The 5-point scale, therefore, strikes an optimal balance between simplicity for respondents and analytical robustness.

An extensive review of the literature informed the development of a structured instrument to capture worker perceptions of ESG initiatives and corporate sustainability performance across various sectors. This resulted in a 15-item questionnaire (Table 2), previously validated by Barbosa et al. (2024).

The instrument includes 15 observable variables, coded from Q1 to Q15, covering aspects such as carbon emission intensity, energy consumption, water use efficiency, waste diversion rate, biodiversity impact, diversity and inclusion metrics, employee turnover rate, health and safety incidents, employee satisfaction and engagement, community engagement, board diversity, executive compensation, ethics and compliance training, and audits by independent consultants.

In the context of this study, the questionnaire employs questions rather than declarative statements to capture workers' perceptions of the integration of ESG criteria in corporate sustainability performance. While Likert scales are traditionally used with declarative statements, their application with questions is also scientifically valid when carefully structured (Barbosa et al. 2024).

The phrasing of questions in the questionnaire was intentional to elicit participants' subjective perceptions in a manner that encourages thoughtful engagement. Each question was designed to prompt respondents to reflect on specific aspects of ESG practices within their organization. Participants rated their responses on a 5-point Likert scale, with options ranging from "*Never*" (1) to "*Always*" (5). This approach allowed for the quantification of subjective perceptions regarding the frequency or extent to which ESG-related practices were observed

Using questions in conjunction with a Likert scale is supported in the literature when the goal is to measure attitudes, opinions, or perceptions that are contextually specific (Dauzón-Ledesma and Izquierdo 2023; Ilagan and Falk 2023). This approach ensures that the responses provide actionable data while preserving the clarity and specificity of the items. The study acknowledges this methodological choice as a strength, as it aligns with the exploratory nature of the research and the diverse demographic characteristics of the respondents.

Figure 2 summarizes the responses to the questionnaire items. Item Q5 (*In your opinion, does the organization implement initiatives for the protection/safety of the corporate work environment, providing quality of life and satisfaction to workers?*), which addresses worker protection, safety, and quality of life, was the most frequently perceived by all groups. Item Q15 (*In your opinion, does the organization implement initiatives to improve the quality of its products, services, and processes, enhancing the company's image?*), related to the quality of services offered, was also notably perceived. Conversely, items Q7 (*In your perception, does the organization implement adequate corporate remuneration (salary) policies?*), Q9 (*In your opinion, does the organization implement social action initiatives in the communities?*), and Q10 (*In your perception, does the organization implement corporate initiatives of social interests of the stakeholders (interested parties)?*) were the least perceived, indicating dissatisfaction with remuneration policies, lack of visible social actions by companies, and the absence of corporate initiatives of social interest.

Subsequently, an exploratory analysis began to propose the PLS-SEM theoretical model, examining the relationship between observable variables and generating dimensions.

PLS-SEM is a variance-based multivariate technique for analyzing complex cause-effect relationships among latent variables (Rahimi et al., 2025). Emphasizing prediction and explanation rather than parameter recovery, PLS-SEM is particularly appropriate for exploratory research and theory development and for situations in which covariance-based SEM is limited (Kumar et al., 2024).

Key methodological properties include its grounding in path modeling and regression, its focus on maximizing explained variance of endogenous constructs, and its integrated treatment of the measurement and structural models to preserve reliability and validity (Barbosa, da Silva, et al., 2023; Armutcu et al., 2024). PLS-SEM is robust to high model complexity, small sample sizes, and nonnormal data distributions, which explains its wide adoption where constructs are multidimensional or under conceptual development (Barbosa, da Silva, et al., 2023; Kumar et al., 2024).

Multivariate statistical analyses (cluster analysis, parallel analysis, factor analysis) supported the theoretical model. After the exploratory analysis, a confirmatory PLS-SEM model was applied to position each item in its respective dimension, confirming the evidence generated by the theoretical model (Table 3).

The results indicated a multidimensional PLS-SEM model with good fit to the unidimensional model (CR >0.700; $F>0.500$), suggesting a second-order characteristic (Figure 3). Additionally, the confirmatory model underwent convergent and discriminant validation tests, with fit indices validating the PLS-SEM model.

Finally, PROMETHEE-RATIO was used to rank the questionnaire items in order to identify how different regions and

TABLE 2 | Research instrument (questionnaire).

Criteria	Main impacts identified	Items	Research instrument questions	References
Environmental	- Water pollution - Soil degradation - Air pollution - Solid waste - Energy consumption - Renewable energies - Recycling - Green innovation	Q1	In your perception, does the organization implement corporate environmental education policies?	(Arif et al. 2020; Baraibar-Diez et al. 2019; Baraibar-Diez and Odriozola 2019; Birindelli et al. 2018; Bravo and Reguera-Alvarado 2019; Conca et al. 2021; De Masi et al. 2021; Gangi et al. 2021; Garcia and Orsato 2020; Minutolo et al. 2019; Miralles-Quirós et al. 2019; Moneva et al. 2020; Ouni et al. 2020; Pirtea et al. 2021; Qureshi et al. 2020; Reboredo and Sowaity 2022; Romano et al. 2020a; Sachin and Rajesh 2021; Shakil 2021; Sul and Lee 2020; Ting et al. 2020)
		Q2	In your perception, does the organization implement corporate initiatives aimed at green innovation? (Green innovation relates to products or processes, including technologies that are involved in saving energy; preventing water, air, and soil pollution; recycling waste; green product designs; or corporate environmental management.)	
		Q3	In your opinion, does the organization consider that climate change issues impact the design of its undertakings, processes, products and corporate services?	
		Q4	In your perception, does the organization implement initiatives to reduce energy consumption?	
		Q5	In your opinion, does the organization implement initiatives for the protection/safety of the corporate work environment, providing quality of life and satisfaction to workers?	
Social	- Gender diversity - Remuneration policy - Intellectual empowerment - Equal opportunity - Community social actions - Investment in innovation - Culture and religion - Relationship with *stakeholders*	Q6	In your perception, does the organization implement corporate initiatives aimed at gender diversity (equal opportunities between men and women)?	(Aboud and Diab 2019; Alsayegh et al. 2020; Arayssi et al. 2020; Baraibar-Diez et al. 2019; Baraibar-Diez and Odriozola 2019; Birindelli et al. 2018; Bravo and Reguera-Alvarado 2019; Conca et al. 2021; De Masi et al. 2021; Gangi et al. 2021; Garcia et al. 2017; Garcia and Orsato 2020; He et al. 2021; Koroleva et al. 2020; Landi et al. 2022; López-Toro et al. 2021; Moneva et al. 2020; Nitescu and Cristea 2020; Ortas, Gallego-Álvarez, et al., 2019; Ouni et al. 2020; Peng and Isa 2020; Pirtea et al. 2021; Qureshi et al. 2020, 2021; Rajesh and Rajendran 2020; Reboredo and Sowaity 2022; Romano et al. 2020a; Sachin and Rajesh 2021; F. Shahzad et al. 2021; Shakil 2021; Sul and Lee 2020; Terzani and Turzo 2021; Ting et al. 2020; Xu et al. 2021; Q. Zhang et al. 2020)
		Q7	In your perception, does the organization implement adequate corporate remuneration (salary) policies?	
		Q8	In your perception, does the organization implement initiatives for the intellectual qualification of workers (training, courses, among others)?	
		Q9	In your opinion, does the organization implement social action initiatives in the communities? (Examples of social actions: prevention of child labor, incentive to first job, incentive to practice sports, incentive to culture, among others).	
		Q10	In your perception, does the organization implement corporate initiatives of social interests of the *stakeholders* (interested parties)? (Corporate social interests are related to the company's impacts on the environment, society, or its relationship with workers, taken into account when making decisions and creating value).	

(Continues)

TABLE 2 | (Continued)

Criteria	Main impacts identified	Items	Research instrument questions	References
Governance	- Audits - Financial performance - Competitiveness - Human capital - Compensation policies - Fighting corruption - Transparency - Enterprise value (capital)	Q11	In your opinion, does the organization carry out audits (internal and/or external) of its corporate processes?	(Atan et al. 2018; Baraibar-Diez et al. 2019; Baraibar-Diez and Odriozola 2019; Birindelli et al. 2018; Bodhanwala and Bodhanwala 2018; Bouslah et al. 2013; Bravo and Reguera-Alvarado 2019; Conca et al. 2021; De Masi et al. 2021; Gangi et al. 2021; Garcia and Orsato 2020; T. C. Kuo et al. 2021; Lokuwaduge and Heenetigala 2017; Mohammad and Wasiuzzaman 2021; Moneva et al. 2020; Ng et al. 2020; Ouni et al. 2020; Pirtea et al. 2021; Qureshi et al. 2020; Reboredo and Sowaity 2022; Romano et al. 2020a; Sachin and Rajesh 2021; Shaikh 2021; Shakil 2021; Sul and Lee 2020; Taliento et al. 2019; Terzani and Turzo 2021; Ting et al. 2020; Xie et al. 2019; E. Pholcus yi Yu et al. 2020)
		Q12	In your perception, does the organization implement corporate initiatives to improve its financial performance and competitiveness?	
		Q13	In your perception, does the organization implement initiatives to improve human capital? (Human capital can be understood as the capacity for knowledge, skills, and attributes of a worker's personality when carrying out their activity, in order to produce economic value).	
		Q14	In your perception, does the organization implement initiatives to fight corruption?	
		Q15	In your opinion, does the organization implement initiatives to improve the quality of its products, services, and processes, enhancing the company's image?	

Source: Barbosa et al. (2024).

whether gender influences workers' perception of the impacts of ESG criteria on corporate sustainability performance.

PROMETHEE-RATIO is a PROMETHEE family variant for multicriteria decision analysis that prioritizes and ranks alternatives through a ratio-based preference index. Based on pairwise outranking, it quantifies relative desirability and mitigates PROMETHEE I and II limitations in criteria weighting, often serving to improve PROMETHEE II outcomes.

The method integrates diverse criteria, accommodates stakeholder preferences, and explicitly handles trade-offs among conflicting objectives. Its interpretability, flexibility, and robustness render it suitable for sustainability assessment, resource allocation, and corporate strategy evaluation. With advances in computational modeling, PROMETHEE-RATIO is positioned to broaden its applicability and strengthen evidence-based decision-making in governance and resource management.

4 | Results

This section describes the construction of multicriteria decision models using the PROMETHEE II method combined with the swing RATIO procedure. The aim is to prioritize ESG criteria items to implement measures addressing the most critical issues based on policyholder preferences and workers' perceptions. Figure 4 illustrates the modeling framework, which employs PROMETHEE II with RATIO for structured decision support. The decision-making process was divided into six stages and replicated eight times to account for different evaluation scenarios based on demographic variables.

This strategic interaction can be guided by the recommendations from the proposed models, as ESG planning actions involve ESG perspectives, along with cost–benefit assessments. These aspects are linked to the practices adopted by companies to meet ESG criteria, including sustainability efforts and worker well-being, as perceived by employees

The multicriteria decision framework begins with characterizing the decision task in the decision process. The second stage involves structuring the problem, listing objectives and criteria as highlighted by Correia et al. (2022). Defining the objectives of the MCDA problem enables the formulation of measurable criteria that precisely and nonredundantly represent the problem. In the third stage, the DM identifies the necessary items meeting ESG criteria (alternatives) to build the evaluation matrix, considering each item's performance for the established criteria. This stage also defines the decision problem's nature and the decision maker's rationale.

Subsequent steps introduce the PROMETHEE II approach combined with the RATIO procedure to process and provide information about the ordering decision process, focusing on ESG context and prioritizing critical items for company interventions. In the fourth stage, DM preference modeling is established by ordering criteria and justifying their importance according to the RATIO procedure for weight assignment. In the fifth stage, critical items related to ESG criteria are evaluated using

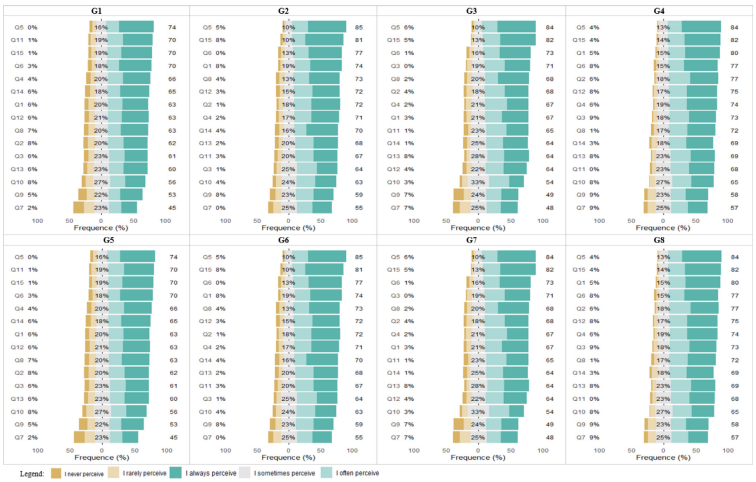

FIGURE 2 | Summary of responses to questionnaire items.

the PROMETHEE II method. The final stage involves analyzing the eight proposed models under different scenarios to provide a final ranking of critical items.

The DM, a professional specializing in development and environment with expertise in occupational health and safety, represents the decision-making process. This individual is directly involved in the decision problem and understands the components of an ESG system and employee needs, making the decision process more flexible and robust.

The structuring of objectives and criteria is based on the three ESG perspectives, as outlined by the PLS-SEM model, establishing three primary objectives for the decision problem. These constructs, adopted as criteria, quantify the objectives and assess the ESG system elements. Table 4 organizes the objectives and criteria, including codes, minimization or maximization indications, and measurement units or scales. The same set of criteria was used across the eight analyzed models.

The set of alternatives for the decision problem was formulated based on the PLS-SEM analysis results, identifying 15 items that encompass an ESG system across the following three perspectives: environmental (E), social (S), and governance (G). For each of the eight analyses (multigroup analysis of demographic characteristics using PLS-SEM), the factor loadings from the cross-loading method served as the consequence matrix, enabling evaluation of the 15 items' performance relative to the three criteria.

In PROMETHEE II, after establishing the criteria/objectives, alternatives, and their performance values for each criterion, the decision task required specifying the weights of the criteria. The swing RATIO elicitation procedure supported the decision maker in this task. Initially, the decision maker was asked to rank the criteria by importance based on their preferences. This requires reflecting on each criterion's contribution to the decision problem, considering how each adds information and influences the decision. The decision maker then ranked the criteria from highest to lowest importance. Table 5 presents this ranking for weight calculation

This preference elicitation procedure for determining the weights reduced the effort required from the DM in indicating the criteria' importance.

After ranking the weights of the criteria, the DM was asked to answer some questions to make importance judgments, as required by the RATIO elicitation procedure. Table 6 presents the questions proposed to the DM, their answers and the values of the weights of the criteria identified from these judgments.

The ranking and computation of criteria weights, as well as the evaluation of ESG items, were facilitated by a PROMETHEE-RATIO decision support system. For the eight analyzed models, the decision task employed the usual preference function for the three criteria. In the PROMETHEE method, this function means that any difference between alternative performances denotes a strict preference (Brans and Mareschal 2005).

The critical items assessment stage involved analyzing the essential elements of an ESG system. After defining the criteria weights, each alternative was evaluated using PROMETHEE II, criterion by criterion. The choice of PROMETHEE II for evaluating critical ESG items is justified for three reasons:

1. The DM adopted a noncompensatory rationality approach, meaning low performance in one criterion could not be offset by high performance in another.

2. The preference structure consisted of strict and indifferent preferences, allowing for comparisons between alternatives to identify critical and indifferent items.

3. The DM aimed to rank the ESG items to prioritize interventions for those in lower positions.

The mathematical structure of the PROMETHEE ranking provides initial recommendations based on outranking relationships to determine the ranking of alternatives (Brans and Vincke 1985). The performance of ESG system items was evaluated using the total net flow value obtained by the method. The

TABLE 3 | Values of factor loadings and composite reliability.

Construct	Item	G1 *F*	G2 *F*	G3 *F*	G4 *F*	G5 *F*	G6 *F*	G7 *F*	G8 *F*
Environmental (E)									
G1 (CR = 0.908); G2 (CR = 0.914); G3 (CR = 0.860); G4 (CR = 0.892); G5 (CR = 0.916); G6 (CR = 0.942); G7 (CR = 0.923); G8 (CR = 0.849)	Q1	0.863	0.828	0.795	0.850	0.883	0.916	0.878	0.816
	Q2	0.874	0.895	0.834	0.858	0.885	0.917	0.870	0.750
	Q3	0.758	0.758	0.684	0.669	0.713	0.742	0.769	0.657
	Q4	0.799	0.839	0.662	0.803	0.823	0.886	0.891	0.745
	Q5	0.779	0.800	0.728	0.757	0.830	0.904	0.783	0.661
Social (S)									
G1 (CR = 0.912); G2 (CR = 0.914); G3 (CR = 0.871); G4 (CR = 0.896); G5 (CR = 0.919); G6 (CR = 0.934); G7 (CR = 0.905); G8 (CR = 0.856)	Q6	0.714	0.777	0.648	0.669	0.763	0.809	0.541	0.649
	Q7	0.802	0.811	0.717	0.820	0.838	0.856	0.866	0.691
	Q8	0.837	0.836	0.769	0.838	0.839	0.914	0.890	0.735
	Q9	0.856	0.831	0.817	0.813	0.827	0.812	0.788	0.794
	Q10	0.889	0.869	0.833	0.827	0.894	0.904	0.924	0.811
Governance (G)									
G1 (CR = 0.925); G2 (CR = 0.936); G3 (CR = 0.911); G4 (CR = 0.911); G5 (CR = 0.932); G6 (CR = 0.918); G7 (CR = 0.903); G8 (CR = 0.867)	Q11	0.782	0.858	0.829	0.795	0.779	0.751	0.657	0.752
	Q12	0.876	0.908	0.844	0.854	0.899	0.852	0.941	0.713
	Q13	0.868	0.885	0.874	0.843	0.881	0.902	0.914	0.750
	Q14	0.829	0.806	0.760	0.806	0.838	0.842	0.675	0.750
	Q15	0.861	0.854	0.791	0.795	0.882	0.801	0.816	0.792
Integration (ESG)									
G1 (CR = 0.950); G2 (CR = 0.959); G3 (CR = 0.934); G4 (CR = 0.941); G5 (CR = 0.958); G6 (CR = 0.964); G7 (CR = 0.957); G8 (CR = 0.923)	E	0.912	0.902	0.851	0.857	0.904	0.925	0.933	0.875
	S	0.939	0.944	0.918	0.924	0.935	0.956	0.942	0.916
	G	0.935	0.952	0.927	0.911	0.944	0.931	0.965	0.917

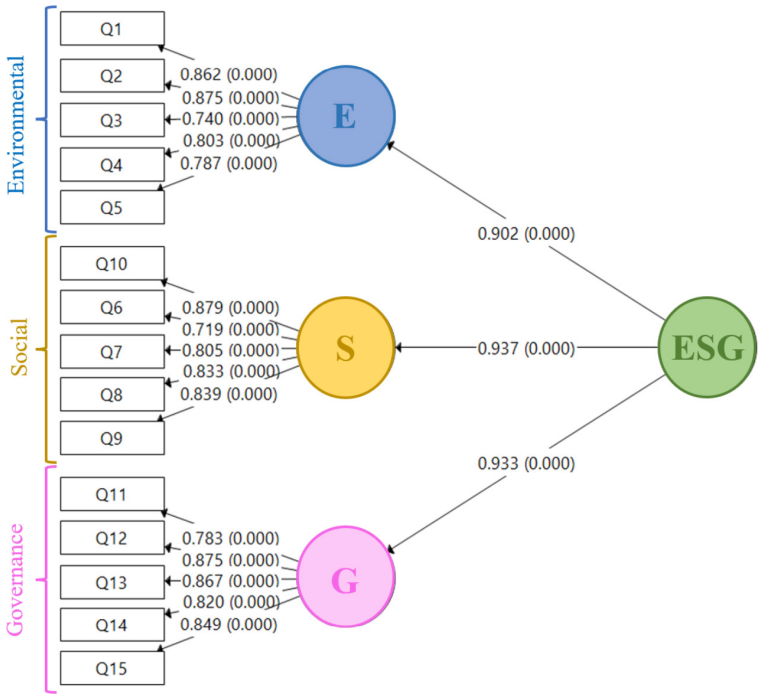

FIGURE 3 | PLS-SEM confirmatory model for all groups. *Note:* Average variance extracted (AVE), heterotrait–monotrait (HTMT) ratio, and variance inflation factor (VIF) values varied between 0.664 and 0.854, 0.149 and 0.835, and 1000 and 3013, respectively, indicating the absence of problems of convergent validity, discriminant validity and multicollinearity.

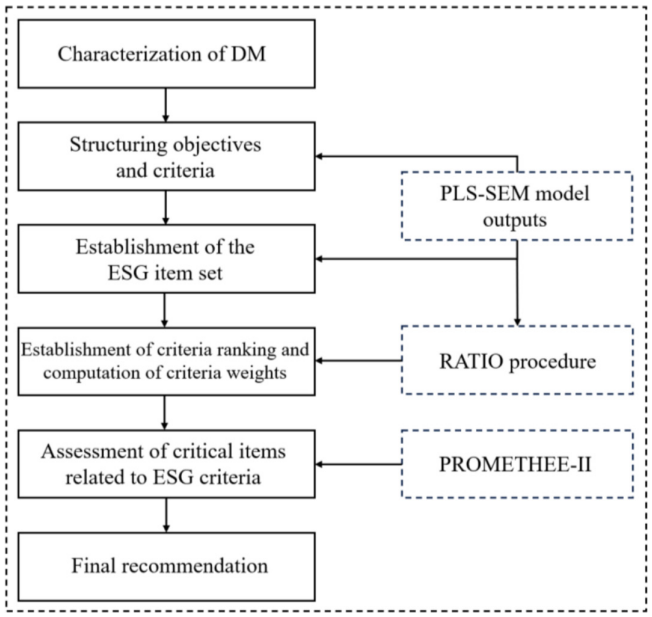

FIGURE 4 | PROMETHEE decision model with RATIO.

final ranking of ESG system items, from best to worst, for each of the eight models is presented in Table 7.

Based on the results of the eight decision models, item Q3 was most frequently observed in the last position for both male and female groups, indicating it should be prioritized. For men, items Q1 and Q4 are subsequent priorities, while for women, item Q5 should also be prioritized. Items Q10 and Q13 consistently ranked in the first positions for both groups, indicating they are not critical and do not require immediate intervention.

This outcome suggests that the hybrid approach using PLS-SEM, PROMETHEE ranking method, and the RATIO procedure effectively identifies critical ESG items for intervention. Implementing actions focused on these critical items can enhance the company's performance in these areas.

Table 8 presents the results of paired comparisons between the eight demographic groups (G1–G8) based on cross-loading values from the questionnaire's 15 items. The Kruskal–Wallis's test ($\chi^2 = 32.206, df = 7, p = 3.719 \times 10^{-5}$) indicated a significant difference between the groups. Dunn's post hoc tests with Bonferroni correction provided adjusted p for group comparisons.

G8 shows significant differences with several other groups (G1, G2, G4, and G5), indicating that G8's values are distinct. The G8 has the highest number of significant differences, especially with G5, which shows a highly significant difference. Other group comparisons do not remain statistically significant after adjusting for multiple testing, indicating no strong evidence of differences in the loading values between these groups.

This analysis suggests that women from the Central-West region (G8) exhibit significantly different factor loadings for the 15 items compared to several other groups. This distinctiveness warrants further investigation to understand what differentiates this group from the others

The findings indicating that “gender” and “demographic region” are among the most influential variables affecting employees' perceptions of the impact of ESG integration on corporate sustainability may be considered controversial in certain contexts. However, they are supported by both theoretical frameworks and empirical evidence, and their significance in this study is well-grounded.

TABLE 4 | Objectives and criteria.

Objectives	Criteria	Min/max	Unit/scale
- Reduce carbon footprint and energy consumption. - Implement eco-friendly practices in operations. - Ensure efficient waste management and recycling initiatives. - Enhance biodiversity conservation efforts.	Environment (E)	Max	Standardized
- Promote diversity, equity, and inclusion within the workforce. - Support community engagement and philanthropic initiatives. - Ensure fair labor practices and employee well-being. - Enhance health and safety standards.	Social (S)	Max	Standardized
- Establish transparent and ethical business practices. - Strengthen board independence and oversight. - Ensure compliance with regulations and ethical standards. - Foster a culture of accountability and integrity in decision-making processes.	Governance (G)	Max	Standardized

TABLE 5 | Establishing the ranking of the criteria.

	G1	G2	G3	G4	G1	G2	G3	G4
Criteria	**Problem 1**	**Problem 2**	**Problem 3**	**Problem 4**	**Problem 5**	**Problem 6**	**Problem 7**	**Problem 8**
E	3°	3°	3°	3°	3°	3°	3°	3°
S	1°	2°	2°	1°	2°	1°	2°	2°
G	2°	1°	1°	2°	1°	2°	1°	1°

TABLE 6 | Second stage of the swing RATIO procedure.

	RATIO procedure		Weight values		
	Questioning (on a scale of 0 to 100, [...])	**Resp.**	**E**	**S**	**G**
Problem 1	How much is the criterion S more important than criterion G?	70	0.1789	0.517	0.3041
	How much times the criterion G more important than criterion E?	70			
Problem 2	How much is the criterion G more important than criterion S?	60	0.1761	0.3169	0.507
	How much times the criterion S more important than criterion E?	80			
Problem 3	How much is the criterion G more important than criterion S?	60	0.1761	0.3169	0.507
	How much times the criterion S more important than criterion E?	80			
Problem 4	How much is the criterion S more important than criterion G?	70	0.1789	0.517	0.3041
	How much times the criterion G more important than criterion E?	70			
Problem 5	How much is the criterion G more important than criterion S?	60	0.1761	0.3169	0.507
	How much times the criterion S more important than criterion E?	80			
Problem 6	How much is the criterion S more important than criterion G?	70	0.1789	0.517	0.3041
	How much times the criterion G more important than criterion E?	70			
Problem 7	How much is the criterion G more important than criterion S?	60	0.1761	0.3169	0.507
	How much times the criterion S more important than criterion E?	80			
Problem 8	How much is the criterion G more important than criterion S?	60	0.1761	0.3169	0.507
	How much times the criterion S more important than criterion E?	80			

TABLE 7 | Rankings of the eight models of critical items in an ESG system.

Men				Women			
Northeast	**Southeast**	**North**	**Central-West**	**Northeast**	**Southeast**	**North**	**Central-West**
Order 1	**Order 2**	**Order 3**	**Order 4**	**Order 5**	**Order 6**	**Order 7**	**Order 8**
Q10	Q12	Q13	Q8	Q10	Q10	Q10	Q15
Q13	Q13	Q12	Q10	Q15	Q8	Q12	Q10
Q9	Q10	Q10	Q12	Q12	Q14	Q13	Q13
Q12	Q11	Q11	Q13	Q13	Q13	Q4	Q11
Q8	Q8	Q15	Q7	Q14	Q2	Q9	Q8
Q15	Q15	Q8	Q9	Q9	Q7	Q15	Q1
Q2	Q9	Q9	Q11	Q8	Q1	Q2	Q14
Q7	Q2	Q7	Q14	Q7	Q9	Q8	Q4
Q1	Q14	Q14	Q6	Q2	Q6	Q1	Q9
Q14	Q7	Q5	Q5	Q11	Q5	Q7	Q12
Q5	Q5	Q3	Q15	Q1	Q12	Q3	Q6
Q6	Q6	Q2	Q2	Q4	Q15	Q14	Q7
Q4	Q1	Q6	Q4	Q6	Q4	Q11	Q2
Q11	Q4	Q1	Q1	Q5	Q11	Q5	Q5
Q3	Q3	Q4	Q3	Q3	Q3	Q6	Q3

Studies have highlighted the role of gender in shaping attitudes and perceptions regarding social and environmental issues. Women are often found to place greater emphasis on ethical, social, and environmental concerns compared to men, who may prioritize economic and governance-related aspects (Khalid, Irfan, and Srivastava 2024; Zahid et al. 2023). These differences can be attributed to socialization processes and cultural norms that influence values and priorities. The results of this study align with these findings, as women demonstrated heightened sensitivity to ESG criteria, particularly in the social and environmental domains.

The impact of demographic regions on ESG perceptions is less widely studied but is no less significant. Regional cultural norms, economic conditions, and regulatory environments contribute to shaping how employees perceive ESG initiatives (Borah et al. 2023; Magio et al. 2021). For example, employees in regions with stronger environmental policies or a history of social justice movements may exhibit greater support for ESG integration. The findings of this study reflect these regional disparities, underscoring the influence of localized contexts on workforce perceptions.

The perception of controversy surrounding these results may stem from differences in prior research that prioritize other factors, such as organizational culture (Zheng et al. 2025) or personality traits (Effah et al. 2024), over demographic variables. This study does not contradict the importance of such factors; rather, it contributes to the literature by highlighting demographic diversity as an additional layer of complexity in understanding ESG integration. The results are supported by a robust methodological framework, including PLS-SEM and PROMETHEE-RATIO analyses, and a large, diverse sample, which enhances the reliability of the findings.

5 | Discussion

Demographic variables, including gender, age, tenure, position, education, and region, influence workers' perception of environmental (Kliejunas et al. 2023), social (Kolling et al. 2023), and governance (Marcoux et al. 2021) integration in corporate sustainability performance. Gender differences shape attitudes toward ESG issues, with women often more supportive of corporate social responsibility and sustainability initiatives (Khalid, Naveed, et al., 2024; Luh et al. 2024). Socialization processes may contribute to women's empathy and community-oriented mindset (Alanazi et al. 2024), leading them to prioritize ethical (Palakshappa et al. 2023), environmental (Jie et al. 2023), and social (Muthukrishnan and Bhattacharyya 2024) considerations. Additionally, women are more likely to perceive the positive impacts of ESG integration on corporate performance (Dempere and Abdalla 2023).

The sample of this investigation comprises more older men than women. Age influences employees' perceptions of ESG criteria (Ali et al. 2023), with younger generations valuing sustainability more (Berglund et al. 2020; Manchanda et al. 2023), while older employees may prioritize traditional business metrics (Trisnowati et al. 2023). Younger generations expect companies to engage in sustainable practices and view ESG integration positively (Fayyaz et al. 2023)

TABLE 8 | Paired comparisons between groups.

First group	Second group	Statistic	*p* adjusted
G1	G2	0.430	1.000
G1	G3	−1.905	1.000
G1	G4	−0.974	1.000
G1	G5	0.609	1.000
G1	G6	1.236	1.000
G1	G7	0.171	1.000
G1	**G8**	−3.346	0.023
G2	G3	−2.336	0.546
G2	G4	−1.404	1.000
G2	G5	0.178	1.000
G2	G6	0.806	1.000
G2	G7	−0.260	1.000
G2	**G8**	−3.777	0.004
G3	G4	0.932	1.000
G3	G5	2.514	0.334
G3	G6	3.141	0.047
G3	G7	2.076	1.000
G3	G8	−1.441	1.000
G4	G5	1.583	1.000
G4	G6	2.210	0.759
G4	G7	1.144	1.000
G4	**G8**	−2.373	0.495
G5	G6	0.627	1.000
G5	G7	−0.438	1.000
G5	**G8**	−3.955	0.002

Note: The bold emphasis is to highlight group 8 (G8) in the table.

There is no gender difference regarding tenure in the company. Tenure shapes employees' views of ESG integration, with longer-term employees potentially more resistant to new initiatives (Ailman et al. 2017; Khvorostyanaya 2022; Kucharska and Kowalczyk 2019). They may have a deeper understanding of company culture and be more skeptical of new ESG initiatives (Allen 2023), whereas newer employees may perceive them as innovative and necessary for future success (Wagner and Boyle 2022).

Men tend to spend more time in the same position within the company. Position within the company significantly influences perception of ESG criteria (Zhu et al. 2022), with executives focusing on strategic benefits like risk management (Alghababsheh et al. 2023) and long-term value creation (López-Concepción et al. 2024), while lower-level employees are more concerned about daily work impacts and job security (Pereira et al. 2024). Executives are more supportive of ESG initiatives when they align with corporate strategy (Diaz-Fernandez et al. 2024) and performance metrics (Tariq et al. 2024), whereas frontline employees may see them as additional job responsibilities (Thakur and Pathak 2023).

The study's sample includes more highly educated women. Higher education correlates with a better understanding of ESG concepts and their business implications (Meling et al. 2023). Individuals with higher education levels are more likely to support and understand the benefits of ESG initiatives (Barbosa et al. 2024; Shahzad et al. 2023).

Employees' geographic location can influence their perception of ESG issues due to regional norms (Borah et al. 2023), values (Khunkaew et al. 2023), and regulatory environments (Akomaning et al. 2023). Regions with stringent environmental regulations (Jahanger et al. 2023) and social policies (X. Li et al. 2022) tend to be more supportive of ESG initiatives, shaping employees' views. Cultural norms (Magio et al. 2021) and legal frameworks (Abu Romman and Al Kuisi 2023) also influence how employees perceive ESG criteria, with regions highlighting environmental policies fostering more positive attitudes toward ESG integration (Sabbir and Taufique 2022).

Demographic variables significantly impact workers' perceptions of ESG integration's effects on corporate sustainability performance (Trivedi 2023). Understanding these influences is vital for companies to effectively implement ESG strategies that resonate with diverse workforce segments (Bar-Massada et al. 2023; Berger et al. 2023; König et al. 2016)

This study acknowledges the substantial body of literature emphasizing the influence of employee personality traits (Effah et al. 2024) and organizational culture (and climate) (Zheng et al. 2025) on perceptions of ESG practices. These factors undoubtedly play critical roles in shaping employees' attitudes and behaviors within organizations. However, demographic variables such as gender (Gavana et al. 2024), age (Fayyaz et al. 2023), tenure (Liu et al. 2024), education (J. Su and Xue 2024), and geographic region (Zhong and Cheng 2024) remain highly relevant as complementary factors that offer additional explanatory power in understanding variations in employee perceptions of ESG practices.

The Big Five personality traits—openness, conscientiousness, extraversion, agreeableness, and neuroticism—have been widely studied in the context of ESG engagement (Bildirici et al. 2024; Effah et al. 2024; Liu et al. 2024; Xia et al. 2024). However, research has shown that personality traits often interact with demographic variables to influence perceptions and behaviors. For instance, women may exhibit higher levels of agreeableness and conscientiousness on average, which are traits positively associated with ethical and sustainability-oriented behaviors (Dempere and Abdalla 2023). Similarly, age can moderate the relationship between personality traits and ESG engagement, as older employees may demonstrate greater conscientiousness and risk aversion, influencing their sustainability-related priorities (Alawadi et al. 2024).

Organizational culture and climate are critical in shaping collective norms and values related to ESG practices (Zheng et al. 2025). However, demographic diversity within the workforce contributes significantly to the formation and evolution

of organizational culture (Gavana et al. 2024). For example, a diverse workforce introduces varying perspectives and experiences that can enrich organizational values and norms (Monteiro et al. 2024). Geographic differences, in particular, may reflect cultural variations in regions where the organization operates, influencing how ESG practices are implemented and perceived (Fu et al. 2022)

While personality traits and organizational culture provide a robust theoretical foundation for understanding ESG engagement, demographic variables offer unique insights that cannot be fully captured by these constructs alone. Demographics provide context-specific information about the workforce composition, which can help explain variations in how employees interpret and respond to ESG initiatives (Su & Xue, 2024). This study demonstrates that gender and geographic region, in particular, play significant roles in shaping perceptions, emphasizing the need for tailored ESG strategies that address demographic-specific concerns.

5.1 | Policy and Managerial Implications

The findings of this study provide significant policy and managerial implications that contribute to the effective integration of ESG criteria into corporate sustainability practices

From a policy perspective, the results highlight the importance of considering workforce demographic diversity when formulating regulations and guidelines for ESG practices. Policymakers should encourage organizations to adopt inclusive ESG frameworks that address the varied needs and perceptions of diverse employee groups.

These results align with other studies, in which (i) policies should promote gender-sensitive approaches to sustainability, recognizing the differences in how men and women perceive and engage with ESG initiatives (Gallego-Sosa et al. 2024); (ii) regional disparities in perceptions call for localized ESG guidelines that consider cultural and socio-economic factors. Tailoring ESG policies to regional contexts ensures their relevance and effectiveness (Fu et al. 2022); (iii) governments and regulatory bodies should incentivize companies to invest in training programs that increase awareness of ESG principles across all demographic groups (Shehawy et al. 2024)

From a managerial standpoint, this research offers actionable insights for corporate leaders seeking to enhance the effectiveness of their ESG strategies that align with other studies, in which (i) managers should implement targeted ESG initiatives that address the specific concerns of demographic subgroups, such as women or younger employees, who may have distinct perspectives on sustainability practices (Heubeck 2024); (ii) organizations can improve employee engagement by actively involving workers from diverse demographic backgrounds in the development and evaluation of ESG initiatives. This participatory approach fosters a sense of ownership and commitment to sustainability goals (Gavana et al. 2024); (iii) to address the disparities in perception between regions, managers should design region-specific ESG strategies that resonate with the values and priorities of the local workforce (Cho et al. 2021); (iv) finally, leveraging the insights from this study, companies should regularly assess the impact of their ESG initiatives on employee satisfaction and organizational performance, using tools like PLS-SEM and PROMETHEE-RATIO to ensure data-driven decision-making (Darsono et al. 2025; Ziolo et al. 2019).

These implications underscore the need for organizations to adopt a proactive and inclusive approach to ESG integration, aligning their strategies with both policy requirements and workforce diversity

6 | Conclusions

Based on the data provided and the previous analysis, several conclusions can be drawn about the relative influence of demographic variables such as gender and demographic region in comparison with age, length of time at the company, current position, and level of education on the perception of workers on the impacts of integrating ESG criteria on corporate sustainability performance.

Gender and social influences markedly shape attitudes toward social and environmental matters. Women generally exhibit stronger support for ESG initiatives, heightened ethical, social, and environmental concerns due to inherent empathetic tendencies and social conditioning. For instance, female representation on corporate boards correlates with advocacy for environmental and social governance practices (Masi et al., 2021). Conversely, men may approach ESG support differently, often highlighting economic and governance aspects over social and environmental impacts (Madden 2022). Regarding geographic regions, prevailing cultural norms and values significantly shape perceptions of ESG criteria. Regions characterized by robust environmental activism (Brochado et al. 2017), social justice movements (Cuenca-Soto et al. 2023), and stringent regulatory frameworks (Cicchiello et al. 2023) tend to foster favorable attitudes toward ESG integration.

Cross-regional comparisons reveal that employees in regions with stringent environmental regulations and a culture of corporate responsibility exhibit greater support for ESG initiatives. Conversely, areas with weaker regulatory frameworks may breed skepticism or limited awareness regarding ESG benefits. While age influences perceptions due to generational disparities (Atman Uslu and Yildiz Durak 2022), its impact is less pronounced compared to gender and region, which are deeply embedded in cultural and social values. Company tenure impacts familiarity and adaptability to change (de Gilder et al. 2005), yet it does not fundamentally alter core values shaped by gender and regional cultural norms.

Position within a company influences strategic versus operational perspectives on ESG (Soh and Martinov-Bennie 2015) but plays a secondary role compared to the broader cultural influences of gender and region. While higher education levels enhance awareness of ESG issues (Saleh and Atan 2021), they do not necessarily alter core values influenced by gender and region. Gender and demographic region emerge as the most influential variables affecting workers' perceptions of ESG integration's impact on corporate sustainability.

These variables shape fundamental values and attitudes toward ESG issues more profoundly than age, tenure, position, or education level. This underscores the necessity for companies to tailor their ESG communication and implementation strategies to accommodate these influential demographic factors. Engaging employees through culturally and socially resonant approaches can enhance the effectiveness and acceptance of ESG initiatives, thereby bolstering corporate sustainability performance.

This study makes significant theoretical contributions to the literature on ESG criteria and corporate sustainability performance by bridging critical gaps in the understanding of demographic influences on ESG perceptions.

First, this research expands the application of theoretical frameworks, such as stakeholder theory and social identity theory, to the ESG context. By demonstrating how demographic variables, such as gender, age, tenure, education, and geographic location, shape workers' perceptions of ESG criteria, the study extends the boundaries of these frameworks to include workforce diversity as a key determinant of organizational sustainability outcomes.

Second, the integration of advanced analytical methods—PLS-SEM and the PROMETHEE-RATIO method—provides a novel methodological contribution to the field. The study illustrates the value of combining these tools for exploring complex, multidimensional relationships, setting a precedent for future research on ESG and sustainability. This approach contributes to the methodological literature by offering a robust framework for analyzing worker perceptions and organizational performance.

Third, the study fills a gap in the ESG literature by addressing the underexplored role of workforce demographics in influencing sustainability practices. Prior research has largely focused on external stakeholders or organizational-level metrics (Amarna et al. 2025; Lui and Zainuldin 2024). By emphasizing the internal perspectives of workers, this study highlights the importance of demographic nuances in shaping ESG strategies, enriching the theoretical discourse on employee-centered sustainability initiatives.

Finally, the research contributes to the evolving discourse on the practical relevance of ESG frameworks. It provides theoretical insights that connect demographic diversity to the successful integration of ESG principles, emphasizing the role of inclusivity and representation in fostering sustainable corporate practices. These insights advance our understanding of the interplay between theory and practice in the context of ESG adoption.

By addressing these gaps, the study advances the theoretical understanding of ESG integration and offers a foundation for further exploration of the demographic dimensions of corporate sustainability

This study has limitations, notably the nonrepresentative sample regarding gender distribution, potentially biasing results. Cross-sectional data were used, offering insights at a single time point and overlooking temporal changes in ESG perceptions. Subjectivity in perception measurements, influenced by personal biases and recent company actions, may hinder data reliability. Additionally, demographic variables interact intricately (e.g., gender and demographic region), influencing perceptions in multifaceted ways.

Drawing from the analysis and identified limitations, future research avenues can elucidate the impact of demographic variables like gender, age, tenure, working hours, education, and region on ESG perceptions. Tracking longitudinal changes in employee attitudes toward ESG integration can unveil evolving trends. Comparative studies across regions can elucidate how cultural norms and regulatory environments shape ESG perceptions. Exploring the influence of different educational backgrounds, including specialized sustainability training, is warranted. Investigating corporate culture's role, including leadership commitment and organizational values, on ESG perceptions is crucial. Assessing how economic fluctuations affect employee views on ESG initiatives merits attention. Developing and validating robust tools to measure ESG insights comprehensively is essential. Addressing these gaps can provide a deeper understanding of how demographic variables influence ESG perceptions, informing the development of more effective and inclusive corporate ESG strategies.

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Ethics Statement

The study was approved by the Ethics Committee of the Federal University of Paraíba (CAAE: 37320620.8.0000.5185).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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