

Hasan, Saqr Ali Saleh; Waghule, S. N.; Hasan, Murad Baqis

## Article

# Linking environmental management accounting to environmental performance: the role of top management support and institutional pressures

Cogent Business & Management

## Provided in Cooperation with:

Taylor & Francis Group

*Suggested Citation:* Hasan, Saqr Ali Saleh; Waghule, S. N.; Hasan, Murad Baqis (2024) : Linking environmental management accounting to environmental performance: the role of top management support and institutional pressures, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 11, Iss. 1, pp. 1-20, <https://doi.org/10.1080/23311975.2023.2296700>

This Version is available at:

<https://hdl.handle.net/10419/325951>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by/4.0/>

## Linking environmental management accounting to environmental performance: the role of top management support and institutional pressures

Saqr Ali Saleh Hasan, S. N. Waghule & Murad Baqis Hasan

To cite this article: Saqr Ali Saleh Hasan, S. N. Waghule & Murad Baqis Hasan (2024) Linking environmental management accounting to environmental performance: the role of top management support and institutional pressures, Cogent Business & Management, 11:1, 2296700, DOI: [10.1080/23311975.2023.2296700](https://doi.org/10.1080/23311975.2023.2296700)

To link to this article: <https://doi.org/10.1080/23311975.2023.2296700>



© 2024 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 13 Feb 2024.



Submit your article to this journal [↗](#)



Article views: 3025



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 9 View citing articles [↗](#)

# Linking environmental management accounting to environmental performance: the role of top management support and institutional pressures

Saqr Ali Saleh Hasan<sup>a</sup>, S. N. Waghule<sup>b</sup> and Murad Baqis Hasan<sup>c</sup>

<sup>a</sup>Accounting Department, Tamar University, Dhamar, Yemen; <sup>b</sup>Department of Commerce, Anandrao Dhonde Alias Babaji College, B. A. M. University, Aurangabad, India; <sup>c</sup>Financial Administration Department, Central University of Punjab, Bathinda, India

## ABSTRACT

Using two theoretical lenses—knowledge-based view (KBV) and the institutional theory—the current study aims to examine the relationship of environmental management accounting (EMA) to environmental performance (EP), in addition to explore the mediating effect of top management support (TMS) and the moderating effect of institutional pressures (IP). A cross-sectional study using a structured questionnaire was conducted on 299 Yemeni manufacturing SMEs. Partial least square structural equation modeling (PLS-SEM) technique via Smart PLS version 4 software was used for the analysis of quantitative data collected from the respondents. The results indicated that EMA positively and directly affects EP, and indirectly through TMS. Additionally, TMS partially mediates the EMA-EP link. More importantly, IP positively moderates the impact of EMA on EP. Furthermore, EP positively affects FP. The theoretical and practical implications of these results are also discussed.

## IMPACT STATEMENT

This study investigates the correlation between environmental management accounting (EMA) and environmental performance within the context of manufacturing SMEs in Yemen, considering the influence of top management support and institutional pressures. The significance of this study arises from the relatively nascent status of EMA as a branch of accounting, leading to a scarcity of related research. Moreover, existing studies on this subject have predominantly been conducted in developed nations, leaving a notable gap in empirical research for developing and less developed countries. Yemen's current industrial practices, influenced by the energy sector, manufacturing industries, and ongoing conflicts, have resulted in environmental pressures and adverse impacts. The environmental challenges, particularly those stemming from manufacturing activities, remain intricate. Therefore, this study aims to promote the integration of EMA practices in manufacturing SMEs in Yemen, with the goal of advancing environmental protection objectives. The findings from this research serve as valuable resources for policymakers, professionals, and enterprises, offering insights that can contribute to the development and implementation of mechanisms and policies fostering sustainability in Yemen's manufacturing SMEs.

## ARTICLE HISTORY

Received 18 October 2023  
Revised 11 December 2023  
Accepted 11 December 2023

## KEYWORDS

Environmental management accounting; environmental performance; top management support; institutional pressures; financial performance

## REVIEWING EDITOR

Collins Ntim, University of Southampton, United Kingdom of Great Britain and Northern Ireland

## JEL CLASSIFICATIONS

M41; M19; Q65

## 1. Introduction

Environmental concerns have escalated in significance and garnered greater academic focus, not just within developed nations but also within developing nations (Al-Swidi et al., 2023a; Aslam et al., 2021; Huang & Shih, 2009; Shahab et al., 2018). This growing relevance can be attributed to the adverse impacts it has on the economic standing and strategic priorities of these nations (Al-Hakimi et al., 2022; Al-Swidi et al., 2022; Tseng & Chiu, 2013), and Yemen is no exception. As one of the least developed

**CONTACT** Saqr Ali Saleh Hasan ✉ [Saqrhasan81@gmail.com](mailto:Saqrhasan81@gmail.com) ✉ Accounting Department, Tamar University, Dhamar, Yemen

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

© 2024 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

countries, Yemen faces environmental sustainability challenges, ranking critically at 47th in the Environmental Performance Index (EPI) among Asian countries (Latif, 2022). On the other hand, the current pollution in Yemen caused by the energy sector, manufacturing industries, and the conflict is leading to economic, environmental, and social consequences (Al-Wesabi et al., 2022), underscoring the urgent need for addressing environmental concerns, especially given its pivotal geographical location and potential impact on the broader region (Al Asbahi et al., 2020).

Recognizing the need to find solutions that reconcile sustainability goals (Shehzad et al., 2023), firms are now motivated to enhance environmental mitigation measures and report environmental impacts to meet stakeholder expectations (Iredele et al., 2020; Jinadu et al., 2015; Nguyen et al., 2021). Due to these anticipations, companies have been compelled to use different environmental management methods, such as EMA, and to include environmental sustainability within the field of strategic management. EMA is regarded as an important topic of debate due to its role in helping management recognize and utilize the necessary information regarding EP (Tashakor et al., 2019). Environmental accounting is touted as 'the management of information on the environmental impacts and the financial consequences of environmentally relevant business activities that support internal and external decision-making, reporting, and accountability' (Latan et al., 2018: 297). Many studies have revealed the importance of EMA in improving corporate environmental performance (EP; Nkundabanyanga et al., 2021; Latan et al., 2018), however, it is still unclear how EMA improves EP due to the ambiguity surrounding it (Chuang & Huang, 2018; Mansoor et al., 2021). Understanding this relationship requires examining the direct and/or indirect effect of EMA on EP, focusing on potential mediating and/or moderating variables. Consistent with this approach, the present research centers on the role of top management support (TMS) as a potential mediator and under the conditional effect of institutional pressures (IP). As such, this study addresses TMS and IP as critical factors linking EMA to EP.

EMA, as an intangible asset, holds significance for companies engaged in environmental initiatives (Ilyas et al., 2020), since it is essential for improving their EP (Latan et al., 2018). However, making the resource allocation and development decisions necessary to achieve effective practices requires top management support (Blass et al., 2014). TMS plays an important role in many organizational behavior research such as EMA adoption behavior (Phan et al., 2017; Wang et al., 2019). Prior research indicated that TMS contributes to translating EMA practices into organizational outcomes (e.g. Bresciani et al., 2023; Wijethilake et al., 2017). On the basis of the same logic, it can be predicted that TMS may also mediate the effect of EMA on EP. Furthermore, the importance of IP should not be overlooked when adopting EMA, because IP is inextricably linked to the specific circumstances in which EMA is used (Gunarathne et al., 2021). Numerous Previous research refers that IP plays an important role in motivating organizations to adopt and implement EMA within their operational framework (Phan & Baird, 2015; Wang et al., 2019). Consequently, there is a need for a better comprehension of the relationships between EMA, TMS, and EP along with examining how IP influences the EMA-EP relationship. Moreover, to establish compelling arguments regarding the significance of EP, it is essential to empirically demonstrate - the link between EP and financial performance (FP).

In all, this study aims to:

- Examine the effect of EMA on EP,
- Explore whether TMS mediates the EMA-EP relationship, and
- Investigate whether IP moderates the EMA-EP relationship.

The firms surveyed are manufacturing SMEs in Yemen. Despite the importance of environmental practices (in this case EMA) for improving corporate EP, several studies have revealed that SMEs lack interest in environmental practices and sustainability because of poor financial situations (Memon et al., 2020), especially in developing countries. Manufacturing firms still face complex challenges in establishing effective governance systems (Kirschke & Newig, 2017; Wagner, 2020), acquiring an understanding and awareness of environmental concerns (Ikram et al., 2019), addressing deficiencies in technology infrastructure and skilled workforce, and navigating the intricacies of EMA design and implementation (Moktadir et al., 2018). These challenges have caused some manufacturing SMEs to move away from the market (Al Koliby et al., 2022a, 2022b; Hussain et al., 2015). Therefore, Yemen provides a favorable environment for exploring this matter, and the outcomes might offer valuable insights for learning and decision-making for both researchers and professionals.

This study makes several contributions. First, this study focuses on SMEs in the context of least developing countries, such as Yemen when evaluating the relationship between EMA and EP. While some studies have explored the connection between EMA and EP, they have primarily focused on developed and developing countries (Danso et al., 2019; Latif et al., 2020). Moreover, despite the growing environmental concern about the environmental impacts of manufacturing SMEs, their engagement in environmental practices remains substandard (Al-Hakimi et al., 2023), requiring further research. Second, it examines the mediating role of TMS between EMA and EP. Third, it explores the moderating role of IP in the EMA-EP relationship. Finally, by integrating FP, this study expands the debate on the relationship between EMA, EP, and FP in another context (Agyemang et al., 2021; Aigbedo, 2021; Deb et al., 2022).

The rest of the paper is structured as follows. The second and third sections present the research context and theoretical background. The following sections review the empirical literature and hypotheses development, outline the research design, and report the findings and discussion. The final section concludes the paper.

## 2. Background

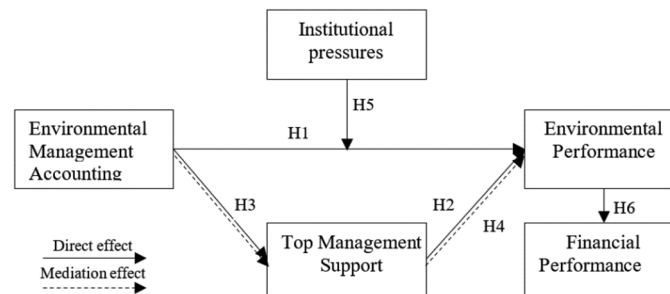
On a worldwide scale, small and medium enterprises (SMEs) have been recognized as a significant catalyst for the economic progress of both developed and developing nations due to their substantial number and the significant portion of the workforce engaged in them. For developing countries, SMEs constitute no less than 90% of businesses, contribute to 40%–60% of the GDP, and offer nearly 40% of global industrial production and 35% of global exports (Asgary et al., 2020). In the Yemeni context, SMEs play a crucial role in the economy, as highlighted by the Yemeni Ministry of Industry & Trade (2016), and the World Bank (2015). Beyond being significant employers, SMEs pave the way for the future workforce (Aga et al., 2015). Despite the dominance of SMEs in the manufacturing sector, their contribution to the country's GDP is relatively modest (Al-Hakimi et al., 2021; Goail & Al-Hakimi, 2021). According to the World Bank's (2015) report, the manufacturing sector's contribution to the national GDP declined from 19% between 1990 and 1994 to 15% between 2005 and 2010. Additionally, USAID. (2020) indicated that manufacturing SMEs constitute only 9.9% of Yemen's GDP and employ just 4% of the workforce, a comparatively low percentage compared to other developing economies. While all of these results from numerous challenges, such as inadequate infrastructure, difficulties in sourcing raw materials, insufficient technical support, slow adoption of new technologies, and a shortage of skilled workers. These hurdles are compounded by a lack of financing opportunities (AlQershi et al., 2020). Nevertheless, the suboptimal performance of SMEs in Yemen underscores a crucial issue and provides a compelling reason for academic researchers to investigate the primary factors contributing to this situation. On the other hand, examining the pivotal role of SMEs in the development of emerging economies, particularly in the Yemeni context, contributes significantly to the existing literature.

Moreover, given Yemen's environmental sustainability challenges, ranking 47<sup>th</sup> in the EPI among Asian countries (Latif, 2022), urgent attention is needed to address environmental concerns due to Yemen's strategic geographical location and potential impact on the broader region (Al Asbahi et al., 2020). The SME manufacturing sector in Yemen is particularly noted for its subpar EP (Al-Hakimi et al., 2023), placing it in a challenging position amid global competition (Battour et al., 2021). The current pollution in Yemen, stemming from the energy sector, manufacturing industries, and conflicts, is resulting in economic, environmental, and social consequences (Al-Wesabi et al., 2022). Manufacturers now recognize the imperative to find solutions that align with sustainability goals (Shehzad et al., 2023). Despite assertions by various authors, including Malca et al. (2019), and Veronica et al. (2019), that SMEs drive growth in emerging economies, environmental practices in these economies remain under-researched (Al-Hakimi et al., 2022).

## 3. Theoretical literature

### 3.1. Theoretical basis

Relying on the knowledge-based view (KBV) and the institutional theory, the conceptual model that illustrates the relationships among the key constructs of this study has been developed (Figure 1).



**Figure 1.** Research model.

Source: Authors' own work.

This research investigates the connection between EMA, TMS, and EP based on KBV. The KBV of firms builds upon and expands the Resource-Based View (RBV), with a particular focus on how businesses generate, obtain, safeguard, leverage, and disseminate knowledge (Fakhreddin & Foroudi, 2022; Grant, 1996). In the context of the KBV, knowledge is recognized as a crucial strategic asset for organizations (Kengatharan, 2019). The objective of the firm is to create and utilize this knowledge (Nonaka, 1994). Knowledge resources are challenging to replicate and are especially important for ensuring long-term competitive advantage. According to the findings of Wiklund and Shepherd (2003), knowledge resources are intangible and ever-changing, making them hard to imitate, and they contribute to securing a sustained competitive advantage over the long term (Curado & Bontis, 2006). In this study, EMA and TMS were utilized as tools to gauge EP. These are intangible assets that hold value for a firm's success and enhance its EP (Latan et al., 2018).

Along with KBV, this study adopted the institutional theory to investigate the moderating effect of IP. Institutional theory, as outlined by Scott et al. (2004), posits that various institutional factors play a role in shaping businesses' choice to adopt a particular change, including IP, as discussed by Powell and Colyvas (2008). As a result, this theory theoretically supports the current study. The literature offers valuable information on how these factors within institutions can lead to organizational change (Bamfo et al., 2023). Such studies by Gholami et al. (2013; Qian et al., 2018) provide how various organizational transformations might be caused by practices like EMA adoption and performance management. Nonetheless, the existing body of literature lacks a robust interpretation and empirical substantiation demonstrating how corporate theory supports and elucidates the adoption of EMA and the attainment of ecological objectives within a corporation (Chaudhry & Amir, 2020). The present research aims to address this gap and deficiency in the literature by incorporating IP with KBV in explaining the effect of EMA on EP and FP with the mediating role of TMS under the influence of IP.

### 3.2. Environmental management accounting

EMA is characterized as ecological and financial management through the use and execution of comprehensive techniques and procedures for reporting on sustainability (Chiou et al., 2011). According to Latan et al. (2018), EMA is defined as 'the management of information on the environmental impacts and the financial consequences of environmentally relevant business activities that support internal and external decision-making, reporting, and accountability'. EMA distinguishes itself from conventional accounting systems by recognizing environmental data, quantifying environmental metrics, and analyzing environmental data into financial records, effectively it takes environmental considerations. From a management accounting viewpoint, EMA represents a fusion of cost and financial accounting practices aimed at reducing environmental impacts, mitigating risks, and lowering costs (Bresciani et al., 2023). EMA deals with ecological data that has ecological implications and improves the sustainability performance of a business. EMA can be split into two distinct elements: the materialistic aspect and the financial aspect. The tangible aspect of EMA relies on data regarding the natural environment, quantified in physical units (Dakwale et al., 2011). whereas the intangible aspect of the EMA is focused on business operations that have an impact on the ecological and are expressed in the financial aspect (Mansoor et al., 2021).



### **3.3. Top management support**

As a result of its role within the company, top management steers the course of organizational activities (Sheikh et al., 2018). The organization adheres to the actions, guidance, and endeavors of top management in establishing the ultimate trajectory for the firm's development (Liu et al., 2020). The important function of TMS makes it the most crucial and fundamental factor affecting the success of a project (ibid). Overall, TMS holds importance in shaping a company's behaviors and operations (Lin, 2010). The literature suggests that TMS is considered a crucial internal driver for initiating specific behaviors (Blass et al., 2014). Furthermore, scholars have identified TMS as an intangible resource capable of augmenting a business' achievements (Perez et al., 2007).

### **3.4. Institutional pressures**

From the perspective of institutional theory, external and institutional environments, including laws, values, cultures, shared cognitions, norms, and social expectations, exert significant influence on organizational behaviors and practices (DiMaggio & Powell, 1983; Wang et al., 2019). To attain and sustain legitimacy, organizations are inclined to adjust their behaviors, and structures, and embrace prevailing practices in accordance with the external and institutional environment (DiMaggio & Powell, 1983).

## **4. Empirical literature and hypotheses development**

### **4.1. Environmental management accounting and environmental performance**

EMA enables businesses to recognize potential environmental advantages by serving as a means to implement financial controls and environmental management strategies. This, in turn, empowers businesses to gauge, oversee, and disclose their EP. Past research conducted by Henri and Journeault (2010) suggests a positive relationship between environmentally sustainable methods and firm performance. When advanced management accounting practices like EMA are utilized, they contribute to more effective control and decision-making processes. EMA is valuable for monitoring EP and tracking ecological costs (Burritt & Saka, 2006). Moreover, EMA is viewed as a methodology for disclosing information that assists companies in achieving enhanced FP and EP (Zhou et al., 2017). EMA is considered a crucial subject of discussion as it assists management in locating and using the information required to enhance EP. EMA is regarded as the internal management instrument employed by the company to address both its environmental responsibilities and traditional methods (Qian et al., 2018). EMA is considered a means to address both financial and physical environmental concerns. literature has affirmed that both physical and financial data are valuable for effective decision-making that enhances EP. EMA greatly improves EP (Asiaei et al., 2021). The scholars verified that EMA contributes favorably to EP disclosure. (Nkundabanyanga et al., 2021). Accordingly, it can be assumed that:

H1: EMA is positively related to EP.

### **4.2. Top management support and environmental performance**

Top management that is dedicated to environmental concerns will embrace an accounting system that provides data like material flow cost accounting system will be adopted by top management that is environmentally conscious (Christ & Burritt, 2015). The body of research shows that when senior management is aware that their actions might improve ecological performance, their incentive to do so increases (Latan et al., 2018). Additionally, research indicates that ecological committees within companies rely on TMS for addressing environmental matters, which in turn contributes that result in higher EP. (Dixon-Fowler et al., 2017). According to earlier studies (Ilyas et al., 2020; Spencer et al., 2013), senior management commitment and support are important in resolving environmental problems. TMS enables businesses to start and carry out green initiatives and ecological concerns (Sarkis et al., 2010). Based on this, the following assumption can be put forward:

H2: TMS is positively related to EP.

### **4.3. Environmental management accounting and top management support**

Many researchers have conducted their research on the manager's role in different contexts. Researchers argue that TMS is significantly affected by organizational practices (Akthar, 2022; De Vries, 2000), given that leaders guide the organization in line with its organizational priorities. Jacobsen and Bøgh Andersen (2015) have asserted that organizations thriving in uncertain environments become crucial catalysts for viability, success, and expansion. Consequently, these organizations require their leaders or TMS capabilities to inspire employees to enhance performance and compete effectively in the market. For the EP, EMA is certainly important because the stakeholders expect an organization to make wise and responsible use of available resources. This also means that firms are required to protect the environment, lessen their usage, and avoid waste generation from the air, water, energy, minerals, and other materials used in the manufacturing process (Akthar, 2022). It is also expected to recycle and reuse the materials to the maximum extent instead of relying on nature to handle these issues (ibid). Preservation of nature in its actual form is the prime responsibility of an organization vis-à-vis the dumping of hazardous materials in the environment (Arulrajah et al., 2016). Bresciani et al. (2023) also believed that TMS is influenced by EMA practices. However, the question of whether TMS is influenced by EMA practices still needs to be answered. Therefore, it can be assumed that:

H3: EMA is positively related to TMS.

### **4.4. Mediating of top management support**

Although limited, prior research (e.g. Bresciani et al., 2023; Nkundabanyanga et al., 2021) has established the direct impact of EMA on EP. However, there has been a noticeable absence of attention to the potential mediating role played by TMS in this relationship. EMA helps measure, control, and disclose corporate EP (Naranjo Tuesta et al., 2021). EMA aids businesses in meeting their ecological obligations and directly acknowledging the economic advantages associated with enhanced ecological and FP (Ferreira et al., 2010). Additionally, EMA is essential for tracking ecological expenditures and recording EP (Burritt & Saka, 2006). EP is greatly impacted by eco-friendly practices (Henri & Journeault, 2010). Nonetheless, this process is facilitated by TMS, which plays a central role in examining corporate behaviors, such as the application of EMA (Phan et al., 2017), and the uptake of contemporary accounting practices/systems (Tung et al., 2014), such as EMA in this study. Accordingly, it can be assumed that:

H4: TMS mediates the EMA-EP relationship.

### **4.5. Moderating of institutional pressures**

IP forces organizations to implement environmental management techniques, according to the institutional theory. In addition to technological efficiency, IP represents the constraints placed on enterprises to embrace environmental management techniques by governments, professions, or society, in addition to technological efficiency (Jalaludin et al., 2011). In general, these pressures can be categorized into three fundamental elements: coercive, mimetic, and normative (DiMaggio & Powell, 1983). It is commonly proposed and experimentally verified that the espousal of sustainability management methods, which encompasses ecological strategies used by companies, is influenced by IP (Gunarathne & Lee, 2019).

Despite the important role that EMA plays in improving EP, the adoption of EMA within an organization is influenced by numerous factors, including IP. Previous studies have also highlighted the crucial roles played by various institutional pressures in compelling organizations to embrace and implement EMA (Christ & Burritt, 2013; Wang et al., 2019). Numerous studies suggest that IP plays a moderating role in shaping the effects of ecological management practices on EP. For instance, Kalyar et al. (2020) discovered that IP moderates the association between green supply chain practices and the EP and FP of textile companies. Similarly, Dubey et al. (2015) observed that IP moderates the effect of overall quality management and supplier relationship management on the EP enterprises in the Indian rubber industry. Accordingly, the following hypothesis can be presented:

H5: IP positively moderates the EMA-EP relationship.



#### 4.6. Environmental performance and financial performance

EP is becoming an increasingly important concern for a diverse group of stakeholders globally, including governments, corporations, lawmakers, and consumers (Soloivida & Latan, 2017). Changing is seen as a threat to environmental stability; as a result, climate change mitigation strategies must include sustainable environmental practices like cutting greenhouse gas emissions. (Anthony, 2019). According to the literature, EP includes internal and external, along with ethical and value-driven considerations related to developmental issues (Wu et al., 2020). They have demonstrated how EP metrics tackle ecological issues, encompassing aspects such as internal processes, interactions with a variety of stakeholders, the mitigation of external consequences, and adherence to ecological regulations. Emphasizing the integration of ecological efficiency among stakeholders, it has been suggested that environmental accounting provides businesses with a valuable means of communicating their environmentally friendly policies and achievements. However, because of conflicting results from earlier studies, more research is needed for EMA, EP, and FP (Iwata & Okada, 2011; Latan et al., 2018). Many empirical investigations have provided evidence supporting the favorable link between an organization's EP (Clarkson et al., 2011; Eltayeb et al., 2011). Similarly, an important correlation between EP and FP has also been shown in long-term investigations (Wagner & Schaltegger, 2004). Based on this, the following hypothesis can be proposed:

H6: EP is positively related to FP.

The proposed research model, illustrated in Figure 1, displays the relationship between EMA, EP, and FP in the presence of TMS as a mediating variable and IP as a moderating variable.

### 5. Research design

#### 5.1. Data and sampling

To achieve the goals of the current study, a quantitative method was utilized with data gathered from managers/owners of manufacturing SMEs in Yemen via a questionnaire. The study's intended population encompasses various manufacturing sectors, such as food and beverage, packaging, furniture, plastics, and textiles, as well as petrochemical and chemical industries. The unit of analysis for this study represents manufacturing SMEs. According to the 'number of employees' criteria outlined by the Yemeni Ministry of Industry and Trade (YMIT, 2014), SMEs were defined. According to this classification, small enterprises were defined as those with 4–9 employees, while medium-sized enterprises were defined as those with 10–50 employees.

From the YMIT (2014) database, which has been referenced by several studies (e.g. Al-Hakimi et al., 2023; Goail & Al-Hakimi, 2021), a sample of SMEs from various manufacturing sectors located in the Sana'a region of Yemen was selected according to a simple random sampling method. Overall, there are approximately 1,058 manufacturing SMEs situated in the Sana'a region. Following the guidelines provided by Krejcie and Morgan (1970), the sample size was calculated using the formula presented below, yielding a sample size of 282. To address potential non-response and minimize errors, the initial sample size was subsequently expanded to 400.

$$n = \frac{X^2 NP (1 - P)}{e^2 (N - 1) + X^2 P (1 - P)}$$

$$n = \frac{3.841 * 1058 * 0.5 (1 - 0.5)}{0.05^2 (1058 - 1) + 3.841 * 0.5 (1 - 0.5)} = 282$$

Where  $N$  is the population size,  $X^2$  is the Chi square table value for one degree of freedom,  $P$  is the population proportion, and  $e$  is the accuracy degree.

Subsequently, SME managers were personally contacted via telephone to explain the research's purpose and request their participation. Out of 400 questionnaires distributed via email/and in person, 299 questionnaires were suitable for analysis. Table 1 shows the number of questionnaires distributed, received, and suitable for analysis.

**Table 1.** Questionnaire distribution.

Sample size	Distributed	Suitable for analysis
282	400	299

Source: Authors' own work.

**Table 2.** Sample characteristics.

Category	Frequency (%)	Category	Frequency (%)
Gender:		Position:	
Male	259(86.62%)	Manager	82 (27.42%)
Female	40(13.38%)	Owner	217 (72.58%)
Experience:		Age:	
1–5 years	70(23.41%)	Less than 30 years	64 (21.40%)
6–10 years	91(30.44%)	31–40 years	101 (33.78%)
11–15 years	97(32.44%)	41–50 years	85 (28.43%)
Above 15 years	41(13.71%)	Above 50 years	49 (16.39%)

Source: Authors' analysis.

The studied firms varied in terms of size (5–9 employees accounted for 66.22% and 10–50 employees for 33.78%) and age (Less than 20years-26.76% and 20years and above-73.24%). In addition, the participants varied in terms of demographic and organizational characteristics, as shown in [Table 2](#).

## 5.2. Variables

The construct measurement items were adapted from previous studies:

- EMA (Independent variable): it was measured using four items adopted from Wang et al. (2019).
- EP and FP (Dependent variables): EP was measured using a three-item scale adopted from Bresciani et al. (2023), while FP was measured with three items adopted from Deb et al. (2022).
- TMS (Mediator): it was measured with three items adopted from Wang et al. (2019).
- IP (Moderator): it was measured with three items adopted from Gunarathne et al. (2021).

A Likert scale with five points was employed to evaluate responses, ensuring consistency across all items in the questionnaire. For a comprehensive list of the variables and the corresponding items used for measurement as in [Appendix 1](#).

## 5.3. Analysis methods

For the data analysis, the structural equation modelling partial least squares (SEM-PLS) via SmartPLS version 4 software was employed, following the recommendations provided by Ringle et al. (2015). The extensive advantages associated with PLS-SEM have led to its broad adoption in research within the domains of management and related disciplines within the social sciences (Al-Swidi et al., 2023b; Goail & Al-Hakimi, 2021). This method is particularly appropriate when working with limited sample sizes, as indicated by Henseler et al. (2009), and when the research primarily emphasizes prediction, as highlighted by Hair et al. (2022). When used on complex models with limited sample sizes, it demonstrates increased statistical power compared to covariance-based Structural Equation Modeling (SEM). This is consistent with the current study's context, as PLS-SEM is capable of examining relationships among multiple constructs simultaneously, even with a sample size of 299 cases. The PLS model encompasses two interconnected components: the 'measurement model' and the 'structural model'.

Before testing the hypotheses, the presence of common method bias (CMB) was checked following the recommendations of Podsakoff et al. (2012) using Harman's single-factor test. The findings affirm that the data is devoid of CMB, as the percentage of variance in one factor was reported to be below the 50% cutoff. Additionally, as proposed by Fuller et al. (2016), an alternative method to check for CMB involved examining the collinearity variance inflation factor (VIF) in SmartPLS version 4 software. The results also indicate that the VIF values are below the suggested cutoff of 3, as proposed by Fuller et al. (2016). Hence, the data does not raise concerns about CMB.

## 6. Empirical results and discussion

### 6.1. Measurement model

For this study, the measurement model was assessed using the confirmatory composite analysis (CCA) method (Hair et al., 2020). When the composite reliability (CR) and Cronbach's alpha ( $\alpha$ ) values are more than 0.70, the reliability is reached (Nunnally & Bernstein, 1994). Additionally, 'convergent validity' and 'discriminant validity' were employed to evaluate the construct validity (Hair et al., 2019).

To verify convergent validity, the average variance extracted (AVE) value for each concept must be more than 0.50 (Sarstedt et al., 2022). Additionally, each item's factor loadings must be greater than 0.70. (Hair et al., 2018), as shown in Tables 3 and Figure 2.

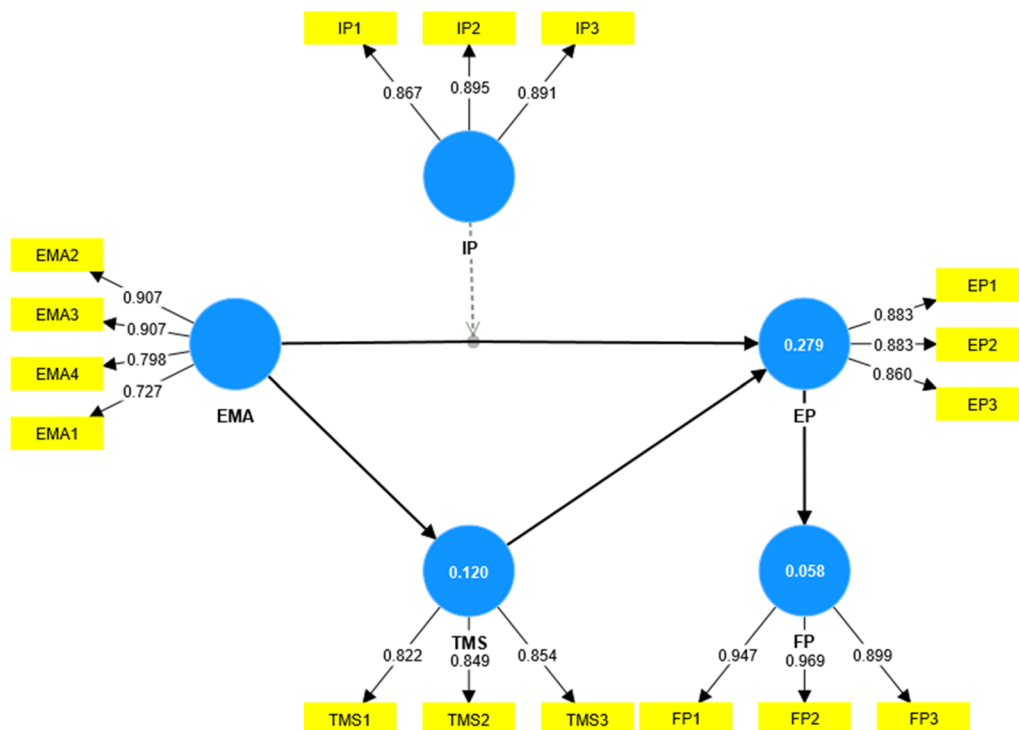
To confirm the validity of the discriminant, the 'Heterotrait-Monotrait (HTMT)' approach was utilized, following the guidance of Henseler et al. (2015). In accordance with Henseler et al. (2015), the values

**Table 3.** Loadings, reliability, and convergent validity.

Variables	Items code	Factor loading	$\alpha$	CR	AVE
EMA	EMA1	.727	.856	.877	.702
	EMA2	.907			
	EMA3	.907			
	EMA4	.798			
TMS	TMS1	.822	.811	.863	.709
	TMS2	.849			
	TMS3	.854			
IP	IP1	.867	.860	.861	.782
	IP2	.895			
	IP3	.891			
EP	EP1	.883	.848	.853	.766
	EP2	.883			
	EP3	.860			
FP	FP1	.947	.933	.948	.882
	FP2	.969			
	FP3	.899			

Note: AVE=average variance extracted; CR=composite reliability;  $\alpha$  = Cronbach's alpha; EMA=environmental management accounting; TMS=top management support; IP=institutional pressures; EP=environmental performance; FP=financial performance.

Source: Authors' analysis.



**Figure 2.** Measurement model.

Source: Authors' analysis.

within the HTMT matrix must remain below 0.90, especially in relationships between different variables. In our study, the results demonstrated that none of the values exceeded this threshold, as shown in Table 4. As shown in Tables 3 and 4, all criteria 'loadings, reliability, and validity' have been satisfied, affirming the validity of the measurement models. In summary, the findings confirm that the constructs in the model (as depicted in Figure 1) demonstrate both convergent and discriminant validity.

Lastly, the model's adequacy with the collected data was assessed, and the RMSEA value of 0.075 indicates an acceptable fit for the measurement model (Byrne, 2016).

## 6.2. Structural model

The structural model was assessed using the CCA procedure's second-step recommendations (Hair et al., 2020). The model's routes (Figure 1) were assessed for significance using a t-statistic calculated using the bootstrapping method (Peng & Lai, 2012). Bootstrapping with 5,000 resamples yielded robust path estimates for hypothesized associations. PLS-SEM supports the predicted correlations in Tables 5–7.

The findings of the hypotheses are summarized in Table 5 and Figure 3. The results reveal that all paths exhibited positive and significant relationships. So, the following hypotheses are supported: H1, H2, H3, and H6.

Moreover, the interaction analysis of EMA and IP on EP was carried out to investigate whether IP serves as a moderator in the connection between EMA and EP. The findings, as outlined in Table 6, affirm that IP positively moderates the connection between EMA and EP. Therefore, H5 is supported.

Additionally, an indirect analysis was carried out to investigate whether TMS serves as a mediator in the connection between EMA and EP, consistent with Sarstedt et al. (2020) recommendations. The findings, as outlined in Table 7, affirm that TMS mediates the association between EMA and EP. Although EMA had a significant indirect effect on EP ( $\beta=0.054$ ,  $p<0.05$ ), it also had a significant direct effect

**Table 4.** Discriminant validity.

Variables	EMA	TMS	IP	EP	FP
EMA					
TMS	.380				
IP	.091	.238			
EP	.514	.343	.189		
FP	.064	.242	.293	.268	

Source: Authors' analysis.

**Table 5.** Path coefficients (direct effects).

Path	$\beta$	t value	p-value	Confidence interval		Decision
				BCI LL	BCI UL	
EMA→EP	.392	7.239	.000	0.286	0.503	H1: Supported
TMS→EP	.155	2.618	.009	0.036	0.267	H2: Supported
EMA→TMS	.346	6.184	.000	0.240	0.461	H3: Supported
EP→FP	.240	3.825	.000	0.114	0.359	H6: Supported

Source: Authors' analysis.

**Table 6.** Path coefficients (moderating effect).

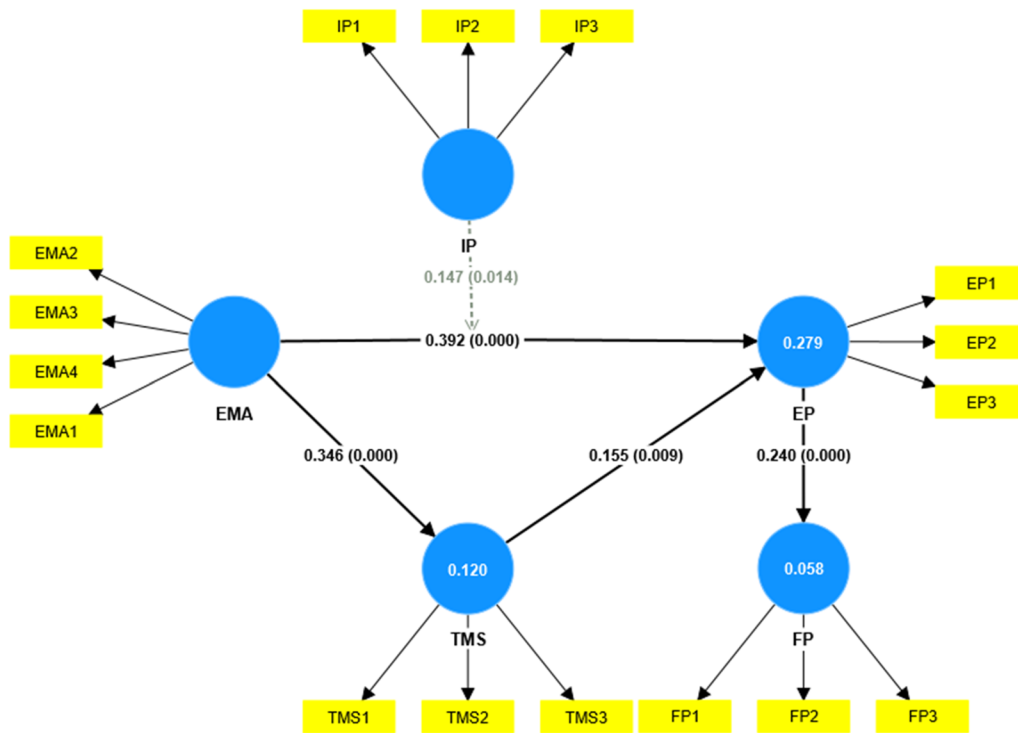
Path	$\beta$	t value	p-value	Confidence interval		Decision
				BCI LL	BCI UL	
EMA*IP→EP	.147	2.457	.014	0.032	0.266	H1: Supported

Source: Authors' analysis.

**Table 7.** Path coefficients (indirect effects).

Path	Direct path			Indirect path			Confidence interval		Decision
	$\beta$	t value	p-value	$\beta$	t value	p-value	BCI LL	BCI UL	
EMA→TMS→EP	0.392	7.239	0.000	0.054	2.300	0.021	0.012	0.103	H4: Partial mediation

Source: Authors' analysis.



**Figure 3.** Structural model.

Source: Authors' analysis.

**Table 8.**  $R^2$ , prediction, and effect size.

Constructs	$R^2$	$Q^2$	$f^2$ About		
			TMS	EP	FP
EMA			0.136	0.183	
IP					
TMS	0.120	0.109		0.028	
EP	0.279	0.233			0.354
FP	0.058	0.007			

Source: Authors' analysis.

( $\beta=0.392$ ,  $p<0.01$ ), implying that TMS partially mediates the EMA-EP relationship. Consequently, H4 is supported.

Subsequently, the model's capacity was assessed to explicate variance using the  $R^2$  values for the internal variables. As presented in Table 8, the  $R^2$  values for the internal variables in our model were as follows: TMS (0.120), EP (0.279), and FP (0.058). These results can be interpreted according to Chin's guidelines for forecasting, where 0.10 signifies weak prediction, 0.33 indicates moderate prediction, and 0.67 suggests strong prediction (Chin, 1998).

Additionally, Cohen's  $f^2$  criteria were employed to evaluate the magnitude of each predictor's effect (Cohen, 2013). Cohen's guidelines classify  $f^2$  values of '0.35, 0.15, and 0.02' as 'large, medium, and small effects', respectively. Accordingly, the effect sizes in our study were as follows: EMA on TMS had an effect size of 0.136, EMA on EP had an effect size of 0.183, TMS on EP had an effect size of 0.028, and EP on FP had an effect size of 0.354 (refer to Table 8 for details). Moreover, the model's predictive capacity using Stone-Geisser's  $Q^2$  was assessed. The  $Q^2$  values for the internal variables, namely TMS (0.109), EP (0.233), and FP (0.007), all exceeded zero, indicating sufficient predictive relevance (following the criteria of Hair et al., 2022; Peng & Lai, 2012).

### 6.3. Discussion of results

This research seeks to enhance the Knowledge-Based View (KBV) theory by examining the connection between EMA and EP, with a focus on the mediating influence of TMS. Additionally, it examines the

role of IP as a moderator between EMA and EP. The results show that EMA positively affects EP, consistent with prior research that posited a similar positive relationship. (e.g. Nkundabanyanga et al., 2021; Solovida & Latan, 2017). In this research, EMA is regarded as a managerial accounting tool employed to address environmental challenges. Our study suggests that organizations should contemplate the adoption of EMA as a means to enhance their EP. Top management, for instance, ought to keep track of all materialistic inputs and outputs, including trash, emissions, water, and materials. Analyses of product inventories, product environmental effects, and product improvement should all be acknowledged by top management. Furthermore, an accounting system can identify, assess, and categorize costs and obligations related to the environment. The results also reveal a favorable effect of EMA on TMS, corresponding with previous research that reinforces the favorable correlation between EMA and TMS (e.g. Bresciani et al., 2023). Perez et al. (2007) discovered that using TMS for ecological problems can improve EP. Literature has verified the valuable contribution of TMS in addressing environmental concerns. (Bresciani et al., 2023; Ilyas et al., 2020). The EP of firms can be improved if management places greater emphasis on environmental concerns (Rehman et al., 2021a). TMS also plays as a mediator in the EMA-EP link. Environmentally conscious businesses depend on TMS to gain a competitive edge (Spencer et al., 2013). Previous scholars did not consider the mediating role of TMS between EMA and EP. The outcomes of our study follow the KBV, which suggests that knowledge-based resources like EMA directly contribute to improve EP and indirectly influence it through TMS. Moreover, the results indicated that IP modifies the association between EMA and EP. Lastly, there is a favorable correlation between EP and FP affirming Hypothesis 6. The results of our study are in line with earlier research (e.g. Eltayeb et al., 2011; Yang et al., 2011) that show how EP enhances FP.

## 7. Conclusion

This empirical investigation was carried out on manufacturing SMEs in Yemen, an example of a LDC. The results of this study boost our understanding of the subject and address a significant research gap in sustainability literature. This study suggests a new model that offers a broader view of the EMA-EP relationship by investigating the mediating role of TMS and the moderating role of IP. The findings align with KBV and institutional theory as they provide empirical evidence supporting the positive and noteworthy impact of EMA on EP via TMS, under different levels of IP, for manufacturing SMEs in Yemen. More specifically, the findings indicate that EMA is positively related to TMS, which in turn is positively related to EP. In addition, TMS acts as a mediator between EMA and EP. Importantly, the effect of EMA on EP is moderated by IP. Furthermore, EP is positively related to FP. Accordingly, this study has provided great contributions and insights to both theory and practice as follows

### 7.1. Theoretical implications

Previous research has seldom delved into the influence of EMA, TMS, and IP on EP, and subsequently on FP. Our research expands on this by demonstrating that EP is affected by EMA practices both directly and indirectly in the context of Yemeni manufacturing SMEs. Therefore, our study incorporates EMA, TMS, and IP within the framework of KBV to forecast EP. EMA exerts a notable impact on EP when considered in conjunction with TMS. Furthermore, the findings clarify that IP encourages manufacturing SMEs to harness the complete potential of EMA, resulting in improved EP. The previous researcher used EMA to calculate corporate EP (Bresciani et al., 2023). Our study findings show that the association between EMA and EP depends on IP. The researchers employed the Natural Resource-Based View theory to examine the association between EMA and EP (Solovida & Latan, 2017). Moreover, they also apply Resource Orchestration Theory to evaluate EP through EMA (Asiaei et al., 2021). Previous studies have only partially considered investigating the connection between EMA and EP using the KBV. thus, this research fills this gap in the literature as a result. Within the framework of KBV, TMS acts as a mediating factor between EMA and EP. Even businesses have significant Assets like EMA that need the backing of upper management to be deployed. TMS may be able to elevate EP, according to earlier studies (Rehman et al., 2021b).



Additionally, research shows that ecological organizations rely on TMS to obtain a competitive edge (Spencer et al., 2013). Our study uniquely incorporates TMS within the framework of the KBV to assess EP. Additionally, IP is employed as a moderating variable between EMA and EP within the KBV framework. This is a novel approach as previous researchers did not explore this relationship using the KBV perspective (Dumont et al., 2017).

Lastly, the research also discovered a substantial link between ecological and financial success. Most previous study has only examined one component of organizational success, either an environmental one (Aigbedo, 2021; Eljido-Ten, 2007) or economical (Saeidi et al., 2018). They noticed performance as a singular variable, but in our study, we have sought to bridge this gap by separately evaluating each variable. Nevertheless, this recent analysis reveals that ecological and economic benefits are obtained through EMA in succession. This discovery helps reconcile previous findings concerning the correlation between EMA and EP, reinforcing the notion that it ultimately leads to environmental sustainability (King & Lenox, 2001; Mayndarto & Murwaningsari, 2021).

## **7.2. Practical implications**

From a management standpoint, our research plays an important role in ascertaining EP through the lenses of EMA, TMS, and IP. If Yemeni SMEs aim to improve their EP, their focus should be on implementing an accounting system that systematically records various materialistic inputs and outputs, for example, energy, waste, water, emissions, materials, and more. Additionally, management should give due recognition to analyzing product inventory, analysis of product improvement, and analysis of product ecological effects. Furthermore, an accounting system can calculate, identify, and categorize expenses and liabilities associated with the environment. If a company wants to enhance EP, it should concentrate on TMS and IP. The senior management teams must give whatever resources are needed for EMA implementation. Hence, with the backing of top management, improvements in EP can be realized. Lastly, management must prioritize addressing IP if they aim to improve EP.

## **7.3. Limitations and scope for future research**

Although the useful information supplied by this study, it is essential to acknowledge its constraints, which, in turn, warrant future investigation. First, the research's sample was confined to SMEs situated in the Sana'a region of Yemen. Therefore, forthcoming research could thus concentrate on certain company sizes, industries, or regions to get a deeper grasp of the connection between EMA and EP in various circumstances or contexts within the framework of emerging and developed countries. Second, this research relied on a cross-sectional survey methodology, which does not permit for causal conclusions because it does not account for the temporal relationships among EMA, TMS, EP, IP, and FP. Therefore, forthcoming research must aim to gather longitudinal data to capture the conditional impacts.

## **Authors' contributions**

Saqr Ali Saleh Hasan: Conception and design of the work, acquisition of data, or analysis and interpretation of data; Drafting the article or revising it critically for important intellectual content; Final approval of the version to be published; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Email: [Saqrhasan81@gmail.com](mailto:Saqrhasan81@gmail.com). S. N. Waghule: Conception and design of the work; Drafting the article or revising it critically for important intellectual content; Final approval of the version to be published. Email: [Hasansaqr95@gmail.com](mailto:Hasansaqr95@gmail.com). Murad Baqis Hasan: Drafting the article or revising it critically for important intellectual content; Final approval of the version to be published. Email: [ac.murad.2020@gmail.com](mailto:ac.murad.2020@gmail.com).

## **Disclosure statement**

The authors declare that they have no competing interests.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## About the authors

**Saqr Ali Saleh Hasan** is currently a PhD scholar at Department of Commerce, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, India. He is working as a senior lecturer in the department of Accounting at Thamar University, Yemen. His research interests include managerial and cost accounting, accounting information system, and environmental management accounting.

**S. N. Waghule** is Professor in the Department of Commerce, Anandrao Dhonde Alias Babaji College, B. A. M. University, Aurangabad, India. His research interests are financial management, corporate accounting, entrepreneurship and innovation. He has published several papers. He has participated in several international and national conferences.

**Murad Baqis Hasan** is currently a PhD scholar at Department of Financial Administration, Central University of Punjab - India. His research interests include ESG (environmental, social, and governance), green innovation, and sustainability.

## Data availability statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## References

- Aga, G., Francis, D., & Rodríguez-Meza, J. (2015). SMEs, age, and jobs: A review of the literature, metrics, and evidence. *World Bank Policy Research Working Paper*, (7493).
- Agyemang, A. O., Yusheng, K., Twum, A. K., Ayamba, E. C., Kongkuah, M., & Musah, M. (2021). Trend and relationship between environmental accounting disclosure and environmental performance for mining companies listed in China. *Environment, Development and Sustainability*, 23(8), 1–20. <https://doi.org/10.1007/s10668-020-01164-4>
- Aigbedo, H. (2021). An empirical analysis of the effect of financial performance on environmental performance of companies in global supply chains. *Journal of Cleaner Production*, 278, 121741. <https://doi.org/10.1016/j.jclepro.2020.121741>
- Akthar, N. (2022). Top management support: Underlying mechanism between green human resource management practices and environmental performance. *Journal of Digitainability, Realism & Mastery (DREAM)*, 1(02), 48–62. <https://doi.org/10.56982/journalo.v1i02.21>
- Al Asbahi, A. A. M. H., Fang, Z., Chandio, Z. A., Tunio, M. K., Ahmed, J., & Abbas, M. (2020). Assessing barriers and solutions for Yemen energy crisis to adopt green and sustainable practices: A fuzzy multi-criteria analysis. *Environmental Science and Pollution Research International*, 27(29), 36765–36781. <https://doi.org/10.1007/s11356-020-09700-5>
- Al Koliby, I. S. M., Abdullah, H. H., & Suki, N. M. (2022a). Linking entrepreneurial competencies, innovation and sustainable performance of manufacturing SMEs. *Asia-Pacific Journal of Business Administration*, 16(1), 21–40.
- Al Koliby, I. S. M., Abdullah, H. H., & Suki, N. M. (2023). Linking knowledge application, digital marketing, and manufacturing SMEs' sustainable performance: The mediating role of innovation. *Journal of the Knowledge Economy*, 1–27. <https://doi.org/10.1007/s13132-023-01157-4>
- Al Koliby, I. S., Mohd Suki, N., & Abdullah, H. H. (2022b). Linking knowledge acquisition, knowledge dissemination, and manufacturing SMEs' sustainable performance: The mediating role of knowledge application. *The Bottom Line*, 35(4), 185–202. <https://doi.org/10.1108/BL-12-2021-0123>
- Al-Hakimi, M. A., Al-Swidi, A. K., Gelaidan, H. M., & Mohammed, A. (2022). The influence of green manufacturing practices on the corporate sustainable performance of SMEs under the effect of green organizational culture: A moderated mediation analysis. *Journal of Cleaner Production*, 376, 1–15. <https://doi.org/10.1016/j.jclepro.2022.134346>
- Al-Hakimi, M. A., Goail, M. M., Al-Hattami, H. M., Murshid, M. A., Saleh, M. H., & Moghalles, S. A. M. (2023). Improving operational performance of manufacturing SMEs: The interactive effect of technical and human lean practices. *International Journal of Quality & Reliability Management*, 40(4), 1092–1110. <https://doi.org/10.1108/IJQRM-12-2021-0443>
- Al-Hakimi, M. A., Saleh, M. H., & Borade, D. B. (2021). Entrepreneurial orientation and supply chain resilience of manufacturing SMEs in Yemen: The mediating effects of absorptive capacity and innovation. *Heliyon*, 7(10), e08145. <https://doi.org/10.1016/j.heliyon.2021.e08145>
- AlQershi, N. A., Mokhtar, S. S. M., & Abas, Z. B. (2020). CRM dimensions and performance of SMEs in Yemen: The moderating role of human capital. *Journal of Intellectual Capital*, 23(3), 516–537. <https://doi.org/10.1108/JIC-05-2020-0175>

- Al-Swidi, A. K., Al-Hakimi, M. A., Al-Sarraf, J., & Al Koliby, I. S. (2023a). Innovate or perish: Can green entrepreneurial orientation foster green innovation by leveraging green manufacturing practices under different levels of green technology turbulence? *Journal of Manufacturing Technology Management*, 35(1), 74–94. <https://doi.org/10.1108/JMTM-06-2023-0222>
- Al-Swidi, A. K., Al-Hakimi, M. A., Gelaidan, H. M., & Al-Temimi, S. K. A. (2022). How does consumer pressure affect green innovation of manufacturing SMEs in the presence of green human resource management and green values? A moderated mediation analysis. *Business Ethics, the Environment & Responsibility*, 31(4), 1157–1173. <https://doi.org/10.1111/beer.12459>
- Al-Swidi, A. K., Hair, J. F., & Al-Hakimi, M. A. (2023b). Sustainable development-oriented regulatory and competitive pressures to shift toward a circular economy: The role of environmental orientation and Industry 4.0 technologies. *Business Strategy and the Environment*, 32(7), 4782–4797. <https://doi.org/10.1002/bse.3393>
- Al-Wesabi, I., Zhijian, F., Bosah, C. P., & Dong, H. (2022). A review of Yemen's current energy situation, challenges, strategies, and prospects for using renewable energy systems. *Environmental Science and Pollution Research International*, 29(36), 53907–53933. <https://doi.org/10.1007/s11356-022-21369-6>
- Anthony, B.Jr (2019). Green information system integration for environmental performance in organizations. *Benchmarking: An International Journal*, 26(3), 1033–1062.
- Arulrajah, A. A., Opatha, H. H. D. N. P., & Nawaratne, N. N. J. (2016). Green human resource management practices: A review. *Sri Lankan Journal of Human Resource Management*, 5(1), 1–16. <https://doi.org/10.4038/sljhrm.v5i1.5624>
- Asgary, A., Ozdemir, A. I., & Özyürek, H. (2020). Small and medium enterprises and global risks: Evidence from manufacturing SMEs in Turkey. *International Journal of Disaster Risk Science*, 11(1), 59–73. <https://doi.org/10.1007/s13753-020-00247-0>
- Asiaei, K., Bontis, N., Alizadeh, R., & Yaghoubi, M. (2021). Green intellectual capital and environmental management accounting: Natural resource orchestration in favor of environmental performance. *Business Strategy and the Environment*, 31(1), 76–93. <https://doi.org/10.1002/bse.2875>
- Aslam, S., Elmagrhi, M. H., Rehman, R. U., & Ntim, C. G. (2021). Environmental management practices and financial performance using data envelopment analysis in Japan: The mediating role of environmental performance. *Business Strategy and the Environment*, 30(4), 1655–1673. <https://doi.org/10.1002/bse.2700>
- Bamfo, B. A., Asiedu-Appiah, F., & Ameza-Xemalordzo, E. (2023). Developing a framework for entrepreneurship ecosystem for developing countries: The application of institutional theory. *Cogent Business & Management*, 10(2), 2195967. <https://doi.org/10.1080/23311975.2023.2195967>
- Battour, M., Barahma, M., & Al-Awlaqi, M. (2021). The relationship between HRM strategies an sustainable competitive advantage: Testing the mediating role of strategic agility. *Sustainability*, 13(9), 5315. <https://doi.org/10.3390/su13095315>
- Blass, V., Corbett, C. J., Delmas, M. A., & Muthulingam, S. (2014). Top management and the adoption of energy efficiency practices: Evidence from small and medium-sized manufacturing firms in the US. *Energy*, 65, 560–571. <https://doi.org/10.1016/j.energy.2013.11.030>
- Bresciani, S., Rehman, S. U., Giovando, G., & Alam, G. M. (2023). The role of environmental management accounting and environmental knowledge management practices influence on environmental performance: Mediated-moderated model. *Journal of Knowledge Management*, 27(4), 896–918. <https://doi.org/10.1108/JKM-12-2021-0953>
- Burritt, R. L., & Saka, C. (2006). Environmental management accounting applications and ecoefficiency: Case studies from Japan. *Journal of Cleaner Production*, 14(14), 1262–1275. <https://doi.org/10.1016/j.jclepro.2005.08.012>
- Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (3rd ed.). Routledge.
- Chaudhry, N. I., & Amir, M. (2020). From institutional pressure to the sustainable development of firm: Role of environmental management accounting implementation and environmental proactivity. *Business Strategy and the Environment*, 29(8), 3542–3554. <https://doi.org/10.1002/bse.2595>
- Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern Methods for Business Research*, 295(2), 295–336.
- Chiou, T.-Y., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transportation Research Part E: Logistics and Transportation Review*, 47(6), 822–836. <https://doi.org/10.1016/j.tre.2011.05.016>
- Christ, K. L., & Burritt, R. L. (2013). Environmental management accounting: The significance of contingent variables for adoption. *Journal of Cleaner Production*, 41, 163–173. <https://doi.org/10.1016/j.jclepro.2012.10.007>
- Christ, K. L., & Burritt, R. L. (2015). Material flow cost accounting: A review and agenda for future research. *Journal of Cleaner Production*, 108, 1378–1389. <https://doi.org/10.1016/j.jclepro.2014.09.005>
- Chuang, S.-P., & Huang, S.-J. (2018). The effect of environmental corporate social responsibility on environmental performance and business competitiveness: The mediation of green information technology capital. *Journal of Business Ethics*, 150(4), 991–1009. <https://doi.org/10.1007/s10551-016-3167-x>
- Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2011). Does it pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy*, 30(2), 122–144. <https://doi.org/10.1016/j.jaccpubpol.2010.09.013>

- Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.
- Curado, C., & Bontis, N. (2006). The knowledge-based view of the firm and its theoretical precursor. *International Journal of Learning and Intellectual Capital*, 3(4), 367–381. <https://doi.org/10.1504/IJLIC.2006.011747>
- Dakwale, V. A., Ralegaonkar, R. V., & Mandavgane, S. (2011). Improving the environmental performance of building through increased energy efficiency: A review. *Sustainable Cities and Society*, 1(4), 211–218. <https://doi.org/10.1016/j.scs.2011.07.007>
- Danso, A., Adomako, S., Amankwah-Amoah, J., Owusu-Agyei, S., & Konadu, R. (2019). Environmental sustainability orientation, competitive strategy and financial performance. *Business Strategy and the Environment*, 28(5), 885–895. <https://doi.org/10.1002/bse.2291>
- De Vries, M. F. (2000). A journey into the 'Wild East': Leadership style and organizational practices in Russia. *Organizational Dynamics*, 28(4), 67–77.
- Deb, B. C., Rahman, M. M., & Rahman, M. S. (2022). The impact of environmental management accounting on environmental and financial performance: Empirical evidence from Bangladesh. *Journal of Accounting & Organizational Change*, 19(3), 420–446. In press. <https://doi.org/10.1108/JAOC-11-2021-0157>
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147–160. <https://doi.org/10.2307/2095101>
- Dixon-Fowler, H. R., Ellstrand, A. E., & Johnson, J. L. (2017). The role of board environmental committees in corporate environmental performance. *Journal of Business Ethics*, 140(3), 423–438. <https://doi.org/10.1007/s10551-015-2664-7>
- Dubey, R., Gunasekaran, A., & Ali, S. S. (2015). Exploring the relationship between leadership, operational practices, institutional pressures, and environmental performance: A framework for green supply chain. *International Journal of Production Economics*, 160, 120–132. <https://doi.org/10.1016/j.ijpe.2014.10.001>
- Dumont, J., Shen, J., & Deng, X. (2017). Effects of green HRM practices on employee workplace green behavior: The role of psychological green climate and employee green values. *Human Resource Management*, 56(4), 613–627. <https://doi.org/10.1002/hrm.21792>
- Elijido-Ten, E. (2007). Applying stakeholder theory to analyze corporate environmental performance. *Asian Review of Accounting*, 15(2), 164–184. <https://doi.org/10.1108/13217340710823378>
- Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resour. Conserv. Recycle*, 55(5), 495–506. <https://doi.org/10.1016/j.resconrec.2010.09.003>
- Fakhreddin, F., & Foroudi, P. (2022). The impact of market orientation on new product performance through product launch quality: A resource-based view. *Cogent Business & Management*, 9(1), 2108220. <https://doi.org/10.1080/23311975.2022.2108220>
- Ferreira, A., Moulang, C., & Hendro, B. (2010). Environmental management accounting and innovation: An exploratory analysis. *Accounting, Auditing & Accountability Journal*, 23(7), 920–948. <https://doi.org/10.1108/09513571011080180>
- Fuller, C. M., Simmering, M. J., Atinc, G., Atinc, Y., & Babin, B. J. (2016). Common methods variance detection in business research. *Journal of Business Research*, 69(8), 3192–3198. <https://doi.org/10.1016/j.jbusres.2015.12.008>
- Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers' perception on green information systems (is) adoption and environmental performance: Results from a field survey. *Information & Management*, 50(7), 431–438. <https://doi.org/10.1016/j.im.2013.01.004>
- Goaill, M. M., & Al-Hakimi, M. A. (2021). Does absorptive capacity moderate the relationship between entrepreneurial orientation and supply chain resilience? *Cogent Business & Management*, 8(1), 1–20. <https://doi.org/10.1080/23311975.2021.1962487>
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109–122. <https://doi.org/10.1002/smj.4250171110>
- Gunarathne, N., & Lee, K.-H. (2019). Institutional pressures and corporate environmental management maturity. *Management of Environmental Quality: An International Journal*, 30(1), 157–175. <https://doi.org/10.1108/MEQ-02-2018-0041>
- Gunarathne, A. D N., Lee, K. -H., & Hitigala Kaluarachchilage, P. K. (2021). Institutional pressures, environmental management strategy, and organizational performance: The role of environmental management accounting. *Business Strategy and the Environment*, 30(2), 825–839. <https://doi.org/10.1002/bse.2656>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2018). *Multivariate data analysis* (8th ed.). Cengage Learning.
- Hair, J. F., Howard, M., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, 109, 101–110. <https://doi.org/10.1016/j.jbusres.2019.11.069>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.).
- Hair, J., Risher, J., Sarstedt, M., & Ringle, C. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Henri, J.-F., & Journeault, M. (2010). Eco-control: The influence of management control systems on environmental and economic performance. *Accounting, Organizations, and Society*, 35(1), 63–80. <https://doi.org/10.1016/j.aos.2009.02.001>
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115–135. <https://doi.org/10.1007/s11747-014-0403-8>



- Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). *The use of partial least squares path modeling in international marketing*. In Sinkovics, R.R. and Ghauri, P.N. (Eds.) *New Challenges to International Marketing (Advances in International Marketing)* (Vol. 20; pp. 277–319). Emerald Group Publishing Limited.
- Huang, P.-S., & Shih, L.-H. (2009). Effective environmental management through environmental knowledge management. *International Journal of Environmental Science & Technology*, 6(1), 35–50. <https://doi.org/10.1007/BF03326058>
- Hussain, M., Ajmal, M. M., Khan, M., & Saber, H. (2015). Competitive priorities and knowledge management: An empirical investigation of manufacturing companies in UAE. *Journal of Manufacturing Technology Management*, 26(6), 791–806. <https://doi.org/10.1108/JMTM-03-2014-0020>
- Ikram, M., Zhou, P., Shah, S., & Liu, G. (2019). Do environmental management systems help improve corporate sustainable development? Evidence from manufacturing companies in Pakistan. *Journal of Cleaner Production*, 226, 628–641. <https://doi.org/10.1016/j.jclepro.2019.03.265>
- Ilyas, S., Hu, Z., & Wiwattanakornwong, K. (2020). Unleashing the role of top management and government support in green supply chain management and sustainable development goals. *Environmental Science and Pollution Research International*, 27(8), 8210–8223. <https://doi.org/10.1007/s11356-019-07268-3>
- Iredele, O. O., Tankiso, M., & Adelowotan, M. O. (2020). The influence of institutional isomorphism and organizational factors on environmental management accounting practices of listed Nigerian and South African firms. *South African Journal of Accounting Research*, 34(3), 183–204. <https://doi.org/10.1080/10291954.2019.1675254>
- Iwata, H., & Okada, K. (2011). How does environmental performance affect financial performance? Evidence from Japanese manufacturing firms. *Ecological Economics*, 70(9), 1691–1700. <https://doi.org/10.1016/j.ecolecon.2011.05.010>
- Jacobsen, C. B., & Bøgh Andersen, L. (2015). Is leadership in the eye of the beholder? A study of intended and perceived leadership practices and organizational performance. *Public Administration Review*, 75(6), 829–841. <https://doi.org/10.1111/puar.12380>
- Jalaludin, D., Sulaiman, M., & Nazli Nik Ahmad, N. (2011). Understanding environmental management accounting (EMA) adoption: A new institutional sociology perspective. *Social Responsibility Journal*, 7(4), 540–557. <https://doi.org/10.1108/17471111111175128>
- Jinadu, O., Agbeyangi, B. A., & Mamidu, I. A. (2015). Impact of environmental management accounting on current practices and future sustainability in South-West Nigerian polytechnics. *International Journal of Economics Commerce and Management*, 3(10), 586–603.
- Kalyar, M. N., Shoukat, A., & Shafique, I. (2020). Enhancing firms' environmental performance and financial performance through green supply chain management practices and institutional pressures. *Sustainability Accounting, Management and Policy Journal*, 11(2), 451–476. <https://doi.org/10.1108/SAMPJ-02-2019-0047>
- Kengatharan, N. (2019). A knowledge-based theory of the firm: Nexus of intellectual capital, productivity and firms' performance. *International Journal of Manpower*, 40(6), 1056–1074. <https://doi.org/10.1108/IJM-03-2018-0096>
- King, A. A., & Lenox, M. J. (2001). Does it pay to be green? An empirical study of firm environmental and financial performance: An empirical study of firm environmental and financial performance. *Journal of Industrial Ecology*, 5(1), 105–116. <https://doi.org/10.1162/108819801753358526>
- Kirschke, S., & Newig, J. (2017). Addressing complexity in environmental management and governance. *Sustainability*, 9(6), 983. <https://doi.org/10.3390/su9060983>
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607–610. <https://doi.org/10.1177/001316447003000308>
- Latan, H., Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Wamba, S. F., & Shahbaz, M. (2018). Effects of environmental strategy, environmental uncertainty, and top management's commitment to corporate environmental performance: The role of environmental management accounting. *Journal of Cleaner Production*, 180, 297–306. <https://doi.org/10.1016/j.jclepro.2018.01.106>
- Latif, N. (2022). Comprehensive environmental performance index (CEPI): An intuitive indicator to evaluate the environmental quality over time. *Environmental Research Communications*, 4(7), 075016. <https://doi.org/10.1088/2515-7620/ac8338>
- Latif, B., Mahmood, Z., Tze San, O., Mohd Said, R., & Bakhsh, A. (2020). Coercive, normative and mimetic pressures as drivers of environmental management accounting adoption. *Sustainability*, 12(11), 4506. <https://doi.org/10.3390/su12114506>
- Lin, H.-F. (2010). An investigation into the effects of is quality and top management support on ERP system usage. *Total Quality Management & Business Excellence*, 21(3), 335–349. <https://doi.org/10.1080/14783360903561761>
- Liu, J., Liu, Y., & Yang, L. (2020). Uncovering the influence mechanism between top management support and green procurement: The effect of green training. *Journal of Cleaner Production*, 251, 119674. <https://doi.org/10.1016/j.jclepro.2019.119674>
- Malca, O., Peña-Vinces, J., & Acedo, F. J. (2019). Export promotion programmes as export performance catalysts for SMEs: Insights from an emerging economy. *Small Business Economics*, 55(3), 831–851. <https://doi.org/10.1007/s11187-019-00185-2>
- Mansoor, A., Jahan, S., & Riaz, M. (2021). Does green intellectual capital spur corporate environmental performance through green workforce? *Journal of Intellectual Capital*, 22(5), 823–839. <https://doi.org/10.1108/JIC-06-2020-0181>

- Mayndarto, E. C., & Murwaningsari, E. (2021). The effect of environmental management accounting, environmental strategy on environmental performance and financial performance moderated by managerial commitment. *Journal of Industrial Engineering and Management Research*, 2(2), 35–38.
- Memon, A., Yong An, Z., & Memon, M. Q. (2020). Does financial availability sustain financial, innovative, and environmental performance? Relation via opportunity recognition. *Corporate Social Responsibility and Environmental Management*, 27(2), 562–575. <https://doi.org/10.1002/csr.1820>
- Moktadir, M. A., Ali, S. M., Kusi-Sarpong, S., & Shaikh, M. A. A. (2018). Assessing challenges for implementing Industry 4.0: Implications for process safety and environmental protection. *Process Safety and Environmental Protection*, 117, 730–741. <https://doi.org/10.1016/j.psep.2018.04.020>
- Naranjo Tuesta, Y., Crespo Soler, C., & Ripoll Feliu, V. (2021). Carbon management accounting and financial performance: Evidence from the European Union emission trading system. *Business Strategy and the Environment*, 30(2), 1270–1282. <https://doi.org/10.1002/bse.2683>
- Nguyen, T. H., Elmagrhi, M. H., Ntim, C. G., & Wu, Y. (2021). Environmental performance, sustainability, governance and financial performance: Evidence from heavily polluting industries in China. *Business Strategy and the Environment*, 30(5), 2313–2331. <https://doi.org/10.1002/bse.2748>
- Nkundabanyanga, S. K., Muramuzi, B., & Alinda, K. (2021). Environmental management accounting, board role performance, company characteristics, and environmental performance disclosure. *Journal of Accounting & Organizational Change*, 17(5), 633–659. <https://doi.org/10.1108/JAOC-03-2020-0035>
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creatio. *Organization Science*, 5(1), 14–37. <https://doi.org/10.1287/orsc.5.1.14>
- Nunnally, J. C., & Bernstein, I. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill Education.
- Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of Operations Management*, 30(6), 467–480. <https://doi.org/10.1016/j.jom.2012.06.002>
- Perez, E. A., Ruiz, C. C., & Fenech, F. C. (2007). Environmental management systems as an embedding mechanism: A research note. *Accounting, Auditing & Accountability Journal*, 20(3), 403–422.
- Phan, T. N., & Baird, K. (2015). The comprehensiveness of environmental management systems: The influence of institutional pressures and the impact on environmental performance. *Journal of Environmental Management*, 160, 45–56. <https://doi.org/10.1016/j.jenvman.2015.06.006>
- Phan, T. N., Baird, K., & Su, S. (2017). The use and effectiveness of environmental management accounting. *Australasian Journal of Environmental Management*, 24(4), 355–374. <https://doi.org/10.1080/14486563.2017.1354235>
- Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, 63(1), 539–569. <https://doi.org/10.1146/annurev-psych-120710-100452>
- Powell, W. W., & Colyvas, J. A. (2008). *Micro foundations of institutional theory. The Sage Handbook of Organizational Institutionalism* (pp. 276–298). Sage.
- Qian, W., Burritt, R. L., & Monroe, G. S. (2018). Environmental management accounting in local government: Functional and institutional imperatives. *Financial Accountability & Management*, 34(2), 148–165. <https://doi.org/10.1111/faam.12151>
- Rehman, S. U., Bresciani, S., Ashfaq, K., & Alam, G. M. (2021a). Intellectual capital, knowledge management and competitive advantage: A resource orchestration perspective. *Journal of Knowledge Management*, 26(7), 1705–1731. <https://doi.org/10.1108/JKM-06-2021-0453>
- Rehman, S.-U., Kraus, S., Shah, S. A., Khanin, D., & Mahto, R. V. (2021b). Analyzing the relationship between green innovation and environmental performance in large manufacturing firms. *Technological Forecasting and Social Change*, 163, 120481. <https://doi.org/10.1016/j.techfore.2020.120481>
- Ringle, C. M., Wende, S., & Becker, J. M. (2015). *SmartPLS 3* (pp. 584). SmartPLS GmbH.
- Saeidi, S. P., Othman, M. S. H., Saeidi, P., & Saeidi, S. P. (2018). The moderating role of environmental management accounting between environmental innovation and firm financial performance. *International Journal of Business Performance Management*, 19(3), 326–348. <https://doi.org/10.1504/IJBPM.2018.092759>
- Sarkis, J., Gonzalez-Torre, P., & Adenso-Diaz, B. (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management*, 28(2), 163–176. <https://doi.org/10.1016/j.jom.2009.10.001>
- Sarstedt, M., Hair, J. F., Jr, Nitzl, C., Ringle, C. M., & Howard, M. C. (2020). Beyond a tandem analysis of SEM and PROCESS: Use of PLS-SEM for mediation analyses! *International Journal of Market Research*, 62(3), 288–299. <https://doi.org/10.1177/1470785320915686>
- Sarstedt, M., Hair, J. F., Jr, & Ringle, C. M. (2022). “PLS-SEM: Indeed a silver bullet”—retrospective observations and recent advances. *Journal of Marketing Theory and Practice*, 31(3), 261–275. <https://doi.org/10.1080/10696679.2022.2056488>
- Scott, G., Leritz, L. E., & Mumford, M. D. (2004). The effectiveness of creativity training: A quantitative review. *Creativity Research Journal*, 16(4), 361–388. [https://doi.org/10.1207/s15326934crj1604\\_1](https://doi.org/10.1207/s15326934crj1604_1)
- Shahab, Y., Ntim, C. G., Chengang, Y., Ullah, F., & Fosu, S. (2018). Environmental policy, environmental performance, and financial distress in China: Do top management team characteristics matter? *Business Strategy and the Environment*, 27(8), 1635–1652. <https://doi.org/10.1002/bse.2229>



- Shehzad, M. U., Zhang, J., Latif, K. F., Jamil, K., & Waseel, A. H. (2023). Do green entrepreneurial orientation and green knowledge management matter in the pursuit of ambidextrous green innovation: A moderated mediation model. *Journal of Cleaner Production*, 388, 135971. <https://doi.org/10.1016/j.jclepro.2023.135971>
- Sheikh, A. A., Rana, N. A., Inam, A., Shahzad, A., & Awan, H. M. (2018). Is e-marketing a source of sustainable business performance? Predicting the role of top management support with various interaction factors. *Cogent Business & Management*, 5(1), 1516487. <https://doi.org/10.1080/23311975.2018.1516487>
- Solovida, G. T., & Latan, H. (2017). Linking environmental strategy to environmental performance: Mediation role of environmental management accounting. *Sustainability Accounting, Management and Policy Journal*, 8(5), 595–619. <https://doi.org/10.1108/SAMPJ-08-2016-0046>
- Spencer, S. Y., Adams, C., & Yapa, P. W. (2013). The mediating effects of the adoption of an environmental information system on top management's commitment and environmental performance. *Sustainability Accounting, Management and Policy Journal*, 4(1), 75–102. <https://doi.org/10.1108/SAMPJ-10-2011-0030>
- Tashakor, S., Appuhami, R., & Munir, R. (2019). Environmental management accounting practices in Australian cotton farming: The use of the theory of planned behavior. *Accounting, Auditing & Accountability Journal*, 32(4), 1175–1202. <https://doi.org/10.1108/AAAJ-04-2018-3465>
- Tseng, M.-L., & Chiu, A. S. (2013). Evaluating firm's green supply chain management in linguistic preferences. *Journal of Cleaner Production*, 40, 22–31. <https://doi.org/10.1016/j.jclepro.2010.08.007>
- Tung, A., Baird, K., & Schoch, H. (2014). The relationship between organizational factors and the effectiveness of environmental management. *Journal of Environmental Management*, 144, 186–196. <https://doi.org/10.1016/j.jenvman.2014.05.025>
- USAID. (2020). Available at: <https://www.usaid.gov/yemen/fact-sheets/economic-growth-recoverylivelihoods-and-agriculture>.
- Veronica, S., Manlio, D. G., Shlomo, T., Antonio, M. P., & Victor, C. (2019). International social SMEs in emerging countries: Do governments support their international growth? *Journal of World Business*, 55(5), 100995. <https://doi.org/10.1016/j.jwb.2019.05.002>
- Wagner, M. (2020). Global governance in new public environmental management: An international and intertemporal comparison of voluntary standards' impacts. *Business Strategy and the Environment*, 29(3), 1056–1073. <https://doi.org/10.1002/bse.2417>
- Wagner, M., & Schaltegger, S. (2004). The effect of corporate environmental strategy choice and environmental performance on competitiveness and economic performance: An empirical study of EU manufacturing. *European Management Journal*, 22(5), 557–572. <https://doi.org/10.1016/j.emj.2004.09.013>
- Wang, S., Wang, H., & Wang, J. (2019). Exploring the effects of institutional pressures on the implementation of environmental management accounting: Do top management support and perceived benefit work? *Business Strategy and the Environment*, 28(1), 233–243. <https://doi.org/10.1002/bse.2252>
- Wijethilake, C., Munir, R., & Appuhamy, R. (2017). Proactive sustainability strategy and corporate sustainability performance: The mediating effect of sustainability control systems. *Journal of Environmental Management*, 203(Pt 1), 582–616. <https://doi.org/10.1016/j.jenvman.2017.07.008>
- Wiklund, J., & Shepherd, D. (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal*, 24(13), 1307–1314. <https://doi.org/10.1002/smj.360>
- World Bank. (2015). The republic of Yemen: Unlocking the potential for economic growth. World Bank Reports No. 102151-YE.
- Wu, J., Yang, J., & Zhou, Z. (2020). How does environmental regulation affect environmental performance? A case study of China's regional energy efficiency. *Expert Systems*, 37(3), 12326. <https://doi.org/10.1111/exsy.12326>
- Yang, M. G., Hong, P., & Modi, S. B. (2011). Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms. *International Journal of Production Economics*, 129(2), 251–261. <https://doi.org/10.1016/j.ijpe.2010.10.017>
- Yemen Ministry of industry and trade. (2014). *General Report of the Result of the Comprehensive Industrial Survey*.
- Yemeni Ministry of Industry and Trade. (2016). Available at: <http://www.moit.gov.ye/moit/frontpage>.
- Zhou, Z., Zhao, W., Chen, X., & Zeng, H. (2017). MFCA extension from a circular economy perspective: Model modifications and case study. *Journal of Cleaner Production*, 149, 110–125. <https://doi.org/10.1016/j.jclepro.2017.02.049>

## Appendix 1. Questionnaire items

<b>Environmental management accounting</b>
Our organization's accounting system records all physical inputs and outputs (such as energy, water, materials, wastes, and emissions).
Our organization's accounting system can carry out product inventory analyses, product improvement analyses, and product environmental impact analyses.
Our organization uses environmental performance targets for physical inputs and outputs.
Our organization's accounting system can identify, estimate, and classify environmental-related costs and liabilities.
<b>Top management support</b>
The top management team in our organization is committing to implementing environmental management accounting.
The implementation of environmental management accounting can receive full support from our top management team.
Top management team consistently assesses the business impact on the environment by implementing environmental management accounting.
<b>Institutional pressures</b>
Compliance with international and national environmental standards.
Awareness of best practices in the industry.
Professional groups' attention to environmental issues.
<b>Environmental performance</b>
Our organization improved compliance with environmental standards.
Our organization reduces air emissions.
Our organization reduces energy consumption.
<b>Financial Performance</b>
Increases in profit margin and sales revenues.
Increases in market share.
Increase in return on investment.