Effects of Energy Management Practices on Environmental Performance of Indian Small- and Medium- Sized Enterprises: A Moderating Role of Top Management Commitment

Abstract

Achieving energy efficiency through adoption of energy management practices remain top priorities among industry. Studies focusing on energy management practices are scarce and this area needs to be focused. Building on the perspective of resource-based view and behavioral theory of corporate governance, the purpose of the study is to develop and test an integrative framework linking manufacturing firm's energy management practices (EMPs) to environmental and financial performance through mediating roles played by energy efficiency and audit. The moderating role played by the top management commitment is further examined. Structural equation modeling was employed to test the hypotheses alongside Hayes' PROCESS to check moderation effects. Results from a survey of 637 employees working in Small- and Medium- sized Enterprises (SMEs) of Indian manufacturing firms indicate that EMPs result into increased environmental as well as financial performance of the firm. It was also found that energy efficiency mediates the relationship between the adoption of EMPs and environmental performance, amplified by top management commitment. Further, energy audit mediates the effect of EMPs on energy efficiency. Industries in developing countries face reluctance in implementing EMPs due to the perception of high financial obligations. The study contributes to offering the new research directions to identify alternatives that monetises environmental concepts such as energy efficiency, leading to higher performance of SMEs.

Keywords: Energy management practices; Energy efficiency; Firm performance; Top management commitment; Manufacturing firms; Energy audit.

1. Introduction

Fast-paced industrialization, higher energy usage trends and economic development forecasts, manufacturing firms are integrating energy management practices (EMPs) as core element of strategic planning process for the next decade (Shashi, Centobelli, Cerchione, & Singh, 2019). The shift on EMPs with an increasing industrial energy efficiency as a cost-effective mean, firms strive to achieve high industry competitiveness (Hasan et al., 2021) and industrial sustainability (Chowdhury et al., 2019). Contextually, EMPs are “postulated as promising means of reducing energy consumption” (Fernando & Hor, 2017, p. 65). Proactive adoption of EMPs in the manufacturing processes helps firms to reduce its harmful environment impacts (Sen, Roy, & Pal, 2015) leading to sustainable development (Abdelaziz, Saidur, & Mekhilef, 2011). The manufacturing sector is the growth driver of an economy, that accounts for 23% of global energy consumption (International Energy Agency, 2019) but one of the root cause of environmental issues including intensive use of non-renewable natural resources (Yang, Hong, & Modi, 2011; Shrauf & Miragliotta, 2015; Vesal, Siahtiri, & O'Cass, 2020).

The small and medium-sized enterprises (SMEs) face resource constraints and thus are feeling increasing pressure to identify and adopt energy-efficient technologies, production processes to improve environmental as well as financial performance (Porter & van der Linde, 1995; Schulze et al., 2016)). More specifically, SMEs expect that EMPs will bring energy efficiency that helps offering the green products to the market, leading to improved firm performance mitigating return on investment (Liu & Liang, 2015). Collectively, SMEs impact on environment through EMPs is high with increased financial savings, but implementation rates remain low (Richert, 2017).

Various scholars studying EMPs in developed nations such as USA, Sweden, Japan have found positive effects of EMPs on firm performance (e.g, Thollander, & Ottosson, 2010; Fernando et al., 2018; Nishitani, & Kokubu, 2020), however, empirical evidence concerning SMEs originating from emerging economies are still scant. India contributes to 6.4% of global total CO_2 emissions (IEA, 2020) making Indian manufacturing SMEs a natural setting for this study as it contributes to GDP and employment development. In this context, advancing the existing literature validating the interplay between EMPs and firms' environmental-financial performance in emerging economy such as India requires an empirical investigation.

Researchers focusing on EMPs have heavily relied upon resource-based view (Wright, Dunford, & Snell, 2001) as it has been propounded that firms proactively engaged in EMPs build inherent resources which are difficult to copy offering sustainable competitive advantage. In this context, firms are expected to take advantage of synergistic efforts aligning environmental issues and strategic investments in EMPs as one of the key resources to meet burgeoning demand of green products and gain long-term benefits (Yong et al., 2019; El-Kassar and Singh, 2019). It has been empirically established in the past that EMPs results into higher energy efficiency by detecting inefficient/malfunctioning equipment and processes repairing/replacing the same with more environmental-friendly machines/systems (e.g., Ball et al. 2019; Palm & Thollander, 2010), however, the mediating role of energy efficiency on EMPs-environmental performance is yet to be investigated.

Implementing successful EMPs is highly dependent on top management commitment: without this commitment, there remains higher risk of failure as well as discontinuance of EMPs adoption across different manufacturing processes within the firm (Turner & Doty, 2007). Energy-efficient technologies are advancing day by day, and it is the top management who instill the awareness and knowledge to achieve higher energy efficiency and then leverage this capability to fuel the firm performance. Building upon behavioral theory of corporate governance as socially situated and socially constituted agency underlying top management commitment (Westphal & Zajac, 2013), this study builds on the notion that implementation of EMPs succeeds when the role of top management commitment is considered alongside energy efficiency. The adoption of energy efficient initiatives increases when top management has full knowledge on production processes (Sola & Mota, 2020). Previous studies on the success of adopting EMPs and how this affects firm performance are unclear in analysing the moderating effect of top management commitment (Fernando et al., 2018; Yusliza et al., 2019; El-Kassar & Singh, 2019).

To work towards these contributions, we investigate following research question: what is the relationship between EMPs, energy efficiency, top management commitment and *environmental-financial performance of SMEs?* Thus, this study contributes in three ways: First, it explores the relationship between EMPs and environmental-financial performance of manufacturing SMEs in India and the results will contribute to that incipient body of research on business strategy and environmental sustainability, through the lens of resource-based view. Second, it examines the moderating impact of top management commitment in the context of relationships between EMPs-energy efficiency-environmental performance, through the lens of theory of behavioral theory of corporate governance. Third, this study also contributes the mediation effect of energy efficiency and audit on EMPs and firm performance along with moderation by the top management commitment in emerging economy.

2. Literature review and hypotheses development

2.1 The resource-based view

A firm's collection of resources or assets—whether tangible or intangible, static or dynamic—are the central tenets of the resource-based view (RBV; Lockett et al., 2009). RBV is a theory considering the notion of a firm's nature and its strategic behavior: that is, RBV is used to examine how firms operate (Lockett & Thompson, 2001). Scholars have suggested that a firm's performance will vary according to its resources, emphasizing the need for resource heterogeneity. For example, Barney (1991) observed that a firm with ownership of specific resources that are "valuable, rare, inimitable and non-substitutable" will achieve a Sustainable Competitive Advantage (SCA) (Lockett et al., 2009, p. 11) that keeps firm holding a specific privileged position over competitors. Thus, the firm's accomplishment of a SCA is dependent on its ability to build valuable and rare resources that are difficult to imitate in the short run. For example, Fernando et al. (2018) provided a view that energy management enable businesses to create valuable and rare resources such as renewable energy supply chain.

Such firm-specific capabilities act instrumental in creating resources which enhance the value for the firm. For example, Wu et al. (2006) proved how RBV- logic of IT-enabled capabilities can transform resources into higher value for the firm. In fact, industry practicing energy efficiency with systematized energy blueprint cost-saving and the regulation culture are more imperative drivers for energy management (Hasan et al., 2021), that creates the most valued, rare and difficult-to-imitate resources. Hart (1995), meanwhile, incorporated strategic management with a competitive advantage rooted in environmentally sustainable capabilities or resources, referred to as a natural-resource-based-view. Notably, Song et al. (2007) argued that an RBV, when used optimally, has a greater influence on financial performance. This study uses these theories as a framework and aims to contextualize EMPs, energy audits, and energy efficiency within the internal capabilities of a firm, leading to enriched performance and, eventually, an SCA (Fernando et al., 2018).

2.2 EMPs

Firms have increasingly adopted practices that minimize the negative impact of their operations on the environment by reducing energy wastage without compromising their output or production quality (Abdelaziz et al., 2011; Cagno & Trianni, 2013). Such energy management was made possible through the adoption of novel "energy-efficient technologies" (Seliger, 2007) and "technology optimization processes" when needed. Along with this, EMPs have improved energy-saving through effective maintenance and load reduction in non-productive phases (Herrmann et al., 2008; Fernando et al., 2018). However, few researchers have provided an authoritative source of EMPs due to complex industrial processes and different application veracity across contexts, countries, and firms (Fernando & Hor, 2017).

2.3 Performance measures

Firm performance is multi-faceted, and this study considers two aspects: environmental performance and economic performance. According to Kleindorfer et al. (2005), environmental performance can be classified as a "firm's performance in fulfilling environmental responsibilities." Many studies have attempted to explore environmental performance from the perspective of firms' environmentally responsive behaviors (Sroufe, 2003; Matos & Hall, 2007; Montabon et al., 2007; Yang, Hong, & Modi, 2011). The recent increased pressure on firms to adopt initiatives that helps to achieve environmental performance which is an instrumental to achieve environmental sustainability (Post, Rahman, & McQuillen, 2015) as one of the Sustainable Development Goals (SDGs) under firms' UNDP management (Mattera, & Ruiz-Morales, 2020).

Adoption of environmental innovations was more effective for improving environmental performance, relative to the economic performance of the firms (Long et al., 2017) and hence taken as central measure of firm performance. Environment performance measures helps to track and compare the firms on their extent contribution in SDGs. In fact, SDGs compass offer framework and method for implementation to the large firms, but empirical validation is required for SMEs.

Correspondingly, economic performance has been evaluated by financial measures adding economic values to all the stakeholders (Saeed et al., 2018). For example,) environmental and financial (economic) performance measures were used to study the effect of cleaner production system on sustainability (Ozturk et al., 2014; Tayyab et al., 2020). Financial performance can be defined as a "firm's responsibilities towards profit and shareholder wealth maximization" (Yang et al., 2011). In achieving SDGs, it is believed that access to the finance is critical and therefore SMEs financial management and control is aligned with energy management practices to seek financial performance goals (Žigienė, Rybakovas, & Alzbutas, 2019). This study will conceptualize and operationalize performance as environmental and financial performance hereafter.

2.4 EMPs – operationalization and energy audits

EMPs are functionally dependent on industry, firm size, geographical coverage, the intensity of energy conservation, and preferential quality management (Gordić et al., 2010; Fernando et al., 2018). In this context, EMPs as instruments capture the development of energy-efficient technologies and result in knowledge among firms concerning the implementation of EMPs and the multi-dimensional nature of their measurement, which must be re-studied and re-tested (Ang, 2008). Unlike many previous studies that largely looked at EMPs as uni-dimensional construct (e.g., Tachmitzaki, Didaskalou & Georgakellos, 2020), in line with recent suggestion from Fernando et al. (2018), the present study propounds energy knowledge and awareness as two major sub-dimensions of EMPs. Fernando & Hor (2017) conceptualization of EMPs centers on the combination of "energy awareness", and "energy knowledge" and the same conceptual framework was applied in a study by Fernando et al. (2018) to understand the dimensions of EMPs.

Nevertheless, there have been contrasting views with regard to the operationalization of EMPs, particularly for the manufacturing sector, due to its fragile energy management adoption (Prindle, 2010). An absence of "awareness of energy conservation" practices and a lack of "knowledge of energy management" among employees are some of the principal reasons for ineffective energy auditing and lower energy efficiency in manufacturing firms (Turesky & Connell, 2010; Shrouf & Miragliotta, 2015). Awareness and knowledge of energy are the central dimensions of EMPs, and energy auditing is the behavioral domain of EMPs; thus was excluded in the operationalization of EMPs. This study has characterized the EMP construct as consisting of two aspects, "energy awareness" and "energy knowledge" to specifically suit the manufacturing sector.

Studies have shown that when employees' awareness of "energy management" is high, firms can perform better in energy auditing processes. The term "energy audit" can be classified as an energy survey, analysis, or evaluation, and was defined by Gordić et al. (2010) as "a procedure that analyses the way energy is currently used in a factory and identifies alternatives for reducing energy costs" (p. 2786). For firms whose employees undertook regular training on energy reduction and management practices and had access to energy-saving guidelines and continuous communication with energy committees (Fernando & Hor, 2017), there were, generally speaking, higher levels of energy awareness across the firm. This eventually helped firms perform better in periodic reviews and achieve the energy development goals outlined in energy auditing strategies. Indeed, comprehensive knowledge about energy management practices can support firms in improving their energy auditing performance from a monitoring perspective. Moreover, since rigorous scientific monitoring requires knowledge of energy management (or "energy knowledge"), increased knowledge allows firms to achieve a better "energy auditing performance" (Vikhorev, Greenough, & Brown, 2013).

Furthermore, access to a highly knowledgeable energy committee and a clearly defined set of procedures with appropriate energy databases (Fernando et al. 2018) can improve firms' performances in energy audits and reviews. This also facilitates the exchange of ideas regarding improvement, specific to functionalities. It has been shown that the higher the energy awareness across a firm, the better the firm will perform in an energy audit, and, energy knowledge is a definite predictor of high energy audit performance.

Researchers have indicated that upon implementation of EMPs, it was believed that those firms which maintained energy practices properly and regularly would achieve better energy efficiency.

For example, Xu et al. (2013) observed that the continuous monitoring of building roofs significantly enhanced energy efficiency in the context of buildings. Meanwhile, in biogas utilization, Pöschl, Ward, & Owende (2010) offered evidence suggesting that an accurate energy audit yields better energy efficiency. Considering the case of the California Portland Cement Company, thorough review and refinement audits boosted confidence and achieved higher energy efficiency, as reflected by the company's energy performance indicators (EPIs; Boyd, Dutrow & Tunnessen, 2008). Based on this discussion and the conceptual framework outlined above, it was hypothesized that,

H_1: Energy management practices (EMPs) are positively related to successful energy audits of manufacturing firms.

H_2: Energy audits are positively related to the energy efficiency of manufacturing firms.

2.5 EMPs, energy efficiency, and environmental performance

As stated above, energy management practices are a vital means of achieving industrial energy efficiency, reducing energy loss, and, in turn, minimizing the effects of global warming (IPCC, 2007). A holistic approach to EMPs, unlike piecemeal approaches to energy reduction programs, allows for significant progress towards energy efficiency performance goals (Ball et al., 2009). When embedding "energy awareness" and "energy knowledge" as a part of EMPs into the context of energy-saving decisions, the value created as a result of energy efficiency is substantial and achieving energy efficiency is a natural consequence (Tonn & Martin, 2000). To illustrate, continuously working with data on EMPs has helped manufacturing firms to enhance energy efficiency by allowing them to detect inefficient or malfunctioning equipment and assess their use of technological energy (Backlund et al., 2012).

In the context of industrial consumption, Palm & Thollander (2010) examined the positive relationship between EMPs and energy efficiency. Furthermore, specifically considering the manufacturing industry, Gordić et al. (2010) provided a comprehensive view of the link between implementing an energy management matrix and energy efficiency. Boyd & Curtis (2010) applied "good" EMPs that strongly predict energy savings as a measure of energy efficiency to US manufacturing firms requiring ample energy. Other notable studies have attempted to establish a link between EMPs and energy efficiency (Antunes, 2014). Finally, Fernando & Hor (2017) tested the influence of EMPs on the energy efficiency of ISO 14000-certified manufacturing firms in Malaysia. Based on a review of the literature, it was thus hypothesized that,

H_3: EMPs are positively related to the energy efficiency of manufacturing firms.

Firms in the manufacturing sector have increased their focus on EMPs and expect to achieve higher energy efficiency and competitively enhance their environmental performance as a result. With a complete understanding of energy efficiency, firms can achieve higher levels of energy-saving—a part of environmental performance (Tanaka, 2008)—throughout the lifecycles of their products. Considering direct impact, Zeng et al. (2010) found that the adoption of EMPs in the context of cleaner production technologies enhances firms' environmental performance. Moreover, Martin et al. (2012) observed that firms with increased efforts in implementing EMPs had improved firm performance in terms of energy conservation and a reduced impact on the environment.

Pons et al. (2013) established that manufacturing firms with increasing energy efficiency have higher environmental performance. They found that technologies with a higher savings potential in manufacturing firms enhanced the firms' environmental performance. With a view to improving environmental performance, manufacturing firms have strengthened their capacities in the form of the adoption of EMPs, along with more regulated efforts regarding energy efficiency mechanisms. The existing energy-efficient measures favorably influence the positive link between EMPs and environmental performance.

With this in mind, the following hypotheses were formulated:

H_4: Energy efficiency is positively related to the environmental performance of manufacturing firms;

H_5: Energy efficiency mediates the positive relationship between EMPs and the environmental performance of manufacturing firms.

Of course, the most important goal of a manufacturing firm is making money, which is reflected by their financial performance and other commonly used financial performance measures, such as return-on-assets (ROA), return-on-investment (ROI), and stock price (Pons et al., 2013). Sen, Roy, & Pal (2015) proposed alternative ways of measuring financial performance, including increased revenue or profit and increased ROE or cash-flows. Thus, before adopting an EMP, manufacturing firms must ensure that ROIs are made by assessing financial performance. In this context, Sueyoshi & Goto (2010) found that EMPs positively influenced the financial performance of Japanese manufacturing firms. The firms focused on enhancing "energy awareness" and offered training to their employees to increase overall "energy knowledge," and, as a result, achieved better financial performance. Based on this discussion, it was therefore hypothesized that,

H_6: EMPs are positively related to the financial performance of manufacturing firms.

2.6 The moderation effect of top management commitment

Considering diversity, the top management formally received significant importance in strategic leadership literature (Joshi & Roh, 2009), due to their key role in developing and executing key business policies and practices, including EMPs (Blass et al., 2014). Grounded in division of decision-making process, agency theory promulgates the decision control rooted through ownership and control that enables management of the firms by actively shaping policies and guidelines. The logic of institutionalizing role of top management in corporate governance, faced a criticism of over-emphasize on control instead strategy formation, strategy-consulting, resources-provision etc. (Hillman & Dalziel, 2003). The agency theory is focusing more on economic side, and therefore, behavioural view of the firm focusing upon behavioural perspective of corporate governance is considered vital when firm serves multiple stakeholders including society (Kaczmarek, 2017). Behavioural view sets firms to see beyond the “bounded rationality” of top management and operate relationships and decision making within socially accepted context, recapitulated in behavioural theory of corporate governance (Westphal & Zajac, 2013).

Behavioural theory of corporate governance comprised cross-hybridization of positive agency theory and behavioural view of the firm includes “broad conduct and process of the firms with entire human side” (Kaczmarek, 2017, p. 901) forming critical role of top management in achieving sustainable capacities. Therefore, behavioural theory of corporate governance proved to be meaningful theoretical lens that helps firms to adopt practices addressing larger societal issues including environmental management. The role of top management from the perspective of economics (resource allocation and decision management) and human-behavioral view of firm (societal concern) is highly contextual considering their set priorities to achieve sustainable goals offering competitive advantage and image of "trendsetter" (Dubey et al., 2018). This theory suggests how the use of intuitional logic and behavioural lens influences top management to choose sustainable energy management practices.

Firms with a lack of top management commitment face significant challenges, as top management holds skills, knowledge, and competencies regarding manufacturing efficiency and consequently affect the adoption of EMPs (Blass et al., 2014). For manufacturing firms, top management commitment is the gateway toward sustainability (Eccles et al., 2012) and helps to gain a competitive advantage. Indeed, top management commitment is a critical construct; it lays down a strong foundation for involving employees in energy management and inspiring stakeholders by clearly stating the vision and rationale behind the adoption of EMPs. Well-established firms with higher top management commitment levels can establish long-term views among employees and provide clear guidelines regarding the adoption of EMPs (Rauter et al., 2015).

It is well-documented in the literature that EMPs positively increase the perception of energy efficiency. In addition, by promoting the adoption of EMPs, firms with higher management commitment have the advantage of displaying superiority by integrating a high level of technical knowledge into their operations (Rauter et al., 2015) and simultaneously instilling the conviction and importance of achieving energy efficiency among their employees. Fernando et al. (2018) argued that a firm's ability to create "energy awareness" and "energy knowledge" among employees regarding energy management, coupled with heightened top management commitment, strengthens a firm's ability to save energy. Therefore, firms with more top management commitment have more potential to achieve energy efficiency with the help of EMPs within the firm.

Firms that adopt EMPs minimize their energy losses and improve energy efficiency, ultimately bettering the firm's performance regarding environmental concerns, such as by limiting the amount of pollution (Famiyeh et al., 2018). Firms with more substantial top management commitment, meanwhile, incentivize the achievement of predefined energy efficiency goals through the use of technology. Finally, technical knowledge of energy efficiency will significantly improve the firm's environmental performance. These propositions can be transposed into the following hypotheses:

H_7: Top management commitment moderates the positive relationship between EMPs and the energy efficiency of manufacturing firms.

H_8: Top management commitment moderates the positive relationship between energy efficiency and the environmental performance of manufacturing firms.

The research framework used in this study is depicted in Fig. 1.

=== Insert Fig. 1 Here===

3. Research methods

3.1 Sample

Manufacturing firms are better suited to the energy management studies as they contribute maximum in energy needs and carbon emissions (Yong et al., 2019). Therefore, the data was collected from manufacturing companies operating in India as they are a major cause of the deterioration of the natural environment (Centobelli et al., 2019). A small- and medium-sized manufacturing company from Gujarat was selected. Gujarat was a natural choice: the region accounts for 18% of India's industrial output. It yields the highest production of chemicals and textiles (specifically denim) and ranks the second highest in pharmaceuticals production (KPMG, 2018). It was felt reasonable to select individuals who could willingly give the desired details and held the required knowledge or expertise (Famiyeah et al., 2018, Lewis & Sheppard, 2006); therefore, a purposive sampling technique was administered using "key informants" who were knowledgeable about EMPs (Bernard, 2002). Another criterion of the respondents is that they should be situated relatively highly in the organizational hierarchy and are, as such, aware of companies' strategic environmental management. A standardized instrument in the form of an English-based structured questionnaire was applied through a cross-sectional intercept survey.

The sampling unit for this study was manufacturing companies sp. SMEs, while the sampling element was senior-level managers, top management, or owners. A convenience sampling approach was used to select sampling units available in the District Industry Centre. The SME manufacturing companies of Gujarat were contacted through interception survey to collect unbiased data during October 2019 to February 2020. In total, 900 respondents were approached on the companies' premises with prior consent gained over the phone. Of these, 637 responses containing partial information or incomplete questionnaires (~70% approximate response rate) were received over six months. Finally, 594 usable responses were retained for the analysis after removing all responses with missing values. The respondents' profile (see Table 1) is as follows: 37.4% of respondents worked in chemical companies and 28.3% in engineering goods; 56.6% of respondents worked in companies employing over 100 employees; 48.3% of respondents worked in public limited companies; 77.9% of respondents worked with companies that had participated in any of the energy or environmental certification programs, and 67.3% of the respondents had 20+ years' experience in total.

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3.2 Measurement of constructs

The study used two constructs "energy awareness," and "energy knowledge" measuring EMPs, which were adopted from Fernando & Hor (2017). Further, energy audit scale was measured with 5-items adopted from Fernando & Hor (2017). The 5-item energy efficiency scale and 5-item top management commitment scale were also adopted from Femando & Hor (2017). Furthermore, the dependent measures of performance, such as the 5-item environmental performance scale, used the work of Zhu, Sarkis & Lai (2008) and Famiyeh et al. (2018) as the basis for scale. Finally, the 5-item financial performance scale was adopted from Montabon et al. (2007) and Yang et al. (2011). Each of these constructs was measured on a 5-point Likert-type scale, where "1 = strongly disagree" and "5 = strongly agree."

3.3 Bias

A single self-reported questionnaire was used to collect responses on endogenous and exogenous constructs, which was based on complete adherence to the guidelines developed by Podsakoff, MacKenzie, Lee, & Podsakoff (2003). It must be noted, however, that there is a risk of common method variance (CMV) when self-reported questionnaires are used to collect responses (Fuller et al., 2016). The measure deemed most appropriate to remedy this was Harman's single-factor approach, which was used to assess the presence of CMV (Babin, Griffin, & Hair, 2016). The result of this approach indicated that one factor contributed to 22.9% of the variance (less than 50%), signaling no threat of any common method bias (Harman, 1976).

4. Analysis and results

4.1 Assessment of measurement model

In the first step, exploratory factor analysis (EFA) was performed to assess the factorial structure of the constructs, such as EMPs and "energy efficiency" and performance measures, "environmental and financial." A two-step SEM procedure followed this. In total, 35 items measuring all the constructs were subject to a varimax rotation with principal components analysis. In so doing, seven factors were extracted, including "financial performance," "environmental performance," "energy efficiency," and "top management commitment," as well as second-order EMP constructs, consisting of "energy knowledge," "energy awareness," and "energy audit," contributing to 59.92% of the variance. Table 2 presents the factors with item loadings, scale reliability, and construct validity measures. The Cronbach alpha value of all the factors was above the cut-off value of 0.6 (Nunnally, 1978), suggesting reliable scales.

=== Insert table 2 here ===

AMOS 27.0 software was used to perform the data analysis. The covariance-based SEM (CB-SEM)—the most effective procedure for structural equation modeling (Rigdon, 1998)—was carried out for statistical analysis. CB-SEM is appropriate for studies that emphasize exploration and prediction and has the ability to handle complex models (Sinkovics et al., 2016). Finally, the two-stage approach of SEM was administered using a maximum likelihood estimation (MLE) technique.

The fitness of the measurement model was assessed through confirmatory factor analysis (CFA), using several fit indices, such as normed chi-square (CMIN/df), goodness-of-fit index (GFI), comparative fit index (CFI), normed-fit index (NFI), and root-mean-square-error-of-approximation (RMSEA; Hair et al., 2010; Byrne, 2010). This study considered EMPs as multi-dimensional constructs comprising "energy awareness" and "energy knowledge," and, as such, a second-order CFA was performed. In the first run of the measurement model, it was observed that all fit indices were not within the recommended level; therefore, the model was revised by deleting the items with factor loadings of less than 0.5 (Hair et al., 2010). Upon inspection, items EP1, EP2, FP4, FP5, EE2, EK2, and EU5 had lower factor loading values and were eliminated from further analysis. Performing CFA again, it was found that all the indices were within the acceptable limits [CMIN/df = 2.212 (≤ 5); GFI = 0.953 (≥ 0.9); AGFI = 0.931 (≥ 0.9); NFI = 0.918 (≥ 0.9); CFI = 0.953 (≥ 0.9) and RMSEA = 0.045 (≤ 0.08)].

Several criteria were used to establish the validity of the scales, including average variance extracted (AVE), composite reliability (Hair et al., 2010), and discriminant validity (Fornell & Larcker, 1991). It was found that all the items were significant ($t > 1.96$), and their factor loadings were above 0.5. Moreover, each construct's AVE values were well above 0.5, while their composite reliabilities were above 0.7, indicating the establishment of convergent validity. Square root values of AVEs were compared with inter-construct correlations to assess discriminant validity; this was based on Fornell & Larcker's (1981) approach (Table 3).

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4.2 Testing of the structural model

The derived hypotheses based on the proposed structural model were tested through SEM in the second step of this study. Predictability of the structural model was assessed through acceptable goodness-of-fit indices (χ^2 = 192.04; CMIN/df = 2.342; GFI = 0.958; AGFI = 0.939; NFI = 0.924;

CFI = 0.954; RMSEA = 0.0548). The study findings supported hypotheses H_1 ($\gamma = 0.21$; $t = 2.535$; $p < 0.05$), H_2 ($\gamma = 0.10$; $t = 1.721$; $p < 0.1$), H_3 ($\gamma = 0.56$; $t = 5.952$; $p < 0.05$), H_4 ($\gamma = 0.45$; $t = 4.525$; $p < 0.05$), H_5 ($\gamma = 0.25$; $t = 3.298$; $p < 0.05$), and H_6 ($\gamma = 0.50$; $t = 6.178$; $p < 0.05$), as shown in Table 4. The existing model explained 39% of the variance in environmental performance and 25% of the variance in financial performance (Fig. 2).

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=== Insert fig. 2 here ===

The indirect effects were tested using bootstrapping approach for multiple mediation relationships. We have bootstrapped the indirect effects of EMPs on environmental performance via energy audit and energy efficiency using AMOS 27.0. On following Preacher & Hayes (2008) approach, bootstrap estimates were derived from 5000 bootstrap samples with 95% bias-corrected confidence (table 5). Findings revealed that energy audit mediates the relationship between EMPs and energy efficiency (since 95% CI does not contain zero). The indirect effects also showed that energy efficiency mediates EMPs and environmental performance (LB: 0.081, UB: 0.347). Sequentially, energy audit and energy efficiency were also mediating EMPs to environmental performance link (LB: 0.001, UB: 0.025).

4.3 The moderating effect of top management commitment

To test the moderating effect of top management commitment for hypothesis H_7 (EMPs → energy efficiency) and H_8 (energy efficiency → environmental performance), Hayes' PROCESS macro regression (Model 1) was used (Hayes, 2012). Table 6 shows that the moderation effect of top management commitment for energy efficiency → environmental performance ($t = 2.03$; $p < 0.05$) and EMPs → energy efficiency ($t = 2.1742$; $p < 0.05$) was found to be significant. Upon further examination of these relationships, conditional process analysis indicated that top management commitment strengthens the positive relationship between "energy efficiency" and "environmental performance," as top management commitment is strengthened from low to high. Following Aiken & West (1991), the levels low and high were defined using ±1 standard deviation (SD) from the mean of continuous moderator- top management commitment. Values with -1SD from the mean were labelled as “low”, +1SD from the mean as “high” and between ±1SD from the mean as “medium”. Top management commitment also strengthens the positive relationship between "environmental management practices" and "energy efficiency," as top management commitment is increased from low to high (Table7, Fig. 3).

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=== Insert fig. 3 here ===

5. Discussion and Implications

With rising pressure to be more eco-friendly due to heightened environmental concerns, manufacturing firms have started investing in EMPs and energy-efficient technologies. This study assessed effect of adoption of EMPs on SMEs’ environmental performance and financial performance. This study found that among the manufacturing SME firms investigated, EMPs positively influence the energy audit of the firms. The hypothesis H_1 was thus confirmed. Adoption of EMPs provided the key performance indicators of energy savings which were used to assess the energy audit. The study also signified that the energy audit positively influences a firm's energy efficiency practices (H_2). Having an accurate and stringent auditing system elevates the ability to achieve better energy-saving practices and conservation. This reflects that through energy audit, more opportunities can be identified within the firm for reducing energy use, that ascribed value to energy consumption, offer a justification to resource allocation for energy-efficient projects (Fernando & Hor, 2017). The energy efficiency should be achieved through effective implementation of EMPs in Manufacturing SMEs.

Furthermore, the direct effect of EMPs and energy efficiency was significant and positive (H_3), The indirect effect of EMPs to energy efficiency partially mediated by energy audit. Empirically, the findings are consistent with the research studies such as Palm & Thollander (2010); Gordić et al. (2010) which indicated that EMPs implementation influences energy efficiency positively. Hence, the implementation of EMPs to establish the position of most energy-efficient firm in

Indian manufacturing SMEs is more apparent. Energy efficiency positively influences environmental performance (*H_4*) and financial performance (*H_6*). This evidenced that energy efficiency through adoption of EMPs to achieve energy conservation, waste management, resource optimization leads to lower manufacturing costs, that improves financial performance (Iqbal, Kang, & Jeon, 2020). Indeed, firms adopting EMPs will have higher environmental performance if they invest in energy-efficient technologies and equipment. The findings also suggested that energy efficiency partially mediates the relationship between EMPs and environmental performance (*H_5*).

Rather basing on singly theory, this study has integrated RBV theory with behavioural theory of corporate governance with context-specific variables reflecting internal resources in the form of energy-efficient practices and EMPs resulting high predictive power. The empirical evidence supported the effect of top management commitment in increasing the influence of EMPs on energy efficiency is significant and positive. We expected firms' adoption of EMPs to be very high when strong intervention from top management was present that leads to higher energy efficiency. Possibly, the positive stance taken by top management on adoption of EMPs increased the likelihood of development of novel ideas to increase the energy efficiency among employees.

We further argued that top management commitment influences energy efficiency- environmental performance relationship positively. In sum, the moderation effect of top management commitment was found significant; therefore, hypotheses *H_7* and *H_8* were confirmed that offers a significant empirical support for this moderation link. The companies with low top management commitment find difficult to implement EMPs successfully. This reflects the role of deeper deliberation of top management regarding establishing energy-efficient positioning of firm to achieve higher environmental performance in short run and help aligning achievement of UNDP goals is extremally critical.

5.1 Implications for researchers

The comprehensive model developed in this study is suited to address the questions posed in the literature regarding the fragmented integration of EMP constructs. This model offers a better understanding of how the adoption of EMPs, aligned with energy efficiency in the presence of high/low top management commitment, enhances a manufacturing firm's environmental and financial performance. Previous studies adopted a causal approach to understanding the role of EMPs in affecting performance (Fernando & Hor, 2017; Fernando et al., 2018) and undermined the procedural approach to the implementation captured in this dynamic model. This study makes three specific contributions.

- First, this model shows that the adoption of EMPs enhances energy efficiency through the improved energy auditing practices of manufacturing firms. We also found that the adoption of EMPs, along with energy auditing and energy-efficient mechanisms, places manufacturing firms in a more environmentally viable and financially stronger position, thereby providing competitive advantages. The model, based on RBV, was tested for reliability and validity and its structural relationships using standard practices suggested by Hair et al. (2012). Moreover, this study offers a stable structure of EMP measurement and construction. This is in contrast to previous studies, such as those of Abdelaziz et al. (2011), Lee et al. (2011), and Fernando & Hor (2017), which have yielded inconclusive results.

- Second, building on the important construct "top management commitment," this study also investigated the moderation effect in the link between EMPs, energy efficiency, and environmental performance, differing from Fernando & Hor's (2017) study. The results demonstrated the significant effect of top management commitment in enhancing this relationship, placing the construct in a position of strategic priority as per behavioural theory of corporate governance. The implementation of EMPs was well organized due to accurate and timely energy auditing practices in the manufacturing firms (Gordić et al., 2010). Furthermore, it was found that continuous intervention and knowledge sharing from top management helps manufacturing firms to achieve higher levels of energy-saving and, as such, energy efficiency, leading ultimately to improved environmental performance.

- Finally, this study offers an understanding of RBV regarding industrial market factors, and specifically how the use of EMPs for energy efficiency (natural factor) with advanced knowledge of energy-efficient technologies (technology factor) brings forth a firm's ability to achieve a sustainable competitive advantage in the long run.

5.2 Implications for practice

- This study determines the effects of EMPs on a firm's performance in the manufacturing sector. EMPs are highly effective in improving energy efficiency, and firms should continuously invest in and build on an EMP adoption system to save energy more effectively (Fernando & Hor, 2017). With top management support, newer energy management practices leading to further environmental concepts can be identified, and, therefore, awareness, knowledge, and training should be frequently provided to employees. Firms should show interest in adopting the right energy auditing practices by creating early-stage awareness and understanding regarding the critical parameters of EMPs.

- Through the rigorous planning of energy auditing, coupled with the development of human capital and technologies, the intended energy efficiency is achievable. Firms should undertake an internal or external (via a government agency) energy audit to monitor the efficient use of energy (Fernando & Hor, 2017). Audit help firms to identify inefficient and redundant equipment that leads to energy saving (Mascarenhas et al., 2019). The realized energy efficiency leads to better environmental performance. Therefore, firms should develop a strategic energy management plan, aiming for improvement in environmental performance, with a clear focus on the adoption of energy-efficient operations, equipment, and technologies.

- Firms should continuously invest in building their energy management capabilities by understanding the value of tapping into the environmental issues that could, eventually, offer a distinct competitive advantage to the firm. Energy efficiency should be established within the firm first, while the sustainable mindset should be developed to integrate energy management systems to achieve higher levels of energy efficiency and saving (Brunke, Johansson, & Thollander, 2014).

- Operationally top management should conduct regular meetings and workshops with their employees to sensitize the employees towards EMPs for raising energy knowledge, specific to importance of their energy audit performance. Strategically, firms' top management should be conscious of environmental performance benchmarking (Hartmann & Vachon, 2017). Top management should be active in selecting the right environmental performance parameters achieved through energy-efficient mechanisms. The effective adoption of EMPs also drives the financial performance of the manufacturing firm. This insight is significant, as it informs practitioners to advocate the return-on-investment logic to invest more in EMPs.

5.3 Implications for policy makers

- As reported in most studies, the SDGs targets in developing nations are less attained (Gupta, Kumar, & Wasan, 2021) and the effective adoption of EMPs by manufacturing SMEs will contribute significantly to achieve nation-wide SDGs in India. Policy makers, therefore, should help manufacturing SMEs in establishing training centers to improve energy management knowledge (Zuo & Zhao, 2014) and also conduct external audits with incentivize such adoption practices.
- It is proposed that the government should allocate funds to develop sustainable infrastructure and build energy-efficient technologies and equipment to encourage manufacturing firms (Fernando et al., 2016).
- This quantitative study offers the important motivation for adopting EMPs to allow for the increased environmental performance of the firm. In a like manner, more success stories should be developed regarding the effective implementation of EMPs and its specific environmental impact.
- The government should regularly publicize the environmental performance parameter with benchmarking goals to help firms incorporate environmental concerns into their strategic energy management plans.

6. Conclusion, limitations and future scope

Drawing upon the resource-based view theory, the main goal of this study was to understand how EMPs can enhance the environmental performance and financial performance in manufacturing SMEs in India. The present study also demonstrated the role of top management commitment in creating unmatched valuable resources such as EMPs through the lens of behavioural theory of corporate governance. The findings revealed the mediation effect of energy audit and energy efficiency on environmental performance that offers a strategic path to the practitioners for achieving SCA.

This study is not without limitations. For the purposes of this study, we focused on the moderation effect of top management commitment on environmental performance. In future studies, more moderating variables, such as firm size, industry type, and stakeholder pressure, could be considered to advance the body of knowledge of energy management practices. In addition, the use of secondary data for environmental performance and financial performance would help to refine the results. Further research can use longitudinal data to establish the causal relationship between energy management practices and firms' performances. This study focuses on Indian manufacturing firms, and practitioners are warranted in using a model that may vary across different contexts: whether by industry or by country. The sample collected in this study came from manufacturing firms, and no information was gathered regarding its status of ISO 14001 or ISO 50001. Therefore, future studies may replicate the model, using a firm with ISO 140001 or ISO50001; alternatively, a comparison can be made in the context of their financial or environmental performance. Future studies may also consider other non-financial measures of the economic performance to offer important insights.

Notations

SME	Small- and Medium- Sized Enterprise
EMPs	Energy Management Practices
ISO	International Organization for Standardization
RBV	Resource-based View
SCA	Sustainable Competitive Advantage
UNDP	United Nations Development Programme
SGD	Sustainable Development Goals

ROA	Return-on-Assets
ROI	Return-on-Investment
CMV	Common Method Variance
SEM	Structural Equation Modeling
CI	Confidence Interval
SD	Standard Deviation
SE	Standardized Estimates
γ	Path estimate (regression coefficient)
t	t-statistic value of a path
p	Probability level of statistical significance
α	Cronbach alpha

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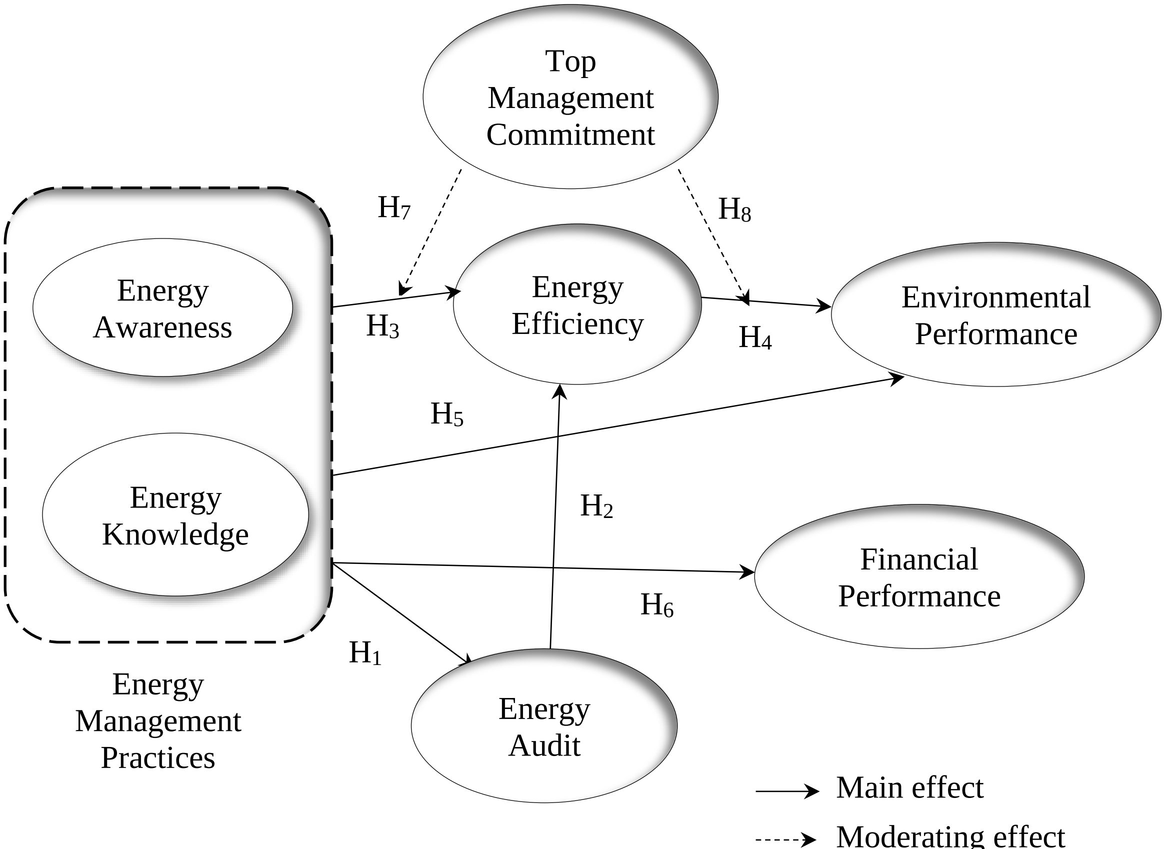

Fig. 1. The research model.

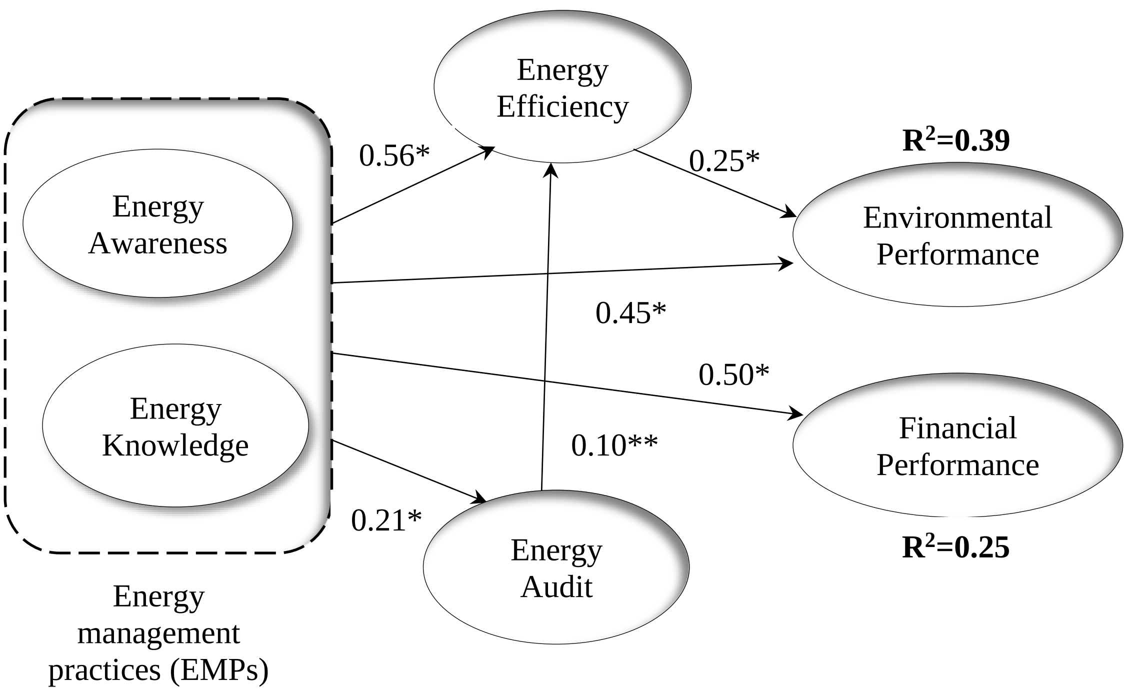

Fig. 2. Results of the structural model.

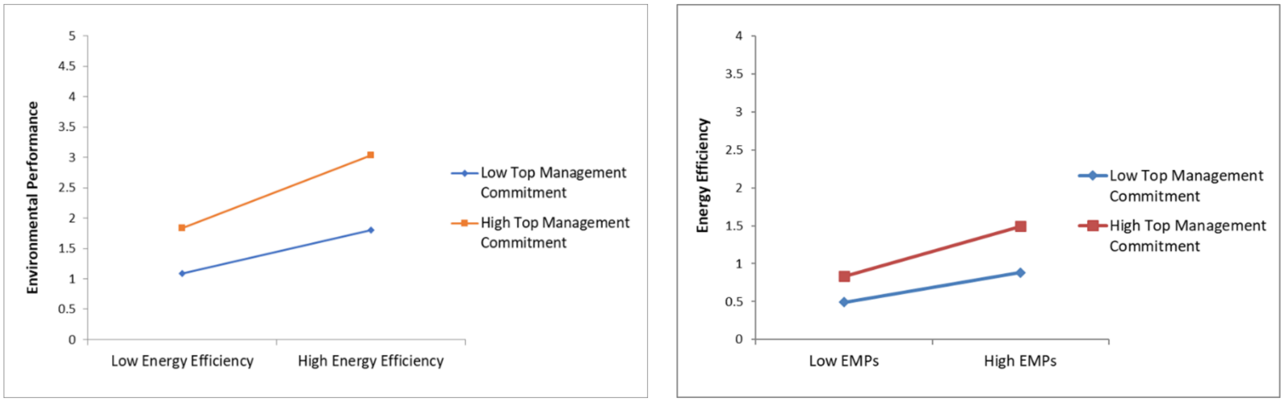

Fig. 3. The moderation effect of top management commitment.

Table 1
Company characteristics of the respondents.

Variables	Particulars	Frequency	%
Type of company	Chemical	222	37.4
	Dairy	24	4.0
	Engineering	168	28.3
	Fertilizer	24	4.0
	Oil and gas	24	4.0
	Pharmaceutical	48	8.1
	Pulp and paper	24	4.0
	Sugar	24	4.0
	Textiles	36	6.1
Number of employees	0 to 30	42	7.1
	31 to 100	216	36.4
	101 to 200	123	20.7
	201 - 999	213	35.9
Type of ownership	Public limited	287	48.3
	Private limited	188	31.6
	Partnership company	2	0.3
	Other	117	19.7
Size of the company	Micro	51	8.6
	Small	212	35.7
	Medium	331	55.7
Participation with energy or environmental certification	Yes	463	77.9
	No	131	22.1
Total years of experience	6 to 10	27	4.5
	11 to 20	167	28.1
	21 to 40	400	67.3

Note: Computed based on n=594 responses; %= Percentage

Table 2
Factor loadings, scale reliabilities, and construct validity.

Factors	Item	Factor loadings	Cronbach alpha (α)	Average variance extracted (AVE)	Composite reliability
Financial Performance (FP) (11.097%)	FP2	0.789	0.793	0.55	0.779
	FP1	0.762			
	FP3	0.714			
	FP4	0.683			
	FP5	0.580			
Environmental Performance (EP) (10.682%)	EP2	0.741	0.778	0.53	0.771
	EP3	0.692			
	EP5	0.687			
	EP4	0.657			
	EP1	0.650			
Energy Efficiency (EE) (8.910%)	EE4	0.749	0.761	0.49	0.74
	EE3	0.732			
	EE5	0.651			
	EE2	0.509			
Top Management Commitment (TMC) (8.493%)	TMC1	0.807	0.658	0.53	0.767
	TMC4	0.761			
	TMC2	0.754			
Energy Audit (EAU) (6.94%)	EAU4	0.823	0.652	0.61	0.733
	EAU3	0.810			
	EAU5	0.560			
Energy Knowledge (EK) (7.76%)	EK4	0.773	0.727	0.5	0.754
	EK5	0.721			
	EK2	0.537			
Energy Awareness (EA) (6.046%)	EA5	0.762	0.610		
	EA4	0.751			

Note: K-M-O measure of sampling adequacy = 0.839; Bartlett's test of sphericity ($p<0.05$).

Table 3
Discriminant validity.

	EMPs	Energy Audit	Energy Efficiency	Environmental Performance	Financial Performance
EMPs	**0.707**				
Energy Audit	0.132	**0.781**			
Energy Efficiency	0.372	0.186	**0.700**		
Environmental Performance	0.391	0.084	0.419	**0.728**	
Financial Performance	0.336	0.096	0.306	0.258	**0.742**

Note: diagonal values are $\sqrt{AVE}$; off-diagonal values are inter-construct correlations; AVE= Average Variance Extracted; EMPs=Energy Management Practices

Table 4
Confirmation of hypotheses.

Paths	Path estimate (γ)	t-value	Sig.	Direct effect	Indirect effect
EMPs → Energy Audit	0.21	2.535	0.011*	0.212	---
Energy audit → Energy Efficiency	0.10	1.721	0.085**	0.100	---
EMPs → Energy Efficiency	0.56	5.952	0.000*	0.557	0.021
EMPs → EP	0.45	4.525	0.000*	0.449	0.143
Energy Efficiency → EP	0.24	3.298	0.000*	0.247	---
EMPs → Financial Performance	0.50	6.178	0.000*	0.498	---

Note: EMPs = Environmental management practices; EP= Environmental performance; *$p < 0.05$; **$p < 0.1$.

Table 5
Specific Indirect effects for Mediation.

Paths	Estimands	Bootstrap (95%CI)	Sig.
EMPs → Energy Efficiency→EP	0.203	(0.081, 0.347)	0.018*
EMPs → Energy Audit →EP	0.029	(0.003, 0.076)	0.07**
EMPs → Energy Audit → Energy Efficiency → EP	0.008	(0.001, 0.025)	0.044*

Note: EMPs = Environmental management practices; EP= Environmental performance; *p < 0.05; **p <0.1.

Table 6
Results of moderation analysis.

Predictors	B	SE	t	95% CI (LL, UL)
Environmental Performance				
Energy Efficiency x Top Management Commitment	0.2472	0.1217	2.0301*	(0.008, 0.486)
Energy Efficiency				
EMPs x Top Management Commitment	0.1456	0.067	2.1742*	(0.014, 0.277)

Note: *p<0.05; EMPs= Environmental Management Practices; CI= Confidence Interval; LL= Lower Limit; UL= upper Limit; B= Unstandardized Beta; SE= Standard Error; Bootstrap Sample size= 5000

Table 7
Conditional effects of top management commitment.

Path	Top management Commitment	Effect	SE	t	95% CI (LL, UL)
Energy Efficiency → EP	Low	0.447	0.073	6.144**	(0.30, 0.59)
	Medium	0.546	0.062	8.728**	(0.42, 0.67)
	High	0.596	0.071	8.421**	(0.46, 0.73)
EMPs → Energy Efficiency	Low	0.163	0.036	4.511**	(0.09, 0.23)
	Medium	0.222	0.031	7.158**	(0.16, 0.28)
	High	0.251	0.036	6.903**	(0.18, 0.32)

Note: $^{**}p<0.1$; EP= Environmental Performance; EMPs= Environmental Management Practices; SE= Standard Error; CI= Confidence Interval; LL= Lower Limit; UL= upper Limit; Bootstrap Sample size= 5000

Appendix A

Measurement scale used.

Variable	Source	Items
Energy Management Practices (EMPs)	Fernando & Hor (2017)	**Energy Awareness**
		• "There are easily accessible/visible guidelines to energy saving available around the company" (EA1)
		• "Energy awareness training is regularly provided to all employees in our company" (EA2)
		• "Energy efficiency achievements are prominently featured in stakeholder communication or annual reports" (EA3)
		• "The Energy Committee regularly communicates with the company's employees to create awareness" (EA4)
		• "Employees are encouraged to participate in energy improvement programs" (EA5)
		Energy Knowledge
		• "The energy manager/committee members have sufficient knowledge in energy management" (EK1)
		• "Our company has a developed energy training program with clear expected results" (EK2)
		• "Our company invites external energy management specialists to train or audit existing capabilities" (EK3)
		• "Our company has a well-developed energy management database" (EK4)
		• "Our company has clear procedures describing the sequence of steps in implementing an energy management program/activity" (EK5)
Energy Audit	Fernando & Hor (2017)	• "Our company has a master plan detailing the entire energy management program including current and future development plans" (EAU1)
		• "Our company regularly performs energy audits to measure energy consumption for improvement" (EAU2)
		• "The energy manager/committee regularly conducts periodic meetings with area/functional owners to discuss improvements" (EAU3)
		• "The Energy Committee proactively seeks guidance on energy management issues from more experienced employees" (EAU4)
		• "There is a periodic review on the effectiveness of the overall energy program" (EAU5)
Energy Efficiency	Fernando & Hor (2017)	• "Our company has reduced its energy use per unit of revenue adopting Energy Efficient Equipment and Technology" (EE1)
		• "Our company has reduced the cost of energy consumption using Energy Efficient Equipment and Technology" (EE2)
		• "Our company has reduced energy wastage through energy efficient -equipment selection" (EE3)

		• "Our company has reduced energy wastage in the production process through Energy Efficient Equipment and Technology" (EE4) • "Our company has reduced overall energy consumption significantly throughout using energy efficient technology" (EE5)
Environmental Performance	Zhu, Sarkis & Lai (2008) and Famiyeh et al. (2018)	• "In our company, there is reduction of air emission level compared to three years ago air emission level" (EP1) • "In our company, there is reduction of water wastage level compared to three years ago water wastage level" (EP2) • "In our company, there is reduction of soil wastes level compared to three years ago soil wastes level" (EP3) • "In our company, there is decrease of consumption for hazardous/harmful/toxic materials compared to three years ago" (EP4) • "In our company, there is overall improvement of an environmental situation relative to three years ago and to main competitor(s)" (EP5)
Financial Performance	Montabon et al. (2007) and Yang et al. (2011)	• "Compared to three years ago, our company's return on sales has improved" (FP1) • "Compared to three years ago, our company's return on investment has improved" (FP2) • "Compared to three years ago, relative to our main competitor(s), our return on sales has improved" (FP3) • "Compared to three years ago, relative to our main competitor(s), our Return on Investment has improved" (FP4) • "Compared to three years ago, our cost savings has improved" (FP5)
Top Management Commitment	Femando & Hor (2017)	• "Our company management has a formal Energy Manager or a departmental/functional position in charge of an Energy Committee" (TMC1) • "Our company management has delegated authority to the Energy Committee/Energy Conservation cell for managing energy improvement activities" (TMC2) • "Our company management actively participates in energy management programs (planning, auditing and monitoring)" (TMC3) • "Our company management has allocated the Energy Committee/Energy Conservation cell with a financial budget for energy improvement" (TMC4) • "Our company management actively encourages and promotes energy improvement programs among the company's employees" (TMC5)

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