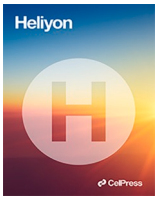
Heliyon 10 (2024) e32725

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

Enhancing Kurdistan's manufacturing companies' sustainable waste management: A norm activation approach to green accounting, CSR, and environmental auditing oversight

Hawta Tareq Faieq [a,b,*], Kemal Cek [a]

[a] Department of Accounting and Finance, Cyprus International University, Northern Cyprus, Mersin 10, Lefkosa, 99040, Turkey
[b] Department of Accounting, College of Administrative and Financial Sciences, Knowledge University, Iraq, Erbil, 44001

ARTICLE INFO

Keywords:
Carbon neutrality
Corporate social responsibility
Ecological footprint
Environmental auditing
Green accounting
Waste management practices
Sustainability

ABSTRACT

The significance of accurate energy production prediction cannot be overstated, especially in the context of achieving carbon neutrality and balancing traditional and clean energy sources. Unlike conventional models with simplified assumptions or limited data inputs hindering energy usage optimization, waste reduction and efficient resource allocation, we introduced a novel structural equation modelling approach to eight manufacturing industries' sustainable waste management practices (SWMPs) in Iraq. This comprehensive analysis, conducted with Smart PLS software on 375 responses aims to enhance energy production predictions' accuracy and support sustainability goals contribute to achieving carbon neutrality goals and promote a balanced energy mix that supports sustainability and environmental stewardship. The findings reveal noteworthy insights: notably, chemical manufacturing companies exhibit a substantial advantage from green accounting practices, witnessing a 78.1 % and 45.8 % improvement in environmental auditing oversight and SWMPs, respectively, compared to other manufacturing sectors. Compared to conventional grey models, our model demonstrates that a 1-unit improvement in CSR enhances environmental auditing oversight effectiveness by 33.4 % and sustainable waste management by 56.9 % across industries. By leveraging these data-driven insights and innovative approaches, we can drive positive change towards a more sustainable and resilient energy future, collectively contributing to a more resilient, efficient, and sustainable energy ecosystem that benefits societies, economies, and the environment. The heightened accuracy of energy production prediction facilitated by our novel model empowers stakeholders at regional and global levels to make informed decisions, mitigate risks, support policy development, achieve sustainability goals, formulate effective policies and foster collaboration.

1. Introduction

Recently, the field of waste management has experienced significant growth in opportunities for improvement. These opportunities encompass the implementation of extended producer responsibility policies [1] and the promotion of public-private partnerships to develop sustainable waste management solutions [2]. Additional opportunities exist, such as the utilization of waste-to-resource approaches to enhance resource efficiency and reduce waste [3]. This involves implementing advanced waste management

* Corresponding author.
E-mail addresses: hawta.faiq@knu.edu.iq (H.T. Faieq), kcek@ciu.edu.tr (K. Cek).

https://doi.org/10.1016/j.heliyon.2024.e32725
Received 13 November 2023; Received in revised form 19 May 2024; Accepted 28 May 2024
Available online 8 June 2024

technologies, including anaerobic digestion and bioreactors, to generate energy from waste [4]. However, despite the promising benefits of these opportunities, waste management still faces various challenges and complexities. The disposal of waste presents significant environmental concerns and undermines sustainable development [5]. Key issues contributing to waste management complexities include open burning of waste and illegal dumping leading to health and environmental hazards [6], poor waste segregation and recycling due to a lack of public awareness and education [7], inadequate waste collection and disposal due to limited funding and resources [8], and insufficient waste management facilities and infrastructures, especially in developing countries [9]. The urgent need for corporate-level solutions to promote Sustainable Waste Management Practices (SWMP) is evident, particularly in the Kurdistan Region of Iraq. It is important not to overlook countries like the Kurdistan Region of Iraq in ongoing discussions regarding sustainable waste management. Excluding them from these conversations can cloud academic judgments, particularly considering the dominant involvement of countries like Norway [10], Japan [11], China [12], Germany [13] and the BRICS [14] in promoting this initiative. Similar to many other nations, the region faces significant challenges related to unsustainable waste practices, which contribute to environmental issues like greenhouse gas emissions, water pollution, and land contamination. To address these challenges effectively, adopting sustainable waste management strategies is crucial to reduce carbon emissions, and ecological footprints and ensure long-term sustainability in Kurdistan.

In the context of efforts to promote carbon neutrality and reduce ecological footprint, there is a growing recognition of the importance of corporate-level solutions alongside country-specific initiatives. Recent studies have delved into the roles of information and communication technology, trade openness and financial development in carbon emission reduction [15], as well as the influence of natural resource rent and corruption governance on the environmental Kuznets curve for ecological footprint [16]. Additionally, there is increasing attention on the potential of artificial intelligence to drive green innovation [17], and the significance of financial development, renewable energy adoption, and industrialization in reducing ecological footprint [18]. In contrast to these initiatives, our research emphasizes the foundational roles and interactions between corporate strategies and environmental management practices specifically green accounting, Corporate Social Responsibility (CSR), environmental auditing, and SWMPs.

Despite the predominant focus of sustainable waste management studies on specific areas such as waste-to-energy, challenges, and opportunities, and sustainable development, there has been a recent emergence of other themes in the debates. These themes encompass topics like green accounting, CSR, and environmental auditing. They have expanded to address issues such as the role of CSR in sustainable waste development in emerging economies, green accounting and the sustainable development of listed enterprises, and environmental audit in the sustainable development of the green economy. However, despite their noteworthy contributions, the integration of green accounting, CSR, and environmental auditing has been largely overlooked in waste sustainability debates. Waste management approaches have become a crucial component of contemporary sustainable development initiatives. Yet, there is currently no integrated framework that analyzes the effects of green accounting, CSR, and environmental auditing on SWMP amid escalating energy costs and shortages [19], carbon emissions [15,20] and ecological footprints [18]. Comparing the sustainability initiatives of different corporations is complicated by various empirical gaps, including the lack of standardization in green accounting and the inability to assess its effectiveness. This highlights the pressing need for contemporary studies to address these gaps. Therefore, this study investigates the effects of green accounting and CSR on the effectiveness of environmental auditing oversight in promoting SWMPS in Kurdistan's manufacturing companies. With a limited understanding of the connectedness between green accounting, CSR, the effectiveness of environmental auditing oversight and SWMP, the following research inquiries will be addressed.

1) In Kurdistan's manufacturing companies, do green accounting and corporate social responsibility contribute to the promotion of sustainable waste management practices through environmental auditing?
2) What is the degree of effectiveness of environmental auditing in mediating interactions between green accounting and sustainable waste management practices, in manufacturing companies?
3) What is the degree of effectiveness of environmental auditing in mediating interactions between CSR and sustainable waste management practices in manufacturing companies?

By leveraging these data-driven insights and innovative approaches, we can drive positive change towards a more sustainable and resilient energy future, collectively contributing to a more resilient, efficient, and sustainable energy ecosystem that benefits societies, economies, and the environment. The heightened accuracy of energy production prediction facilitated by our novel model empowers stakeholders at regional and global levels to make informed decisions, mitigate risks, support policy development, achieve sustainability goals, formulate effective policies and foster collaboration.

2. Literature review

The integration of green accounting, environmental auditing and CSR in the context of sustainable waste management practices is still lacking and commands significant empirical attention. This section reviews the related papers and identifies the research gaps concerning Kurdistan's manufacturing companies.

2.1. The normative activation theory, environmental behaviour and sustainable waste management

Our study is grounded in the theory that social and personal norms play a crucial role in shaping individual decision-making and behaviour. By applying Normative Activation Theory (NAT) to sustainable waste management, our research contributes to understanding its effectiveness and relevance in promoting environmentally responsible actions. NAT is included in our study due to its

significance in elucidating the relationship between individual behaviour and normative influences. We aim to investigate how the adoption of SWMP is influenced by the normative activation process using the Normative Activation Model (NAM). This model helps us explore how psychological factors driving managers' intentions and behaviours, regulatory policies, and industry standards impact green accounting, CSR, environmental auditing oversight, and sustainable waste management dynamics within society and organizations.

Drawing from Steg and Groot's framework, environmental behaviour hinges significantly on ascribed responsibility [21]. This study expands on this notion, positing that the efficacy of environmental auditing oversight is bolstered by corporate managers embracing pro-environmental behaviour. Esfahani, Rahman and Zakaria contend that adopting green accounting practices and engaging in CSR activities, elements of ascribed responsibility, positively influence corporate managers' behaviour, fostering pro-environmental actions [22]. While normative activation theory has not been utilized to analyze the impact of green accounting and CSR practices on enhancing SWM, previous insights suggest that their incorporation in waste management discussions leads to the development of new SWMPs. Jansson supports this notion by asserting that responsible managers proactively safeguard the environment [23], while Zhang and Wang highlight that environmentally conscious managers advocate for the adoption of resource-efficient technologies and ecological innovations [24]. Various studies have explored different facets related to environmental behaviour and waste management, including firms' performance and green self-efficacy [25], energy potential valuation [26], and waste management transformation [27]. However, the synergistic relationship between green accounting, corporate social responsibility, environmental auditing oversight effectiveness, and SWM remains underexplored. Consequently, the subsequent section of this study empirically delves into these connections to mitigate potential biases that might result in inaccurate SWM assessments and decisions.

2.2. Related studies

While nascent ideas exist regarding the interactive linkages among green accounting, CSR and the effectiveness of environmental auditing oversight in SWMPs, past empirical studies have yielded inconclusive findings. Therefore, our study integrates green accounting, CSR, environmental auditing, and sustainability concepts to introduce a novel approach to sustainable waste management. The study by Farouk, Cherian, and Jacob highlighted the potential of environment management accounting, also known as green accounting, to enhance decision-making for improved environmental performance in companies [28]. This inquiry, although lacking specific measured outcomes, presents a fascinating area of research. Yuliarini and Ismail further emphasized that environmental accounting extends beyond accounting principles to encompass sustainable development considerations [29]. The complexities of technology adoption across different economic landscapes, particularly the pronounced AI-green innovation relationship in developed nations versus developing ones [17], underscore the importance of exploring environmental accounting's roles in SWMP. Notably, the significance of environmental accounting is accentuated by observations revealing that financial development and industrialization contribute to environmental damage, with a unidirectional causal relationship between industrialization and ecological footprint [18]. Therefore, integrating environmental accounting into a corporation's sustainability strategy is crucial for waste reduction, efficient resource allocation, and achieving SDGs.

Tu and Huang's exploration of green design's feasibility involved analyzing its correlation with green accounting for enterprises [29]. Their findings emphasized that green design is a response to the worsening global environment. This observation gains significant academic credibility, especially considering the ecological overshoot, where resource consumption and waste exceed our ecological capacity [16]. Given the escalating environmental degradation due to global economic activities [18], it is intriguing to investigate how deploying green accounting practices alongside CSR and environmental auditing oversight can address issues stemming from inadequate waste management measures. Therefore, this study aims to contribute to the existing literature by delving deeper into such initiatives.

Despite numerous efforts to promote sustainability in waste management, challenges persist in achieving waste management goals like zero waste [12]. For instance, Nelles, Gruenes, and Morscheck's research on waste management in Germany highlights concerns about waste treatment costs and conflicts between municipal and private waste management entities [13]. Weghmann's study further emphasizes Germany's significant contribution to Europe's plastic packaging waste, amounting to over 18 % of the total [13]. Considering the growing influence of geopolitics on the environmental Kuznets curve in contemporary literature [30], there is a recognized need for normative factors, awareness of consequences, and moral obligations to shape organizations' pro-environmental behaviour, as proposed by the NAT [25]. Aligning with this perspective, the integration of green accounting, CSR and environmental auditing practices can enhance companies' involvement in sustainable waste management.

Sakai et al. emphasize the necessity of considering persistent organic pollutants and hazardous compounds for promoting a material-cycling society in Japan [11]. Given the significant quest for a more sustainable waste management solution, adopting green accounting, CSR, and environmental auditing can contribute to achieving Japan's pollution reduction target [31]. Supporting this viewpoint, Xiao, Wu, and Stephen highlighted Norway's waste disposal lag [32], while Rossi and Morone's research identified China's substantial solid waste treatment backlog, ranging from 60 to 70 billion tonnes [33]. Additionally, Udeagha and Ngepah discussed the challenges of Municipal Solid Waste Management (MSWM) in fast-developing and fossil fuel-dependent global economies, particularly impacting low-income countries [34]. They pointed out that MSWM affects various aspects such as the environment, socioeconomic factors, health, aesthetics, and infrastructure due to waste generation, treatment, and disposal [34].

Meanwhile, countries like Kurdistan have been academically sidelined in these discussions. For instance, Wang, Ren and Li noted that countries such as China, the United States, Turkey, Malaysia and England have made substantial contributions to the global literature database within the Environmental Kuznets curve theory of economic and environmentally sustainable development [30].

This academic sidelining risks clouding corporate decisions and skewing sustainability judgments. Table 1 presents a synthesis of pertinent literature on waste management, highlighting key insights and gaps in existing approaches.

Jones and Jones' political priority framework highlights Norway's waste management crisis [10]. Their research advocates for the advancement of a circular economy to transition waste management practices towards more sustainable approaches. However, achieving the pro-environmental behaviour necessary for sustainability remains challenging without essential social and personal norms, awareness of consequences, and moral obligations. Despite applying methods like lifecycle assessment, substance flow analysis [11], and qualitative analysis [12], achieving SWM appears to be a daunting task. Aligned with this perspective, Lee et al. suggest the need to complement existing waste management strategies such as waste reduction, separation, and utilization [12]. This rationale supports our study's initiative to integrate green accounting, CSR and environmental auditing practices using the NAT to enhance the effectiveness of SWMPs. Therefore, we employ a structural equation modelling approach to explore these interactions, aiming to gain a comprehensive understanding of the potential benefits that can be achieved.

3. Methods

3.1. Methodology

Our analysis identified an empirical gap demonstrating that no multigroup structural equation model has been developed to examine the structural links between green accounting, environmental auditing, CSR and SWMPs (see Fig. 1). Thus, by applying multigroup SEM analysis, we provided a comparative assessment of SWMPs across different manufacturing sectors in Kurdistan, which enhances understanding of sector-specific waste management challenges in Kurdistan. This also guides policymakers and industry stakeholders in developing sector-specific strategies to improve waste management outcomes. Apart from the multigroup SEM analysis representing a sophisticated analytical approach that contributes to the methodological advancements in the field of sustainability research, the selection of the SEM approach in this study is rooted in several key considerations. Firstly, SEM is chosen due to its capability to develop optimal models and theories [36]. This was crucial for understanding complex relationships between green accounting, CSR, environmental auditing, and SWMPs. Secondly, by applying an SEM approach, we were able to meticulously assess measurement errors, which was crucial for ensuring data accuracy, enhancing validity, and improving research quality [36]. Thirdly, SEM facilitates rigorous model testing by introducing a structured approach to evaluating data fit [36]. This was critical for verifying the proposed relationships and hypotheses within the study.

The adoption of SEM in this study aligns with investigating the contributions of green accounting and CSR towards promoting SWMPs through environmental auditing within Kurdistan's manufacturing sector. SEM is suited for evaluating the efficacy of

Table 1
A summary of the most relevant reviewed waste management literature.

Researchers	Research Area	Country	Methodology	Findings	Current situation
Nelles, Gruenes and Morscheck [13]	Waste management in Germany: development to a sustainable circular economy?	Germany	Qualitative analysis of the waste hierarchy approach	The prices for waste treatment vary greatly. Overcapacities of waste-treatment plants lead to falling prices. There are significant problems between the municipal and private waste management companies.	Germany is the largest producer and responsible for over 18 % of Europe's plastic packaging waste [35].
Jones and Jones [10]	Waste management in Norway. Advancing a Circular Economy: A Future without Waste?	Norway	Political priority framework	There is a prevailing waste management crisis. Advancing a circular economy provides a way to shift waste management practices towards more sustainable approaches.	Lags in waste disposal [32]. Hence, adopting the NAT can offer immense benefits in this regard.
Sakai et al. [11]	Waste prevention for sustainable resource and waste management.	Kyoto, Japan.	Lifecycle assessment and Substance flow analysis.	Persistent organic pollutants and hazardous compounds should also be taken into account for the promotion of a material-cycling society.	To meet Japan's pollution reduction target, the community must look for an alternative solution to manage waste more sustainably [31].
Lee et al. [12]	SWM for zero waste cities in China: potential, challenges and opportunities.	China	Qualitative analysis	To fully achieve zero waste cities, it is necessary to complement the existing strategies of waste reduction, waste separation and waste utilization.	China currently has a solid waste treatment backlog of 60–70 billion tonnes [33].
Iyamu, Anda and Ho [14]	A review of municipal solid waste management in the BRIC and high-income countries.	BRICS and high-income countries.	A thematic framework for low-income countries.	Municipal solid waste management is a challenging issue for low-income countries, impacting the environment, socio-economic, health, aesthetics and infrastructure, due to the generated volume of waste, treatment and disposal methods.	The fast-developing and fossil fuel-dependent global economies are concentrated on accelerating economic expansion at the expense of catastrophic environmental repercussions [34].

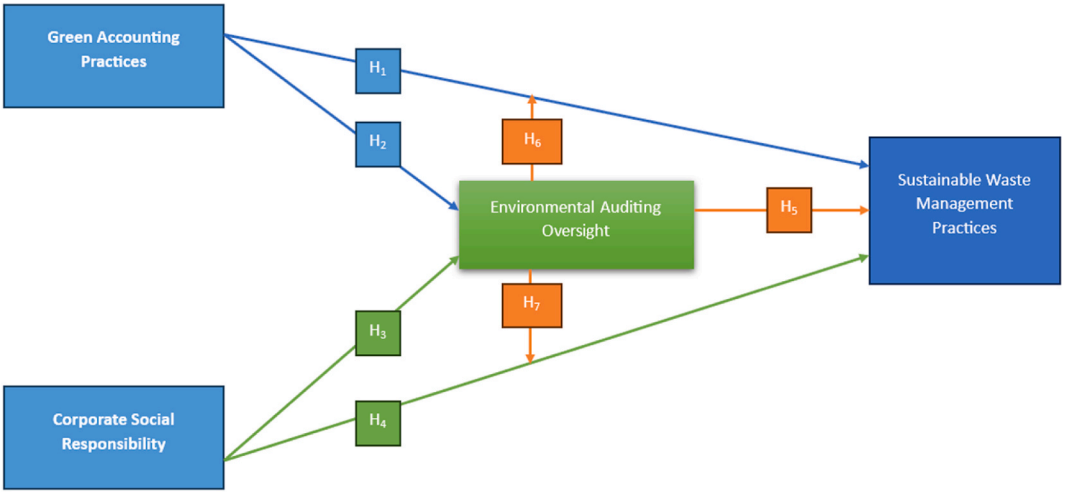


Fig. 1. Conceptualized green accounting, CSR, environmental auditing and SWMPs interactions.

environmental auditing in mediating interactions between green accounting, CSR initiatives, and SWMPS in manufacturing companies, highlighting its utility in analyzing complex relationships. This approach has been successfully applied in sustainability studies [37], exploring factors influencing construction waste reduction [38] and promoting sustainable development through strategies, environmental management accounting, and environmental performance [39]. Data analysis was conducted using Smart PLS, and hypotheses were tested using established path analysis results. This study was approved by the Ethics Committee of Cyprus International University, with ethics approval reference 100–10781. All participants/patients (or their proxies/legal guardians) provided informed consent for the publication of their anonymised case details and images.

3.2. Description of variables and hypothesis development

3.2.1. Green accounting, environmental auditing oversights and SWMPs' interconnectedness

The term "green accounting" denotes an accounting methodology assessing the environmental impacts of economic activities [40]. This study integrates green accounting, known for its ability to measure environmental effects, into the discourse on SWM [41]. Despite limited research on their interconnectedness, there is a significant correlation among green accounting, environmental auditing oversight, and SWMPs, indicating substantial research gaps. Green accounting usage in developing nations is still emerging, with a focus on developed countries like China and the USA [42,43]. While some studies have addressed green accounting [28,29], further investigations are needed to assess its effectiveness in promoting sustainable waste management and its lasting effects on resources, energy use, and the environment. Green accounting helps evaluate environmental impacts and reveals the costs and benefits of environmental initiatives [28,29]. Incorporating normative activation processes establishes desired social norms and expectations regarding SWMPs. Green accounting also aids organizations in informed decision-making regarding resource allocation, energy use, and areas for sustainability improvement. According to Azeez and Mahdi, green accounting facilitates resource monitoring, energy use, associated costs, and waste management [28,29] and encourages the adoption of innovative and efficient methods and environmentally sustainable practices [40,44]. This normative activation, embraced by companies and led by managers and industry leaders, initiates a positive cycle of adoption and improvement in waste management practices, overcoming barriers posed by traditional accounting practices. However, the transition in accounting practices resulting from the adoption of green accounting warrants further investigation, as no studies have substantiated such propositions. Hence, the following hypotheses were formulated.

- **H_1:** The adoption of green accounting practices has a significantly positive effect on sustainable waste management practices.
- **H_2:** The adoption of green accounting practices has a significantly positive effect on audit committee oversight effectiveness.

3.2.2. CSR, environmental auditing oversight and SWMPs' interconnectedness

CSR encompasses a company's commitment to ethical and responsible business practices, considering its impact on employees, customers, communities, and the environment [45]. The nexus of CSR, environmental auditing oversight, and SWMPs contributes significantly to waste management discussions. CSR adoption compels companies to disclose waste management practices and sustainability performance, enhancing transparency and accountability [48]. Stakeholders' expectations, including regulatory bodies and investors, drive normative activation, demanding accountability and transparency in waste management practices, ultimately fostering CSR adoption and enhancing environmental auditing oversight effectiveness. This is crucial for ensuring companies follow best practices and identify areas for improvement to mitigate environmental impacts like air pollution [49], water pollution [50], land pollution [51] and climate change [52]. Recognizing these linkages is vital for promoting sustainable waste management and overall sustainable development. However, empirical validation of these connections remains lacking. In light of such discoveries, we propose

the following hypotheses to fill those voids.

- **H_3:** There is a significantly positive impact of CSR practices on environmental auditing oversight effectiveness.
- **H_4:** There is a significantly positive impact of CSR practices on sustainable waste management practices.
- **H_5:** There is a significantly positive impact of environmental auditing oversight effectiveness on sustainable waste management practices.

3.2.3. The mediating effects of environmental auditing oversight

Green accounting, CSR, environmental auditing, and SWMPs, while conceptually distinct, exhibit interconnectedness that enables mediation interactions. Environmental auditing initiatives can enhance SWMPs by setting the tone at the top and mediating the relationship between green accounting and SWMPs. Sustainability and compliance cultures benefit green accounting and auditing functions by identifying and mitigating waste management costs and risks while enhancing associated benefits [40]. Integrating green accounting with environmental auditing improves transparency and accountability in waste management performance monitoring and reporting, including identifying SWM opportunities and assessing green accounting efficacy. Implementing these recommendations guided by the audit committee can enhance CSR and SWMPs. Normative activation processes, such as peer influences, social norms, regulatory pressures, and stakeholder expectations, drive companies to adopt green accounting and CSR, promoting SWMPs. These processes influence individual behaviours, encourage environmentally friendly actions, and facilitate transitioning to sustainable waste management. Effective audit committee oversight strengthens the relationship between green accounting and SWMPs, supporting CSR's influence on SWMPs. Consequently, we proposed the following hypotheses.

- **H_6:** Environmental auditing positively mediates the relationship between green accounting and sustainable waste management practices.
- **H_7:** Environmental auditing positively mediates the relationship between CSR and sustainable waste management.

3.2.4. Conceptual framework

Following the formulation of hypotheses illustrating the interrelationships between green accounting, CSR, environmental auditing and SWMPs, a conceptual model is presented in Fig. 1. As such, hypotheses 1 and 2 denote green accounting's influence on SWMPs and environmental auditing, respectively. CSR's influence on environmental auditing and SWMPs is delineated by arrows stemming from CSR as assumed in H_3 and H_4, respectively. H_5 represents environmental auditing's influence on SWMPs. Meanwhile, environmental auditing's mediating effects on the influence of green accounting on SWMPs as well as its mediating effects on the influence of CSR on SWMPs are delineated by H_6 and H_7.

3.3. Data

To collect primary data, respondents were asked to respond to self-administered questionnaires. The research expanded upon the green practices' measurement framework proposed by Guo et al. to develop 12 adapted green accounting constructs [25]. These constructs were assessed using a five-point Likert scale, with responses ranging from 1 indicating "to a very large extent" to 5 indicating "to no extent". The application of green accounting is essential for evaluating the economic ramifications of SWMP. Prior investigations, such as those conducted by Khan and Gupta, have effectively employed a meta-analysis approach to examine the influence of incorporating corporate green accounting practices as critical tools for sustainable development on firm performance [53]. These studies offer valuable insights into the role of green accounting in fostering environmentally responsible business strategies.

Using borrowed auditing committee oversight items provided by Al-Shaer and Zaman [46] and DeZoort [54], we developed 8 new environmental auditing oversight items while CSR was developed using 15 variable items. Studies conducted by Gray [55] and Bennett

Table 2
Sustainable waste management practices variable constructs measurement.

Dimensional aspects of SWMPs	Practices/perspectives	No.	Criteria
Social management practices	Community interests' practices	SWMP1	Charity contribution
		SWMP2	Socio-oriented mission statement
Human management practices	Human resources development practices	SWMP3	Training and development
		SWMP4	Employee satisfaction
Environmental management practices	Environmental pollution practices	SWMP5	Noise pollution
		SWMP6	Greenhouse gas emissions
		SWMP7	Total waste disposal
	Resource usage practices	SWMP8	Renewable energy resources
		SWMP9	Efficiency of raw materials
		SWMP10	Reducing waste as inputs
		SWMP11	Decreasing harmful materials
Economic management practices	Financial performance practices	SWMP12	Investments
		SWMP13	Costs drivers
		SWMP14	Revenue inflows
		SWMP15	Sales volume

[56] have elucidated the significance of environmental audits in pinpointing areas necessitating enhancements and guaranteeing adherence to legal requirements. This study delves into environmental auditing oversight to evaluate the efficacy of monitoring mechanisms in advancing sustainable waste management practices. In contrast, investigations by Dahlsrud have underscored the pivotal role of CSR in augmenting corporate reputation, fostering stakeholder relationships, and improving environmental performance [57]. By incorporating CSR as a variable, this study aims to investigate how manufacturing companies integrate social and environmental considerations into their waste management strategies. Both environmental auditing oversight and CSR constructs were measured using a 5-point Likert scale, in which the respondents marked whether they "strongly disagreed, disagreed, were unsure, agreed, or strongly agreed".

The concept of SWMPs is a continuously budding concept that does not yet possess the required measurement scales. Partial views regarding the variable's application are evident in studies on the credibility of sustainability reports [46] and best practice measures assessment for construction and demolition waste management in building constructions and studying olive oil mill wastewater management in Turkey [58]. Thus, as presented in Table 2, we developed five-dimensional practices with fifteen SWMP variable constructs based on expert perceptions and the understanding of the reviewed studies [28,57]]. The respondents marked whether they agree "to a very large extent, to a large extent, to some extent, to a little extent and to no extent" on a 5-point Likert scale about the purported SWMPs.

3.3.1. Sampling methods

For the population composition of this study, companies drawn from the top ten performing 2022 Kurdistan Ministry of Trade and Commerce (see Table 3). The reason is that these industries play a crucial role in the growth and development of the Kurdistan economy. Thus, when effectively implemented, green accounting, CSR, environmental auditing and SWMPs will help these businesses become more efficient and profitable. This in turn contributes to the overall economic development of the region. Besides, studying these vital manufacturing industries in connection to this study is instrumental for compliance with waste management reporting, auditing and accountability purposes. Thus, out of the selected 70 manufacturing companies 5 respondents comprising a waste manager, managing director, environmental auditor and regulator, sustainability expert and manufacturing employee were drawn from each of the companies. This is because green accounting, CSR, environmental auditing and SWMPs affect several departments of the manufacturing companies.

The extraction of judgments from different types of respondents with varying job titles also flags expectations that respondents should be informed regarding the adoption of green accounting, CSR, environmental auditing and SWMPs. To avoid violating the independent and identically distributed random variables assumption, we collected more data by increasing the sample size. By collecting responses from additional companies, we strengthened the generalizability of our findings and reduced the impact of potential biases or peculiarities within individual companies. Additionally, by treating the responses within each company as a cluster or subgroup, we were able to account for the potential lack of independence and address the violation of the assumption. Therefore, a judgmental sample of 375 respondents (male = 220 and female = 155) was identified during the study, and these organizations were

Table 3
Characteristics of respondents in the sample.

Variable	Description		Frequency	Percentage
Gender	Male		220	58.67
	Female		155	41.33
	Total		**375**	**100**
Age group	18–30 years		105	28.00
	31–45 years		175	46.67
	46–60 years		95	25.33
	Total		**375**	**100**
Job position	Waste managers		70	18.67
	Managing directors		75	20.00
	Environmental auditors and regulators		75	20.00
	Sustainability experts		70	18.67
	Manufacturing employees		85	22.67
	Total		**375**	**100**
Industry	Leather and allied product		50	13.33
	Apparel manufacturing		50	13.33
	Textile product mills		50	13.33
	Electronic equipment		50	13.33
	Chemical manufacturing		50	13.33
	Beverage and tobacco products		50	13.33
	Food manufacturing		50	13.33
	Other		25	6.67
	Total		**375**	**100**
	GA	**EAO**	**CSR**	**SWMPs**
Mean	3.93	3.44	4.28	4.32
Standard deviation	1.67	0.71	1.83	1.95

GA = Green Accounting; **EAO** = Environmental Auditing Oversight; **CSR**=Corporate Social Responsibility; SWMPs = Sustainable Waste Management Practices.

contacted physically in December 2022 to request their participation. The confidential nature of the investigation precluded the release of the names and details of the findings. Ideas were thus, drawn from waste managers (18.67 %), managing directors (20 %), environmental auditors and regulators (20 %), sustainability experts (18.67 %) and manufacturing employees (22.67 %) as shown in

Table 4
Factor analysis, formative analysis and collinearity results.

Abbrev.	Green Accounting (GA)	Factor loadings	Outer weights (sig.)	VIF
GA3	The company quantifies and evaluates the environmental impacts of waste management activities through green accounting methods.	0.769	0.000	1.418
GA4	Green accounting is utilized to monitor and measure the efficiency and effectiveness of waste management strategies.	0.754	0.000	1.809
GA6	Green accounting helps identify opportunities for cost savings and resource optimization in waste management practices.	0.712	0.000	1.535
GA8	Green accounting provides a comprehensive assessment of the social and environmental aspects of waste management.	0.746	0.000	2.011
GA9	The company sets specific waste-related targets and goals based on green accounting indicators.	0.713	0.000	1.623
GA11	The company regularly communicates its green accounting practices and waste management performance to stakeholders.	0.795	0.000	1.810
	Corporate Social Responsibility (CSR)	**Factor loadings**	**Outer weights (sig.)**	**VIF**
CSR5	Our company communicates its waste management practices and initiatives to stakeholders as part of its corporate social responsibility reporting.	0.822	0.000	1.315
CSR7	Our company considers the well-being and satisfaction of employees in its waste management practices as part of corporate social responsibility.	0.814	0.000	1.582
CSR8	Corporate social responsibility initiatives support our company in complying with waste management regulations and standards.	0.796	0.000	1 0.827
CSR9	Our company allocates resources and invests in sustainable waste management practices as part of its corporate social responsibility commitments.	0.800	0.000	1.688
CSR11	Our company actively seeks partnerships and collaborations with other organizations to enhance sustainable waste management as part of corporate social responsibility.	0.804	0.000	2.266
CSR13	Our company considers the social and economic benefits of waste management practices in its corporate social responsibility assessment.	0.816	0.000	1.847
CSR15	Corporate social responsibility principles guide our company in setting goals and targets for improving waste management performance.	0.807	0.000	1.493
Abbrev.	Environmental Auditing Oversight (EAO)	Factor loadings	Outer weights (sig.)	VIF
EAO1	Environmental auditing oversight helps identify areas of improvement in our company's waste management practices.	0.725	0.000	1.721
EAO2	The findings and recommendations from environmental audits have positively influenced our company's waste reduction efforts.	0.767	0.000	1.910
EAO4	Our company regularly conducts environmental audits to monitor and evaluate waste management performance.	0.769	0.000	2.064
EAO5	Environmental auditing oversight plays a significant role in promoting transparency and accountability in our waste management practices.	0.715	0.000	2.385
EAO6	Environmental audits help identify potential risks and vulnerabilities in our company's waste management processes.	0.781	0.000	1.797
EAO7	The information and data gathered through environmental audits are valuable for making informed decisions about sustainable waste management initiatives.	0.703	0.000	2.005
EAO8	Our company has dedicated resources and personnel responsible for overseeing environmental auditing in the context of waste management.	0.746	0.000	1.025
	Corporate Social Responsibility (CSR)	**Factor loadings**	**Outer weights (sig.)**	**VIF**
SWMP2	The company's mission statement emphasizes social responsibility in waste management practices.	0.813	0.000	1.315
SWMP3	The company provides training and development opportunities for employees to enhance waste management skills.	0.798	0.000	1.582
SWMP4	The company considers waste management practices as part of employee satisfaction and well-being.	0.791	0.000	1.827
SWMP5	The company takes measures to reduce noise pollution resulting from waste management activities.	0.823	0.000	1.688
SWMP9	The company organization optimizes the use of raw materials to minimize waste generation.	0.805	0.000	2.266
SWMP10	The company actively seeks ways to reduce waste by optimizing inputs in the production process.	0.788	0.000	1.847
SWMP11	The company takes steps to minimize the use of hazardous or harmful materials in waste management.	0.801	0.000	1.493
SWMP12	The company allocates financial resources towards sustainable waste management initiatives.	0.722	0.000	1.315
SWMP14	The company explores opportunities to generate revenue from sustainable waste management activities.	0.733	0.000	1.582

Table 3. As per Table 3, a significant improvement can be seen in the manufacturing companies' CSR (MN = 4.28) as well as their SWMPs (MN = 4.32), but it is necessary to improve the oversight of their environmental auditing (MN = 3.44) and green accounting practices (MN = 3.93). Furthermore, there is considerable variation between the companies in terms of their SWMPs (SD = 1.95) and CSR practices (SD = 1.83).

3.3.2. Validity, reliability and model fitness tests

In evaluating the initial draft of the questionnaire for validity, three experts were engaged, comprising an academic specialist, an auditor, and a manufacturing employee. Their collective input was instrumental in refining the questionnaire to ensure its capability to elicit reliable and accurate responses regarding SWMPs from the study participants. Subsequently, discriminant and convergent validity tests were employed to assess the construct validity of the variables. According to Henseler, Ringle and Sarstedt, discriminant validity is achieved when two measures that are not intended to be related demonstrate no relationship, whereas convergent validity is established when two measures are designed to assess similar constructs and exhibit a demonstrable connection [47]. The evaluation of discriminant validity utilized the Heterotrait–Monotrait (HTMT) criterion, while convergent validity was evaluated based on the Average Variance Extracted (AVE) criterion, which mandates that AVE values exceed 0.50 to establish convergent validity [47]. Reliability assessments were conducted using Cronbach's alpha test for internal consistency and the composite reliability test, with the premise that variables achieving Cronbach's alpha and composite reliability values of no less than 0.70 are deemed reliable [47]. To evaluate the model's fitness, the Standardized Root Mean Square Residual (SRMR) was employed as an absolute measure of fit, with SRMR values below 0.08 indicating a favourable fit [36,47]. Additionally, the Normed Fit Index (NFI) was utilized, requiring values of at least 0.80 for acceptable fit and 0.90 for excellent fit [36,58]]. Moreover, the Chi-square test, along with the D_G and D_ULS criteria, were utilized to provide further insights into the model's fitness [47].

Table 5
Multigroup Heterotrait–monotrait (HTMT) results.

Industry	Variables	GA	EAO	CSR	SWMPs
L&AP	***GA***	-	-	-	-
	CSR	*0.690*	-	-	-
	EAO	*0.644*	*0.673*	-	-
	SWMPs	*0.598*	*0.637*	*0.645*	-
AM	***GA***	-	-	-	-
	CSR	*0.511*	-	-	-
	EAO	*0.495*	*0.506*	-	-
	SWMPs	*0.428*	*0.470*	*0.497*	-
TPM	***GA***	-	-	-	-
	CSR	*0.618*	-	-	-
	EAO	*0.522*	*0.587*	-	-
	SWMPs	*0.503*	*0.533*	*0.540*	-
EQ	***GA***	-	-	-	-
	CSR	*0.713*	-	-	-
	EAO	*0.696*	*0.708*	-	-
	SWMPs	*0.584*	*0.593*	*0.701*	-
CM	***GA***	-	-	-	-
	CSR	*0.708*	-	-	-
	EAO	*0.695*	*0.702*	-	-
	SWMPs	*0.671*	*0.688*	*0.694*	-
B&TP	***GA***	-	-	-	-
	CSR	*0.715*	-	-	-
	EAO	*0.610*	*0.619*	-	-
	SWMPs	*0.599*	*0.604*	*0.611*	-
FM	***GA***	-	-	-	-
	CSR	*0.732*	-	-	-
	EAO	*0.618*	*0.639*	-	-
	SWMPs	*0.592*	*0.609*	*0.622*	-
Other	***GA***	-	-	-	-
	CSR	*0.635*	-	-	-
	EAO	*0.540*	*0.588*	-	-
	SWMPs	*0.489*	*0.535*	*0.561*	-
Overall sample	***GA***	-	-	-	-
	CSR	*0.850*	-	-	-
	EAO	*0.663*	*0.628*	-	-
	SWMPs	*0.587*	*0.594*	*0.612*	-

* GA = *Green Accounting;* ***EAO*** = *Environmental Auditing Oversight;* ***CSR***=*Corporate Social Responsibility;* ***SWMPs*** = *Sustainable Waste Management Practices.*

***L&AP:** Leather and Allied Product;* ***AP:** Apparel Manufacturing;* ***TPM:** Textile Product Mills;* ***EQ:** Electronic Equipment;* ***CM:** Chemical Manufacturing;* ***B&TP:** Beverage and Tobacco Products and* ***FM:** Food Manufacturing.*

4. Research findings and discussions

4.1. Factor analysis

In the initial SEM approach, factor analysis outcomes were utilized to establish relationships among constructs. Specifically, constructs exhibiting factor loadings of 0.70 or higher were considered to be strongly associated with the latent variables, as suggested by Henseler, Ringle and Sarstedt [58], following the findings presented in Table 4.

This implies that the chosen variables are closely aligned with the underlying latent variables and hold conceptual significance. Consequently, the study encompassed an examination of 6 constructs related to green accounting, 7 related to environmental auditing oversight, 7 related to CSR, and 9 related to SWMPs. Following the analysis of the formative indicators of outer weights, a significant degree of external or convergent validity was identified at the 1 % significance level. Subsequently, we advanced to examine the absolute and relative magnitudes of these outer weights. To investigate potential inflated variances among variables attributable to correlation or interaction effects, a Variance Inflation Factor (VIF) analysis was conducted. Notably, the VIF values extracted from Table 4 were found to be below 3.3, suggesting the absence of evidence for multicollinearity.

4.2. Discriminant validity, internal consistency and convergent validity tests

Upon establishing the less distant and conceptually significant variable constructs successfully, our investigation extended to scrutinize their multigroup validity and reliability. As delineated in Table 5, the selected variables exhibited discriminant validity across all manufacturing companies and the entire sample. This assertion is corroborated by the HTMT values, all of which were below 0.90, as indicated in the findings [47].

Continuing the analysis, we observed a consistent presence of convergent validity among the variables across all manufacturing companies and the entire sample, as indicated by the results of the AVE test. The AVE values presented in Table 6 surpass the predetermined criterion of 0.50 [47], affirming the convergence of measurements. Consequently, given the findings on discriminant and convergent validity, we concluded that the selected variables demonstrated high validity. Therefore, it is valid to infer that the effects of green accounting and CSR on the efficacy of environmental auditing in promoting SWMPs within Kurdistan's manufacturing

Table 6
Multigroup convergent validity, internal consistency and composite reliability tests.

Industry	Variables	AVE	Cronbach's Alpha	rho_A	rho_C
L&AP	***GA***	*0.559*	*0.722*	*0.748*	*0.802*
	CSR	*0.555*	*0.801*	*0.810*	*0.818*
	EAO	*0.553*	*0.780*	*0.817*	*0.826*
	SWMPs	*0.618*	*0.816*	*0.822*	*0.830*
AM	***GA***	*0.562*	*0.817*	*0.826*	*0.866*
	CSR	*0.553*	*0.819*	*0.826*	*0.869*
	EAO	*0.556*	*0.860*	*0.865*	*0.872*
	SWMPs	*0.612*	*0.830*	*0.844*	*0.850*
TPM	***GA***	*0.557*	*0.742*	*0.756*	*0.767*
	CSR	*0.556*	*0.794*	*0.802*	*0.806*
	EAO	*0.555*	*0.806*	*0.824*	*0.836*
	SWMPs	*0.615*	*0.810*	*0.819*	*0.826*
EQ	***GA***	*0.563*	*0.756*	*0.772*	*0.785*
	CSR	*0.555*	*0.794*	*0.809*	*0.869*
	EAO	*0.554*	*0.812*	*0.822*	*0.896*
	SWMPs	*0.617*	*0.827*	*0.836*	*0.890*
CM	***GA***	*0.555*	*0.787*	*0.795*	*0.807*
	CSR	*0.552*	*0.800*	*0.812*	*0.825*
	EAO	*0.554*	*0.812*	*0.827*	*0.834*
	SWMPs	*0.614*	*0.802*	*0.809*	*0.811*
B&TP	***GA***	*0.556*	*0.801*	*0.810*	*0.823*
	CSR	*0.551*	*0.815*	*0.823*	*0.830*
	EAO	*0.553*	*0.809*	*0.817*	*0.822*
	SWMPs	*0.620*	*0.817*	*0.825*	*0.831*
FM	***GA***	*0.558*	*0.811*	*0.827*	*0.835*
	CSR	*0.553*	*0.818*	*0.836*	*0.844*
	EAO	*0.552*	*0.811*	*0.820*	*0.832*
	SWMPs	*0.615*	*0.815*	*0.826*	*0.833*
Other	***GA***	*0.561*	*0.796*	*0.806*	*0.815*
	CSR	*0.554*	*0.801*	*0.814*	*0.830*
	EAO	*0.640*	*0.794*	*0.807*	*0.812*
	SWMPs	*0.616*	*0.808*	*0.813*	*0.819*
Overall sample	***GA***	*0.561*	*0.817*	*0.826*	*0.866*
	CSR	*0.554*	*0.819*	*0.826*	*0.869*
	EAO	*0.636*	*0.860*	*0.865*	*0.896*
	SWMPs	*0.616*	*0.845*	*0.848*	*0.890*

companies are substantiated by our analysis. Regarding the reliability test conducted, it was observed that both Cronbach's alpha, rho_A, and rho_C values exceeded the designated 0.70 threshold [36]. This indicates that highly reliable conclusions can be inferred from all the industry samples as well as the overall sample.

The well-established results from SEM demonstrate a high degree of reliability in elucidating the effects of green accounting and CSR on the effectiveness of environmental auditing in advancing SWMPs within Kurdistan's manufacturing enterprises. The subsequent section of the study presents the outcomes of the model fitness test, affirming the established model's reliability and suitability for analysis.

4.3. Model fit

Reporting the model fit summary results, the SRMR values are less than 0.08 across all manufacturing companies and the overall sample [36]. Furthermore, the NFI values exceeded 0.95 across all manufacturing companies and the overall sample, which indicates an excellent fit [36]. Table 7 shows satisfactory model fits as evidenced by significant $\chi 2$ values at 1 % [36]. Therefore, the deployed structural equation models provided a satisfactory measure of the effects of green accounting and CSR on the effectiveness of environmental auditing in promoting SWMPs across Kurdistan's manufacturing companies.

4.4. Path analysis

To conclude our analysis, notable variations between CM, EQ, FM, L&AP, AM, TPM, B&TP and other types of manufacturing industries were examined in terms of the effects of GA and CSR on SWMPs via EAO. Subsequently, ranks were determined according to the extent of the impact across all industries, and the multi-group analysis results are provided in Table 8. The analysis of path coefficients indicated that the effects of GA on SWMPs and EAO, as well as the effects of CSR on EAO and SWMPs, and EAO's effects on SWMPs, were notably strong within chemical manufacturing companies. Subsequently, similar trends were observed across other manufacturing sectors, including EQ, FM, L&AP, AM, TPM, B&TP, and others. In specific contexts, the validation of CSR's effects on EAO and SWMPs, as well as EAO's effects on SWMPs, was confirmed. In summary, these effects were significantly more pronounced across the entire study sample, thereby supporting hypotheses 1, 2, 3, 4, and 5. To further substantiate these established hypotheses, the non-zero confidence interval values with associated p-values of 0.000, falling between 0 and 1, were considered significant. Additionally, the established Q_2 values of 49.7 %, 52 %, 51.2 %, 58.9 %, and 37.1 % for the overall sample were deemed satisfactory in establishing the model's predictive relevance.

As indicated by the mediating effects results in Table 9, it can be inferred that effective environmental auditing does not act as a mediator in the relationship between green accounting and SWMPs. Similarly, the findings suggest that effective environmental auditing does not mediate the relationship between CSR and SWMPs. Consequently, hypotheses 6 and 7 were not substantiated across all manufacturing companies and the aggregated sample.

The observed variations in path coefficients were found to be statistically significant across all manufacturing companies, as detailed in Table 10. These differences indicate that the adoption of GA, EAO, CSR, and SWMPs varied significantly between chemical manufacturing companies and other industries. Specifically, these differences were notable in terms of GA's effects on SWMPs (0.278; $\rho < 0.001$) and EAO (0.308; $\rho < 0.001$), CSR's effects on EAO (0.270; $\rho < 0.001$) and SWMPs (0.518; $\rho < 0.001$) and EAO effects on SWMPs (0.390; $\rho < 0.001$).

Table 7
Multigroup model fit summaries.

Industry	Model	SRMR	NFI	$\chi 2$	d_G	d_ULS	95 %
L&AP	*Saturated model*	*0.060*	*0.967*	*65.40*[a]	*1.812*	*2.325*	*6.641*
	Estimated model	*0.060*	*0.967*	*65.40*[a]	*1.812*	*2.325*	*6.641*
AM	*Saturated model*	*0.058*	*0.969*	*65.70*[a]	*1.834*	*2.327*	*6.636*
	Estimated model	*0.058*	*0.969*	*65.70*[a]	*1.834*	*2.327*	*6.638*
TPM	*Saturated model*	*0.056*	*0.966*	*65.30*[a]	*1.816*	*2.333*	*6.632*
	Estimated model	*0.056*	*0.966*	*65.30*[a]	*1.816*	*2.333*	*6.632*
EQ	*Saturated model*	*0.059*	*0.968*	*65.60*[a]	*1.822*	*2.322*	*6.639*
	Estimated model	*0.059*	*0.968*	*65.60*[a]	*1.822*	*2.322*	*6.639*
CM	*Saturated model*	*0.062*	*0.970*	*65.90*[a]	*1.828*	*2.320*	*6.647*
	Estimated model	*0.062*	*0.970*	*65.90*[a]	*1.828*	*2.320*	*6.647*
B&TP	*Saturated model*	*0.057*	*0.967*	*65.10*[a]	*1.814*	*2.331*	*6.642*
	Estimated model	*0.057*	*0.967*	*65.10*[a]	*1.814*	*2.331*	*6.642*
FM	*Saturated model*	*0.058*	*0.966*	*65.80*[a]	*1.832*	*2.336*	*6.635*
	Estimated model	*0.058*	*0.966*	*65.80*[a]	*1.832*	*2.336*	*6.635*
Other	*Saturated model*	*0.061*	*0.969*	*65.50*[a]	*1.820*	*2.325*	*6.636*
	Estimated model	*0.061*	*0.969*	*65.50*[a]	*1.820*	*2.325*	*6.636*
Overall sample	*Saturated model*	*0.059*	*0.968*	*65.412*[a]	*1.825*	*2.328*	*6.639*
	Estimated model	*0.059*	*0.968*	*65.412*[a]	*1.825*	*2.328*	*6.639*

[a] Significant at 0.001.

Table 8
Multigroup path analysis.

Industry	Rank	HOC	Unstd. Est.	Std. Est.	t. stat.	p.Val.	R2	Q2	Hypothesis
CM	1	GA - > SWMPs	0.464	0.117	3.966	<0.001	0.501	0.495	H1: Supported
		GA - > EAO	0.442	0.108	4.093	<0.001	0.450	0.497	H2: Supported
		CSR - > EAO	0.340	0.076	4.474	<0.001	0.548	0.499	H3: Supported
		CSR - > SWMPs	0.580	0.149	3.893	<0.001	0.532	0.508	H4: Supported
		EAO - > SWMPs	0.430	0.103	4.175	<0.001	0.447	0.394	H5: Supported
EQ	2	GA - > SWMPs	0.407	0.097	4.196	<0.001	0.496	0.477	H1: Supported
		GA - > EAO	0.386	0.075	5.147	<0.001	0.471	0.446	H2: Supported
		CSR - > EAO	0.310	0.064	4.844	<0.001	0.440	0.471	H3: Supported
		CSR - > SWMPs	0.560	0.135	4.148	<0.001	0.474	0.447	H4: Supported
		EAO - > SWMPs	0.380	0.088	4.318	<0.001	0.429	0.336	H5: Supported
FM	3	GA - > SWMPs	0.354	0.066	5.364	<0.001	0.438	0.425	H1: Supported
		GA - > EAO	0.335	0.064	5.234	<0.001	0.392	0.388	H2: Supported
		CSR - > EAO	0.280	0.042	6.667	<0.001	0.440	0.412	H3: Supported
		CSR - > SWMPs	0.510	0.127	4.016	<0.001	0.416	0.386	H4: Supported
		EAO - > SWMPs	0.320	0.072	4.444	<0.001	0.406	0.297	H5: Supported
L&AP	4	GA - > SWMPs	0.305	0.051	5.980	<0.001	0.391	0.375	H1: Supported
		GA - > EAO	0.289	0.054	5.352	<0.001	0.336	0.327	H2: Supported
		CSR - > EAO	0.250	0.034	7.353	<0.001	0.440	0.359	H3: Supported
		CSR - > SWMPs	0.470	0.125	3.760	<0.001	0.354	0.321	H4: Supported
		EAO - > SWMPs	0.250	0.031	8.065	<0.001	0.383	0.255	H5: Supported
AM	5	GA - > SWMPs	0.260	0.042	6.190	<0.001	0.332	0.325	H1: Supported
		GA - > EAO	0.248	0.026	9.538	<0.001	0.450	0.265	H2: Supported
		CSR - > EAO	0.220	0.018	12.222	<0.001	0.440	0.301	H3: Supported
		CSR - > SWMPs	0.350	0.055	6.364	<0.001	0.287	0.272	H4: Supported
		EAO - > SWMPs	0.220	0.014	15.714	<0.001	0.362	0.212	H5: Supported
TPM	6	GA - > SWMPs	0.219	0.013	16.847	<0.001	0.443	0.375	H1: Supported
		GA - > EAO	0.211	0.015	14.067	<0.001	0.450	0.234	H2: Supported
		CSR - > EAO	0.190	0.024	7.917	<0.001	0.243	0.223	H3: Supported
		CSR - > SWMPs	0.180	0.022	5.455	<0.001	0.224	0.219	H4: Supported
		EAO - > SWMPs	0.190	0.028	6.785	<0.001	0.344	0.166	H5: Supported
B&TP	7	GA - > SWMPs	0.183	0.021	8.714	<0.001	0.443	0.225	H1: Supported
		GA - > EAO	0.178	0.019	9.368	<0.001	0.450	0.188	H2: Supported
		CSR - > EAO	0.156	0.014	11.143	<0.001	0.194	0.186	H3: Supported
		CSR - > SWMPs	0.100	0.011	9.091	<0.001	0.186	0.159	H4: Supported
		EAO - > SWMPs	0.110	0.012	9.167	<0.001	0.326	0.125	H5: Supported
Other	8	GA - > SWMPs	0.126	0.018	4.731	<0.001	0.443	0.175	H1: Supported
		GA - > EAO	0.134	0.022	5.929	<0.001	0.450	0.151	H2: Supported
		CSR - > EAO	0.107	0.008	10.800	<0.001	0.155	0.152	H3: Supported
		CSR - > SWMPs	0.162	0.015	4.757	<0.001	0.158	0.105	H4: Supported
		EAO - > SWMPs	0.140	0.019	7.368	<0.001	0.320	0.104	H5: Supported
Overall	N/A	GA - > SWMPs	0.781	0.627	4.731	<0.001	0.443	0.497	H1: Supported
		GA - > EAO	0.458	0.415	5.929	<0.001	0.450	0.520	H2: Supported
		CSR - > EAO	0.334	0.384	3.811	<0.001	0.440	0.512	H3: Supported
		CSR - > SWMPs	0.569	0.525	4.757	<0.001	0.530	0.589	H4: Supported
		EAO - > SWMPs	0.413	0.514	4.731	<0.001	0.281	0.371	H5: Supported

4.5. Discussions

A substantial number of qualitative research studies do not offer measurable insights into gains attributed to related propositions. Among them are CSR [45] and green accounting [28,29], methodologies for waste-sustainable actions. Therefore, the current study's findings validate and elucidate the interconnection between GA, CSR, EAO effectiveness, and SWMP methodology. As such, where household-level studies showed that greenhouse gas emissions can be reduced by 4.40 tons annually by replacing air conditioners with more efficient models [19], our expanded analysis at the industry level yields considerable contributions to greenhouse gas emissions reduction initiatives. Our study findings denote that GA significantly enhances SWMPs by 46.4 % ($\beta_1 = 0.464$) and promotes EAO effectiveness by 44.2 % ($\beta_2 = 0.442$). Such effects are highly concentrated among chemical manufacturing companies followed by EQ, FM, L&AP, AM, TPM, B&TP and other manufacturing companies. Apart from what the NAM opines as ascribed responsibility [21], stakeholder engagement as suggested by the stakeholders' approach is a contributing factor. This is also attributed to varying levels of organizational culture and commitment, resource availability and resource utilization, regulatory framework, technology and infrastructure, waste generation and environmental impact. These effects are also significant across the entire sample of Kurdistan's manufacturing companies by 78.1 % and 45.8 %, respectively. This contributes to a more environmentally sustainable approach. These novel constellations are emerging trends capable of playing instrumental roles in Tapio decoupling models showing an M-shaped decoupling between economic growth and carbon emissions [20]. When applied to nations like Japan, which are actively seeking alternative strategies to manage waste more sustainably and achieve pollution reduction goals [31], our findings hold significant implications. Similarly, these results are relevant to China, facing a substantial backlog of solid waste treatment amounting to 60–70

Table 9
Multigroup mediating effect analysis.

Industry	Mediating effect	Differences				
		Std. Est.	t.stat.	p.val		Decision
L&AP	GA - > EAO - > SWMPs	0.062	0.579	0.135	Insignificant	H6: Not supported
	CSR - > EA O- > SWMPs	0.079	0.510	0.551	Insignificant	H7: Not supported
AM	GA - > EAO - > SWMPs	0.055	0.483	0.220	Insignificant	H6: Not supported
	CSR - > EA O- > SWMPs	0.065	0.245	0.376	Insignificant	H7: Not supported
TPM	GA - > EAO - > SWMPs	0.049	0.685	0.307	Insignificant	H6: Not supported
	CSR - > EA O- > SWMPs	0.059	0.395	0.438	Insignificant	H7: Not supported
EQ	GA - > EAO - > SWMPs	0.043	0.518	0.421	Insignificant	H6: Not supported
	CSR - > EA O- > SWMPs	0.050	0.245	0.473	Insignificant	H7: Not supported
CM	GA - > EAO - > SWMPs	0.037	0.371	0.264	Insignificant	H6: Not supported
	CSR - > EA O- > SWMPs	0.041	0.450	0.319	Insignificant	H7: Not supported
B&TP	GA - > EAO - > SWMPs	0.031	0.722	0.356	Insignificant	H6: Not supported
	CSR - > EA O- > SWMPs	0.022	0.175	0.528	Insignificant	H7: Not supported
FM	GA - > EAO - > SWMPs	0.025	0.621	0.176	Insignificant	H6: Not supported
	CSR - > EA O- > SWMPs	0.027	0.280	0.297	Insignificant	H7: Not supported
Other	GA - > EAO - > SWMPs	0.018	0.754	0.186	Insignificant	H6: Not supported
	CSR - > EAO- > SWMPs	0.019	0.475	0.487	Insignificant	H7: Not supported
Overall sample	GA - > EAO - > SWMPs	0.062	0.723	0.473	Insignificant	H6: Not supported
	CSR - > EA O- > SWMPs	0.079	0.510	0.613	Insignificant	H7: Not supported

billion tonnes [33]. Our research aligns with Azeez's arguments, indicating that the adoption of green accounting aids corporations in monitoring resource usage, energy consumption, costs, and waste management practices [41]. This perspective is further supported by Rounaghi, who emphasizes that embracing green accounting practices encourages the adoption of innovative and efficient methods [40]. Likewise, Burritt et al. suggest that this leads to the implementation of environmentally sustainable practices, which play a crucial role in waste reduction and environmental performance enhancement [44]. Additionally, the adoption of green accounting contributes to advancements in environmental auditing by providing regulators with insights into the environmental impacts of economic activities. This encompasses waste management strategies addressing air pollution [49], water pollution [50], land pollution [51], and climate change [52]. Unlike studies by Chengzhe and Jing, which focus on China [42], and Ferieka, Meutia, and Taqi's examination of the USA [43], our study validates the propositions of hypotheses 1 and 2 within the context of a developing country. This novel contribution paves the way for establishing globally applicable SWMPs.

Adding further empirical weight to this study are establishments denoting that CSR positively influences both environmental auditing and SWM across all manufacturing companies and the combined study sample. Adding to Tat Dat Bui and others' study outcomes identifying a set of 146 barriers to SWM using the fuzzy Delphi method [8], our SEM approach outcomes suggest that both challenges can be collectively reduced significantly by adopting CSR practices. Thus, unlike Tat Dat Bui and others' study findings, our study emphasizes the theoretical basis of NAT, which elucidates how awareness of consequences and moral obligations shape pro-environmental behaviour [25]. As this uncovers the lack of a comprehensive approach to SWM policy development, this study's energy policy suggestions are well poised to fill such voids. This is crucial in dealing with a generated volume of wastes, treatment and disposal methods challenges [14] and catastrophic environmental repercussions of fossil fuels [34].

Our study presents a unique contribution by establishing direct estimations that link CSR, environmental auditing oversight effectiveness and SWM. Despite being a subject of longstanding academic debate, prior studies did not reveal these interactive connections [45,51]. Therefore, through the application of an SEM approach to analyze these structural relationships, our study has successfully achieved its objectives in this aspect. The findings underscore the significance of integrating CSR practices with environmental auditing oversight effectiveness to achieve SWM goals. This integration yields numerous benefits, including enhanced waste recycling rates, waste reduction initiatives and improved overall environmental performance. It also aids corporations in identifying areas for improvement, thereby mitigating potential environmental hazards such as air pollution [49], water pollution [50], land pollution [51], and climate change [52], all of which are associated with SWM and sustainable development [29]. Additionally, our study supports hypothesis 5, which suggests a positive interaction between environmental auditing and SWMPs across all manufacturing companies within the study sample.

Where studies dwell on vital subject matters like trade openness and carbon neutrality [20], artificial intelligence's direct, indirect, spillover, and heterogeneity effects on green innovation [17] and the fuzzy Delphi method's role in identifying sustainable solid waste management barriers [8], our study uses an SEM approach to analyze how these processes influence individual behaviours, encourage environmentally friendly actions, and facilitate transitioning to sustainable waste management within the context of manufacturing companies. In contrast to the framework proposed by Li and others, our prediction model is grounded not only in the recognition that ecological demands for resource consumption and waste generation have surpassed our biological carrying capacity but also in offering innovative strategies to mitigate ecological overshoot [16]. Based on these considerations and our study's empirical findings, the promotion of green accounting practices within chemical manufacturing companies has demonstrated a substantial enhancement in environmental auditing oversight and sustainable waste management by 78.1 % and 45.8 %, respectively. This underscores their significant contribution to addressing the persistent state of ecological overshoot, as discussed by Li and others [16].

The collective industry findings reveal a limited alignment of environmental auditing oversight in Kurdistan with the integration of

Table 10
Multi-group analysis.

Relationships	CM-EQ		CM-FM		CM- L&AP		CM-AM		CM-TPM		CM-B&TP		CM-Other	
	Diff.	**p.val.**	**Diff.**	**p.val.**	**Diff.**	**p.val.**	**Diff.**	**p.val.**	**Diff.**	**p.val.**	**Diff.**	**p.val.**	**Diff.**	**p.val.**
GA - > SWMPs	0.057	<0.001	0.011	<0.001	0.159	<0.001	0.204	<0.001	0.245	<0.001	0.281	<0.001	0.278	<0.001
GA -> EAO	0.056	<0.001	0.107	<0.001	0.153	<0.001	0.194	<0.001	0.231	<0.001	0.264	<0.001	0.308	<0.001
CSR - > EAO	0.003	<0.001	0.060	<0.001	0.009	<0.001	0.120	<0.001	0.150	<0.001	0.230	<0.001	0.270	<0.001
CSR - > SWMPs	0.200	<0.001	0.070	<0.001	0.110	<0.001	0.230	<0.001	0.400	<0.001	0.480	<0.001	0.518	<0.001
EAO - > SWMPs	0.050	<0.001	0.110	<0.001	0.180	<0.001	0.210	<0.001	0.240	<0.001	0.320	<0.001	0.390	<0.001

Note: * *The differences were computed by subtracting L&AP, AM, TPM, EQ, B&TP, FM and other industries recorded industry effects from the chemical manufacturing companies' observed highest industry values. The differences are significant in the relationships between chemical manufacturing industries and L&AP, AM, TPM, EQ, B&TP, FM and other industries ($p < 0.001$).*

green accounting into SWMPs by 6.2 % and the assurance of CSR with SWMPs by 7.9 %. Considering the contemporary nature of the study, considerable sustainable waste management benefits are not only confined to Kurdistan's manufacturing companies' lagging SWMPs but are also conceivable when applied in various contexts. Examples include Norway's challenges in waste disposal [32], China's pursuit of zero waste cities alongside waste reduction, separation, and utilization strategies [12], and Kyoto, Japan's efforts to promote a material-cycling society [11]. These findings diverge from Gautam and Singh's argument highlighting CSR integration as enhancing ethical and responsible business conduct significantly [45] and Rajic et al.'s proposition asserting that green accounting practices significantly lead to reduced greenhouse gas emissions [59]. Similar to Rajic et al.'s study findings, we, therefore, identify ethical raw materials sourcing, philanthropy, and sustainable business practices as crucial factors in enhancing the effectiveness of environmental audit oversight [59]. These factors contribute significantly to the innovative nature of the current study, which stands as the first of its kind. Through this study, potential explanations emerge regarding why Kurdistan manufacturing companies' green accounting, CSR, and SWMPs lack adequate monitoring by environmental audit oversight. This deficiency can be attributed to a lack of integration, specifically the failure to integrate environmental audit oversight effectively into the overall waste management strategy, resulting in an ineffective mediation of the relationship between green accounting and SWMPs. When compared to other studies, we also join the ranks of researchers like Shamsadini, Askari and Askari and suggest that environmental auditing may overlook various aspects of waste management, such as upstream activities like product design and manufacturing or downstream activities like consumer behaviour [60]. Additionally, environmental auditing may not effectively engage stakeholders such as local communities and employees in the waste management process, which can impede the development of effective solutions to waste management challenges. This limited scope of the auditing process hinders a thorough evaluation of the relationship between green accounting and SWM.

5. Conclusions

Our main focus was on streamlining and illustrating green accounting, CSR, environmental auditing oversight effectiveness and SWMPs' interconnectedness. In a context where waste production levels, costs, global warming, and environmental degradation are on the rise, waste agents (companies) and waste principals (governments) are constantly striving to establish and promote SWMPs. The misallocation of resources, escalating waste production levels, conflicts of interest between waste agents and waste principals, and a lack of mechanisms for identifying, monitoring, and being accountable for waste risks, as well as a deficiency in reporting and commitment to SWMPs, have greatly amplified these issues. Consequently, our study stands out by integrating these concepts and developing an original model. This offers innovative approaches to fostering SWMPs in Kurdistan manufacturing companies.

The findings reveal noteworthy insights: notably, chemical manufacturing companies exhibit a substantial advantage from green accounting practices, witnessing a 78.1 % and 45.8 % improvement in environmental auditing oversight and sustainable waste management, respectively, compared to other manufacturing sectors. This contributes to a deeper understanding of the benefits of adopting sustainability practices in the chemical manufacturing sector. Compared to conventional grey models, our model demonstrates that a 1-unit improvement in CSR enhances environmental auditing oversight effectiveness by 33.4 % and sustainable waste management by 56.9 % across industries. This comparison helps establish the effectiveness of the new model and underscores the importance of incorporating CSR practices for better environmental outcomes. Based on the current study, a lack of ascribed responsibility and stakeholder engagement threatens waste management sustainability in manufacturing companies, which sheds light on critical areas for improvement. The study uncovers that environmental auditing oversight in Kurdistan is insignificantly well-positioned for integrating green accounting with sustainable waste management practices by 6.2 % and ensuring CSR with sustainable waste management practices by 7.9 %. To overcome these limitations, the study implores manufacturing companies to engage stakeholders effectively, integrate waste management into the overall strategy, and conduct environmental audits. These findings also mandate corporations to implement SWMPs and use CSR practices to identify areas for improvement. Waste reduction and resource minimization may be partly achieved by increasing recycling and minimizing waste.

The study provides substance to the normative activation theory by incorporating the application of the principal-agent theory in the context of waste sustainability problems. This allows waste principals and stakeholders to effectively address conflicts of interest and ensure efficient use of resources and reduce waste and environmental damage. Practically, this is achievable by waste agents and principals working collaboratively to develop sustainable waste policies and practices, engaging with stakeholders to address concerns and promoting responsible resource management. Scientifically, the study provides insights into the application of SEM in examining the relationship between green accounting, CSR, and environmental auditing oversight, contributing to the literature on SEM methodology.

6. Policy implications

Recognizing that awareness of consequences and moral obligations shape pro-environmental behaviour, the study's policy implications demand a comprehensive approach to SWM policy development, encompassing CSR integration, awareness campaigns, behavioural insights, collaboration, and effective monitoring and evaluation. In light of the study's overall perspective, we propose a set of 8 specific energy policies comprising mandatory environmental auditing standards, incentives for sustainable practices, capacity-building programs, public reporting requirements, collaborative partnerships, promotion of renewable energy, waste management regulations, and public awareness campaigns.

6.1. Limitations and future recommendations

The study is not without limitations. Firstly, the study is limited to a specific region, the Kurdistan Region of Iraq. Therefore, the findings may not be generalizable to other regions with different waste management challenges. Secondly, the study limits its examination to leather and allied products, apparel, textile product mills, electronic equipment, chemical manufacturing, beverage and tobacco products and food manufacturing industries in the Erbil City of Kurdistan. Therefore, the findings cannot be generalised to other industries or extended to more general scenarios with different waste management practices. In light of these limitations, further research is necessary to dispel the preoccupation that SWMPs apply only to industries and countries. There is also a need to involve stakeholders such as government agencies, industry associations, environmental organizations, and local communities in research initiatives to foster collaboration, knowledge sharing, and co-creation of sustainable solutions.

Ethical declarations

This study was approved by the Ethics Committee of Cyprus International University, with ethics approval reference 100–10781. All participants/patients (or their proxies/legal guardians) provided informed consent for the publication of their anonymised case details and images.

Data availability

The data associated with our study is confidential and has not been deposited into any publicly available repository.

CRediT authorship contribution statement

Hawta Tareq Faieq: Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Kemal Çek:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e32725.

References

[1] A. Diggle, T.R. Walker, Implementation of harmonized Extended Producer Responsibility strategies to incentivize recovery of single-use plastic packaging waste in Canada, Waste Manag. 110 (1) (2020) 20–23.
[2] I. Arbulú, J. Lozano, J. Rey-Maquieira, The challenges of municipal solid waste management systems provided by public-private partnerships in mature tourist destinations: the case of Mallorca, Waste Manag. 51 (2016) 252–258.
[3] H. Wilts, N. Von Gries, B. Bahn-Walkowiak, From waste management to resource efficiency—the need for policy mixes, Sustainability 8 (7) (2016) 622.
[4] M. Kamali, T. Gameiro, M.E. Costa, I. Capela, Anaerobic digestion of pulp and paper mill wastes–An overview of the developments and improvement opportunities, Chem. Eng. Jour. (2016) 162–182.
[5] O.E. Ogunmakinde, T. Egbelakin, W. Sher, Contributions of the circular economy to the UN sustainable development goals through sustainable construction, Res., Cons. and Recy. 178 (2022) 106023.
[6] Y.H. Shih, S.J. Kasaon, C.H. Tseng, H.C. Wang, L.L. Chen, Y.M. Chang, Health risks and economic costs of exposure to PCDD/Fs from open burning: a case study in Nairobi, Kenya. Air Qua, Atmos. & Healt. (2016) 201–211.
[7] J.K. Debrah, D.G. Vidal, M.A. Dinis, Raising awareness on solid waste management through formal education for sustainability: a developing countries evidence review, Recycling 6 (1) (2021) 6.
[8] T.D. Bui, F.M. Tsai, M.L. Tseng, M.H. Ali, Identifying sustainable solid waste management barriers in practice using the fuzzy Delphi method, Res., Cons. and Recy. 154 (2020) 104625.
[9] W. Leal Filho, L. Brandli, H. Moora, J. Kruopienė, Å. Stenmarck, Benchmarking approaches and methods in the field of urban waste management, J. Clean. Prod. 112 (2016) 4377–4386.
[10] S.M. Jones, Waste management in Norway. Advancing a Circular Economy: A Future without Waste?, Springer, 2021, pp. 111–139.
[11] S.I. Sakai, J. Yano, Y. Hirai, M. Asari, R. Yanagawa, T. Matsuda, H. Yoshida, T. Yamada, N. Kajiwara, G. Suzuki, T. Kunisue, Waste prevention for sustainable resource and waste management, J. Mater. Cycles Waste Manag. (2017) 1295–1313.
[12] R.P. Lee, B. Meyer, Q. Huang, R. Voss, Sustainable waste management for zero waste cities in China: potential, challenges and opportunities, Clean Energy 3 (2020) 169–201.
[13] M. Nelles, J. Gruenes, G. Morscheck, Waste management in Germany–development to a sustainable circular economy? Proc. Environ. Sci. 35 (2016) 6–14.
[14] H.O. Iyamu, M. Anda, G. Ho, A review of municipal solid waste management in the BRIC and high-income countries: a thematic framework for low-income countries, Habitat Int. 95 (2020) 102097.
[15] Q. Wang, S. Hu, R. Li, Could information and communication technology (ICT) reduce carbon emissions? The role of trade openness and financial development, Telecommun. Pol. (2023) 102699.

[16] R. Li, Q. Wang, L. Li, S. Hu, Do natural resource rent and corruption governance reshape the environmental Kuznets curve for ecological footprint? Evidence from 158 countries, Res. Pol. 85 (2023) 103890.
[17] Q. Wang, T. Sun, R. Li, Does artificial intelligence promote green innovation? An assessment based on direct, indirect, spillover, and heterogeneity effects, Energy Environ. (2023) 0958305X231220520.
[18] Q. Wang, Y. Ge, R. Li, Does improving economic efficiency reduce ecological footprint? The role of financial development, renewable energy, and industrialization, Ener. & Env. (2023) 0958305X231183914.
[19] O.A. Lawal, A.A. Jimoh, K.A. Abdullah, B.A. Bello, E.D. Awoyemi, Economic and environmental impact of energy audit and efficiency: a report from a Nigeria household, Ener. for Sust. Dev. 79 (2024) 101387.
[20] Q. Wang, L. Wang, R. Li, Trade openness helps move towards carbon neutrality-Insight from 114 countries, Sust, Dev. 32 (1) (2024) 1081–1095.
[21] L. Steg, J. De Groot, General antecedents of personal norms, policy acceptability, and intentions: the role of values, worldviews, and environmental concern, Soc. Nat. Resour. 24 (4) (2011) 349–367.
[22] M.D. Esfahani, A.A. Rahman, N.H. Zakaria, Green IT/IS adoption as corporate ecological responsiveness: an academic literature review, Jour. of Soft Comp. and Dec. Sup. Sys. 2 (1) (2015) 35–43.
[23] J. Jansson, Green consumer behavior: Determinants of curtailment and eco-innovation adoption, J. Consum. Market. 27 (2010) 358–370.
[24] Y. Zhang, Z. Wang, Antecedents of employee electricity saving behavior in organizations: an empirical study based on norm activation model, Energy Pol. 62 (2013) 1120–1127.
[25] L. Guo, Y. Xu, G. Liu, T. Wang, C. Du, Understanding firm performance on green sustainable practices through managers' ascribed responsibility and waste management: green self-efficacy as moderator, Sustainability 11 (18) (2019) 4976.
[26] B. Debnath, A.M. Bari, S.M. Ali, T. Ahmed, I. Ali, G. Kabir, Modelling the barriers to sustainable waste management in the plastic-manufacturing industry: an emerging economy perspective, Sus. Analy. and Mod. 3 (2023) 100017.
[27] T.A. Kurniawan, X. Liang, E. O'Callaghan, H. Goh, M.H. Othman, R. Avtar, T.D. Kusworo, Transformation of solid waste management in China: Moving towards sustainability through digitalization-based circular economy, Sustainability 14 (4) (2022) 2374.
[28] S. Farouk, J. Cherian, J. Jacob, Green accounting and management for sustainable manufacturing in developing countries, Int. Jour. of Bus. and Manag. 7 (20) (2012) 36.
[29] J.C. Tu, H.S. Huang, Analysis on the relationship between green accounting and green design for enterprises, Sustainability 7 (5) (2015) 6264–6277.
[30] Q. Wang, F. Ren, R. Li, Exploring the impact of geopolitics on the environmental Kuznets curve research, Sus, Dev (2023).
[31] A. Zaman, Zero-waste: a new sustainability paradigm for addressing the global waste problem, in: The Vision Zero Handbook: Theory, Technology and Management for a Zero Casualty Policy, Spring. Inter. Pub., Cham, 2022, pp. 1195–1218. Feb 3 (pp. 1–24).
[32] Y. Xiao, J. Wu, M.J. Stephen, Advancing a circular economy: a future without waste? Palgrave Macmillan, Acta Politic. 58 (2023) 483–486. Switzerland.
[33] F. Rossi, P. Morone, North–South waste trade: Prime Example of the circular economy or Major environmental Threat? Circ. Econ. and Sus. (2023) 1–24.
[34] M.C. Udeagha, N. Ngepah, Striving towards carbon neutrality target in BRICS economies: assessing the implications of composite risk index, green innovation, and environmental policy stringency, An Inter. Jour. of Envir. Health and Sus 9 (1) (2023) 1–27.
[35] V. Weghmann Waste Management in Europe.
[36] M. Sarstedt, C.M. Ringle, J.F. Hair, Partial least squares structural equation modeling, Hand. of Mark. Res. 26 (1) (2017) 1–40.
[37] A. Mardani, E.K. Zavadskas, D. Streimikiene, A. Jusoh, M. Khoshnoudi, A comprehensive review of data envelopment analysis (DEA) approach in energy efficiency, Renew. Sustain. Energy Rev. 70 (2017) 1298–1322.
[38] J. Liu, Y. Yi, X. Wang, Exploring factors influencing construction waste reduction: a structural equation modeling approach, J. Clean. Prod. 276 (2020) 123185.
[39] J.S. Appannan, R. Mohd Said, T.S. Ong, R. Senik, Promoting sustainable development through strategies, environmental management accounting and environmental performance, Bus. Strat. Environ. 32 (4) (2023) 1914–1930.
[40] M.M. Rounaghi, Economic analysis of using green accounting and environmental accounting to identify environmental costs and sustainability indicators, Inter. Jour. of Eth. and Sys. 35 (4) (2019) 504–512.
[41] K.A. Azeez, I.A. Mahdi, Value Stream Mapping within green accounting: opportunities and challenges, Resmilitaris 13 (1) (2023) 1401–1411.
[42] N. Chengzhe, T. Jing, Discussion on green accounting information disclosure of the Steel industry from the perspective of sustainability, Acc. and Corp. Manag. 4 (6) (2022) 23–28.
[43] H. Ferieka, M. Meutia, M. Taqi, The growth of green accounting in Indonesia: a Bibliometric analysis using R, KnE Soc. Sci. (2022) 177–197.
[44] R.L. Burritt, C. Herzig, S. Schaltegger, T. Viere, Diffusion of environmental management accounting for cleaner production: evidence from some case studies, J. Clean. Prod. 224 (2019) 479–491.
[45] R. Gautam, A. Singh, Corporate social responsibility practices in India: a study of top 500 companies, Glob. Bus. and Manag. Res.: Int. J. 2 (1) (2010) 41–56.
[46] H. Al-Shaer, M. Zaman, Credibility of sustainability reports: the contribution of audit committees, Bus. Strat. Environ. 27 (7) (2018) 973–986.
[47] J. Henseler, C.M. Ringle, M. Sarstedt, A new criterion for assessing discriminant validity in variance-based structural equation modeling, J. Acad. Market. Sci. 43 (2015) 115–135.
[48] J. Martínez-Ferrero, I.M. Garcia-Sanchez, B. Cuadrado-Ballesteros, Effect of financial reporting quality on sustainability information disclosure, Corp. Soc. Responsib. Environ. Manag. 1 (2015) 45–64.
[49] A. Luthra, B. Chaturvedi, S. Mukhopadhyay, Air pollution, waste management and livelihoods: Patterns of cooking fuel use among waste picker households in Delhi, Geol. Rev. 113 (2) (2023) 229–245.
[50] N. Topić Popović, V. Lorencin, I. Strunjak-Perović, R. Čož-Rakovac, Shell waste management and utilization: mitigating organic pollution and enhancing sustainability, Appl. Sci. 13 (1) (2023) 623.
[51] H. Salim, M. Jackson, R.A. Stewart, C.D. Beal, Drivers-Pressures-State-Impact-Response of Solid Waste Management in Remote Communities: A Systematic and Critical Review, Clea. Waste Sys., 2023 100078.
[52] M. Hupponen, J. Havukainen, M. Horttanainen, Long-term evolution of the climate change impacts of solid household waste management in Lappeenranta, Finland, Waste Manag. 157 (2023) 69–81.
[53] S. Khan, S. Gupta, The interplay of sustainability, corporate green accounting and firm financial performance: a meta-analytical investigation, Sus. Acc., Manag. and Pol. Jour. (2023) ahead-of-print No. ahead-of-print.
[54] F. DeZoort, An investigation of audit committees' oversight responsibilities, Abacus 2 (1997) 208–227.
[55] N.J. Bennett, Using perceptions as evidence to improve conservation and environmental management, Conserv. Biol. 30 (3) (2016) 582–592.
[56] R. Gray, Social, environmental and sustainability reporting and organisational value creation? Whose value? Whose creation? Acc., Aud. & Acc. Jour. 19 (6) (2006) 793–819.
[57] A. Dahlsrud, How corporate social responsibility is defined: an analysis of 37 definitions, Corp. Soc. Resp. and Envir, OR Manag. 15 (1) (2008) 1–3.
[58] P.V. Saez, M. del Río Merino, A.S. González, C. Porras-Amores, Best practice measures assessment for construction and demolition waste management in building constructions, Resour. Conserv. Recycl. 375 (2013) 52–62.
[59] S. Rajic, V. Đorđević, I. Tomasevic, I. Djekic, The role of food systems in achieving the sustainable development goals: environmental perspective, Bus. Strat. Environ. 31 (3) (2022) 988–1001.
[60] K. Shamsadini, M. Askari Shahamabad, F. Askari Shahamabad, Analysis of factors affecting Environmental Audit (EA) implementation with DEMATEL method, Soc. Res. Jour. 19 (5) (2023) 777–796.