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Research paper

Environmental Management Accounting in Omani Manufacturing Firms: Antecedents and Outcomes

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Abstract

The present study aimed to evaluate the antecedents and outcomes of Environmental Management Accounting (EMA) implementation, and to assess the mediating roles of EMA in the relationships between EUTY and OPRF, ESGY and OPRF, and ESTY and OPRF. It further aimed to analyse the moderating effect of TMC on the relationship between EMA implementation and OPRF. The current study was conducted among small and medium manufacturing enterprises (SMEs) in Oman, using a survey of 383 managers. Results from structural equation modelling revealed that EUTY , ESGY, and ESTY are positive predictors of EMA implementation in manufacturing SMEs in Oman. Furthermore, it was found that EMA implementation significantly mediated the relationships among EUTY and OPRF, ESGY and OPRF, and ESTY and OPRF. Results further confirmed that TMC serves as a significant and positive catalyst for the relationship between EMA implementation and OPRF. The currently studied rare, mediated-moderated conceptual model to evaluate the antecedents and outcomes of EMA implementation makes the current study rare of its kind, contributing to the literature on EMA implementation, sustainability, and the resource-based view.

Keywords: *Environmental Management Accounting (EMA); Environmental Uncertainty (EUTY); Environmental Safety (ESTY); Environmental Strategy (ESGY); Organisational Performance (OPRF); Top Management Control (TMC).*

1. Introduction

The emerging awareness of climate change, the depletion of natural resources, and environmental degradation has made it necessary for businesses to adopt sustainable practices to address these issues (Appiah-Kubi et al., 2025; Rasheed et al., 2025; Ullah et al., 2024). These growing environmental challenges have led businesses to place a sharp focus not only on their financial performance but also on their environmental and social performance. It has led to the increased significance of the idea of triple bottom line (TBL), which suggests that an organisation should ensure that it is monitoring and improving its performance in financial, social, and environmental terms instead of enhancing financial performance only (Marzouk & El Ebrashi, 2024; Mat Yusoh et al., 2023). It is because mere focus on financial performance is now insufficient in the contemporary business world to meet sustainability and performance standards. That is why many contemporary organisations seek to incorporate various sustainable practices to support their performance from TBL perspectives. Alqassabi (2020) suggests that the challenge of maintaining sustainable performance is particularly pertinent in the manufacturing sector, as environmental concerns and regulations significantly shape companies' ability to remain profitable.

The manufacturing sector in Oman is not exempt from this sustainability challenge. Given the rapid industrialisation of the Sultanate of Oman in the past few decades and the crucial role of the manufacturing sector in this, a pressing need arises to closely monitor the carbon footprint and sustainability challenges in its manufacturing sector (Gulvady & Jyotirmayee, 2023; Ibrahim et al., 2024; Sulaiman, 2025). According to Al Balushi and Elgeddawy (2025), small and medium enterprises (SMEs) in Oman face various environmental challenges that can significantly influence their growth and sustainability. Siyabi and Hakro (2020) suggest that Oman is home to thousands of manufacturing SMEs, which account for a significant share of the country's economic growth. It means that the sustainable growth of these SMEs can ultimately drive the country's sustainable development. However, SMEs in Oman face formidable challenges such as limited access to finance, a lack of proper ESGY, technological backwardness, and other limitations, which often result in the implementation of unsustainable practices that can hinder their sustainable performance (Gulvady & Jyotirmayee, 2023; Ibrahim et al., 2024; Siyabi & Hakro,

2020). Therefore, there is a real-time need to adopt various sustainable initiatives and practices in manufacturing businesses to minimise their environmental impacts and better cope with these challenges, thereby achieving the goal of sustainable performance.

Implementing EMA (EMA) is considered a great way to minimise environmental impacts and enhance the TBL performance of business by multiple previous researchers, However, Kadir et al. (2025) suggest that despite the crucial contribution of EMA towards sustainable development emphasised by researchers worldwide, implementing EMA in Oman's manufacturing sector remains underexplored, mainly in academic discourse. There is very little empirical evidence on how different factors can drive EMA implementation and how EMA implementation can contribute to the sustainability performance of businesses in Oman (Kadir et al., 2025). Furthermore, prior researchers investigating predictors of EMA or its outcomes in Omani manufacturing firms rarely presented a combined model that captures both aspects of EMA implementation in a single study. Therefore, there is a need to empirically investigate the predictors of EMA implementation in Oman's manufacturing sector and the effect of this implementation on TBL performance, to provide a holistic view of the predictors and outcomes of EMA implementation in manufacturing SMEs in Oman.

EMA has emerged as a tool to balance economic efficiency with environmental responsibility by monitoring, assessing, and informing organisations' resource use and environmental performance. In this way, EMA serves as the organisation's unique competence, supporting its performance and growth. According to the resource-based view (RBV), a business's unique, non-imitable resources enable it to build sustainable competitive advantage and grow. Building on this view, several researchers have argued that EMA implementation serves as a rare and exclusive resource for businesses, enabling them to enhance their performance in economic and environmental terms (Appannan et al., 2023; Appannan et al., 2020; Rasit et al.). However, prior studies have insufficiently explained EMA in terms of RBV and its role in determining an organisation's TBL performance, particularly in the context of SMEs in Oman. An important factor that helps the organisation realise the benefits of its EMA implementation in terms of OPRF is TMC (TMC), as various researchers have advocated its favourable role in enhancing OPRF. However, none of them empirically assessed how the presence of TMC can influence the relationship between EMA and the OPRF of manufacturing SMEs in Oman (Amir et al., 2025; Khan et al., 2025).

Given the gap identified in the literature regarding EMA implementation, the current study seeks to evaluate different predictors of EMA and the contribution of EMA to TBL OPRF. Furthermore, it aims to assess the mediating role of EMA implementation in the relationship between EMA predictors (such as EUTY, ESTY, and ESGY) and the OPRF of manufacturing SMEs in Oman. By evaluating the moderating effect of TMC on the relationship between EMA implementation and OPRF in manufacturing SMEs in Oman, the current study seeks to examine how higher TMC can enable them to translate EMA implementation into improved TBL performance. By fulfilling its aim, the present study will address a noticeable gap in the literature by examining EMA implementation in Oman's unique socio-economic landscape, using a mediated-moderated model. Being one of the pioneer studies investigating and combining the predictors and outcomes of EMA implementation in a single conceptual model in the context of Omani SMEs, analysing the mediating role of EMA implementation between those antecedents and OPRF, and assessing the TMC as the catalyst between EMA implementation and OPRF of Omani manufacturing SMEs for the first time makes the current study unique. It will add to the empirical literature on RBV, EMA implementation, and sustainability while helping strategy makers in Oman's SMEs understand how they can achieve their sustainability goals by capitalising on their ESGY, ESTY, EUTY, TMC, and, in turn, EMA implementation. The remainder of this paper comprises a review of relevant literature, a description of the methodology used for the current study, the results produced by the researcher, a discussion of those results, and a conclusion of the study, while addressing its implications and limitations (Kadir et al., 2024; Javed et al 2025).

2. Literature Review

EMA refers to the accounting system that helps businesses trace environmental costs and make informed decisions based on accounting information, thereby reducing their environmental impacts (Kadir et al., 2024, 2025; Noor & Bano, 2024). Researchers argue that businesses can identify opportunities to minimise their footprints and enhance performance by leveraging EMA, which offers a more sophisticated approach to environmental monitoring and enables them to embrace proactive sustainability initiatives. (Alnaim & Metwally, 2024; Amir et al., 2024; Ni et al., 2023). This study draws on RBV, which emphasises that businesses should leverage their unique, non-imitable resources to build sustainable competitive advantage and succeed in the business world. Building on this view, several researchers have regarded EMA implementation as a unique and rare resource for businesses to enhance performance and sustainable growth (Appannan et al., 2023; Appannan et al., 2020; Rasit et al.). The current study considers a TBL perspective on OPRF, according to which the business should grow on financial, social, and environmental terms rather than solely on economic performance (Marzouk & El Ebrashi, 2024; Mat Yusoh et al., 2023). Drawing on the literature, the current study considers three predictors of EMA implementation: EUTY, ESGY, and ESTY.

2.1. EUTY and EMA implementation

An important antecedent of EMA implementation identified by several researchers is EUTY. Darvishmotevali et al. (2020) define EUTY as the degree of unpredictability in the external business environment, driven by factors such as technological disruption, fluctuations in customer demand, economic trends, regulatory changes, and competition. Researchers argue that these uncertainties push businesses to adopt EMA, thereby enabling them to become better able and more proactive in coping with them. For instance, Kong et al. (2022) suggest that EMA offers data-driven insights that help businesses navigate the fluctuating environmental landscape and better prepare for future challenges. Researchers suggest that the modern contemporary business world is troubled with a lot of uncertainties related to environmental shifts, such as regulatory changes, demand fluctuation, climate change, etc., making it necessary for businesses to adopt sustainable initiatives such as EMA (Gunarathne et al., 2023; Nguyen et al., 2023; Ni et al., 2023). Higher EUTY pushes businesses to make informed, proactive decisions to better cope with it. It is possible through the practical application of EMA, which enables the organisation to predict uncertainties and make effective decisions to address them promptly. Latan et al. (2018) examined how EUTY, ecological strategies, and managerial commitment can drive EMA practices. They suggested that environmental uncertainties positively drive businesses to adopt EMA. Appiah et al. (2020) also suggest that environmental uncertainties push organisations to adopt EMA, as it can allow them to pioneer forward-looking strategies that cushion the organisation against potential environmental adversities and unlock opportunities for sustainable advancement and operational efficiency. However, the nexus between EUTY and EMA implementation remains underempirically validated, especially in the context of manufacturing SMEs in Oman (Javed & Al-Mulali 2025; Rafique et al., 2025). Therefore, the current study hypothesises that:

H1: EUTY significantly positively affects EMA implementation.

2.2. ESGY and EMA implementation

ESGY is the strategy an organisation uses to address environmental challenges and exploit environmental opportunities, providing a roadmap for achieving organisational goals (Kraus et al., 2020). According to researchers, an effective organisational strategy encompasses both financial and environmental components (Faraz et al., 2024; Pondeville et al., 2013; Thanh Thuy Ngoc, 2025). According to Thanh Thuy Ngoc (2025), an ESGY serves as a compass that guides an organisation in navigating its environmental responsibilities and ambitions. Faraz et al. (2024) suggest that an effective ESGY promotes green behaviour in the organisation and leads to the application of sustainable initiatives like EMA. Gunarathne et al. (2023) also discussed the crucial role of ESGY within the organisation, emphasising that a proactive ESGY enables the organisation to implement EMA to encapsulate and enhance multiplicity in addressing more advanced environmental management initiatives. Another study by Mayndarto and Murwaningsari (2021) examined ESGY and EMA implementation in a model and demonstrated considerable interactions between them. However, they did not address the direct impact of ESGY on EMA implementation. The literature does not provide any further empirical evidence on how the ESGY can lead organisations to implement EMA, especially among manufacturing SMEs in Oman (Ariffin al., 2024; Javed et al., 2024;Javed & Husain, 2024). Therefore, the study hypothesises:
H2: ESGY significantly positively affects EMA implementation.

2.3. ESTY and EMA implementation

Another antecedent that pushes organisations to implement EMA and realise its benefits is ESTY. ESTY refers to the organisation's application of safety guidelines and procedures to address potential environmental hazards (Islam & Rahman, 2022). SAN and HENG (2018) suggest that EMA can significantly help an organisation anticipate and proactively address potential environmental hazards. Ensuring ESTY for the organisation requires that business operations and processes be environmentally friendly and that the organisation minimise its carbon footprint. The increased concern for ESTY leads the organisation to prudent resource management to reduce the risk of environmental degradation. In this regard, EMA serves as a strategic tool to identify and quantify potential environmental hazards associated with the business's activities and to offer data-based insights to guide the organisation's strategic decision-making to minimise adverse environmental impacts. Therefore, it is argued here that safety-focused organisations are more likely to implement EMA, as it enables them to address their ESTY-related concerns. However, the literature appears almost silent on the empirical validation of ESTY's role in determining EMA implementation. Therefore, this gap in the literature needs to be shortened by evaluating this nexus:
H3: ESTY concerns significantly positively affect EMA implementation.

2.4. EMA implementation and OPRF

Drawing on the RBV, it is argued that EMA is a unique organisational competence, enabling it to make informed decisions and enhance its sustainable competitive advantage. EMA helps businesses make informed decisions by acquiring and assimilating valid environmental data. Researchers argue that data-based insights from EMA enable businesses to develop effective strategies to minimise waste, use resources efficiently, reduce environmental impacts, and enhance performance across various aspects (Sari et al., 2021; Solovida & Latan, 2021). A study by Ratanasongtham et al. (2018) of Thai companies found that EMA increases the likelihood of firm survival and growth. Similarly, Thanh Thuy Ngoc (2025) declared that EMA led Vietnamese firms to achieve sustainability by improving their performance in economic, social, and environmental terms. The study by Amir et al. (2024) on Omani firms also confirmed the positive contribution of EMA implementation to organisational sustainability. Various researchers have also advocated the positive role of EMA implementation in determining OPRF. (Gerged et al., 2024; Gunarathne et al., 2021; Jermsittiparsert et al., 2020; Mayndarto & Murwaningsari, 2021). However, a few of them adopted the TBL perspective on OPRF and focused their research on only one or two types of performance. Therefore, there is a need to enhance empirical evidence on how EMA implementation affects overall OPRF, including economic, social, and environmental performance. The current study hypothesises that:
H4: EMA implementation significantly positively influences the OPRF.

2.5. Role of EMA implementation between EUTY and EMA implementation

Combining the reviews of studies in sections 2.1 and 2.4, it can be argued that EMA implementation mediates the relationship between EUTY and OPRF. Different studies in section 2.1 have indicated that EUTY has the potential to lead businesses to adopt EMA in order to better cope with high environmental uncertainties, such as Kong et al. (2022), Gunarathne et al. (2023), Latan et al. (2018), Appiah et al. (2020), and Nguyen et al. (2023). EMA enables businesses to pinpoint more effectively, realise cost efficiencies, and guide proactive environmental decision-making that ultimately helps them address potential environmental instabilities pre-emptively. Previous studies have advocated the positive role of EMA implementation in improving OPRF, Ratanasongtham et al. (2018), Thanh Thuy Ngoc (2025), and Amir et al. (2024). Similarly, many other researchers supported the viewpoint that EMA implementation helps businesses enhance their performance (Gerged et al., 2024; Gunarathne et al., 2021; Jermsittiparsert et al., 2020; Mayndarto & Murwaningsari, 2021). However, none of them evaluated how EMA implementation mediates the relationship between EUTY and OPRF, thereby leaving a gap in the literature. The current study seeks to shorten this gap by hypothesising:
H5: EMA implementation significantly mediates the relationship between EUTY and OPRF.

2.6. Role of EMA implementation between ESGY and EMA implementation

Combining the reviews of studies in sections 2.2 and 2.4, it can be argued that EMA implementation mediates the relationship between ESGY and OPRF. Different studies in section 2.2 have indicated that ESGY can lead businesses to adopt EMA, as firms with an environment-focused strategy seem more willing to adopt eco-friendly initiatives and practices such as EMA. Studies such as Thanh Thuy Ngoc (2025), Faraz et al. (2024), Gunarathne et al. (2023), Mayndarto and Murwaningsari (2021), and Pondeville et al. (2013) provide grounds for arguing that the business's ESGY increases the likelihood of adopting EMA practices. EMA, in turn, allows businesses to combine environmental data with financial metrics, pinpoint and leverage cost efficiencies, and guide them in formulating proactive environmental decisions to enhance environmental efficiency. Previous studies have advocated the positive role of EMA implementation in improving OPRF ,Ratanasongtham et al. (2018), Thanh Thuy Ngoc (2025), and Amir et al. (2024). Similarly, many other researchers also supported the viewpoint that EMA implementation helps businesses monitor, assess, and enhance their performance (Gerged et al., 2024; Gunarathne et al., 2021; Jermsittiparsert et al., 2020; Mayndarto & Murwaningsari, 2021). However, none of them evaluated how EMA implementation

mediates the relationship between ESGY and OPRF, thus leaving a gap in the literature. The current study seeks to shorten this gap by hypothesising:
H6: EMA implementation significantly mediates the relationship between ESGY and OPRF.

2.7. Role of EMA implementation between ESTY and EMA implementation

Combining the reviews of studies in sections 2.3 and 2.4, it can be argued that EMA implementation mediates the relationship between ESTY and OPRF. Different studies in section 2.3 have indicated that ESTY concern has the potential to lead businesses to adopt EMA, as firms with safety concerns are more likely to implement eco-friendly initiatives and practices like EMA that allow them to better cope with environmental hazards by identifying and quantifying those potential environmental hazards associated with the activities of the business and offer data-based insights Islam and Rahman (2022) and SAN and HENG (2018). However, the literature provides no further explanation of this nexus. EMA, in turn, enables businesses to combine environmental data with financial metrics and make informed decisions to address environmental risks arising from their activities and to cover the costs of ESTY, thereby promoting a conscientious approach to both environmental and fiscal responsibilities (Javed & Husain, 2024; Javed, 2023). It helps firms enhance their performance from a TBL perspective. Previous studies have advocated the positive role of EMA implementation in improving OPRF, Ratanasongtham et al. (2018), Thanh Thuy Ngoc (2025), and Amir et al. (2024). Similarly, many other researchers also supported the viewpoint that EMA implementation helps businesses monitor, assess, and enhance their performance (Gerged et al., 2024; Gunarathne et al., 2021; Jermsittiparsert et al., 2020; Mayndarto & Murwaningsari, 2021). However, none of them evaluated how EMA implementation mediates the relationship between ESTY and OPRF, thus leaving a gap in the literature. The current study seeks to shorten this gap by hypothesizing:
H7: EMA implementation significantly mediates the relationship between ESTY and OPRF.

2.8. Role of TMC

TMC refers to the degree of commitment of an organisation's top management (leadership) to translating environmental objectives into measurable financial metrics, such as OPRF (Mayndarto & Murwaningsari, 2021). The literature supports the view that top management engagement in setting environmental targets and supporting the implementation of eco-friendly practices helps organisations meet sustainability goals (Ali, 2021; Appiah et al., 2020). The current study argues that high TMC can magnify the positive effect of EMA implementation on OPRF, as it facilitates EMA's effective integration into organisational practices and the realisation of the goal of sustainable development. Mayndarto and Murwaningsari (2021) examined the moderating effect of managerial commitment on the relationships between EMA and financial and environmental performance. They found that managerial commitment significantly moderates the effect of EMA on environmental performance, but not on economic performance. This means the moderating role of TMC between EMA and overall OPRF remains unknown. Ali (2021) suggested that TMC can mediate the relationship between EMA and organisational efficiency, but the moderating role of TMC on the relationship between EMA and OPRF remained unknown. Prior studies support the positive nexus between TMC and OPRF. However, they never addressed how TMC's presence can influence the effect of EMA implementation on OPRF. The current study hypothesises that:
H8: TMC significantly moderate the association between EMA implementation and OPRF.

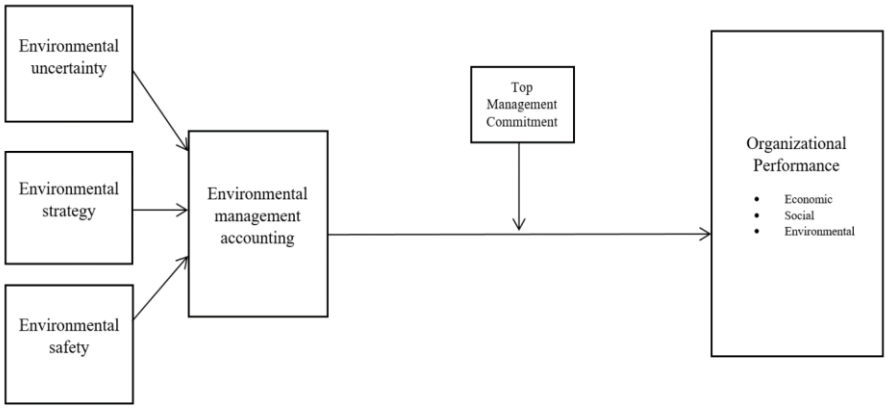

Fig 1: Conceptual Framework.

3. Research Methods

3.1. Research design and data collection

The study seeks to assess the antecedents (EUTY, ESTY, and ESGY) and outcomes (OPRF) of EMA, while examining the mediating role of EMA between its antecedents and OPRF, and the moderating role of TMC on the relationship between EMA and OPRF in manufacturing SMEs in Oman. To fulfil this purpose, the current study conducted a survey-based study of the manufacturing sector in Oman. The study population comprised top and middle-level managers operating in the Sultanate of Oman's manufacturing sector. According to the National Centre for Statistics and Information (2015-2022), there are about 64000 SMEs registered in the Sultanate of Oman. Top- and middle-level managers were selected for the current study because they are likely to have the information and knowledge relevant to the deployment and impact of EMA within their respective organisations. To select a sample from the population, a non-probability sampling method was chosen because it is one of the most suitable methods for selecting a sample from a large population, given that the population size (managers in SMEs in Oman) is unknown. The sample size was selected by following Cochran's method (1977). The sample size, first computed at a 95% confidence level with a 5% margin of error, was 384, but the finite population adjustment formula was used to adjust it to a final sample of almost 383 managers of SMEs in Oman. Hence, the data was collected from 383 managers (top-level and middle-level) of manufacturing SMEs of Oman. To collect data, an online survey was conducted in which a structured questionnaire was sent to targeted

participants via email, and they were asked to complete it. Follow-up telephonic calls were made to remind them and request their responses (Javed et al., 2023; Rababah et al., 2022; Husain et al., 2021).

3.2. Instrument and measures

The structured questionnaire was the main instrument for data collection, designed by extracting measurement scales from the literature. Each of ESTY and TMC was measured using a five-item measurement scale (each) extracted from Mohd Fuzi et al. (2019). ESGY was measured using a four-item scale previously used by Gunarathne et al. (2021). EMA was measured using a six-item scale previously used by Gunarathne et al. (2021). OPRF was measured using a nine-item scale previously used by Gunarathne et al. (2021). The construct of EUTY was measured through the five-item scale adopted from the study of Latan et al. (2018). The researcher used a 5-point Likert scale, with one indicating "strongly disagree" and five indicating "strongly agree."

4. Analysis and Results

The study drew on 381 valid responses from managers working in manufacturing firms in Oman. As expected in this sector, Table 1 shows that men formed the majority (64.3%), while women accounted for 35.7% of the sample. A closer look at age and work experience shows that most respondents were senior professionals: nearly half (48.3%) were over 40 years old, and more than one-third (36.2%) reported over 25 years of work experience. This pattern suggests that the responses were shaped by managers who are both seasoned and well-placed to reflect on organisational practices. Educational attainment was also high, with the majority holding at least a bachelor's degree (44.4%), while a substantial proportion had completed a master's (33.6%) or doctoral degree (11.3%). On the organisational side, most firms were well-established: 45.9% had been operating for more than 20 years, and 34.6% employed over 500 people. Certification levels varied: 36.5% of firms reported adherence to international standards (such as ISO), though almost half reported having none.

Table 1: Demographic Characteristics of Respondents (N = 381)

Variable	Category	Frequency	Percentage
Gender	Male	245	64.3%
	Female	136	35.7%
Age	25–29 years	26	6.8%
	30–34 years	63	16.5%
	35–39 years	108	28.3%
	40 years & above	184	48.3%
Experience	10–14 years	109	28.6%
	15–19 years	68	17.8%
	20–24 years	66	17.3%
	More than 25 years	138	36.2%
Education	Diploma	39	10.2%
	Bachelor's degree	169	44.4%
	Master's degree	128	33.6%
	Doctorate (PhD)	43	11.3%
	Other degree	2	0.5%
Firm Size	Less than 50 employees	32	8.4%
	51–100 employees	46	12.1%
	101–300 employees	74	19.4%
	301–500 employees	97	25.5%
	501 and above	132	34.6%
Firm Age	Less than 5 years	31	8.1%
	5–10 years	52	13.6%
	11–20 years	123	32.3%
	More than 20 years	175	45.9%
Certification	Yes	139	36.5%
	No	188	49.3%
	Not sure	54	14.2%

The measurement model was first evaluated for reliability and validity. Table 2 shows that across all constructs, the indicators loaded strongly on their respective factors, with most outer loadings exceeding the recommended threshold of 0.70 (Cronbach, 1951) and ranging from 0.71 to 0.88, indicating satisfactory indicator reliability. The composite reliability values ranged from 0.87 for EMA to 0.95 for OPRF, while Cronbach's alpha values also exceeded the acceptable threshold across all constructs (Sarstedt et al., 2021). This shows that the items consistently measure their respective constructs. Evidence of convergent validity was equally strong, as the AVE values were comfortably above the recommended minimum of 0.50 (Hair et al., 2019), the values ranged from 0.59 for EMA to 0.69 for ESGY, suggesting that each construct was able to capture a substantial proportion of variance from its items. An additional check for multicollinearity was conducted by examining the variance inflation factor. The results showed that the indicators were free from problematic levels of collinearity, with values well below the conservative threshold, such as 2.52 for EMA1 and 2.07 for ESGY1. This further strengthens the model's robustness.

Table 2: Reliability Psychometrics

Items	Outer loadings	VIF	Cronbach's alpha	CR (rho_a)	CR (rho_c)	AVE
EMA1	0.844	2.524	0.863	0.870	0.898	0.595
EMA2	0.734	1.752				
EMA3	0.707	1.578				
EMA4	0.728	1.647				
EMA5	0.778	1.980				
EMA6	0.826	2.355				
ESGY1	0.847	2.077	0.855	0.861	0.902	0.697
ESGY2	0.768	1.650				
ESGY3	0.876	2.343				

ESGY4	0.845	2.093				
ESTY1	0.818	1.781	0.850	0.851	0.899	0.690
ESTY3	0.820	1.990				
ESTY4	0.859	2.361				
ESTY5	0.825	1.980				
EUTY1	0.839	2.310	0.883	0.891	0.914	0.681
EUTY2	0.766	1.985				
EUTY3	0.817	2.237				
EUTY4	0.863	2.798				
EUTY5	0.839	2.258				
OPRF1	0.806	2.398	0.943	0.947	0.952	0.688
OPRF2	0.841	2.839				
OPRF3	0.815	2.600				
OPRF4	0.795	2.318				
OPRF5	0.883	3.843				
OPRF6	0.860	3.326				
OPRF7	0.848	2.842				
OPRF8	0.760	2.114				
OPRF9	0.849	2.950				
TMC1	0.850	2.645	0.871	0.878	0.906	0.660
TMC2	0.756	2.136				
TMC3	0.826	2.263				
TMC4	0.803	2.099				
TMC5	0.823	2.060				

The discriminant validity of the constructs was established using both the Fornell–Larcker criterion and the heterotrait–monotrait (HTMT) ratio (see Table 3). The Fornell–Larcker results showed that the square root of each construct's AVE was consistently higher than its correlations with other constructs (Fornell & Larcker, 1981). For example, the square root of AVE for ESGY was 0.835, which was greater than its correlations with ESTY (0.555) and EUTY (0.525). Similarly, OPRF demonstrated an AVE of 0.829, higher than its correlations with EMA (0.606) and TMC (0.498). These comparisons indicate that each construct accounts for more variance among its indicators than among indicators of other constructs, thereby satisfying the Fornell–Larcker requirement. Next, the HTMT results provided further evidence of discriminant validity. All values were below the conservative threshold of 0.85, with most ranging between 0.56 and 0.74. For instance, the HTMT ratio between EMA and OPRF was 0.663, while that between ESGY and ESTY was 0.646. These results confirm that the constructs are empirically distinct and that multicollinearity across constructs is not a concern.

Table 3: Discriminant Validity

Variables	EMA	ESGY	ESTY	EUTY	OPRF	TMC
EMA	0.771					
ESGY	0.537	0.835				
ESTY	0.693	0.555	0.830			
EUTY	0.634	0.525	0.665	0.825		
OPRF	0.606	0.554	0.567	0.606	0.829	
TMC	0.689	0.468	0.682	0.596	0.498	0.812
HTMT Ratio						
EMA	-					
ESGY	0.619	-				
ESTY	0.802	0.646	-			
EUTY	0.713	0.601	0.763	-		
OPRF	0.663	0.613	0.628	0.653	-	
TMC	0.790	0.538	0.788	0.674	0.543	-

The overall model demonstrated satisfactory fit and predictive power. Table 4 demonstrated that the SRMR value of 0.050 was well below the recommended 0.08 threshold, while the NFI value of 0.855 further confirmed acceptable model fit (Hair et al., 2019; Ringle et al., 2022). The explanatory power of the structural model was moderate to substantial, with R^2 values of 0.550 for EMA and 0.498 for OPRF. The adjusted R^2 values were also close in magnitude, indicating good model stability. In terms of predictive validity, the Q^2 values were 0.538 for EMA and 0.450 for OPRF, both well above zero, indicating strong predictive relevance. The root mean square error (RMSE) and mean absolute error (MAE) values (0.682 and 0.521 for EMA; 0.745 and 0.558 for OPRF) indicate that the predictive model performs consistently, with only minor prediction errors.

Table 4: Model Goodness and Predictive Measures

Variable	Q^2predict	RMSE	MAE	R2	Adj. R2	Model Fit	
EMA	0.538	0.682	0.521	0.550	0.547	SRMR	0.050
OPRF	0.450	0.745	0.558	0.498	0.490	NFI	0.855

The hypothesis-testing results in Table 5 provide strong support for the proposed model. H1 predicted a relationship between EUTY and EMA, and the results revealed a significant positive effect ($\beta = 0.264$, $t = 5.223$, $p < 0.001$), thereby supporting H1. This finding suggests that uncertainty acts as a positive predictor of EMA implementation. H2 was supported, as ESGY showed a significant positive impact on EMA ($\beta = 0.152$, $t = 3.275$, $p < 0.001$), highlighting the critical role of strategic direction. Similarly, H3, which posited a positive influence of ESTY on EMA, was also supported ($\beta = 0.444$, $t = 8.812$, $p = 0.000$), indicating that a stronger focus on safety encourages EMA practices. The results further confirmed H4, which proposed that EMA positively influences OPRF. The effect was significant ($\beta = 0.260$, $t = 3.884$, $p < 0.001$), suggesting that EMA implementation translates directly into sustainability outcomes.

Table 5: Hypotheses Testing (PLS-SEM)

Hypothesis	Path	Estimates	SE	T value	P values	Decision
H1	EUTY -> EMA	0.264	0.051	5.223	0.000	Accepted
H2	ESGY -> EMA	0.152	0.046	3.275	0.001	Accepted
H3	ESTY -> EMA	0.444	0.050	8.812	0.000	Accepted
H4	EMA -> OPRF	0.260	0.067	3.884	0.000	Accepted
H5	EUTY -> EMA -> OPRF	0.068	0.023	2.904	0.002	Accepted
H6	ESGY -> EMA -> OPRF	0.041	0.016	2.517	0.006	Accepted
H7	ESTY -> EMA -> OPRF	0.109	0.031	3.516	0.000	Accepted
H8	TMC x EMA -> OPRF	0.081	0.040	2.027	0.021	Accepted

Regarding mediation, H5 was supported, with EMA mediating the relationship between EUTY and OPRF ($\beta = 0.068$, $t = 2.904$, $p = 0.002$). H6 was also accepted, as EMA mediated the link between ESGY and OPRF ($\beta = 0.041$, $t = 2.517$, $p = 0.006$). Likewise, H7 was supported, with EMA mediating the effect of ESTY on OPRF ($\beta = 0.109$, $t = 3.516$, $p < 0.001$). These findings confirm that EMA serves as a key mechanism through which environmental drivers shape OPRF. Finally, H8 proposed that TMC moderates the relationship between EMA and OPRF. The interaction effect was significant ($\beta = 0.081$, $t = 2.027$, $p = 0.021$), supporting the hypothesis that management commitment amplifies the impact of EMA on OPRF. The interaction plot in Figure 2 illustrates this effect, showing that organisations with higher levels of TMC exhibit a steeper positive slope between EMA implementation and OPRF than those with lower levels of TMC.

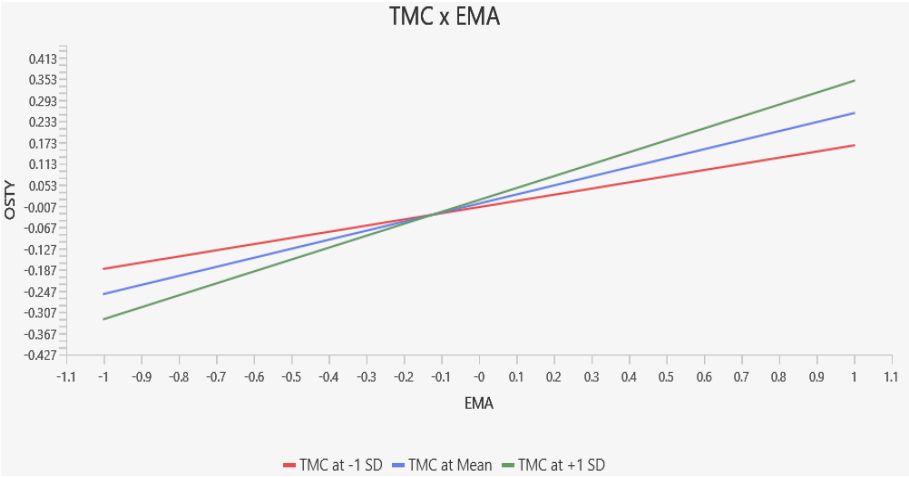

Fig. 2: Moderating Effect.

5. Discussion of Findings

The study analysed the antecedents of EMA implementation, including EUTY, ESGY, and ESTY, and the effect of EMA implementation on OPRF. It further assessed the mediating role of EMA implementation across all three relationships: EUTY and OPRF, ESGY and OPRF, and ESTY and OPRF. Furthermore, the current study examined how TMC's presence can enhance the relationship between EMA implementation and OPRF. Results from the previous section indicate that EUTY was a positive predictor of EMA implementation in manufacturing SMEs in Oman, thereby supporting H1. This result supports the viewpoint of multiple past researchers emphasising the potential of EUTY to lead the organisation towards EMA adoption, Kong et al. (2022), Latan et al. (2018), Appiah et al. (2020), and Ao et al. (2023), as those researchers also posited that EUTY drives EMA adoption as EMA offers data-driven insights to organisations that allow them to navigate the fluctuating environmental landscape and enhance their efficiency. Hence, the current study suggests that manufacturing SMEs in Oman facing EUTY should implement EMA to manage these uncertainties better.

Results further indicated that ESGY was a positive predictor of EMA implementation in manufacturing SMEs in Oman, thereby supporting the acceptance of H2. This result also aligns with the viewpoint of multiple prior researchers emphasising the positive role of ESGY in deriving EMA adoption, Thanh Thuy Ngoc (2025), Faraz et al. (2024), Gunarathne et al. (2023), and Mayndarto and Murwaningsari (2021), as those scholars also posited that ESGY motivates organisations to implement EMA, as EMA offers data-driven insights to organisations that allow them to meet the goals and targets of their ESGY. Hence, the current study suggests that manufacturing SMEs in Oman with an environmentally oriented strategy should implement EMA to support the effective and successful implementation of their ESGY. Similarly, the study's results confirmed the positive role of ESTY concerns in driving EMA adoption among manufacturing SMEs in Oman, thereby supporting the acceptance of H3. This result also aligns with the views of prior researchers who emphasise the positive role of an ESTY orientation in driving EMA adoption, Islam and Rahman (2022) and SAN and HENG (2018). However, the limited previous literature does not provide any further support for this finding. The current results are new in this regard, as they suggest that increased concern for ESTY leads the organisation to adopt prudent resource management practices as a result of EMA implementation. Hence, the current study suggests that manufacturing SMEs in Oman with ESTY concerns should implement EMA to manage their environmental impacts better and address environmental hazards.

The current study's results affirmed the positive role of EMA implementation in improving OPRF. Based on these results, H4 was accepted, and it was suggested that Omani manufacturing SMEs can enhance their TBL performance by implementing EMA, as it enables them to make informed decisions by acquiring and assimilating valid environmental data. These results are in line with revelations of multiple prior researchers, such as Ratanasongtham et al. (2018), Thanh Thuy Ngoc (2025), Amir et al. (2024), Gerged et al. (2024), Gunarathne et al. (2021), and Mayndarto and Murwaningsari (2021), who supported the positive impact of EMA implementation on different types of performances. However, the current study, which takes a holistic view of OPRF (TBL perspective), is a new finding suggesting that SMEs in Oman should implement EMA to support all three types of performance. H5, H6, and H7 examined the mediating roles of EMA implementation in EUTY -OPRF, ESGY-OPRF, and ESTY-OPRF. The findings have supported all three mediation hypotheses. It has been found that EMA implementation significantly mediates the association between EUTY and OPRF of manufacturing SMEs of Oman. This

finding though new but gets theoretical support from previous studies such as Kong et al. (2022), Gunarathne et al. (2023), Latan et al. (2018), Appiah et al. (2020), and Nguyen et al. (2023) emphasizing the positive role of EUTY towards EMA implementation and studies emphasizing the psotive role of EMA implementation towards OPRF (Ratanasongtham et al. 2018), Thanh Thuy Ngoc (2025), Amir et al. (2024), Gerged et al. (2024), Gunarathne et al. (2021), and Mayndarto and Murwaningsari (2021).
Similarly, the positive mediating role of EMA implementation between ESGY and OPRF found in the current study is also supported by previous findigns such as Thanh Thuy Ngoc (2025), Faraz et al. (2024), Gunarathne et al. (2023), and Mayndarto and Murwaningsari (2021) (emphasizing the positive role of ESGY towards EMA implementation) and studies emphasizing the positive role of EMA implementation towards OPRF Ratanasongtham et al. (2018), Thanh Thuy Ngoc (2025), Amir et al. (2024), Gerged et al. (2024), Gunarathne et al. (2021), and Mayndarto and Murwaningsari (2021). Similarly, the finding of a mediating role of EMA implementation between ESTY and OPRF receives theoretical support from the work of Islam and Rahman (2022) and SAN and HENG (2018), who argue that ESTY concerns lead businesses to adopt eco-friendly practices. Although these past studies have not directly addressed the mediation paths (through EMA) from EUTY, ESGY, and ESTY to OPRF, they provide support for the currently identified mediated paths. Based on these revelations, it is suggested that SMEs in Oman coping with high EUTY, with an ESGY, and with ESTY concerns are very likely to implement EMA, which, in turn, supports their OPRF.
The last hypothesis examined the moderating effect of TMC on the relationship between EMA implementation and OPRF. It was found that TMC significantly enhances the positive effect of EMA implementation on OPRF in manufacturing SMEs in Oman, thereby confirming the moderating role of TMC and supporting the acceptance of H8. This finding aligns with previous research by Mayndarto and Murwaningsari (2021) and Ali (2021), who confirmed TMC's intervention in the relationship between EMA and performance (either through moderation or mediation). However, these studies did not address or explain TMC's moderating impact on the relationship between EMA implementation and a firm's overall OPRF. Hence, the current study found that manufacturing SMEs in Oman with high TMC are more likely to translate their EMA into high OPRF.

6. Conclusion

The current study performed a survey of manufacturing SMEs of Oman to assess the antecedents and outcomes of EMA implementation, along with the assessment of mediating roles of EMA implementation between EUTY and OPRF, ESGY and OPRF, and ESTY and OPRF and the analysis of the moderating effect of TMC on the relationship between EMA implementation and OPRF. The current study evaluated three predictors of EMA, i.e. EUTY, ESGY, and ESTY, while it evaluated the OPRF as the outcome of EMA implementation in manufacturing SMEs of Oman. Data collected from 383 managers were used to compute results using structural equation modelling. The current study found that EUTY, ESGY, and ESTY are positive predictors of EMA implementation in manufacturing SMEs in Oman. Furthermore, it was found that EMA implementation significantly mediated the relationships between EUTY and OPRF, ESGY and OPRF, and ESTY and OPRF. Furthermore, it was declared that the TMC serves as a significant catalyst in the relationship between EMA implementation and OPRF, as SMEs with high TMC were more likely to translate the positive effect of their EMA on OPRF.

6.1. Implications of the study

The present study has significant implications for the literature and practice.

6.1.1. Theoretical implications

Theoretically, the present study, being one of the pioneering studies to investigate and combine predictors and outcomes of EMA implementation within a single conceptual model in the context of Omani SMEs, makes a significant contribution to the literature. Being the first to analyse the mediating role of EMA implementation between those antecedents and OPRF in a single model, and to assess the moderating effect of TMC in the relationship between EMA implementation and OPRF, will add to the relevant literature, which currently has prevailing gaps. As these mediated and moderated paths have not been previously explained, particularly with empirical evidence (such as in manufacturing SMEs in Oman), this study will enhance the empirical literature on these paths. In this way, the current study advances the literature on EMA implementation, RBV, and sustainability by providing evidence on rarely assessed paths.

6.1.2. Practical implications

The current study presents useful findings and guidelines for strategy makers of SMEs in Oman striving for sustainability, outlining how they can achieve sustainability goals through the effective implementation of EMA. The current study and its guidelines will help them identify different predictors of EMA implementation and the role of EMA implementation in improving their economic, environmental, and social performance. In this way, they will be able to formulate more effective strategies to promote EMA implementation in their organisation. For instance, the current study suggests that building and implementing an ESGY could help them promote EMA implementation, thereby motivating them to develop their ESGY further and embed environmental considerations into their organisational strategy. The current study will also help business strategy makers realise how EMA implementation can help them better cope with environmental uncertainties through proactive decision-making, thereby increasing the likelihood of EMA implementation.
Furthermore, they can better understand how important the TMC is to actually realise the benefits of EMA in terms of their performance. Hence, the current study can promote the adoption of EMA among them, thereby enhancing their OPRF and advancing their sustainability and the attainment of the economic, environmental, and social objectives of the Sustainable Development Goals (SDGs). It means that the current study and its implications are not limited to SMEs; instead, they can play a significant role in the sustainable development of Oman's overall manufacturing sector by guiding organisations towards the SDGs.

6.1.3. Policymaking implications

The current study and its guidelines will also help policymakers in Oman recognise the crucial roles of ESGY, ESTY concerns, and EUTY in shaping EMA implementation. Furthermore, it will help them realise that implementing EMA among manufacturing SMEs can contribute positively to the sustainable development of the sector. The current study will assist policymakers in formulating and implementing effective policies to promote EMA implementation in the sector. For instance, they can develop new EMA reporting standards and policies

to mandate EMA implementation among them. In this way, they can ensure that the manufacturing sector in Oman contributes positively to achieving the SDGs.

6.2. Limitations and future research directions

Beyond its theoretical implications, the current study still has some shortcomings that may limit its generalizability. For instance, the current findings are primarily relevant to manufacturing SMEs in Oman, while the circumstances of EMA implementation, its predictors, and its outcomes may vary across sectors. To address this concern, future researchers should conduct cross-sector investigations and comparisons to examine how EMA implementation affects OPRF across sectors. Furthermore, the influence of other variables, such as regulatory pressure or environmental costs, can make a considerable difference in the implementation of EMA, particularly among SMEs. Therefore, future researchers should consider the effects of those intervening variables to enhance findings.

References

[1] Amir M, Javed S, Hisam MW (2025), "From crisis to opportunity: exploring the adoption of distance learning platforms in higher education for students' academic excellence". International Journal of Educational Management, Vol. 39 No. 5 pp. 1256–1273, https://doi.org/10.1108/IJEM-06-2023-0306.

[2] Ariffin, N. H. M., Yusoff, F. H., Mansor, N. N. A., Javed, S., & Nazir, S. N. (2024). Assessment of sustainable healthcare management policies and practices in Oman: A comprehensive analysis using an ai-based literature review. Multidisciplinary Reviews, 7(11), 2024257. https://doi.org/10.31893/multirev.2024257

[3] Al Balushi, Z., & Elgeddawy, M. (2025). Addressing Organisational Challenges for the Sustainability of Small and Medium Enterprises in the Sultanate of Oman: A Conceptual Paper. In *AI and IoT: Driving Business Success and sustainability in the Digital Age: Volume 1* (pp. 813-820). Springer. https://doi.org/10.1007/978-3-031-92240-4_75.

[4] Ali, A. (2021). Determining mediating role of managerial commitment and technological capability between EMA and organisational efficiency: a case of middle eastern countries. *Arthatama: Journal of Business Management and Accounting*, *5*(2), 27-38.

[5] Alnaim, M., & Metwally, A. B. M. (2024). Institutional Pressures and EMA Adoption: Do ESGY Matter? *Sustainability*, *16*(7), 3020. https://doi.org/10.3390/su16073020

[6] Alqassabi, M. A. (2020). Insights on sustainability of small and medium enterprises in Oman: a conceptual framework. *International Journal of Economics and Financial Issues*, *10*(1), 209-218. https://doi.org/10.32479/ijefi.9063.

[7] Amir, M., Azhar, Z., Kishan, A., & Krishnen, L. (2024). From the implementation of EMA to organisational sustainability: Does stakeholder integration strengthen it? *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, *18*(4), 1065-1089. https://doi.org/10.64534/Commer.2025.027

[8] Ao, X.-Y., Ong, T. S., Aprile, R., & Di Vaio, A. (2023). EUTY and digital technologies corporate in shaping corporate green behavior and tax avoidance. *Scientific Reports*, *13*(1), 22170. https://doi.org/10.1038/s41598-023-49687-w

[9] Appannan, J. S., Mohd Said, R., Ong, T. S., & Senik, R. (2023). Promoting sustainable development through strategies, EMA and environmental performance. *Business Strategy and the Environment*, *32*(4), 1914-1930. https://doi.org/10.1002/bse.3227.

[10] Appannan, J. S., Said, R. M., & Senik, R. (2020). Environmental proactivity on environmental performance: an extension of natural resource-based view theory (NRBV). *International Journal of Industrial Management*, *5*, 56-65. https://doi.org/10.15282/ijim.5.0.2020.5622.

[11] Appiah-Kubi, E., Dura, C. C., Niță, D., Drigă, I., Preda, A., & Baltador, L. A. (2025). The effect of digitalization on sustainability reporting: The role of sustainability competence, green knowledge integration, and stakeholder pressure. *Business Strategy and the Environment*, *34*(1), 1133-1153. https://doi.org/10.1002/bse.4024

[12] Appiah, B. K., Zhang, D., Majumder, S. C., & Monaheng, M. P. (2020). Effects of ESGY, uncertainty and TMC on the environmental performance: Role of EMA and environmental management control system. *International Journal of Energy Economics and Policy*, *10*(1), 360-370. https://doi.org/10.32479/ijeep.8697.

[13] Christine, D., Yadiati, W., Afiah, N. N., & Fitrijanti, T. (2019). The relationship of EMA, ESGY and managerial commitment with environmental performance and economic performance. *International Journal of Energy Economics and Policy*, *9*(5), 458-464. https://doi.org/10.32479/ijeep.8284

[14] Colwell, S. R., & Joshi, A. W. (2013). Corporate ecological responsiveness: Antecedent effects of institutional pressure and TMC and their impact on OPRF. *Business Strategy and the Environment*, *22*(2), 73-91. https://doi.org/10.1002/bse.732

[15] Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297-334. https://doi.org/10.1007/BF02310555

[16] Darvishmotevali, M., Altinay, L., & Köseoglu, M. A. (2020). The link between EUTY , organisational agility, and organisational creativity in the hotel industry. *International journal of hospitality management*, *87*, 102499. https://doi.org/10.1016/j.ijhm.2020.102499.

[17] Di Vaio, A., Zaffar, A., & Chhabra, M. (2024). Intellectual capital through decarbonization for achieving Sustainable Development Goal 8: a systematic literature review and future research directions. *Journal of Intellectual Capital*, *25*(7), 54-86. https://doi.org/10.1108/JIC-05-2024-0131.

[18] Di Vaio, A., Zaffar, A., Chhabra, M., & Balsalobre-Lorente, D. (2024). Carbon accounting and integrated reporting for net-zero business models towards sustainable development: a systematic literature review. *Business Strategy and the Environment*, *33*(7), 7216-7240. https://doi.org/10.1002/bse.3863.

[19] Faraz, N. A., Ahmed, F., & Xiong, Z. (2024). How firms leverage corporate ESGY to nurture green behavior: Role of multi-level environmentally responsible leadership. *Corporate Social Responsibility and Environmental Management*, *31*(1), 243-259. https://doi.org/10.1002/csr.2565.

[20] Febrian, W. D., & Sani, I. (2023). Systematic Literature Review: Implementation of Talent Management for Crewing in Shipping Companies to Organisational Sustainability. *Indonesian Journal of Business Analytics*, *3*(5), 1837-1848. https://doi.org/10.55927/ijba.v3i5.5792.

[21] Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39-50. https://doi.org/10.1177/002224378101800104.

[22] Gerged, A. M., Zahoor, N., & Cowton, C. J. (2024). Understanding the relationship between EMA and firm performance: The role of environmental innovation and stakeholder integration – Evidence from a developing country. *Management Accounting Research*, *62*, 100865. https://doi.org/10.1016/j.mar.2023.100865.

[23] Gulvady, S., & Jyotirmayee, V. (2023). Behavioural Engagement, Current Practices, and Future Prospects of Industrial Sectors Towards Environmental Sustainability in Oman. *Business Transformation-Accelerators for Sustainable Growth*, *189*.

[24] Gunarathne, A. N., Lee, K. H., & Hitigala Kaluarachchilage, P. K. (2021). Institutional pressures, environmental management strategy, and OPRF: The role of EMA. *Business Strategy and the Environment*, *30*(2), 825-839. https://doi.org/10.1002/bse.2656.

[25] Gunarathne, N., Lee, K.-H., & Hitigala Kaluarachchilage, P. K. (2023). Tackling the integration challenge between ESGY and EMA. *Accounting, Auditing & Accountability Journal*, *36*(1), 63-95. https://doi.org/10.1108/AAAJ-03-2020-4452

[26] Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (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.

[27] Horry, R., Booth, C. A., & Mahamadu, A.-M. (2024). Contributions of environmental management systems (ISO 14001) towards the delivery of sustainable development goal 12. In *The Elgar Companion to the Built Environment and the Sustainable Development Goals* (pp. 250-264). Edward Elgar Publishing. https://doi.org/10.4337/9781035300037.00024.

[28] Husain, U., Javed, S., & Ananda, S. (2021). Digital marketing as a game changer strategy to enhance brand performance. International Journal of Technology Marketing, 15(2-3), 107-125. https://doi.org/10.1504/IJTMKT.2021.118226

[29] Ibrahim, O. A., Alqassabi, M. A., & Abdel-Gadir, S. E. M. (2024). Factors Influencing Sustainability of Women Entrepreneurship in Oman: Challenges and Opportunities. *Journal of Ecohumanism*, *3*(4), 262-278. https://doi.org/10.62754/joe.v3i4.3519.

[30] Islam, N., & Rahman, S. K. (2022). Corporate EMA Practicing and Reporting in Bangladesh. *arXiv preprint arXiv:2208.12541*.

[31] Khan, A. A., Bahrawe, S., & Javed, S. (2025). Impact of AI on Accounting Practices. Trends and Challenges of Electronic Finance: Perspectives from Emerging Markets, 429. https://doi.org/10.1007/978-981-96-3304-3_24.

[32] Kadir, M. R. A., AlBalushi, A. rahim saleh I., & Javed, S. (2024). Institutional Pressure and Business Sustainable Performance: Does Environmental Management Accounting Matter? IIM Kozhikode Society & Management Review, 14(2), 207-219. (Original work published 2025) https://doi.org/10.1177/22779752241244878.

[33] Javed, S., Husain, U., Mohammed, S., Khan, M. S., Jaouadi, W., & Nazir, S. (2025). Is industy 4.0 the key to sustainable manufacturing? Unravelling the impact of innovation and continuous improvement in emerging economies. Multidisciplinary Reviews, 9(3), 2026108. https://doi.org/10.31893/multirev.2026108

[34] Javed, S., & Al-Mulali, U. (2025). Navigating the Innovation–Sustainability Paradox: The Strategic Role of Leadership and Industry 4.0 in Oman's Manufacturing Sector. Sustainability, 17(6), 2595. https://doi.org/10.3390/su17062595.

[35] Jermsittiparsert, K., Somjai, S., & Toopgajank, S. (2020). Factors affecting firm's energy efficiency and environmental performance: the role of EMA, green innovation and environmental proactivity. *International Journal of Energy Economics and Policy*, *10*(3), 325-331. https://doi.org/10.32479/ijeep.9220.

[36] Javed, S., Nazir, S., Malik, G. M., Khan, A. A., & Jalil, S. (2024). Sustainable Practice of IFRS And Economic Growth: Evidence from A Case Study on A Developing Country. Innovation Economics Frontiers, 27(2), 57-70. https://doi.org/10.36923/iefrontiers.v27i2.242

[37] Javed, S., & Husain, U. (2024). A VECM investigation on the nexus among government spending, oil revenues, and economic growth: empirical evidence from the sultanate of Oman. Innovation Economics Frontiers, 27(2), 1-12. https://doi.org/10.36923/iefrontiers.v27i2.241.

[38] Javed, S., & Husain, U. (2024). Influence of government expenditure on economic growth: an empirical retrospection based on ARDL approach. FIIB Business Review, 13(2), 208-219. https://doi.org/10.1177/23197145221116453.

[39] Javed, S. (2023). Environmental management accounting and corporate performance: The mediating role of corporate environmental ethics: Evidence from the manufacturing sector. Journal of Environmental Accounting and Management, 11(01), 41-52. https://doi.org/10.5890/JEAM.2023.03.003

[40] Javed, S., Abro, Z., Azad, I., & Khan, M. S. (2023). Robust Financial Inclusion Framework by Examining Literacy Aspects in Oman. Business Perspectives and Research, 0(0). https://doi.org/10.1177/22785337231208299.

[41] Kadir, M. R. A., AlBalushi, A. r. s. I., & Javed, S. (2024). Institutional Pressure and Business Sustainable Performance: Does EMA Matter? *IIM Kozhikode Society & Management Review*, 22779752241244878. https://doi.org/10.1177/22779752241244878

[42] Kadir, M. R. A., AlBalushi, A. r. s. I., & Javed, S. (2025). Institutional pressure and business sustainable performance: does EMA matter? *IIM Kozhikode Society & Management Review*, *14*(2), 207-219. https://doi.org/10.1177/22779752241244878.

[43] Kong, Y., Javed, F., Sultan, J., Hanif, M. S., & Khan, N. (2022). EMA implementation and corporate environmental firm performance: a comparison of institutional pressures and EUTY . *Sustainability*, *14*(9), 5662. https://doi.org/10.3390/su14095662.

[44] Kraus, S., Rehman, S. U., & García, F. J. S. (2020). Corporate social responsibility and environmental performance: The mediating role of ESGY and green innovation. *Technological Forecasting and Social Change*, *160*, 120262. https://doi.org/10.1016/j.techfore.2020.120262.

[45] Latan, H., Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Wamba, S. F., & Shahbaz, M. (2018). Effects of ESGY, EUTY and top management's commitment on corporate environmental performance: The role of EMA. *Journal of cleaner production*, *180*, 297-306. https://doi.org/10.1016/j.jclepro.2018.01.106

[46] Marzouk, J., & El Ebrashi, R. (2024). The interplay among green absorptive capacity, green entrepreneurial, and learning orientations and their effect on triple bottom line performance. *Business Strategy and the Environment*, *33*(3), 1962-1976. https://doi.org/10.1002/bse.3588

[47] Mat Yusoh, N. N. A., Tuan Mat, T. Z., & Abdullah, A. (2023). EMA system adoption and sustainability performance: triple bottom line approach. *Management and Accounting Review (MAR)*, *22*(1), 233-267. https://doi.org/10.24191/MAR.V22i01-10.

[48] Mayndarto, E. C., & Murwaningsari, E. (2021). The effect of EMA, ESGY on environmental performance and financial performance moderated by managerial commitment. *Journal of Industrial Engineering & Management Research*, *2*(2), 35-38.

[49] Mohd Fuzi, N., Habidin, N. F., Janudin, S. E., & Ong, S. Y. Y. (2019). Critical success factors of EMA practices: findings from Malaysian manufacturing industry. *Measuring Business Excellence*, *23*(1), 1-14. https://doi.org/10.1108/MBE-03-2018-0015.

[50] Nguyen, T. T. T., Vu, T. P. T., Doan, T. D. U., & Nguyen, T. H. (2023). Impact of Institutional Pressure on Application of EMA in Vietnam Textile and Garment Enterprise. *Journal of Survey in Fisheries Sciences*, *10*(3S), 2011-2028.

[51] Ni, L. K., Ahmad, S. F., Alshammari, T. O., Liang, H. S., Alsanie, G., Irshad, M., Alyafi-AlZahri, R., Binsaeed, R. H., Al-Abyadh, M. H. A., Abu Bakir, S. M. M., & Ayassrah, A. Y. A. B. A. (2023). The role of environmental regulation and green human capital towards sustainable development: The mediating role of green innovation and industry upgradation. *Journal of cleaner production*, *421*, 138497. https://doi.org/10.1016/j.jclepro.2023.138497.

[52] Noor, A., & Bano, A. (2024). Impact of Green Intellectual Capital and EMA on Sustainable Performance: The Moderating Role of Stakeholder Pressure. *Sustainable Trends and Business Research*, *2*(1), 01-14. https://doi.org/10.70291/stbr.2.1.2024.15

[53] Pondeville, S., Swaen, V., & De Rongé, Y. (2013). Environmental management control systems: The role of contextual and strategic factors. *Management Accounting Research*, *24*(4), 317-332. https://doi.org/10.1016/j.mar.2013.06.007

[54] Rafique, R., Javed, S., Amir, M., Shaukat, H. S., & Alzoubi, E. K. (2025). Elevating firms' sustainability through the power of green intellectual capital: a study unveiling sustainable success. International Journal of Learning and Intellectual Capital, 22(2), 125-145. https://doi.org/10.1504/IJLIC.2025.147341.

[55] Rababah, A., Javed, S., & Malik, A. (2022). Is social capital a key factor to enhance firm's performance via manager's intangible capabilities?. IIM Kozhikode Society & Management Review, 11(2), 207-221. https://doi.org/10.1177/22779752211065798.

[56] Rasheed, M., Liu, J., & Ali, E. (2025). Incorporating sustainability in organisational strategy: A framework for enhancing sustainable knowledge management and green innovation. *Kybernetes*, *54*(4), 2363-2388. https://doi.org/10.1108/K-08-2023-1606.

[57] Rasit, Z. A., Bahari, N. A. M., & Alam, M. M. Integrating EMA in the Link between ESGY and Performance: Empirical Evidence of Electri-cal and Electronic Industry.

[58] Ratanasongtham, W., Ussahawanitchakit, P., & Janjarasjit, S. (2018). EMA Capability on Sustainable Performance Development and Firm Survival: Empirical Evidence from ISO 14000 Firms in Thailand. *Journal of Accountancy and Management*, *10*(3), 17-32.

[59] Ringle, C. M., Wende, S., & Becker, J.-M. (2022). SmartPLS 4. Oststeinbek: SmartPLS GmbH. *J. Appl. Struct. Equ. Model.*

[60] SAN, O. T., & HENG, T. B. (2018). The Relationship between Contingent Factors that Influence the EMA and Environmental Performance among Manufacturing Companies in Klang Valley, Malaysia. *International Journal of Economics & Management*, *12*(1).

[61] Sari, R. N., Pratadina, A., Anugerah, R., Kamaliah, K., & Sanusi, Z. M. (2021). Effect of EMA practices on OPRF: role of process innovation as a mediating variable. *Business Process Management Journal*, *27*(4), 1296-1314. https://doi.org/10.1108/BPMJ-06-2020-0264

[62] Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial least squares structural equation modeling. In *Handbook of market research* (pp. 587-632). Springer. https://doi.org/10.1007/978-3-319-05542-8_15-2

[63] Siyabi, A. A., & Hakro, D. (2020). Green economy and sustainable development in the Sultanate of Oman. *Journal of Student Research*, *10*.

[64] Solovida, G. T., & Latan, H. (2021). Achieving triple bottom line performance: Highlighting the role of social capabilities and EMA. *Management of Environmental Quality: An International Journal*, *32*(3), 596-611. https://doi.org/10.1108/MEQ-09-2020-0202

[65] Sulaiman, M. A. B. A. (2025). Green product innovation as a mediator between green market orientation and sustainable performance of SMEs. *Sustainability*, *17*(4), 1628. https://doi.org/10.3390/su17041628

[66] Thanh Thuy Ngoc, T. (2025). Unlocking EMA and environmental performance: a mediated moderation model through green technology innovation and ESGY. *Meditari Accountancy Research*. https://doi.org/10.1108/MEDAR-07-2024-2558

[67] Ullah, S., Ahmad, T., Kukreti, M., Sami, A., & Shaukat, M. R. (2024). How organisational readiness for green innovation, green innovation performance and knowledge integration affects sustainability performance of exporting firms. *Journal of Asia Business Studies*, *18*(2), 519-537. https://doi.org/10.1108/JABS-02-2023-0056

[68] Yang Spencer, S., 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.