Pakistan Journal of Commerce and Social Sciences
2024, Vol. 18(4), 1065-1089
Pak J Commer Soc Sci

From the Implementation of Environmental Management Accounting to Organizational Sustainability: Does Stakeholder Integration Strengthen it?

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Article History

Received: 25 Sept 2024 Revised: 18 Dec 2024 Accepted: 27 Dec 2024 Published: 31 Dec 2024

Abstract

This study investigates the impact of environmental management accounting implementation on organizational sustainability in the manufacturing sector of Pakistan, focusing on the moderating role of stakeholder integration (i.e., behavior of adaptation, interaction with stakeholders, and knowledge of stakeholders). This study employed a quantitative approach utilizing survey data from 267 ISO-certified manufacturing organizations. The study hypotheses were tested through partial least squares structural equation modeling by using SmartPLS software. Findings reveal that environmental management accounting implementation significantly improves organizational sustainability in economic, environmental, and social aspects. The relationship between environmental management accounting implementation and organizational sustainability is notably strengthened by stakeholder interaction and behavior of adaptation, which serve as significant moderators. In contrast, stakeholder knowledge alone indicates minimal impact on organizational sustainability. These results highlight the importance of incorporating stakeholder interaction and adaptability into environmental management accounting practices to maximize sustainability outcomes. This research contributes to theoretical knowledge by expanding stakeholder theory to encompass the dynamic role of stakeholder integration in environmental management accounting implementation for achieving sustainability. Practically, it offers empirical evidence for organizations and policymakers, stressing the need to promote adaptation and interaction with stakeholders through regulatory support and capacity-building programs.

Keywords: Stakeholder theory, environmental management accounting, integration behavior, interaction with stakeholders, knowledge of stakeholders, organizational sustainability, ISO-certified firms.

1. Introduction

The global economy has experienced rapid growth in the 21st century, primarily owing to population growth and industrial expansion (Zhong et al., 2023). Economic progress and industrial growth have led to environmental degradation, which is becoming increasingly serious and reaching unprecedented levels (Wang, Wang, & Wang, 2019; Deb, Rahman, & Rahman, 2022). Environmental concerns are now a top priority for a wide range of stakeholders such as shareholders, consumers, suppliers, workers, and governments (Abdelhalim, 2024; Noor & Bano, 2024). Mounting evidence has revealed that industrial expansion is largely responsible for environmental problems (Wang et al., 2019). Thus, organizational managers are now more aware of environmental concerns such as climate change, carbon emissions, waste management, landfills, land and water pollution, resource consumption, and material recycling (Saeidi et al., 2018).

In the modern business landscape, organizations face a growing array of challenges driven by technological advancements, evolving consumer behavior, shifting regulatory frameworks, emerging market trends, and intensifying competition (Appannan et al., 2023). These challenges demand timely and strategic responses, particularly in sustainability-related areas such as resource allocation, strategy development, and long-term planning. According to Latif, Mahmood, Tze San, et al. (2020), the goal of industrial development is no longer limited to generating economic benefits alone; it must also be compatible with sustainable practices. Achieving substantial changes in business operations requires not only a shift in attitudes but also the adoption of new management strategies, systems, and tools (Deb et al., 2022).

In this context, Environmental Management Accounting (EMA) has emerged as a crucial approach for translating environmental strategies and systems into organizational sustainability (Gerged, Zahoor, & Cowton, 2024; Hasan et al., 2024). This approach bridges traditional management accounting and environmental management, providing both financial information (related to costs and revenues) and physical information (about resources and impacts) to support decision-making and the control of environmental practices (Al-Mawali et al., 2018; Ali, Kausar, & Amir, 2023). EMA can help manage environmental costs, realize environment-related revenue opportunities, and improve organizational sustainability (Appannan et al., 2023).

However, gaps remain in the literature regarding the impact of environmental management accounting on organizational sustainability, particularly in addressing all the dimensions i.e., social, economic, and environmental (Gerged et al., 2024; Horry, Booth, & Mahamadu, 2024). Prior studies have examined various factors such as institutional pressures (Chaudhry & Amir, 2020; Latif, Mahmood, San, et al., 2020), environmental strategies (Aragon-Correa et al., 2008; Al-Mawali et al., 2018; Amir & Chaudhry, 2019; Adomako, Ning, & Adu-Ameyaw, 2021; Adomako & Tran, 2022; Appannan et al., 2023), and human resource and management practices (Bhatti et al., 2022; Umar et al., 2024).

However, there is a need to ascertain if the implementation of EMA exists, and thus, how it fulfills organizational sustainability.

Moreover, recent studies focused on incorporating other factors, such as green innovation (Ibrahim & Mahmood, 2022; Amir, Malik, & Ali, 2024; Gerged et al., 2024), top management support (Gadekar, Sarkar, & Gadekar, 2022; Naeemah & Wong, 2022), competitive intensity (Danso et al., 2020), and stakeholder integration (Awan, Kraslawski, & Huiskonen, 2017b; Brulhart, Gherra, & Quelin, 2019; Adomako & Tran, 2022). Among these, stakeholder integration has been identified as a key factor in effective EMA implementation. Yet, few studies have explored the role of stakeholder integration in strengthening the relationship between EMA and organizational sustainability, particularly in developing countries like Pakistan.

To address these gaps, this study examines the relationship between environmental management accounting and organizational sustainability, focusing on the moderating role of stakeholder integration in Pakistan's manufacturing sector. Drawing on stakeholder theory, the study explores how effective integration through collaborative relationships with customers, shareholders, suppliers, and other stakeholders can enhance EMA implementation and sustainability outcomes (Danso et al., 2020). Such integration includes partnerships with trade associations, strategic alliances, and collaborations with NGOs and business customers (Gerged et al., 2024). This approach aims to provide a deeper understanding of how organizations can align their environmental management practices with stakeholder expectations to achieve sustainable growth.

This study focuses on Pakistan's manufacturing sector, a vital component of the national economy. This sector is not only a major source of employment but also contributes significantly to economic growth (ESP, 2021-2022). Ensuring the sustainability of the sector is essential, as it can help businesses reduce costs, enhance their reputations, and attract environmentally and socially conscious customers. This sector is particularly important for providing employment opportunities for individuals with lower levels of education and skills, thereby diversifying the country's economy away from agriculture. Although Pakistan's manufacturing sector has faced several challenges, it has shown steady growth. Industrial production from this sector averaged 5.16% from 1990 to 2023, peaking at 77.84% in April 2021, and is projected to grow by 3.60% by 2025. Over the past two decades, the sector has emerged as a substantial driving force in the country's economy, contributing over 12% of the Gross Domestic Product (GDP) in 2021 and employing approximately 16% of the nation's workforce, making it the second-largest sector after agriculture (ESP, 2021-2022). However, ensuring sustainability remains a challenge. Thus, this sector's insights are the motivation for this study to guide its sustainability.

The contributions of this study extend to the limited body of knowledge on the role of stakeholder integration in the relationship between environmental management accounting and organizational sustainability, offering insights into how businesses in developing

countries can address sustainability challenges. Policymakers and business leaders can gain potential information from the findings of this study, regarding the importance of integrating stakeholder perspectives into environmental management strategies. Which in return facilitating the development of more effective sustainability policies and practices. Furthermore, regarding Pakistan's manufacturing sector, which significantly contributes to the national economy and employment, findings of the study highlight the potential positive impacts of enhancing sustainability practices on economic growth, environmental protection, and social welfare. The research outcomes serve as a paradigm for other developing nations, providing a framework for integrating EMA and stakeholder engagement to promote sustainable development.

2. Literature Review and Hypotheses Development

Stakeholder theory (Freeman, 2010) suggests that interacting with stakeholders promotes sustainable growth and provides a market edge (Donaldson & Preston, 1995; Steurer et al., 2005). To reach organizational goals, it's crucial to consider the needs of various stakeholders, such as workers, clients, vendors, governmental bodies, rivals, media outlets, and the public (Freeman & Reed, 1983; Steurer et al., 2005; Plaza-Úbeda, de Burgos-Jiménez, & Carmona-Moreno, 2010). Ortiz-de-Mandojana and Bansal (2016) argued that an organization's longevity and prosperity depend on cultivating positive, enduring stakeholder relationships. Rodrigue, Magnan, and Boulianne (2013) noted that EMA implementation addresses stakeholder concerns, enabling organizations to tackle sustainability issues effectively. Stakeholder theory advocates for proactive management of sustainability risks to protect stakeholder interests and create value for both the organization and society (Rodrigue et al., 2013). Moreover, from an environmental management accounting standpoint, stakeholder integration can influence the connection between EMA and organizational sustainability, as effective integration enhances communication, collaboration, and goal alignment, potentially amplifying EMA's positive impact on organizational sustainability (Wijethilake & Lama, 2019). Further, behavioral aspects of stakeholder integration, such as adaptability, interaction, and knowledge sharing, are crucial enablers of EMA's success. Adaptive behavior allows organizations to respond to evolving stakeholder expectations and regulatory demands effectively (Chaudhry & Amir, 2020; Hasan et al., 2024). Saravanamuthu (2018) contended that organizations prioritizing stakeholder engagement and incorporating their concerns into EMA are more likely to achieve long-term environmental, social, and economic benefits for both stakeholders and themselves (Plaza-Úbeda et al., 2010). Consequently, drawing from stakeholder theory, we establish a comprehensive framework for this study to comprehend the importance of stakeholder engagement in driving EMA implementation within organizations.

2.1 Environmental Management Accounting Implementation and Organizational Sustainability

Organizational sustainability has evolved into a critical imperative in the modern era, necessitating the seamless integration of economic, environmental, and social considerations, known as the triple bottom line (TBL) framework (Elkington, 2001; Amir, Siddique, & Ali, 2022). EMA serves as a critical enabler for achieving TBL objectives by integrating financial and non-financial data into organizational decision-making processes (Ferreira, Moulang, & Hendro, 2010; Solovida & Latan, 2021). EMA provides actionable insights into resource allocation, cost structures, and environmental impacts, thereby supporting organizations in achieving sustainability goals (Al-Mawali et al., 2018; Burritt, Schaltegger, & Christ, 2023). For instance, environmental management accounting enhances environmental performance by identifying hidden costs, reducing waste, improving resource efficiency, and fostering compliance with environmental regulations (Salama, 2005; Solovida & Latan, 2021; Huynh & Nguyen, 2024). Furthermore, it supports the economic dimension by offering comprehensive insights into optimal resource allocation (Salama, 2005; Ali et al., 2023).

Numerous prior studies have demonstrated the positive contribution of environmental management accounting in attaining environmental and economic objectives for organizations (Burritt, Hahn, & Schaltegger, 2002; Schaltegger, Viere, & Zvezdov, 2012; Latan et al., 2018; Solovida & Latan, 2021). Schaltegger et al. (2012) study indicates that EMA essentially comprises actions enhancing management efficacy and information utilization in organizational practices. Latan et al. (2018) affirmed EMA's benefits to organizational performance in their study on Australian organizations. Previous studies by Aragon-Correa et al. (2008), Henri and Journeault (2010), and Journeault (2016) demonstrated that eco-efficient practices are positively linked to organizational sustainability. The sophistication of management accounting practices (MAP), such as EMA implementation enhances the level of control and the decision-making process, amplifying the magnitude of its influence on environmental protection and cost utilization. These benefits, such as cost savings (Christmann, 2000), stakeholder relationship management (Phan & Baird, 2015b), eco-innovation performance (Lee & Min, 2015; Daddi et al., 2016), resource efficiency (Simpson & Samson, 2010; Phan & Baird, 2015b) regulatory compliance (Delmas & Toffel, 2004; Phan & Baird, 2015b), and pollution prevention (Simpson & Samson, 2010; Amir et al., 2024), can be realized.

The implementation of environmental management accounting has directly and positively impacted environmental performance across various sectors. However, the link between EMA and social sustainability remains underexplored, with few studies addressing the broader, indirect effects on social aspects (Delmas & Toffel, 2004; Phan & Baird, 2015a). While EMA's environmental and economic contributions are well-documented, its potential to enhance social sustainability—such as stakeholder relations and community

well-being—requires more attention (Solovida & Latan, 2021; Hasan et al., 2024). Moreover, the implementation of EMA has directly and positively impacted environmental performance across various sectors (Burritt et al., 2023; Noor & Bano, 2024). Prior research by Ferreira, Moulang, and Hendro (2010) and (Chaudhry & Amir, 2020) underscores EMA's role in enhancing environmental performance. By providing real-time data on resource consumption and environmental costs, EMA empowers organizations to proactively develop strategies that not only reduce their ecological footprint but also make a positive contribution to environmental preservation. The integration of environmental considerations into decision-making processes plays a pivotal role in advancing sustainability goals (Burritt et al., 2002; Burritt et al., 2019). Moreover, the predominant focus of EMA studies on Western countries leaves a gap in understanding its applicability and influence in diverse global contexts, particularly in developing nations like Pakistan (Ali et al., 2023). Consequently, there is an urgent need to broaden the scope of EMA research to encompass all three dimensions of sustainability (i.e., economic, environmental, and social) broadly and inclusively. To fully unleash EMA's potential for fostering organizational sustainability, addressing these research gaps is essential. Building on the literature, we hypothesize that EMA implementation positively influences organizational sustainability.

- H1: Environmental management accounting implementation has a positive and significant impact on organizational sustainability.

2.2 Moderating Role of Stakeholder Integration

Stakeholder integration is a multi-dimensional concept that operates across diverse facets: understanding stakeholders, active engagement, and effective adaptation to their expectations (Freeman & Reed, 1983; Freeman, 2010). Studies by Berrone et al. (2007) and Gomez-Mejia & Werner (2008) emphasize that fostering strong relationships with stakeholders enhances organizational sustainability. While this has been widely acknowledged, the challenge lies in balancing diverse stakeholder perspectives. Some stakeholders may have conflicting interests, and meeting one group's expectations could lead to dissatisfaction among others (Plaza-Úbeda et al., 2010). Therefore, stakeholder integration requires organizations to actively engage with and adapt to stakeholders' behaviors, ensuring strategies evolve in line with shifting expectations (Kua, 2016b; Bendig, Schäper, & Erbar, 2024). The implementation of environmental management accounting is guided by stakeholder perspectives, ensuring alignment with organizational values and objectives (Salem et al., 2018). Kumarasiri (2017) emphasized that incorporating stakeholder input is crucial for aligning sustainable practices with expectations, particularly in competitive environments. Danso et al. (2020) stated this process necessitates the active participation of various stakeholders in the decision-making process. Such involvement is especially important in developing contexts like Pakistan, where internal stakeholder views carry significant weight due to cultural and structural factors (Awan, Kraslawski, & Huiskonen, 2017a; Nawaz et al., 2021). Thus, organizations

can ensure their strategies remain in sync with changing preferences taking stakeholder behaviors into consideration, thus maintaining their relevance and promoting sustainability.

According to Kua (2016a), after identifying stakeholders across various life-cycle stages, the next crucial step is to comprehend their viewpoints (Kua, 2016a; Wijethilake & Lama, 2019). This suggests that merely being aware of stakeholders does not ensure alignment with their preferences (Salem et al., 2016). The impact of stakeholder integration on sustainability begins when the organization interacts with its stakeholders (Delmas & Toffel, 2004; Steurer et al., 2005; Salem et al., 2018; Nawaz et al., 2021). Research indicates that favorable stakeholder relationships contribute to enhanced organizational sustainability (Berrone, Surroca, & Tribó, 2007; Vachon & Klassen, 2008; Salem et al., 2016; Salem et al., 2018). These interactions provide insights into the environmental effects of organizational actions. Managers can effectively promote positive change towards sustainability by aligning with stakeholders' ethical values (Berrone et al., 2007). Stakeholder theory proposes that incorporating stakeholder concerns into organizational strategy improves sustainability (Barney, 1991; Wijethilake & Lama, 2019; Gerged et al., 2024). Collaboration between organizations and regulatory stakeholders can enhance environmental standing (Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010). Salem et al. (2018) found that environmental policies adopted by organizations and their interactions within stakeholder networks are key factors influencing sustainable growth in developing nations (Rodrigue et al., 2013; Nawaz et al., 2021; Shahzad et al., 2022; Ullah et al., 2024).

Therefore, incorporating the viewpoints of internal stakeholders is imperative due to entrenched hierarchies and traditional values. This approach results in culturally attuned sustainability initiatives, increasing the likelihood of successful environmental management accounting implementation. Hence, given the current dearth of empirical evidence, this study endeavors to explore the moderating role of stakeholder integration in the relationship between environmental management accounting implementation and organizational sustainability. Therefore, the following hypothesis can be proposed.

- H2: Stakeholder integration significantly moderates between environmental management accounting implementation and organizational sustainability.

This hypothesis can be further divided into the following sub-hypotheses based on the dimensions of stakeholder integration for individual testing.

- H2a: Knowledge of stakeholders significantly moderates between environmental management accounting implementation and organizational sustainability.
- H2b: Interaction with stakeholders significantly moderates environmental management accounting implementation and organizational sustainability.
- H2c: Adaptation to behavior significantly moderates between environmental management accounting implementation and organizational sustainability.

Figure 1 presenting the theoretical framework of the study.

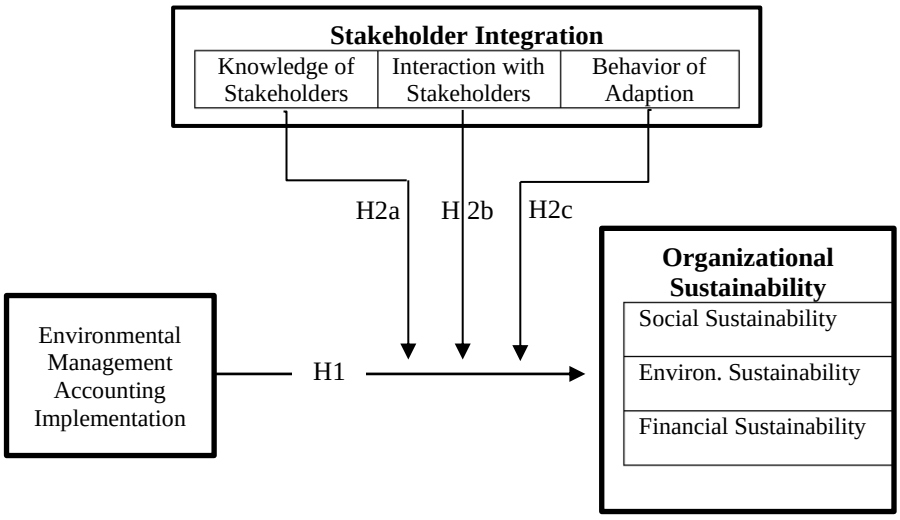

Figure 1: Theoretical Research Framework of the Study

3. Methodology

The current study population consisted of ISO-certified manufacturing organizations in Pakistan. According to the ISO 14001 survey for 2022, there are 994 organizations with 14001 certifications in Pakistan. However, based on the research questions and study relevance, the researcher excluded non-manufacturing organizations (for example, fishing and farming, hotel and social work institutions, and other service industries). Stratified sampling was employed, there are a total of 39 sectors according to ISO categorization, however, we merge these sectors into eight relevant sectors. Based on Krejcie and Morgan's (1970) formula and considering the population as 847 (rounded up to 850), a sample size of 265 was initially deemed appropriate. Additionally, G*Power software was utilized, suggesting a sample size of 74 based on four predictors of the study, with an effect size of 0.15, alpha of 0.05, and confidence level of 0.95, however, we also considered it three times as suggested by (Hair, Risher, et al., 2019). To ensure a satisfactory response rate and address potential issues, the final sample size was set at 300 for the study.

3.1 Questionnaire Design and Measurements

A self-administered questionnaire was distributed to account/environmental managers or executives within ISO 14001-certified manufacturing organizations in Pakistan. The questionnaire contained three major sections. The first section was introductory, describing the study's purpose and assuring confidentiality to the respondent, as their responses will be used only for research purposes. The second section requested demographic information

from our respondents, and the third section assessed the extent of our respondents' agreement with our objective statements on a 5-point Likert scale. The measurement scales were adapted from prior studies.

To measure the 'environmental management accounting implementation' a six items scale was adapted from the study of Wang et al. (2019) and it has strong reliability and validity in the literature as it has also been employed by other scholars (Chaudhry & Amir, 2020; Latif, Mahmood, Tze San, et al., 2020). The scale to measure 'stakeholder integration' consists of three dimensions and is adapted from the study of Danso et al. (2020). Lastly, to measure 'organizational sustainability' a scale from the study of Varela et al. (2019) was adopted as it encompasses three dimensions and a total of nine items, and some past also utilized it (Jayashree et al., 2021; Khan et al., 2021; Solovida & Latan, 2021).

3.2 Data Analysis

To test the study hypotheses, we applied the Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the structural model of the study by utilizing SmartPLS 4 (Ringle, Wende, & Becker, 2022). PLS-SEM was chosen due to its robustness in handling smaller sample sizes, with 267 responses in this study. PLS-SEM provides accurate insights even with smaller datasets as compared to other methods that require larger samples for reliable results. Additionally, PLS-SEM is particularly suited for research focused on prediction, as it can model complex relationships and interactions among the study variables. Based on the study nature and the moderating role of stakeholder integration, PLS-SEM was ideal for capturing the intricate dynamics and ensuring reliable results despite the limited sample size (Hair et al., 2012).

3.3 Common Method Bias

There are chances of common method bias, where the source of data is the same, therefore, to examine potential common method bias in this study, we run Harman's single-factor test. It evaluates whether a single factor accounts for the majority of the variance in the data, indicating a significant common method bias. Results of the unrotated principal component analysis revealed that the first factor explained 32.13% of the total variance, which is far below the threshold of 50%. Hence, it is confirmed that common method bias is unlikely to pose a significant issue in this study (Podsakoff et al., 2003).

4. Empirical Findings

First, we run the frequency test to examine the respondents' demographic profile. The majority of the respondents (32.6%) lie between the ages of 31 and 35 years, representing professionals at a stage where they could actively contribute to organizational practices. Most of the respondents are well educated as 72% of the sample has postgraduate or master's degrees. Additionally, 42.3% had 5-8 years of experience, and 33.3% had over 8 years. It makes sense that most respondents have good knowledge about the organization to provide well-equipped responses. Similarly, our respondents came from a range of

industries, with a significant number from chemicals and pharmaceuticals (30%), ensuring the broad applicability of the findings. Notably, 97% of the organizations were ISO-certified, demonstrating a strong foundation in quality and environmental standards. Lastly, the majority of organizations (71.5%) were privately owned and 36% were large organizations which have more than 500 people. This demographic profile underscores the study's focus on understanding how environmental management accounting practices and stakeholder integration contribute to sustainability in diverse and dynamic organizational settings.

Table 1 presents a detailed evaluation of the descriptive statistics, such as mean, skewness, item-wise loadings, and variance inflation factors (VIF) for all constructs of the study. The mean scores for all items ranged from 3.01 to 3.65, reflecting a moderate agreement among respondents on the constructs measured. Skewness values must be between the threshold range of -1 to +1 and results demonstrated all near to zero proved the data normality. Hair, Risher, et al. (2019) recommended a minimum threshold of 0.07 for loading and all of these values within the range. For instance, environmental management accounting loadings ranged from 0.72 to 0.82, while organizational sustainability loadings were slightly more variable, from 0.62 to 0.83, highlighting the constructs' strong reflective measurement properties, however, OS7 was deleted due to low loading. Lastly, there is no multicollinearity issue among the items as VIF values were all below 3. These findings establish that the measurement scales used in this study are reliable and valid, they provide confidence in the constructs' ability to accurately measure their respective theoretical realms.

Table 1: Items Descriptives, Loading, and Normality

Items	Mean	Skewness	Loadings	VIF
EMA1	3.37	-0.29	0.73	1.78
EMA2	3.45	-0.33	0.76	1.91
EMA3	3.36	-0.34	0.81	2.56
EMA4	3.41	-0.38	0.79	2.49
EMA5	3.34	-0.32	0.82	2.62
EMA6	3.43	-0.38	0.72	1.64
BA1	3.13	-0.07	0.84	2.64
BA2	3.09	-0.04	0.85	2.91
BA3	3.08	-0.02	0.87	2.90
BA4	3.06	0.05	0.83	2.02
BA5	3.25	-0.19	0.88	2.94
INS1	3.01	0.00	0.85	1.95
INS2	3.02	0.00	0.90	2.49
INS3	3.02	-0.01	0.89	2.09
KS1	3.39	-0.46	0.87	2.42
KS2	3.28	-0.33	0.84	2.21
KS3	3.24	-0.21	0.86	2.23
KS4	3.16	-0.18	0.84	2.09
OS1	3.65	-0.42	0.80	2.70
OS2	3.58	-0.22	0.80	2.54
OS3	3.61	-0.37	0.83	2.84
OS4	3.44	-0.25	0.62	1.77
OS5	3.40	-0.05	0.70	2.44
OS6	3.41	-0.03	0.70	2.46
OS8	3.45	-0.22	0.73	2.32
OS9	3.58	-0.30	0.74	2.38

EMA = Environmental management accounting, BA = Behavior of Adaption, INS = Interaction with stakeholders, KS = Knowledge of Stakeholders and OS = Organizational sustainability.

4.1 Assessment of Measurement Model

The Measurement Model assesses constructs' validity and reliability, ensuring indicators effectively converge to represent underlying concepts with strong internal consistency and robust convergent validity. An assessment of convergent validity ensures that the indicators of a construct converge to represent the same underlying concept (Creswell, 2014; Hair, Risher, et al., 2019). As shown in Table 2, the Cronbach's alpha values for all constructs ranged from 0.85 to 0.91, while the composite reliability (CR_rho_a) values ranged from

0.90 to 0.93. These results exceeded the minimum threshold of 0.70, demonstrating strong internal consistency (Hair, Black, et al., 2019). Furthermore, the average variance extracted (AVE) values were above the recommended cutoff of 0.50, indicating that more than 50% of the variance in each construct's items was captured by the construct itself (Fornell & Larcker, 1981). These findings collectively confirm the constructs' reliability and ability to measure the intended dimensions effectively, establishing robust convergent validity.

Table 2: Reliability and Convergent Validity

Constructs	Cronbach's alpha	CR_rho_a	CR_rho_c	AVE
EMA	0.86	0.86	0.90	0.60
BA	0.91	0.91	0.93	0.73
INS	0.85	0.86	0.91	0.77
KS	0.87	0.87	0.91	0.72
OS	0.89	0.90	0.91	0.55

EMA = Environmental management accounting, BA = Behavior of Adaption, INS = Interaction with stakeholders, KS = Knowledge of Stakeholders and OS = Organizational sustainability

We assessed the discriminant validity through the Fornell and Larcker (FL) criterion and the Heterotrait-Monotrait (HTMT) ratio, ensures that each construct is distinct and captures unique aspects of the theoretical framework. According to the FL criterion, the square root of the AVE for each construct was higher than its correlation with other constructs. For example, the AVE square root for BA was 0.853, surpassing its correlation with environmental management accounting is 0.384 and other constructs and thus meeting the FL criterion for discriminant validity. Similarly, the HTMT values for all constructs were below the stringent threshold of 0.85 (Dijkstra & Henseler, 2015). The highest HTMT value 0.531 was observed between the organizational sustainability and INS, which remained within acceptable limits. These results confirm that the constructs are conceptually distinct and free from redundancy, thus fulfilling the discriminant validity requirement.

Table 3: Discriminant Validity

Fornell and Larcker's (FL) criterion					
Constructs	**BA**	**EMA**	**INS**	**KS**	**OS**
BA	**0.853**				
EMA	0.384	**0.773**			
INS	-0.358	-0.216	**0.879**		
KS	0.331	0.333	-0.36	**0.850**	
OS	0.356	0.432	-0.466	0.444	**0.744**
Hterotrait-Monotrait criteria (HTMT)					
BA	-				
EMA	0.434	-			
INS	0.405	0.253	-		
KS	0.372	0.381	0.413	-	
OS	0.393	0.466	0.531	0.491	-

EMA = Environmental management accounting, BA = Behavior of Adaption, INS = Interaction with stakeholders, KS = Knowledge of Stakeholders and OS = Organizational sustainability

4.2 Assessment of Structural Model

The assessment of structural model involves evaluating the relationships between latent variables to test the hypothesized paths, Table 4 provides these insights among study variables. Findings show the direct effect of environmental management accounting on OS, that is positive and statistically significant. It means that integrating environmental considerations into organizational decision-making enhances sustainability outcomes. The positive impact suggests that organizations adopting environmental management accounting practices are better equipped to align their operational strategies with environmental goals, leading to improved resource efficiency and long-term value creation. These findings resonate with stakeholder theory, as Freeman and Reed (1983), assert that addressing stakeholder concerns leads to enhanced organizational performance. Among the moderating variables, INS significantly strengthened the EMA impact on OS, it means that the critical role of active stakeholder engagement in amplifying the effectiveness of EMA practices. Frequent and meaningful interactions with stakeholders foster collaboration, trust, and shared accountability. These dynamics not only facilitate the successful implementation of EMA but also promote joint ownership of sustainability initiatives, thereby enhancing their outcomes. For instance, involving stakeholders in decision-making processes could lead to innovative solutions to sustainability challenges.

Table 4: Hypotheses Testing through PLS-SEM

Hypothesis	Hypothetical Path	Estimates	SD	t_value	p_value	Proved
H1	EMA→OS	0.28	0.06	4.69	0.00	Yes
H2a	KS x EMA→OS	0.04	0.07	0.68	0.25	No
H3b	INS x EMA→OS	0.15	0.06	2.42	0.01	Yes
H4c	BA x EMA→OS	0.16	0.07	2.43	0.01	Yes

EMA = Environmental management accounting, BA = Behavior of Adaption, INS = Interaction with stakeholders, KS = Knowledge of Stakeholders and OS = Organizational sustainability.

Furthermore, findings proved that BA also emerged as a significant moderator and indicating that an organization's ability to dynamically adapt and respond to stakeholder expectations magnifies the impact of environmental management accounting on organizational sustainability. Which mean that adaptive organizations can quickly realign their strategies in response to stakeholder demands, ensuring that EMA practices remain relevant and impactful. This adaptability could be particularly crucial in industries facing rapidly changing environmental regulations or market dynamics.

Contrary to expectations, KS did not exhibit a significant moderating effect ($\beta = 0.04$, $p = 0.25$). While the role of stakeholder knowledge is important, the findings suggest that knowledge alone is insufficient to enhance the effectiveness of EMA practices. Instead, it must be complemented by active engagement and organizational adaptability to yield meaningful results. This implies that organizations should focus not only on understanding stakeholder concerns but also on translating this knowledge into actionable strategies through continuous interaction and flexibility. Figure 2 presents that results confirm that EMA directly fosters OS, and that its influence is significantly enhanced by interaction and adaptability, validating the central tenets of stakeholder theory in driving sustainable organizational practices.

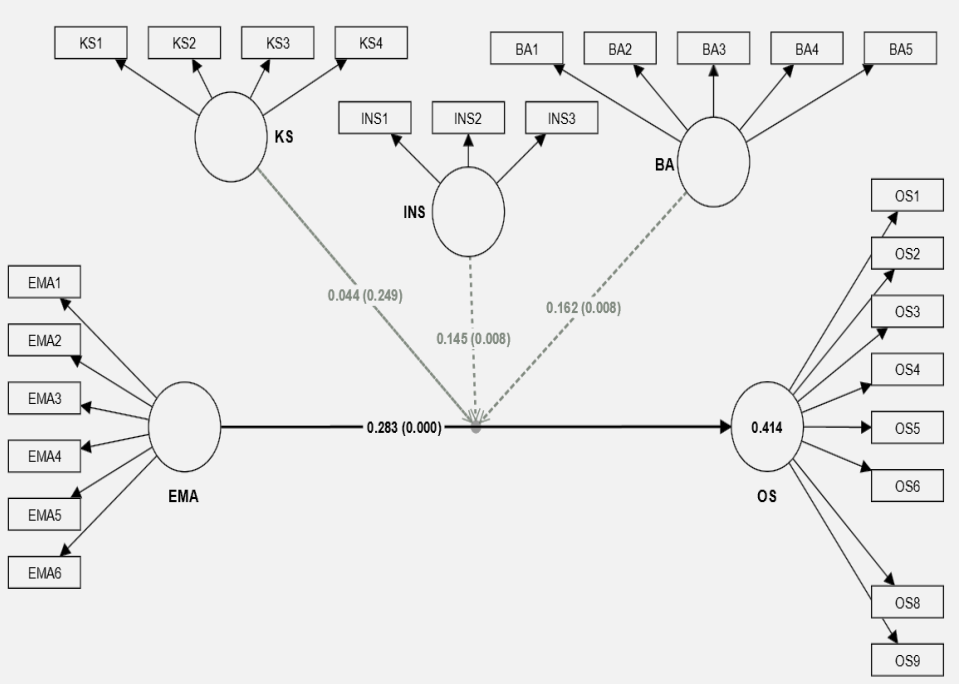

Figure 2: Structural Model

Table 5 presents the overall model fit and predictive accuracy. The SRMR value was 0.067, which was below the threshold of 0.08, indicating a well-fitting model (Ringle et al., 2022). The NFI was 0.859, which is slightly below the ideal value of 0.9, but still acceptable for an explanatory study, reflecting adequate model performance. Predictive relevance was demonstrated by the Q^2 value of 0.35 for OS, signifying moderate predictive accuracy (Hair, Risher, et al., 2019). Furthermore, the RMSE and MAE values for organizational sustainability were 0.812 and 0.634, respectively, indicating an acceptable level of prediction error. These indicators collectively confirm that the structural model is robust and capable of explaining hypothesized relationships with sufficient predictive power.

Table 5: Model Fit and Predict Power

Indicators	**Saturated Model**	**Estimated Model**	**Decision**
SRMR	0.067	0.067	Acceptable
NFI	0.859	0.859	Acceptable
Predict Powers			
Endogenous	Q^2predict	RMSE	MAE
OS	0.35	0.812	0.634

5. Discussion

The present study and its findings align with stakeholder theory, which emphasizes the significant role of stakeholders in determining the sustainable outcomes of an organization (Freeman & Reed, 1983). The current study found that environmental management accounting (EMA) assists organizations in recognizing and integrating environmental costs into their decision-making processes, which enables them to enhance resource efficiency and align their operations with their sustainability objectives. This finding led to the acceptance of H1 and corroborated previous studies highlighting the role of EMA in organizational performance (Chaudhry & Amir, 2020; Appannan et al., 2023; Abdelhalim, 2024). This empirical result also suggests that organizations implementing EMA effectively become able to address expectations of their diverse stakeholders through a structured approach, which ultimately help them enhance OS. Results regarding H2a were found to be insignificant, which suggested that stakeholder knowledge alone does not affect the relationship between EMA and OS. This finding supports the idea that knowledge without applications, actions, or engagement does not bring meaningful results (Freeman, 2010; Hörisch, Freeman, & Schaltegger, 2014). Therefore, the knowledge, while important, must be combined with proper actions and engagement to enhance an active understanding of EMA practices and produce meaningful outcomes. Therefore, it is suggested here that it is not enough to just inform stakeholders, but it is actually needed to engage them in the process of decision-making in order to ensure the comprehensive incorporation of EMA practices into organizational strategy.

H2b of the study was about the moderating impact of stakeholder interaction in the association between EMA and OS. The present study (in line with stakeholder theory) found that organizations that involve their stakeholders in sustainability decisions and discussions, are in the better position to achieve sustainability outcomes because the improved stakeholders' interactions enable them to match their EMA practices with stakeholder preferences, leading towards the trust, cooperation, and communal responsibility (Brulhart et al., 2019; Adomako & Tran, 2022). This finding of the present research was also in line with the revelations of previous research highlighting that active stakeholder engagement strengthens the co-creation of solutions and implementation of EMA practices in the organization (Danso et al., 2020).

H2c of the study suggests that organizational adaptability makes a significant difference to the influence of EMA on OS. The present findings supported this hypothesis by suggesting that adaptable and responsive organizations are in a better position to integrate EMA practices and adjust with those practices for addressing diverse stakeholders' expectation and needs. In this way, they are better positioned to maintain the effectiveness and relevance of their strategies, which leads them to enhance OS. This finding is consistent with suggestions of contingency theory, which emphasizes the importance of syncing organizational practices with external and internal demands for the sake of success (Danso et al., 2020). This finding is also in line with the previous literature emphasizing that

responsive and flexible organizations are better able to implementing EMA practices into their decision-making and operations, thus improving their organizational sustainability (Kumarasiri, 2017; Gerged et al., 2024). By emphasizing the significant roles of stakeholder engagement and organizational adaptability, outcomes of this study accentuate the active role of stakeholder integration in the way of sustainability and optimizing EMA implementation. In this way, the study contributes to the existing literature by revealing that while the EMA has a direct positive effect on OS, this effect magnifies in the presence of strategic stakeholder engagement and organizational adaptability. Hence, the present study necessitates the application of stakeholder-centric approach of EMA in the organization and incorporation of both external and internal outputs into sustainability strategies of the organization in order to align them with extensive organizational goals.

5.1 Conclusion

The present study examined the role of environmental management accounting (EMA) in deriving organizational sustainability along with the moderating roles of stakeholder integration. The study found that EMA implementation makes a significant contribution in the way of fostering OS in manufacturing organizations of Pakistan by improving their economic, social, and environmental performances. Furthermore, the study suggested that stakeholder integration plays a significant moderating role in the relationship between EMA and OS as the active stakeholder engagement strengthens the effect of EMA on OS by amplifying the effectiveness of EMA practices in accomplishing the sustainability objectives. However, the present study highlighted that stakeholder knowledge alone does not have the potential to produce meaningful outcomes without proper action and involvement. Therefore, knowledge, while important, must be combined with strategic stakeholder integration to generate desired outcomes. The study also highlighted the crucial importance of organizational flexibility and responsiveness to strengthen the positive contribution of EMA towards OS. Hence, outcomes of this study emphasize that organizations need to pair the useful knowledge with strategic stakeholder integration and responsiveness in order to achieve sustainability goals through EMA implementation.

5.2 Implications

The research and its findings make a significant contribution to the literature of environmental sustainability and stakeholder theory. By highlighting the importance of implementing environmental sustainability initiatives such as environmental management accounting (EMA), the study aligns with the largely growing global emphasis on research regarding sustainability. Furthermore, the study, through its support towards stakeholder theory and empirical evidence of the roles of EMA and moderating effects of stakeholder integration as well as organizational adaptability, adds to the currently rare empirical literature especially regarding the developing country like Pakistan. The present study helps extend stakeholder theory by emphasizing the positive role of stakeholder integration in strengthening the effect of EMA on OS of manufacturing organizations of Pakistan. The

rare context of the current study (i.e. developing country like Pakistan) suggests that in such contexts with weak institutional structures, stakeholder integration enables organizations to address sustainability challenges and enhance OS in a structured way. The study highlights the pivotal role of stakeholder engagement, thus deepening the understanding of how sustainability strategies and outcomes could be influenced by strategic stakeholder engagement. Additionally, the study incorporates social aspect of sustainability along with economic and environmental sustainability, which aligns with triple bottom-line framework, thus broadening the conceptual scope of EMA.

Practically, the study comes up with useful guidelines for strategy makers, sustainability practitioners, and policymakers that can help them in making effective decisions and taking effective steps to accomplish sustainability. The study can help Pakistani manufacturing organizations, and their managers understand that they need to not only adopt EMA practices but also enhance substantive stakeholder integration and adaptability in the organization in order to achieve OS. The focus on EMA as well as stakeholder integration can ensure the effectiveness and inclusiveness of sustainability initiatives of organizations. The findings can particularly help manufacturing organizations improve their strategic planning towards OS by incorporating stakeholder interaction and integration as important components of EMA application because they can enhance resource efficiency, innovative solutions, and long-term sustainability performance of the organization. The study also encourages manufacturing organizations to build adaptability in order to maximize the benefits of EMA implementation so, the strategy makers of organizations can get better understanding and guide from revelations of this study to design and implement strategies for sake of optimization of EMA in the way of sustainability. The study also can guide policymakers in designing better regulatory frameworks for the manufacturing sector by encouraging EMA initiatives and stakeholder integration in order to promote the sustainability of the sector.

5.3 Limitations and Directions for Future Research

Besides important insights, this study also has a few limitations that can derive opportunities for future researchers. For instance, the current study was based on cross-sectional data which limits the ability to examine the change in the studied phenomenon over the time. Future studies can consider using longitudinal data to better examine the long-term process of affecting organizational sustainability of organizations through environmental management accounting. Secondly, the present study was conducted on ISO-certified manufacturing organizations of Pakistan exclusively while the findings could be different for non-certified organizations or other sectors, thus restricting the generalizability of the research. Future studies should examine the influence of EMA on OS with a more holistic approach by conducting cross-industrial examinations (e.g. non-certified or other than manufacturing sector) to create broad understanding of EMA implementation. Lastly, the insignificant moderating effect of stakeholder knowledge found in the current study necessitates deeper examination of the relationship. Future

researchers should consider examining how knowledge-sharing mechanisms including training programs can enhance the value of stakeholder integration in realizing sustainability goals.

Research Funding

The authors received no internal research grant or external funding for this research study.

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