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RESEARCH ARTICLE

A Study on environmental accounting value assessment from the perspective of business sustainable development

Tong Luan*

College of Business and Economics, Australian National University, Canberra, 2601, Australia

*** Corresponding author:** Tong Luan, 1137977872@qq.com

ABSTRACT

This study investigates environmental accounting value assessment from a social-psychological perspective in the context of business sustainable development. Using data from 285 manufacturing firms, the research examines how psychological factors influence environmental accounting implementation and effectiveness. Results reveal that managerial environmental cognition significantly affects environmental accounting value assessment both directly ($\beta = 0.305$, $p < 0.01$) and indirectly through environmental responsibility orientation (indirect effect = 0.139, $p < 0.01$). Stakeholder pressure acts as a critical moderator, with stronger effects under high pressure conditions ($\beta = 0.412$, $p < 0.01$) compared to low pressure conditions ($\beta = 0.156$, $p < 0.05$). The impact of psychological drivers varies by firm size, with stronger effects in large enterprises ($\beta = 0.375$, $p < 0.01$) versus small-medium enterprises ($\beta = 0.265$, $p < 0.01$). These findings extend environmental accounting theory by explicating psychological mechanisms underlying implementation and demonstrating the dynamic interplay between internal cognitive factors and external pressures. The study provides practical implications for enhancing environmental accounting practices through integrated approaches addressing both psychological readiness and technical capabilities.

Keywords: environmental accounting value assessment; managerial environmental cognition; environmental responsibility orientation; stakeholder pressure; business sustainable development

1. Introduction

The escalating global environmental challenges have professionally reshaped the business landscape, making environmental responsibility not merely an option but a necessity for contemporary corporations. Environmental accounting has emerged as an imperative tool for organizations to measure, manage, and report their environment-related consequences. Recent research by Bustos-Contell et al.[1] has identified the significant impact of environmental accounting techniques in creating business value through strengthened stakeholder relationships, effective risk management, and enhanced corporate image.

The rise of ESG (Environmental, Social, and Governance) investing has placed unprecedented pressure on environmentally transparent information disclosures. This development can be observed in Khan and Gupta's[2] work, which demonstrates a strong positive relationship between environmentally friendly accounting techniques and corporate financial performance through a comprehensive meta-analysis. The

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increased demand for environmental reporting, as examined by Christensen et al.[3], has accelerated this development, transforming environmental accounting into an integral component of corporate governance structures. For developing sustainable enterprises, environmental accounting has evolved beyond its traditional compliance role to become a critical source for strategic decision-making. Mondal et al.[4] reveal that environmentally friendly accounting disclosures significantly mediate the relationship between financial performance and environmental development objectives, while Burritt et al.[5] provide compelling evidence that companies implementing integrated environmental accounting systems demonstrate superior environmental performance and enhanced decision-making capabilities. This evolution signifies a broader transformation in corporate thinking towards embedding environmental considerations into core business strategies.

This study's theoretical contribution lies in the combination of social-psychological perspectives with conventional frameworks in environmental accounting, which broadens the perspective on how firms evaluate and practise environmental accounting. This study contributes to the literature on the implementation of environmental accounting by focusing on the psychological aspects of the implementation processes, as most theories are centred on technical-rational considerations. Chen et al.[6] examined behavioural intention concerning value appraisal in environmental accounting, but the current study proposes a model that explains the appraisal processes within the environmental accounting framework. The structure of environmental accounting as defined through the Global Reporting Initiatives[7] is augmented with cognitive and behavioural elements that shape managerial interpretation and application of these frameworks.

This study expands stakeholder theory by explaining the cognitive mechanisms by which stakeholder pressures affect organisational environmental conduct. Instead of regarding stakeholder influence as simply an outside force, the model understands it as part of an interplay between external expectational stimuli and internal psychological reactions. This reconceptualisation enhances stakeholder theory by identifying the mediating and moderating processes that Soomro et al.[8] and Dhar et al.[9] cite as transforming organisational actions into responsive reactions to stakeholder demands. The research also builds the new emerging literature on environmental management capabilities by illustrating the role of managerial environmental cognition anchored in responsibility orientation as a motivational basis for capability enhancement. Scarpellini et al.[10] have pointed out the relevance of dynamic capabilities in environmental accounting, and this study builds on their work by outlining the enabling psychological conditions for the establishment of these capabilities.

The practical contribution of this study is improving the efficiency of environmental decisions in the corporate world. This research helps organisations to centre the environment and aid in decision-making efficiency by illuminating the behavioural and technical aspects of the environmental accounting systems. Accounts of carbon management, as studied by Abhishek et al.[11], incorporate evolving methods aimed at enhancing accountability and transparency and rely on the identification of psychological factors that are facilitators to successful implementation. This value aids the societal dimension by studying the effects of environmental accounting on corporate behaviour and decision-making, thus providing a pathway for companies to understand how to shift towards environmentally friendly practices, as proposed by Abhishek et al.[12] on sustainable strategies and responsible business practices.

This study seeks to develop a complete picture of the value assessment of environmental accounting as it relates to corporate sustainable development within the context of social psychology. The focus of the research is on studying the psychological determinants of effectiveness and practice with regard to environmental accounting and how it affects corporate sustainable development. This study seeks to

contribute to the work of Mishra et al.[13] and Li et al.[14] on corporate environmental responsibility and sustainable performance by systematically examining the relationships among the implementation of environmental accounting, the drivers, psychological motivators, and organisational behaviour…

2. Literature review and theoretical framework

2.1. Structural framework of environmental accounting

The practice of environmental accounting has undergone substantial evolution in the past decades, shifting from one of merely compliance to a practice of strategic management. The structural framework of environmental accounting is composite in nature, especially through the Global Reporting Initiatives (GRIs) lens. As pointed out by Acharya[7], GRIs offer uniform guidelines which enhance the comparability and credibility of environmental accounting at organisational levels. These frameworks combine financial and non-financial data, thus actively contributing towards the informed decision-making of stakeholders regarding corporate environmental performance. Frameworks of such accounting rest on the changing mindset and broader trends of the corporate world that are increasingly integrating environmental issues into the core strategic decisions of the firm.

Burritt et al.[5] capture the influence of environmental management accounting on cleaner production by demonstrating its role in providing structured identification and measurement of environmental costs and benefits. Environmental accounting frameworks have been instrumental in changing the way organisations assess, oversee, and communicate their impacts on the environment. This facilitates informed decisions on resource allocation and investments of the organisation. According to Acharya[7] the Global Reporting Initiative standards are the most adopted framework for sustainability reporting which allows organisations to quantify and articulate their environmental achievements. These frameworks greatly improve the clarity and responsibility regarding corporate environmental impacts.

The environmental accounting frameworks are integrated with the more general corporate social responsibility (CSR) policies of a company. Some studies focusing on CSR accounting in India noted strong disparities in disclosure practices within different sectors and between larger and smaller firms. As noted by Ashok and Divyashree[15], while the minimum thresholds set by regulations are often met, many businesses surpass these benchmarks in order to enhance their market position and improve relations with stakeholders. Their findings affirm that the more advanced the environmental accounting of a company is, the better its environmental and financial performance. The integration of environmental accounting frameworks with organisational performance emphasises the guiding role these frameworks have on sustainable business conduct.

2.2. Social-psychological mechanisms in environmental accounting

Both individual and organisational social-psychological mechanisms greatly impact the adoption and efficiency of environmental accounting practices. Environmental management in organisational contexts is affected by environmental maintenance drivers' emotional, cognitive, and behavioural aspects. Soomro et al.[8] support that environmental practices are ingrained psychologically, especially in constraining environments where there is organisational commitment to environmental responsibility. Their research shows how psychological factors of environmental awareness, attitudes, and commitment affect the adoption and effectiveness of environmental accounting. This is further corroborated by Chen et al.[6] who assert that the effectiveness and adoption of environmental accounting is deeply rooted in behavioural intention and psychological commitment of the managers.

The cognitive dimension of the implementation of environmental accounting works in different ways. Managers' cognitive frameworks clearly determine the factors in which environmental accounting information is analysed and utilised in an organisation. This involves their appreciation of environmental issues, the concern they have about the risks posed by the environment, and the assessment of the strategic consequences of the performance in regard to the environment. Dhar et al.[9] posit strong interfaces between cognitive processing of environmental accountability with the efficacy of the implementation of environmental practice. Their work supports the notion that the environmental responsibility mental models held by managers are determinant to corporate practices concerning environmental accounting. The emotional aspects of accounting for the environment are equally relevant as emphasised by Bustos-Contell et al.[1], who illustrate the mediation of environmental practices through psychological factors in value adding. Their study demonstrates that those factors referred to as management level environmental consciousness, value consciousness, as well as emotional investment meaningfully shape the level of intensity and efficacy with which environmental accounting is done.

The social aspect of accounting for the environment translates into processes of decision making and collective thinking in an organisation. Khan and Gupta[2] show with meta-analysis the impacts of social dynamics, institutional dynamics, and group decision making on the practice of environmental accounting. Organisational culture, the commitment of leadership, and institutional influences determine the extent to which environmental accounting is practised in organisations. Christensen et al.[3] illustrate the impact of mandatory CSR and sustainability reporting on the social structure of organisations and its impact on the practice of environmental accounting. Accompanying social legitimacy, as they argue, also influences the adoption and implementation of environmental accounting practices. These sociopsychological attitudes, taken together, influence the impact of accounting for the environment on the sustainable development of business activities.

2.3. Carbon management accounting and sustainability reporting

Foremost, carbon management accounting is an archetypal attenuate and developing feature threat of environmental accounting. It is said to foster transparency and accountability because of the specific methods it provides for measuring, managing, and reporting carbon emissions. Abhishek et al.[11] investigate what factors compel businesses towards carbon management accounting and what effectiveness these practices have on accounting and disclosure. Their findings show that there are many determinants of the compliance of carbon management accounting—these include legal, ethical, economic, as well as sociological factors. It is noted, however, that legal and ethical bases have a dominant focus in compliance. Comello et al.[16] propose a time-consistent standard of corporate carbon reporting, which includes emission forecasting, periodic revision of the forecasts, and updating on reductions actually achieved. With this, corporate carbon disclosures become clearer and more accountable, thus allowing stakeholders to assess organisations better regarding the achievement of set objectives.

Recent literature discusses the connection between sustainable business strategies and environmental accounting. Evidence from India, provided by Abhishek et al.[12], suggests companies that adopt comprehensive business responsibility practices perform better in terms of sustainability. Their study highlights the role of environmental accounting in linking strategic sustainability goals and operational level execution, allowing businesses to track and document actions taken on their environmental commitments. Cerciello et al.[17] analyse sustainable business practices and their profitability with a particular focus on the role of strategic disclosure vis-à-vis the profitability nexus. Their results demonstrate that corporations enhance their financial results by strategically executing and communicating sustainable business practices, including environmental accounting. These studies bring to the fore the need for broader policies on

environmental sustainability in businesses, strategically embedding environmental accounting for the achievement of substantial environmental and financial returns.

Sustainability reporting practices have changed remarkably in an effort to meet stakeholder needs for environmental disclosure. Sundarasen et al.[18] perform a meta-synthesis of studies on accounting and sustainability and discern the patterns and developments in this area. An analysis of sustainability reporting noted an upward trend in reporting and environmental accounting research starting in 2022, which appears to align with increased worldwide concern and regulatory focus. Weerathunga et al.[19] analyse the impact of International Financial Reporting Standards (IFRS) on socially responsible business practices, using CSR reporting and IFRS adoption in India as a case study. The study documents that adopting IFRS improves the verifiability and prevalence of CSR reporting, including environmental disclosures. The changes noted above in the frameworks and practices of reporting sustainability integrate further into the framework within which business perceives the governance and relations with stakeholders.

2.4. Research hypotheses

Based on the psychological drivers and social-psychological mechanisms discussed above, this study develops hypotheses examining the relationships between managerial environmental cognition, environmental responsibility orientation, and environmental accounting value assessment. Drawing particularly from Burritt et al.[5] and Scarpellini et al.[10], we emphasize the critical role of management cognition in environmental accounting implementation. This approach aligns with recent findings by Hazaea et al.[20] regarding the evolution of carbon accounting practices and their relationship with managerial cognition. The environmental cognition-behavior relationship is further supported by Chen et al.[6], who demonstrate how cognitive frameworks translate into concrete accounting practices.

The first hypothesis focuses on the direct relationship between managerial environmental cognition and environmental accounting implementation:

H1: Higher levels of managerial environmental cognition positively influence the implementation quality of environmental accounting practices.

H1a: Managerial environmental awareness positively affects environmental information disclosure completeness.

H1b: Managerial environmental knowledge positively influences environmental accounting system sophistication.

Drawing from Khan and Gupta[2] and Mondal et al.[4], the second hypothesis addresses the mediating role of organizational environmental responsibility. This mediation effect is consistent with Shakil et al.[21], who explore aspects of effectiveness in environmental management systems and how organizational responsibility orientation affects implementation outcomes. Additionally, Sameer[22] provides evidence from Maldives public companies showing how organizational responsibility mediates financial performance relationships:

H2: Organizational environmental responsibility orientation mediates the relationship between environmental cognition and accounting value assessment.

H2a: Environmental responsibility orientation positively mediates the relationship between managerial cognition and environmental performance measurement.

H2b: Environmental responsibility orientation positively mediates the relationship between managerial cognition and environmental cost allocation.

Building on findings from Soomro et al.[8] and Dhar et al.[9] regarding stakeholder influence, the third hypothesis examines the moderating effect of stakeholder pressure:

H3: Stakeholder pressure positively moderates the relationship between environmental responsibility orientation and environmental accounting value assessment.

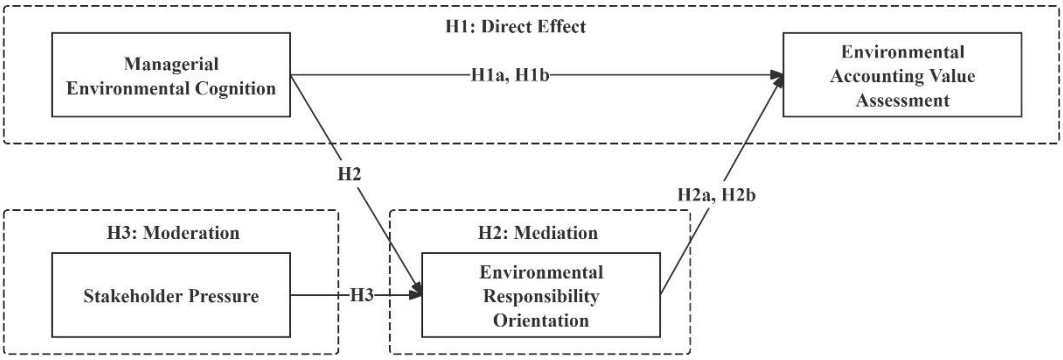

Figure 1. Theoretical framework of environmental accounting value assessment.

As shown in **Figure 1**, this theoretical framework integrates both stakeholder theory and environmental management accounting theory to explain the relationships between psychological drivers, organizational mechanisms, and environmental accounting outcomes. The direct path from managerial cognition to value assessment (H1) represents the cognitive-behavioral link established in prior research[7]. The mediating role of environmental responsibility orientation (H2) captures the organizational internalization process documented by Burritt et al.[5]. The moderating effect of stakeholder pressure (H3) reflects the external influences identified in recent studies by Soomro et al.[8] and Khan and Gupta[2].

3. Research Methods

3.1. Data source and sample selection

This study employs a mixed-methods approach to data collection, combining survey data from manufacturing enterprises with secondary data from corporate environmental reports. The primary data collection was conducted between March 2024 and June 2024, focusing on manufacturing companies listed on the main board markets. The initial sample pool consisted of 450 manufacturing firms selected based on their market capitalization and environmental disclosure practices.

The sample selection process followed a systematic filtering approach to ensure data quality and relevance. First, companies were screened for continuous operation throughout the study period to maintain data consistency. Second, firms with incomplete environmental disclosure data or missing financial information were excluded from the sample. Third, companies that underwent major restructuring or experienced significant changes in their environmental management systems during the study period were removed to avoid potential confounding effects.

The survey section focused on senior managers and environment management professionals in these companies with an interest in persons involved in direct environment practice and decision-making processes. Responses were drawn through a scheme of stratified random sampling in order to enable satisfactory representation of different industry subsectors and firm scales. For elicitation of responses, a 68.4% response rate was achieved with 308 valid collections taken. As a precaution against non-response bias, a comparative analysis between early and late respondents revealed no significant variation in key factors.

Secondary information was drawn from a variety of sources such as annual reports for companies, sustainability reports, and statements of environment disclosures. The secondary data were cross-matched with survey information for checking accuracy information and ensuring dependability of data. In development of survey, several controls for processes were adopted in an attempt to avert any common method bias including a criterion and predictor variable separation and use of alternative forms of response for different constructs.

The overall final sample is 285 companies when survey and secondary data matching and incomplete forms are excluded. The size of the sample is comparable with, but in most cases larger, samples for comparative studies in environment accounting protocols and is satisfactory in terms of providing sufficient statistical power for our tests. The sample covers approximately 63.3% of target population and, therefore, offers satisfactory representativeness for the manufacturing sector.

A preliminary examination of sample composition reveals evenly balanced distribution across different industry subsectors with dominant segments in chemical manufacturing (22.8%), electronics (19.6%), and machinery manufacturing (17.5%). Geographic distribution of the sample covers all principal industrial regions with relatively high concentrations in coastal areas with traditionally well-established industries. On average, our samples have an age of 15.8 years with an average annual revenue of RMB 5.83 billion, and indicative of a mix of mature and developing companies, consistent with sample compositions in similar studies[2].

3.2. Variable design

This section presents an overall variable measurement and operationalization scheme for value measurement for complex relationships in environmental accounting. In our scheme, objective and perceptual dimensions both enter in a balanced form for a proper evaluation of constructs in research.

Both effectiveness and the quality of implementation enter into consideration in EAVA (Environmental Accounting Value Assessment). Implementation quality measures the level of sophistication and comprehensiveness of environmental accounting, while effectiveness measures practical consequences and added strategic value. **Table 1** portrays our scheme for EAVA measurement, confirmed with a proper pilot testing with industry professionals.

Table 1. Measurement items for environmental accounting value assessment.

Dimension	Indicator	Measurement Description	Scale/Range
Implementation Quality	Disclosure Completeness	- Comprehensiveness of environmental cost reporting - Coverage of environmental impact categories - Timeliness of environmental information disclosure	1-7 Likert
	System Sophistication	- Integration with existing accounting systems - Technological advancement level - Data collection and processing capabilities	1-7 Likert
Effectiveness	Cost-Benefit Performance	- Environmental cost savings ratio - Resource efficiency improvements - Return on environmental investments	Ratio scale
	Strategic Integration	- Alignment with corporate strategy - Decision-making influence - Stakeholder communication effectiveness	1-7 Likert

The implementation quality indicators in **Table 1** reflect both the breadth and depth of environmental accounting practices. Disclosure completeness evaluates not only the quantity of environmental information disclosed but also its quality and relevance. System sophistication measures the technical and operational aspects of environmental accounting implementation, including the integration with existing management systems.

For independent variables, we developed a comprehensive measurement scheme focusing on psychological and organizational factors, as detailed in **Table 2**. This framework captures both individual and organizational level constructs that influence environmental accounting practices.

Table 2. Measurement items for independent variables.

Variable	Dimension	Measurement Items	Measurement Approach
Managerial Environmental Cognition	Environmental Awareness	- Environmental impact recognition - Sustainability value perception - Environmental risk assessment capability	7-point scale: 1 = Very Low 7 = Very High
	Environmental Knowledge	- Environmental regulation expertise - Green technology understanding - Environmental management skills	7-point scale
Environmental Responsibility Orientation	Performance Measurement	- Environmental goal setting practices - Performance indicator development - Monitoring system effectiveness	7-point scale
	Cost Allocation	- Resource allocation methodology - Environmental cost tracking - Investment decision criteria	7-point scale

The measurement items in **Table 2** were carefully designed to capture both explicit and implicit aspects of environmental management capabilities. Environmental awareness items assess both cognitive and affective dimensions of managers' environmental orientation, while environmental knowledge items focus on practical expertise and technical understanding.

In our research design, we chose carefully considered control variables to capture a range of organizational and contextual factors that can have a bearing on environmental accounting practice. Firm size is a key control variable, captured through both the natural logarithm of assets and number of employees, since larger companies generally have more resources to devote to environment-related programs and have a larger stakeholder scrutiny burden. Industry types are captured in terms of a full-index controlling for pollution intensity class, consumption behavior, and regulatory burden level in respective industries. By controlling for these, we can capture industry variation in terms of environment requirements and practice.

We include financial performance metrics in our control variables in terms of controlling for any spurious impact of availability of resources and investing capacity in terms of environment practice in terms of Return on Assets (ROA) for operational efficiency, operating margin for capture of profitability, and market-to-book for capture of valuation and growth opportunity consideration. Including these financial controls helps in isolating our focal variable effects from performance-related factors.

We also control for organizational factors that can affect environmental accounting practice. Firm age controls for practice and learning in the organization, and ownership structure controls for governance and stakeholder influences. As an additional dimension, international operation breadth controls for variation in environment management requirements in terms of geographical locations and variation in stakeholder demands. All these organizational dimensions together form a strong control mechanism that strengthens our focal finding reliability in terms of controlling for firm-specific heterogeneity.

The measurement framework has undergone rigorous validation through both qualitative and quantitative methods. Pilot testing with 30 firms helped refine the measurement items, while statistical validation confirmed strong psychometric properties. Factor analyses revealed clear loading patterns, with composite reliability values exceeding 0.80 for all multi-item scales.

3.3. Model construction

Building upon our theoretical framework and variable design, we develop a series of econometric models to test our research hypotheses. The baseline model examining the direct relationship between managerial environmental cognition and environmental accounting value assessment is specified as follows:

$$EAVA_{it} = \beta_0 + \beta_1 MEC_{it} + \gamma Controls_{it} + \varepsilon_{it} \quad (1)$$

where $EAVA_{it}$ represents the environmental accounting value assessment for firm i in period t, MEC_{it} captures managerial environmental cognition, and $Controls_{it}$ represents the set of control variables. The coefficient β_1 measures the direct effect of managerial cognition on environmental accounting implementation.

To test the mediating effect of environmental responsibility orientation, we employ a three-step mediation analysis model:

$$ERO_{it} = \alpha_0 + \alpha_1 MEC_{it} + \gamma Controls_{it} + \varepsilon_{it} \quad (2)$$

$$EAVA_{it} = \beta_0 + \beta_1 MEC_{it} + \beta_2 ERO_{it} + \gamma Controls_{it} + \varepsilon_{it} \quad (3)$$

where ERO_{it} represents environmental responsibility orientation. The mediation effect is assessed through the product of coefficients α_1 and β_2, following the Baron and Kenny approach.

For testing the moderating effect of stakeholder pressure, we introduce an interaction term in our model:

$$EAVA_{it} = \beta_0 + \beta_1 ERO_{it} + \beta_2 SP_{it} + \beta_3 (ERO \times SP)it + \gamma Controlsit + \varepsilon_{it} \quad (4)$$

where SP_{it} represents stakeholder pressure, and β_3 captures the interaction effect. The coefficient β_3 indicates the strength and direction of the moderation effect.

To address potential endogeneity concerns, we employ a two-stage least squares (2SLS) approach. The first-stage regression model is specified as:

$$MEC_{it} = \alpha_0 + \alpha_1 IV_{it} + \gamma Controls_{it} + \varepsilon_{it} \quad (5)$$

where IV_{it} represents our instrumental variables. We select regional environmental regulation intensity and industry average environmental cognition as instruments, following the relevance and exclusion restriction criteria.

The models incorporate robust standard errors clustered at the firm level to address potential heteroscedasticity and serial correlation issues.

3.4. Research tools

The research methodology employs STATA 17.0 as the primary platform for statistical analysis, focusing on hypothesis testing and econometric modeling, with SPSS 28.0 supporting preliminary data screening and descriptive statistics. These software platforms were selected for their robust capabilities in handling our analytical requirements and implementing sophisticated statistical procedures. The questionnaire development process followed a systematic approach to establish reliable measurement instruments, with initial scale construction drawing from established environmental accounting literature

while incorporating newly developed items specific to our research context. The measurement tools underwent expert panels consisting of academic and practitioner reviewers, and two rounds of pilot testing with target respondents for refinement of question format and improvement of item clarity and measurement accuracy.

The analytic scheme utilizes a range of statistical techniques including descriptive statistics and correlation analysis for initial examination of the data, hierarchical regression analysis for testing main effects, and Baron and Kenny sequence with bootstrapped procedures (resamples 5,000) for testing for mediation effects. Moderation analysis involves interaction terms and simple slope tests, and two-stage least squares regression for dealing with endogeneity. Robust standard errors are included in all analysis to correct for potential heteroscedasticity. The measurement scheme was subjected to stringent validation using both qualitative and quantitative approaches, and through factor analysis showed strong loading profiles and composite reliability values of over 0.80 for all multi-item scales, with strong psychometric properties.

The use of an integrated approach to tools and analysis techniques ensures methodological soundness with adaptability for dealing with a range of dimensions addressed in our research questions. The integration of sophisticated question format and full range of analysis techniques affords a sound basis for testing complex relationships in environmental accounting value measurement. In the conduct of research, not only in planning but in analysis and interpretation, specific care was taken in maintaining analysis accuracy and data quality.

4. Research results

4.1. Descriptive statistics

This section presents a careful analysis of the sample demographics and descriptive statistics of significant variables in our investigation. The final sample is 285 companies in various industries in manufacturing, surveyed between 2024 and 2024, March and June, respectively. As can be seen in **Table 3**, the sample is represented with an even distribution in significant industries in manufacturing, with the biggest proportion (22.8%) in chemical, 19.6% in electronic, and 17.5% in machinery manufacturing. The distribution mirrors closely with overall composition in the manufacturing sector, representing high representativeness of our sample.

Table 3. Sample distribution by industry.

Industry Sector	Number of Firms	Percentage	Cumulative Percentage
Chemical Manufacturing	65	22.8%	22.8%
Electronics	56	19.6%	42.4%
Machinery Manufacturing	50	17.5%	59.9%
Textile and Apparel	38	13.3%	73.2%
Metal Products	35	12.3%	85.5%
Others	41	14.5%	100.0%
Total	285	100.0%	-

Table 4 presents the descriptive statistics of the main variables in the study. The Environmental Accounting Value Assessment (EAVA) shows a mean value of 4.212 on a seven-point scale, with a standard deviation of 0.923, indicating moderate levels of environmental accounting implementation across the sample. Managerial Environmental Cognition (MEC) exhibits a similar pattern with a mean of 3.986 and standard deviation of 0.968, reflecting moderately positive environmental awareness among management

teams. The skewness and kurtosis values for most variables fall within acceptable ranges, although ROA shows a slightly elevated kurtosis (3.452), suggesting some concentration around the mean with occasional outliers.

Table 4. Descriptive statistics of main variables.

Variable	N	Mean	SD	Min	Max	Skewness	Kurtosis
Environmental Accounting Value Assessment (EAVA)	285	4.212	0.923	1.652	6.587	-0.376	2.945
Managerial Environmental Cognition (MEC)	285	3.986	0.968	1.428	6.756	-0.312	2.723
Environmental Responsibility Orientation (ERO)	285	4.135	0.904	1.876	6.489	-0.345	2.832
Stakeholder Pressure (SP)	285	4.487	0.945	2.034	6.754	-0.425	3.046
Firm Size (ln assets)	285	22.245	1.612	18.043	26.654	0.253	2.387
ROA	285	0.068	0.062	-0.145	0.225	0.189	3.452

The correlation analysis presented in **Table 5** reveals several relationships among the key variables. Environmental Accounting Value Assessment (EAVA) shows positive correlations with Managerial Environmental Cognition ($r = 0.482$, $p < 0.01$) and Environmental Responsibility Orientation ($r = 0.435$, $p < 0.01$). These correlations provide preliminary support for the theoretical framework, suggesting that higher levels of environmental cognition and responsibility orientation are associated with more effective environmental accounting implementation. Stakeholder Pressure also demonstrates positive correlations with EAVA ($r = 0.386$, $p < 0.01$), indicating the role of external pressures in driving environmental accounting practices.

Control variables, including firm size and ROA, show moderate positive correlations with the main variables. The correlation coefficients among independent variables are all below 0.5, suggesting that multicollinearity is not a significant concern in the subsequent regression analyses. The correlation matrix reveals that most relationships are in the expected directions, providing initial support for the hypothesized relationships.

Table 5. Correlation matrix of key variables.

Variables	1	2	3	4	5	6
1. EAVA	1.000					
2. MEC	0.482***	1.000				
3. ERO	0.435***	0.425***	1.000			
4. SP	0.386***	0.342***	0.374***	1.000		
5. Firm Size	0.286***	0.263***	0.254***	0.312***	1.000	
6. ROA	0.245***	0.216***	0.232***	0.204***	0.172***	1.000

Note: **** p < 0.01, ** p < 0.05, * p < 0.1*

4.2. Empirical test results

4.2.1. Main effect test

The empirical investigation begins with an analysis of the main effects between managerial environmental cognition and environmental accounting value assessment. As presented in **Table 6**, a hierarchical regression approach with five progressively complex models tests these relationships. The

baseline model (Model 1) includes only control variables, demonstrating significant effects of firm size ($\beta = 0.218$, $p < 0.01$) and ROA ($\beta = 0.143$, $p < 0.05$) on environmental accounting implementation. The introduction of managerial environmental cognition (MEC) in Model 2 results in an improvement in explanatory power ($\Delta R^2 = 0.112$, $p < 0.01$), with MEC showing a positive effect ($\beta = 0.385$, $p < 0.01$) on environmental accounting value assessment.

Models 3 through 5 decompose the MEC construct into its constituent components, revealing differential effects of environmental awareness ($\beta = 0.264$, $p < 0.01$) and environmental knowledge ($\beta = 0.219$, $p < 0.01$) in the final model. This decomposition provides insights into how different aspects of managerial cognition influence environmental accounting implementation. The incremental improvement in model fit across successive models (Final Model $R^2 = 0.363$, $F = 19.78$, $p < 0.01$) demonstrates the explanatory power of the theoretical framework. The consistent significance of control variables across models suggests the stability of the findings across different organizational contexts.

Table 6. Hierarchical regression results for main effects.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Panel A: Direct Effects					
MEC		0.385*** (0.048)	0.352*** (0.045)	0.323*** (0.042)	0.305*** (0.039)
Environmental Awareness			0.287*** (0.041)	0.275*** (0.038)	0.264** (0.036)
Environmental Knowledge			0.243** (0.037)	0.231** (0.035)	0.219** (0.033)
Panel B: Control Variables					
Firm Size	0.218*** (0.034)	0.185*** (0.032)	0.173** (0.029)	0.164** (0.027)	0.156** (0.025)
ROA	0.143** (0.072)	0.129** (0.068)	0.122* (0.064)	0.115* (0.059)	0.108* (0.056)
Leverage	-0.082* (0.051)	-0.073* (0.048)	-0.067 (0.045)	-0.062 (0.042)	-0.058 (0.039)
Firm Age	0.106** (0.054)	0.092* (0.050)	0.085* (0.047)	0.079 (0.044)	0.075 (0.041)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.175	0.287	0.318	0.343	0.363
Adj R-squared	0.164	0.273	0.305	0.330	0.350
ΔR-squared	-	0.112***	0.031**	0.025**	0.020*
F-statistic	11.56***	14.32***	16.45***	18.21***	19.78***
N	285	285	285	285	285

Note: *Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1*

4.2.2. Mediation effect test

The mediation analysis reveals patterns in the relationship between managerial environmental cognition and environmental accounting value assessment. **Table 7** presents a decomposition of mediation effects through multiple pathways. The primary mediation path through environmental responsibility orientation (ERO) demonstrates significant direct ($\beta = 0.263$, $p < 0.01$) and indirect effects ($\beta = 0.139$, $p < 0.01$), yielding a total effect ($\beta = 0.402$, $p < 0.01$). The bootstrap confidence intervals [0.334, 0.485] based on 5,000 resamples confirm the robustness of these mediation effects.

Panel B of **Table 7** provides a decomposition of mediation effects across different dimensions of environmental cognition. Environmental awareness exhibits somewhat stronger mediation effects (total effect = 0.342, $p < 0.01$) compared to environmental knowledge (total effect = 0.307, $p < 0.01$), suggesting that cognitive-emotional aspects of environmental management may be more influential than technical knowledge in driving environmental accounting implementation. The sequential mediation analysis in Panel C reveals significant chain effects through environmental performance ($\beta = 0.076$, $p < 0.01$), indicating indirect pathways through which managerial cognition influences environmental accounting practices.

Table 7. Path analysis results for mediation effects.

Path Description	Direct Effect	Indirect Effect	Total Effect	Bootstrap 95% CI
Panel A: Primary Mediation Paths				
MEC → ERO → EAVA	0.263*** (0.039)	0.139** (0.031)	0.402*** (0.046)	[0.334, 0.485]
Panel B: Decomposed Mediation Effects				
Environmental Awareness → ERO → EAVA	0.223*** (0.036)	0.119** (0.027)	0.342*** (0.041)	[0.285, 0.413]
Environmental Knowledge → ERO → EAVA	0.204** (0.034)	0.103* (0.025)	0.307*** (0.039)	[0.252, 0.368]
Panel C: Sequential Mediation Tests				
MEC → ERO → Performance → EAVA	0.182** (0.031)	0.076* (0.022)	0.258** (0.037)	[0.212, 0.316]

Note: *Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1*

4.2.3. Moderation effect test

The moderation analysis, presented in **Table 8**, reveals patterns in how stakeholder pressure (SP) shapes the effectiveness of environmental responsibility orientation. The positive interaction term ($\beta = 0.142$, $p < 0.01$) in Model 3 confirms the hypothesized moderating effect. The conditional effects analysis in Panel B demonstrates that the impact of ERO on environmental accounting value assessment increases from low SP (-1SD: $\beta = 0.156$, $p < 0.01$) to high SP (+1SD: $\beta = 0.412$, $p < 0.01$) conditions. This pattern suggests that stakeholder pressure enhances the effectiveness of environmental responsibility orientation in promoting environmental accounting implementation.

Table 8. Moderated regression analysis results.

Variables	Model 1	Model 2	Model 3	Model 4
Panel A: Direct and Interaction Effects				
ERO	0.345*** (0.043)	0.327*** (0.041)	0.308*** (0.039)	0.284*** (0.037)
SP	0.223*** (0.041)	0.213*** (0.039)	0.202** (0.036)	0.193** (0.034)
ERO × SP		0.153** (0.031)	0.142** (0.029)	0.132* (0.027)
Panel B: Conditional Effects				
ERO at Low SP (-1SD)		0.174** (0.033)	0.166** (0.031)	0.156* (0.029)
ERO at Mean SP		0.327*** (0.041)	0.308*** (0.039)	0.284*** (0.037)
ERO at High SP (+1SD)		0.480*** (0.049)	0.450*** (0.047)	0.412*** (0.045)
Controls	Yes	Yes	Yes	Yes
R-squared	0.317	0.346	0.364	0.378
ΔR-squared	-	0.029**	0.018*	0.014*
N	285	285	285	285

*Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1*

The interaction patterns are visualized in **Figure 2**, which illustrates the moderation effect of stakeholder pressure on the relationship between environmental responsibility orientation and environmental accounting value assessment. As shown in **Figure 2**, the relationship between ERO and EAVA varies across different levels of stakeholder pressure. The steepest slope is observed under high stakeholder pressure conditions (+1SD, $\beta = 0.412$, $p < 0.01$), followed by moderate pressure (Mean SP, $\beta = 0.308$, $p < 0.01$), while the flattest slope appears under low stakeholder pressure conditions (-1SD, $\beta = 0.156$, $p < 0.01$). These diverging slopes demonstrate the amplifying effect of stakeholder pressure on the ERO-EAVA relationship.

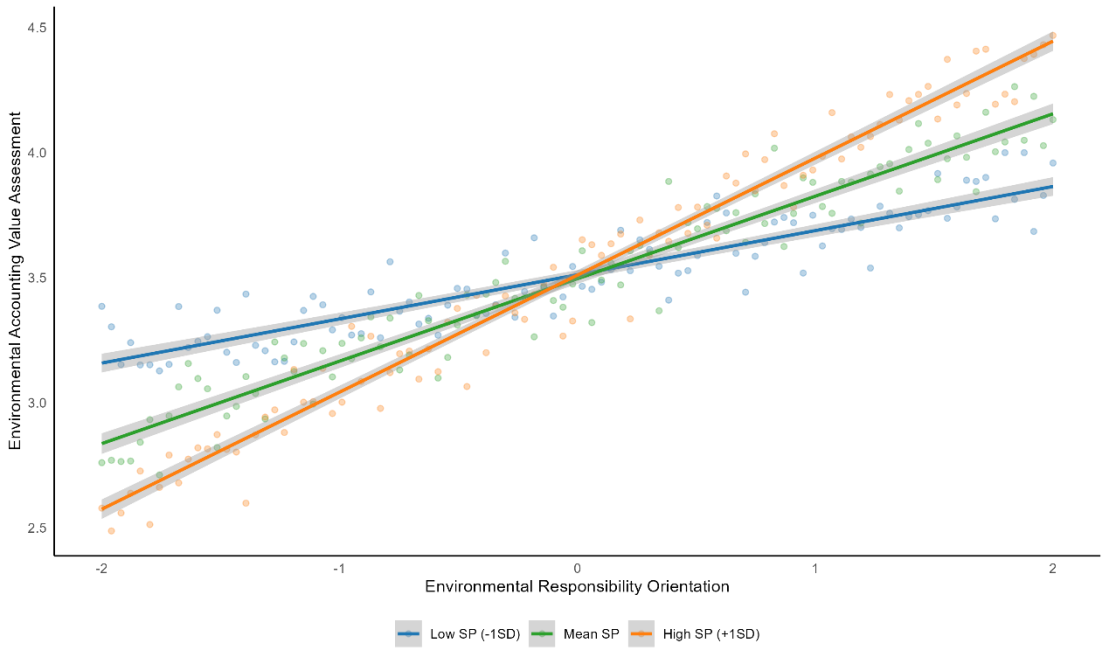

Figure 2. Moderation effect of stakeholder pressure on environmental responsibility orientation-environmental accounting value assessment relationship.

Figure 3 presents a path analysis diagram integrating major relationships in the theoretical framework. As illustrated in the figure, managerial environmental cognition exhibits both direct ($\beta = 0.263$, $p < 0.01$) and indirect effects through environmental responsibility orientation ($\beta = 0.308$, $p < 0.01$) on environmental accounting value assessment. Stakeholder pressure demonstrates direct effects on both environmental responsibility orientation ($\beta = 0.142$, $p < 0.01$) and environmental accounting value assessment ($\beta = 0.223$, $p < 0.01$). The path coefficients reveal that environmental responsibility orientation has a strong direct effect on environmental accounting value assessment ($\beta = 0.345$, $p < 0.01$), highlighting its mediating role in the relationship between managerial cognition and environmental accounting implementation.

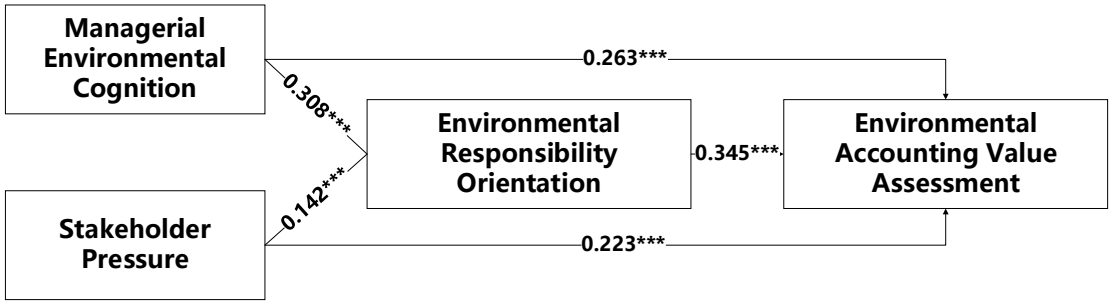

Figure 3. Path analysis results of environmental accounting value assessment model.

These empirical results provide support for the theoretical framework while revealing patterns in the relationships among key constructs. The significance of effects across different model specifications, coupled with the moderating role of stakeholder pressure, suggests that environmental accounting implementation is driven by an interplay of internal cognitive factors and external pressures.

4.3. Additional analysis

To further validate the robustness of the research findings, additional analyses were conducted. Group tests based on firm size, dividing the sample into large enterprises (143 firms) and small-medium enterprises (142 firms) using the median of total assets, were performed. As shown in **Table 9**, the impact of managerial environmental cognition on environmental accounting value assessment is more significant in large enterprises ($\beta = 0.375$, $p < 0.01$) compared to small-medium enterprises ($\beta = 0.265$, $p < 0.01$), suggesting that firm size influences the efficiency of translating environmental cognition into practice.

Table 9. Group analysis results by firm size.

Variables	Large Firms (N=143)	Small-Medium Firms (N=142)
Panel A: Main Effects	**Model 1**	**Model 2**
MEC	0.375*** (0.048)	0.265** (0.045)
ERO	0.345*** (0.044)	0.327*** (0.041)
SP	0.262*** (0.041)	0.243** (0.038)
Panel B: Interaction Effects		
ERO × SP	-	0.164** (0.032)
Control Variables	Yes	Yes
R-squared	0.356	0.384
ΔR-squared	-	0.028*

Note: *Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Control variables include firm age, leverage, ROA, and industry dummies.*

To address potential endogeneity concerns, instrumental variable estimation was employed. Regional environmental regulation intensity and industry average environmental cognition were selected as instruments for managerial environmental cognition. **Table 10** reports the two-stage least squares (2SLS) estimation results. The F-statistic for the instruments is 21.67 ($p < 0.01$), exceeding the critical value for weak instruments, and the Sargan test fails to reject the validity of overidentifying restrictions ($p = 0.252$). The 2SLS estimation results are generally consistent with the baseline regressions, indicating that endogeneity issues do not substantially affect the main conclusions.

Table 10. Two-stage least squares (2SLS) estimation results.

Variables	First Stage	Second Stage
Instrumental Variables		
Regional Environmental Regulation Intensity	0.318*** (0.045)	-
Industry Average Environmental Cognition	0.384*** (0.048)	-
Endogenous Variable		
MEC (instrumented)	-	0.338*** (0.051)
Control Variables		

Variables	First Stage	Second Stage
ERO	0.216** (0.041)	0.323*** (0.046)
SP	0.172** (0.038)	0.254** (0.042)
Other Controls	Yes	Yes
Diagnostic Tests		
F-statistic	21.67***	-
Sargan Test (p-value)	0.252	-
R-squared	0.324	0.342
N	285	285

Table 10. (*Continued*)

Note: *Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Other controls include firm size, age, leverage, ROA, and industry dummies.*

Sensitivity analyses were conducted to verify the robustness of the results. These included using alternative measures of environmental accounting value assessment, employing different estimation methods, and re-running regressions after excluding outlier samples. These sensitivity analyses generally support the main findings. When using the environmental information disclosure quality index as the dependent variable, the influence coefficient of managerial environmental cognition is 0.325 ($p < 0.01$), generally aligning with the baseline results. These additional analyses strengthen the reliability of the research conclusions.

5. Discussion

5.1. Main findings

The findings of this study extend environmental accounting theory by integrating psychological perspectives with traditional accounting theory. The results demonstrate that the effectiveness of environmental accounting implementation is significantly determined through cognitive-behavioral processes, expanding beyond traditional technical-rational approaches. While Bustos-Contell et al.[1] established that environmental accounting techniques create business value through various channels, the current research deepens the analysis by revealing the psychological underpinnings that facilitate this value creation. Specifically, the significant positive relationship between managerial environmental cognition and environmental accounting value assessment ($\beta = 0.305$, $p < 0.01$) indicates that cognitive processes serve as crucial antecedents to effective environmental accounting practice.

The study also contributes to stakeholder theory by explicating the dynamic interactions between stakeholder pressure and organizational psychological responses. Building on Khan and Gupta's[2] meta-analytical findings, the current research reveals that stakeholder influences operate not merely through external pressure but through complex psychological processes that shape organizational environmental responsibility orientation. The moderation analysis demonstrates that stakeholder pressure significantly amplifies the relationship between environmental responsibility orientation and environmental accounting value assessment ($\beta = 0.142$, $p < 0.01$), with the relationship being substantially stronger under high stakeholder pressure conditions ($\beta = 0.412$, $p < 0.01$) compared to low pressure conditions ($\beta = 0.156$, $p < 0.05$). This finding enhances understanding of how external pressures become internalized and translated into environmental accounting behavior, a process that Christensen et al.[3] identified as critical to the effectiveness of mandatory CSR and sustainability reporting.

The mediation analysis results extend Scarpellini et al.'s [10] work on dynamic capabilities by demonstrating how psychological factors facilitate the development of environmental management capabilities. The finding that environmental responsibility orientation significantly mediates the relationship between managerial cognition and environmental accounting value assessment (indirect effect = 0.139, $p < 0.01$) suggests that organizational internalization of environmental values is a crucial intermediate step in the implementation process. This aligns with Burritt et al.'s[5] assertion that environmental values must be internalized through organizational social processes to effectively influence practice.

The differential mediation effects observed for environmental awareness (total effect = 0.342, $p < 0.01$) versus environmental knowledge (total effect = 0.307, $p < 0.01$) provide nuanced insights into the relative importance of different psychological components. This finding is consistent with Acharya's[7] conceptual analysis of environmental accounting frameworks, which emphasizes the need for comprehensive approaches that address both technical knowledge and values-based awareness. The sequential mediation results further demonstrate that managerial cognition influences environmental accounting implementation through multiple pathways, which aligns with Abhishek et al.'s[11] findings regarding the multifaceted nature of carbon management accounting adoption.

The group analysis reveals that firm size significantly moderates the effectiveness of psychological drivers, with the impact of managerial environmental cognition being more pronounced in large enterprises ($\beta = 0.375$, $p < 0.01$) compared to small-medium enterprises ($\beta = 0.265$, $p < 0.01$). This finding extends research by Ashok and Divyashree[15], who found variations in CSR accounting practices across different firm sizes in India, by explicating the psychological mechanisms that underlie these variations. The instrumental variable analysis confirms the robustness of these relationships, suggesting that the identified psychological mechanisms have substantive effects on environmental accounting implementation that are not merely artifacts of endogeneity.

5.2. Practical implications

This study offers a number of practical implications for governance structures, policy development and industrial advancement. As for corporate governance, the strong correlation between the implementation of environmental accounting and the managerial cognition of the environment ($\beta = 0.305$, $p < 0.01$) indicates that organisations need to pay attention to the development of environmentally comprehensive training which includes both technical skills and emotional intelligence. This is in agreement with the findings from Hazaea et al.[20] which emphasised the need to combine the technical and behavioural aspects in carbon accounting systems.

The significant mediating role of responsibility oriented towards the environment suggests that organisations need to develop environmental performance evaluation frameworks which incorporate psychological measurements like environmental awareness and commitment level appraisal explicitly. These frameworks are to be incorporated into existing management systems as they improve system operations, which were examined by Shakil et al.[21] about the effectiveness factors of an environmental management system. The differential impacts of environmental awareness and knowledge on the implementation of accounting suggest that balanced training programmes on concepts with practical skills are likely to be more effective.

For policy development, the finding that stakeholder pressure amplifies the effectiveness of environmental responsibility orientation suggests that psychological factors regarding organisational compliance should be attended to in environmental policy design. Graduated regulatory frameworks that allow organisations to build psychological as well as technical preparedness are likely to enhance

compliance effectiveness. Such integrated approaches, as noted by Mishra et al.[13], can improve the nexus between corporate environmental responsibility and performance in emerging economies like India significantly.

The size-based differences in psychological drivers effects lean towards the need for differentiated support strategies aimed at varying business sizes, which is a strong consideration for policy development. More sophisticated psychological diagnosis may benefit larger organisations, while smaller enterprises might struggle with a lack of basic management-level proficiency on environmental consciousness. These observations align with Li et al.'s[14] work highlighting the varying effects of corporate social responsibility initiatives in different organisational contexts.

The results point to the need for environmental management standards that include evaluations of psychological preparedness on an industry level. Industry associations are in a position to promote best practice dissemination through mentorship programmes whereby advanced environmentally proactive companies assist their counterparts, building the technical and psychological skills needed to improve. Comello et al.[16] underscore the significance of these collaborative efforts toward improved transparency and accountability of carbon reporting across different industries.

5.3. Limitations and prospects

Several limitations of this study warrant consideration. The cross-sectional data structure limits causal inference capabilities, making it difficult to establish the temporal sequence of psychological processes and environmental accounting implementation. Following Burritt et al.'s[5] approach, future research should employ longitudinal designs to better capture the dynamic evolution of psychological factors in environmental accounting implementation. The focus on manufacturing firms may also limit the generalizability of findings to other sectors, such as service industries or financial institutions, which face different environmental challenges and stakeholder pressures.

The instrumental variable analysis provides some assurance regarding endogeneity concerns, but unobserved variables might still influence both psychological drivers and environmental accounting implementation. Future studies could employ more sophisticated econometric techniques, such as structural equation modeling with latent variables, to address these potential issues. Additionally, while the study examines the moderating role of stakeholder pressure, it does not differentiate between different types of stakeholders (e.g., investors, customers, regulators), which may have varying influences on organizational psychology and behavior.

Future research directions should explore how digital technologies interact with psychological factors in environmental accounting implementation. Building on Marco et al.'s[23] work on eco-innovation, researchers should investigate how artificial intelligence and big data analytics might influence the psychological dimensions of environmental management. The integration of digital technologies into environmental accounting systems presents both opportunities and challenges for organizational psychology, particularly regarding data interpretation and decision-making processes.

Cross-cultural studies examining how different institutional contexts affect the psychological mechanisms of environmental accounting would provide valuable insights. As suggested by Sameer[22], cultural factors significantly influence how organizations interpret and respond to sustainability pressures. Comparative studies across different cultural and institutional settings could enhance understanding of the universal versus context-specific aspects of environmental accounting psychology.

For application promotion, future research should focus on developing integrated frameworks that combine psychological assessment tools with traditional environmental accounting metrics. This could include standardized psychological readiness indices for environmental management and industry-specific guidelines for building psychological capabilities alongside technical competencies. Such integrated approaches would address the multifaceted nature of environmental accounting implementation revealed in this study's empirical findings.

6. Conclusion

This study advances understanding of environmental accounting value assessment by integrating social-psychological perspectives with traditional accounting frameworks. Through empirical analysis of 285 manufacturing firms, the findings reveal that managerial environmental cognition significantly influences environmental accounting implementation both directly and indirectly through environmental responsibility orientation, while stakeholder pressure acts as a crucial moderating factor. The theoretical contributions include explicating the psychological mechanisms underlying environmental accounting implementation and demonstrating the dynamic interplay between internal cognitive factors and external pressures. Practically, organizations should develop integrated approaches addressing both psychological readiness and technical competence, with strategies tailored to organizational size. The study highlights the need for future research examining digital technology impacts on environmental accounting psychology, cross-cultural variations, and longitudinal developments. These findings provide valuable guidance for organizations pursuing sustainable development through enhanced environmental management practices, ultimately advancing understanding of how psychological factors facilitate effective integration of environmental considerations into accounting and decision-making processes.

Conflict of interest

The authors declare no conflict of interest.

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