02-TIBSS-3777-640

International Journal of
Trends and Innovations in Business & Social Sciences
Vol. 2 No. 1 (March, 2024), 15-25
ISSN (e): 2959-4634 | DOI: https://doi.org/10.48112/tibss.v2i1.640

Research Article

Non-Energy Benefits: A New Motivational Era for Entrepreneurs from Developing World

Muhammad Faisal Sultan[1*], Muhammad Adeel Mannan[2] & Erum Khan[3]

[1] KASB Institute of Technology - Pakistan
[2] FEST, Hamdard University, Karachi, Pakistan
[3] Sindh Madressatul Islam University - Pakistan

ARTICLE INFO

Article history:

Received: Oct 26, 2023
Revised: March 08, 2024
Accepted: March 27, 2024
Published: March 31, 2024

Keywords:

Company image
Energy efficiency
Energy management
Internet of things (IoT)
Non-energy benefits

ABSTRACT

Most of the time research work conducted on energy management and energy efficiency referred to the developed world. Hence, there is minimal focus on energy management practices and the benefits the process may produce for SMEs. Thus, this is one of the premier studies that try to uncover the non-energy benefits related to energy management with the reference of SMEs from Pakistan. Hence the study is significantly important for researchers, academicians, industrialists, and entrepreneurs to understand the role, impact, and significance of energy management in SME sector of Pakistan. A better understanding of these points will not only flourish research work but will also motivate industrialists, entrepreneurs, and policymakers to focus rigorously on energy management practices. Data were collected through a closed-ended questionnaire from the top-level management of apparel sector SMEs from Pakistan and analysis has been made through PLS-SEM. Findings indicated that leaders from the SME sector are inclined toward renewable energy sources, energy management, and its impact on the company's goodwill.

INTRODUCTION

Studies since past three decades have focused intensively upon energy consumption on economic growth. Similarly, several studies have also tried to uncover the linkage between energy consumption, economic growth of the country & increase of CO2 emission (Salahuddin & Gow, 2019). Thus empirical findings from all over the globe also inferred that effective energy management systems may prevent a significant amount of energy along with bills and hazardous emissions. Energy-efficient mechanisms are a need of every industry, especially for manufacturing industries (Sajjad et al., 2023). Therefore, researchers all over the globe are interested in studying vibrant energy management practices. The surge in research work focused on energy-efficient operations has been witnessed across the globe which

*Corresponding author: Muhammad Faisal Sultan, KASB Institute of Technology - Pakistan
e-mail: mfaisal@kasbit.edu.pk

How to Cite:

Sultan, M. F., Mannan, M. A., & Khan, E. (2024). Non-Energy Benefits: A New Motivational Era for Entrepreneurs from Developing World. *International Journal of Trends and Innovations in Business & Social Sciences, 2*(1), 15–25.

DOI: https://doi.org/10.48112/tibss.v2i1.640

resulted in the energy efficiency of process industries. Especially with the emergence of IoT (Internet of things), energy management became better in the times of industrial revolution 4.0 (Ahmad et al., 2020; Sajjad et al., 2023).

However, most of the time companies are considering economic benefits as the base of decision-making for energy consumption and savings. Similar is the case of Asian markets where there is no direct incentive to implement energy management protocols. Especially, there is a requirement for valid reasons and arguments that are proficient to justify the linkage between energy management & firms' sustainability. Moreover, lacking realistic models concerning emerging economies is also diminishing the motivation of industrialists to adopt energy management practices (Qamar Zia et al., 2022). Last but not least the major concern on the Asian side is to diminish the emission of CO2 rather than economic development. The concern is based on recently highlighted issues of environmental degradation and human health (Fernando & Hor, 2017). Although most South- Asian countries use coal and hydel power as the source of energy production. Pakistan produces 66.5% of its electricity through using coal and hydel sources although the gap between energy produced and energy demands is getting expanded with time. Thus, to bridge this gap South-Asian countries are required to pay deep concern to energy management. One of the best ways of doing this is by focusing on renewable energy sources (Abbas et al., 2018).

Energy management is also perceived as an important tool for energy efficiency that leads to the sustainable development of manufacturing firms. Energy efficiency has also been discussed in several studies as the most significant cost-effective method to preserve environmental degradation (Fernando & Hor, 2017). However, almost all of the South-Asian countries failed to provide electricity to the entire of their population except the Maldives. Although rest of the countries are also trying to curb carbon emissions and electrify their entire population. Pakistan has set no important goals to deal with current problems (Abbas et al., 2018; Naveed et al. 2022). Energy efficiency has been believed as one of the most important measures for the increase of industrial competitiveness that may also aid climate mitigation. However, companies are still feeling reluctant in implementing energy efficiency measures are not been adopted effectively. Although better knowledge of non-energy benefits may alter the thinking of decision-makers and may make them adopt energy efficiency measures that were looked non-profitable previously (Cagno et al., 2019).

Research Gap

Several studies highlighted that the popularity of energy efficiency is on the increasing side. However, most of the studies in this vein are based on developed sides of the world (Fernando & Hor, 2017). Ahmad et al (2020) conducted a study on barriers, drivers, and non-energy benefits with special consideration to the iron and steel industries. However there is a need for systematic and thorough quantitative analysis of each aspect separately through collecting detailed primary data.

Theoretical Framework

The formulation of this study has been grounded on the theme that increase in economic growth resulted in increased consumption of natural resources (Adejumo, 2020). The study by Ahmad et al (2020) highlighted that there are several non-energy benefits of using efficient energy management. Although benefits that are on top of the list are the increase in the lifetime of equipment, improved temperature control, and improved company's image. Although company's image is not highlighted by Ahmad et al (2020), Klemke-Pitek and Majchrzak (2022) and Pusnik et al (2016), etc. Therefore, it is difficult to diminish the importance of the company's image as the non-energy benefit of energy management. However, in Asia, the concern is towards CO2 reduction (Fernando & Hor, 2017), although there are some top-ranked nonenergy benefits. Therefore, to understand the significance of energy management for attaining non-energy benefits (Ahmad et al., 2020), there is a need to relate the concept of energy efficiency to non-energy benefits. These methods will not only motivate entrepreneurs but also industrialists especially from small-scale and less energy-intensive industries (Fernando & Hor, 2017), to capitalize on energy management practices in Pakistan. Moreover, referring to Shrouf et al (2014), it is also beneficial to take advantage of IoT, which may flourish the process of energy management and leads to an increase in energy efficiency.

International Journal of
Trends and Innovations in Business & Social Sciences
Vol. 2 No. 1 (March, 2024) | 15- 25

Hence this study is one of the premier ones that is directed towards non-energy benefits of the energy management process & thus has mass significance for practitioners as well as academicians and researchers. Research may enforce better policy-making by governing bodies that may force industrialists and entrepreneurs to implement better & effective energy management systems. These implementations may provide major non-energy benefits, i.e., other than CO2 reduction and energy benefits. However, it is one of the premier and initial studies on energy-related SMEs from Pakistan and therefore based only on the company's image as the main dependent variable.

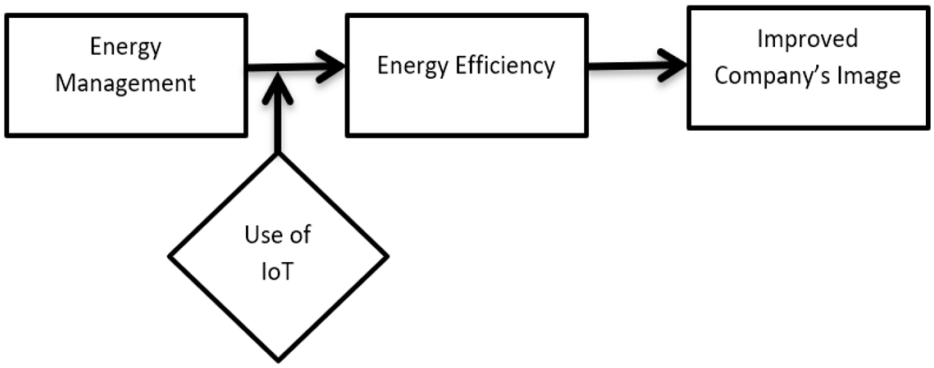

Figure 1. Research Model

LITERATURE REVIEW

Energy management and energy policies are also considered as the major areas of interest in Pakistan. However, governmental policies for energy management & conservation also vary and are found to be less integrated since the independence of the country (Ahmad et al., 2020). Although studies using modern models predicted that renewable sources of energy are best for Pakistan. Findings indicated that wind is the best source of renewable energy followed by hydro, solar, biomass & geothermal forms of energy. These preferences are based on a comparative analysis of important forces e.g., environmental, economic, technical, and socio-political, etc (Ahmad et al., 2020).

On the other hand, the system of energy management also provides several benefits to production firms (Shrouf & Miragliotta, 2015). Thus, the terminology of energy management is quite popular (Ahmad et al., 2020) and has various advantages for the production sector (Shrouf & Miragliotta, 2015). There are various non-energy benefits of energy management systems such as reduced emission of CO2 & reduced waste etc (Nehler & Rasmussen, 2016). Similarly has been indicated by Cagno et al (2019), that the concept of energy efficiency management is in the infancy stage although it has several potential non-energy benefits for consumers as well as production plants.

Energy Management Practices with Energy Efficiency

The Energy Management process is much more fruitful for production firms as it leads to energy efficiency in production sector. In fact, there is a positive relationship between energy management practices in energy efficiency (Fernando & Hor, 2017). The use of daylight or inverter systems to increase energy efficiency might be effective energy efficiency (Lee & Cheng, 2016).

- H1A: There is a relationship between energy management in and attaining of energy efficiency

Energy Efficiency with Improved Company Image

Sustainable corporate behavior is largely dependent upon energy efficiency. Energy efficiency is the main driver of future global competitiveness. It's true as the production sector is the main consumer of primary energy and consumes around 37% of the world's primary energy. Energy efficiency is one of the top agendas for corporates with one of the major examples is ISO 15001 standard (May et al., 2015). Shrouf and Miragliotta (2015) highlighted that the use of an efficient energy management system resulted in a decrease in cost & also resulted in a good reputation for the company. Similar was the findings of Fernando and Hor (2017), energy efficiency not only resulted in the reduction of cost but also produced a favorable impact on a firm's image. However according to one of the latest studies increase in the reputation of the firm is based upon thorough compliance with governmental and international

environmental protocols. These compliances are also rooted into energy saving and energy efficiency & through these company may attain several non-energy benefits. Among these benefits firm's image is perceived as the top-ranked benefit (Haiyun et al., 2021).

- H2A: There is a relationship between energy efficiency in and improved company image
- H3A: Energy Efficiency mediates between energy management and improved company's image of SMEs.

Internet of Things (IoT) with Energy Efficiency

Information on energy usage is mandatory to optimize energy efficiency and therefore there is a need to understand the overall level of energy consumption in the factory (May et al., 2015). The use of IoT is highly significant for energy management which will aid in energy efficiency and provide significant benefits in the age of industrial revolution 4.0 (Shrouf et al., 2014). However, energy management practices may be hampered due to a lack of understanding of energy consumption behavior (Shrouf & Miragliotta, 2015). However, performance indicators are the benchmarks that may highlight whether the performance of the system is working effectively to attain the targets or not (May et al., 2015). Therefore, legitimate to highlight IoT, which is significantly important to deal with the issue of lack of understanding of energy consumption behavior as well as to optimize energy efficiency in factories (Akhtar et al., 2020; Shrouf et al., 2014). Thus, legitimate to believe that innovative energy management practices are also important for energy saving and energy efficiency (Shrouf & Miragliotta, 2015).

- H4A: IoT at moderates the relationship between energy management and energy efficiency.

METHODOLOGY

Research methodology is the part or section of the study in which discusses methods applied in the study along with the logic behind the selection of these methods (Kothari, 2004). Thus, legitimate to declare research methodology as the tool that is used to increase readers' knowledge about the elements used in the study (Onwuegbuzie & Leech, 2005). Thus, Sekaran and Bougie (2016) use two different sections, i.e., research design and sampling design to elaborate on research methods and the logic of their use.

Research Design

The purpose of the research is correlational and it is based on non-contrived study settings with a moderate level of researcher interference & field experiment (Sekaran & Bougie, 2016). Moreover, the study aims to motivate entrepreneurs and industrialists to move towards energy efficiency (Fernando & Hor, 2017), by highlighting non-energy benefits (Ahmad et al., 2020; Klemke-Pitek & Majchrzak, 2022). Therefore, the philosophy of the study is an epistemology that is the philosophy of knowledge and is used to indicate what IS knowledge. (Saunders et al., 2007). The philosophical stance that is required to attach research philosophy with the data collection technique (Assalahi, 2015 & Žukauskas et al., 2018) is Post-Positivism. The stance is useable with both qualitative & quantitative designs (Clark, 1998 & Žukauskas et al., 2018). However, most of the time post-positivism is associated with quantitative research designs (Syed & McLean, 2021). The research strategy is a survey, the research approach is deductive and the time horizon is cross-sectional (Saunders et al., 2007).

Sampling Design

The Sampling Design for this study follows Fernando and Hor (2017), to select top management personnel of SMEs from major cities of Pakistan as used in qualitative research. However, this study does not limit data collection on the basis of the number of employees. Although ISO accreditation and well use of solar systems as a source of renewable energy are the major criteria for the inclusion of the company in the population. Moreover, the total number of SMEs that are fulfilling these two criteria are very low thus the data has been collected from 100 respondents. Most of the selected firms and respondents are from Punjab province while Sind lies in the second number in terms of selected firms as well as respondents.

International Journal of
Trends and Innovations in Business & Social Sciences
Vol. 2 No. 1 (March, 2024) | 15- 25

Research Instrument

The questionnaire was used as the research instrument in several studies by Nehler and Rasmussen (2016) and Zhang et al (2015). Although the adopted version of the questionnaire was used specifically to gauge the impact of energy efficiency by Fernando and Hor (2017). Therefore research instrument for this study is also a closed-ended questionnaire based on Likert scaling. The questionnaire is a hybrid of several studies like Fernando and Hor (2017) and Zhang et al (2015), etc. Sola and Mota (2020), is used to develop research elements for energy management & energy efficiency. Fernando and Hor (2017) along with Sola and Mota (2020) used to develop research elements for energy efficiency. Indication of Purwania et al (2020), is used to develop elements of IoT. Fernando and Hor (2017) and Hasan et al (2021) are used to develop research elements for a company's image and IoT.

Statistical Testing

The research highlighted that Structural Equation Modeling (SEM), is the most preferred way of data analysis of business research problems. The relevance became substantiated when the research model is accompanied by latent variables. SEM is based on two models, i.e., the inner (measurement) model and the outer (structural) model (Wong, 2013). The inner model is plotted to reflect the relationship between major variables of the research while the purpose of the outer model is to highlight the association of indicators with their respective constructs (Zia et al., 2023).

On the other side PLS-SEM is perceived as the best source of implementation too in comparison to Co-variance-based SEM & Web-Based SEM. The postulate is effective as the use of PLS-SEM provides us several advantages like dealing with small samples, lack of understanding about model specification or theoretical framework, etc (Wong, 2013). On the other side, PLS-SEM also used to highlight vibrant paths in the outer model along with the other forms of required & interrelated effects (Vijayabanu & Arunkumar, 2018).

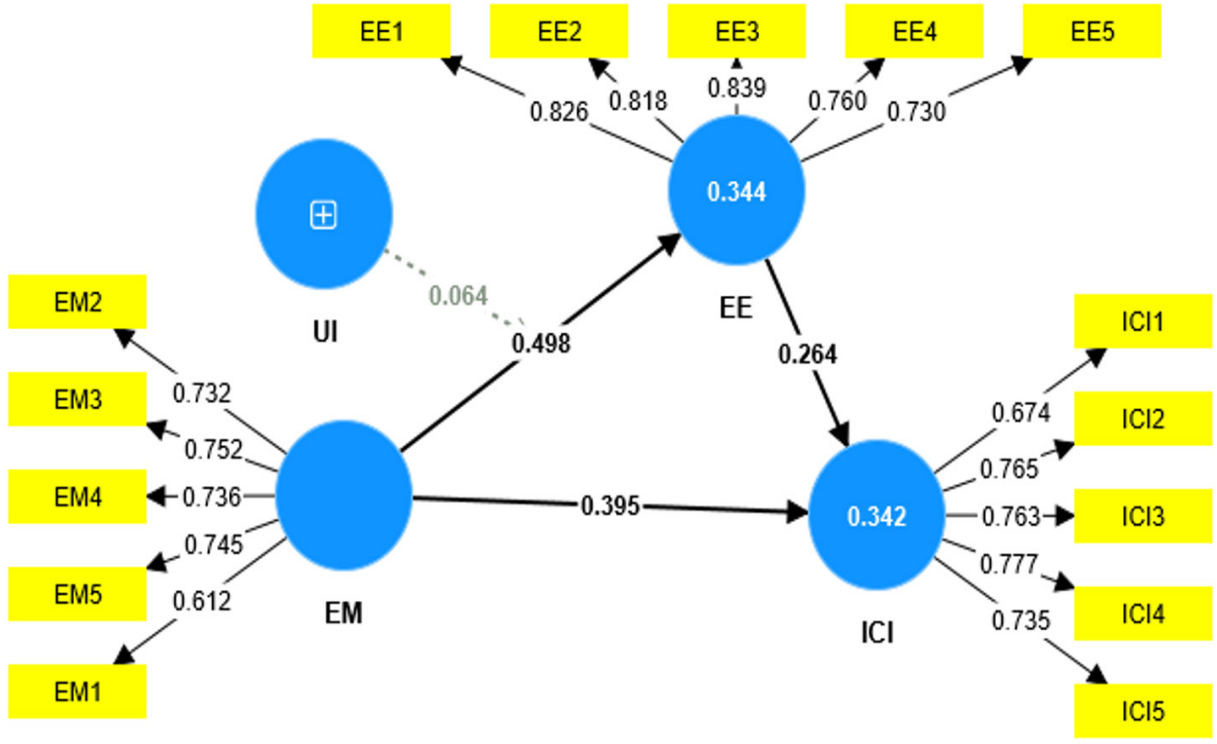

Figure 2. Outer Loading (CFA)

Figure 2 is embossed to indicate the reliability value for each of the indicators which are known as outer loading. The indicator is similar to factor loading & thus, potent to legitimize the use of indicators in the research process (Afthanorhan, 2013). Although no element with a value lesser than 0.6 must be retained and elements having values from 0.60 to 0.70 are permitted to be included in the model if the inclusion does not harm convergent criteria associated with the model (Sander & Teh, 2014). However, for the legitimate inclusion of an element, it must yield a value of 0.70 or above to reflect positively upon

International Journal of
Trends and Innovations in Business & Social Sciences
Vol. 2 No. 1 (March, 2024) | 15- 25

the overall research model (Sander & Teh, 2014). Hence on the bases of figure 3, no element may be eliminated from the model as every element has an outer loading of 0.70 or above except one in energy management (EM). Although the value of the EM1 is more than 0.60 and hence there is no need for deletion.

Table 1
Construct Reliability and Convergent Validity

Construct	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
EE	0.854	0.860	0.896	0.633
EM	0.764	0.774	0.841	0.515
ICI	0.798	0.804	0.861	0.553
UI	0.815	0.849	0.862	0.513

Table 1 is positioned to indicate construct reliability & convergent validity. According to Hair et al (2017), the combination of composite reliability and average variance extracted (AVE) is used to highlight convergent validity. Although AVE with values of 0.5 or above is sufficient to reflect convergent validity (Yaacob et al., 2021). On the other side Cronbach's Alpha, Goldstein rho & composite Reliability are also used to highlight construct reliability. According to Vijayabanu and Arunkumar (2018), the minimum acceptable value for Cronbach's alpha is 0.6 while the minimum value for Composite reliability is 0.7. However, Table 2 shows that the model does not have any issue with construct reliability & convergence as all the reliability indicators including composite reliability have values that are more than 0.60. On the other hand AVE for all the variables is also higher than 0.50 and hence legitimate to reflect that table 1 is also effective to reflect convergent validity.

Table 2
Discriminant Validity (HTMT-Ratio)

	EE	EM	ICI	UI	UI x EM
EE					
EM	0.675				
ICI	0.582	0.680			
UI	0.403	0.479	0.580		
UI x EM	0.069	0.087	0.056	0.058	

Table 2 is used to reflect discriminant validity. The tool used is known as Heterotrait-Monotrait Ratio which is perceived as best for determining discriminant validity. The maximum value that is legitimized to assure discriminant validity is 0.85 and above this value, no value can determine discriminant validity (Hair et al., 2017). Therefore, it is optimal to indicate that table 2 is effectively highlighting the discriminant validity as there is no value at any of the junctions that is equal to or greater than 0.85.

Table 3
Predictive Accuracy (Coefficient of Determination)

	R-square	R-square adjusted
EE	0.544	0.538
ICI	0.530	0.529

Table 3 is plotted to reflect quality criteria through predictive accuracy. That is termed as the coefficient of determination and with appropriate values, it is the measure of the appropriateness of structural and measurement models (Purwanto et al., 2020). Wong (2013), indicated that 0.25 is the lowest value that may assure predictive accuracy that is the change that 1% change in the predictor variable may bring to the outcome variable(s). However, greater values of the criteria are preferred as 0.75 is treated as substantial and 0.5 is moderate. Hence, table 3 it is valid to indicate that model has the predictive accuracy as the coefficient of determination is moderate for each of the cases tested for the model fitness.

International Journal of
Trends and Innovations in Business & Social Sciences
Vol. 2 No. 1 (March, 2024) | 15- 25

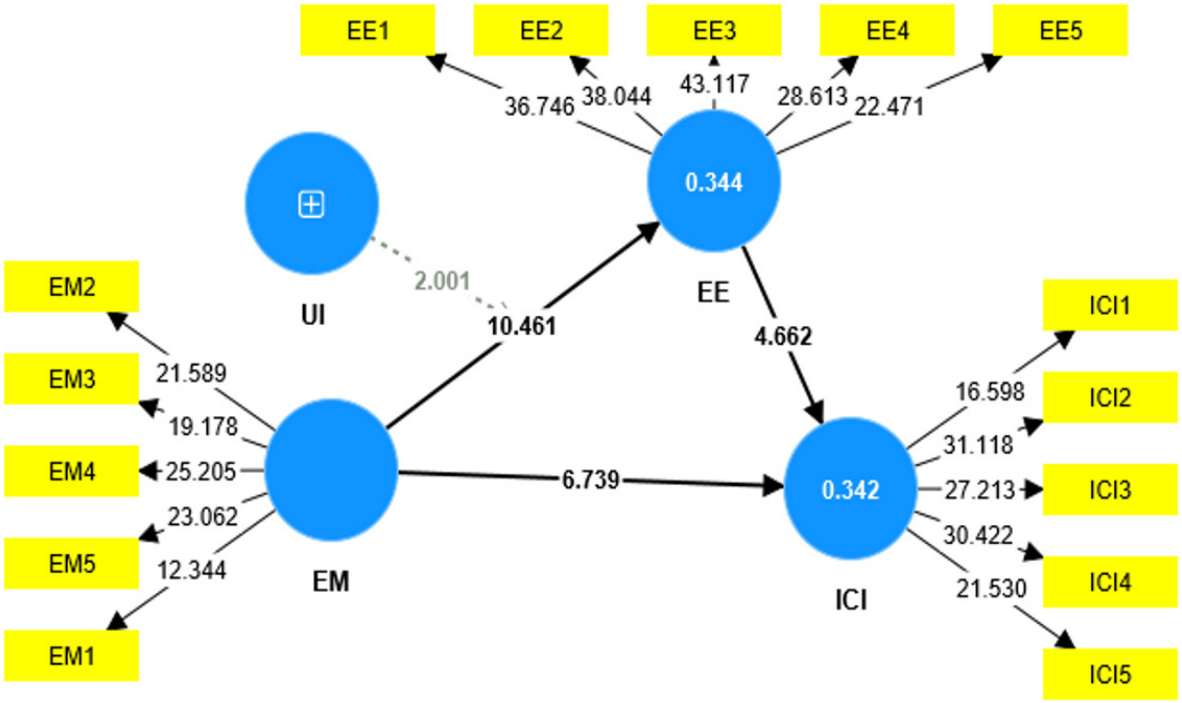

Figure 3. Path Coefficient

Table 4 and Figure 3 are used to indicate the path coefficient to reflect the impact of variables on each other. Along with table 3 and table 5, it is part of inferential statistics (Silaparasetti et al., 2017). Two major criteria need to be fulfilled for the legitimization of the impact of the variable, i.e., t-statistical value and p-value. The minimum value of t-stats that may reflect the impact is 1.97 and the maximum p-value that may assure the impact is 0.05 (Hair et al., 2017). Both of these criteria need to be fulfilled to ensure the impact of the variable over the other (Hair et al., 2017). Hence in light of Table 4 and Figure 4, it is optimal to reflect that there is a definite impact of energy management practices in SMEs on energy efficiency and energy efficiency over the improvement of the company's image.

Table 4
Path Coefficient

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
EE -> ICI	0.264	0.265	0.057	4.662	0.000
EM -> EE	0.498	0.499	0.048	10.461	0.000
EM -> ICI	0.395	0.398	0.059	6.739	0.000
UI -> EE	0.166	0.172	0.047	3.562	0.000
UI x EM -> EE	0.064	0.066	0.032	2.001	0.045

Table 5
Specific Indirect Effects

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
UI x EM -> EE -> ICI	0.017	0.018	0.009	1.799	0.072
EM -> EE -> ICI	0.131	0.133	0.032	4.070	0.000
UI -> EE -> ICI	0.044	0.046	0.018	2.466	0.014

Table 5 is also a form of path coefficient. The purpose is to reflect indirect effects that are specific indirect effects (mediation). However, the criteria for the assurance of impact is the same i.e., t-statistical value and p-value with the same brackets mentioned by Hair et al (2017). Hence, legitimate to declare that energy efficiency is an effective mediator for two relationships, i.e., in the relationship between energy management and improved company's image and the Internet of things and improved company's image.

Table 6
Hypotheses Assessment Summary

There is no relationship of energy management in SMEs and energy efficiency in the firm.	Rejected
There is no relationship between energy efficiency in SMEs on improved company's image	Rejected
Energy Efficiency does not mediate the relationship between energy management and improvement of company's image of SMEs.	Rejected
The Internet of things does not moderate the relationship of energy management practices in SMEs of Pakistan and energy efficiency	Rejected

CONCLUSION & DISCUSSION

The findings of the study highlighted that the management of SMEs is also inclined towards the use of energy management processes to attain energy efficiency. Therefore, the claims of Cagno et al (2019) and Shrouf and Miragliotta (2015), are found to be true that energy efficiency is well-known terminology and has several advantages. Moreover, energy management is also found to be a potent predictor of energy efficiency and therefore the study is consistent with Fernando and Hor (2017) and Lee (2015). Although according to the findings of the survey energy efficiency is found to be efficient for increasing of firm's goodwill and image, therefore findings are also consistent with Haiyun et al (2021); Fernando and Hor (2017) and Shrouf and Miragliotta (2015). Last but not least IoT is also found to be a potent moderator of energy management practices and energy efficiency in apparel sector SMEs. Thus, legitimate to reflect that findings of the study are also found to be parallel with Akhtar et al. (2020); Shrouf et al. (2014) and Shrouf and Miragliotta (2015).

Policy Implications

The findings of the study can motivate entrepreneurs as well as entrepreneurs to follow energy management practices. Therefore, considering these impacts governments may impose some sections on production sector SMEs to use renewable energy sources. Similar was reflected by Chen et al (2014) and Rafique and Rehman (2017). Moreover, through considering the study entrepreneurs from the apparel sector may also develop organizational policies to use renewable energy sources for energy management. This is also aligned with the indication of business models indicated by Amer and Daim (2010).

Area for Future Studies

This study is one of the initial ones that focus on the energy management system of SMEs for the apparel sector to trace the linkage between energy management practices and the improvement of the company's Image. Rear studies conducted on energy management practices with reference of South-East Asia. Thus the framework and methodology of this study may be used by other researchers to conduct further research on the non-energy benefits of the energy management process in the SME sector. Similarly, further studies might be conducted with the moderation of any other variable.

Competing Interests

The authors has declared that no competing interests exist.

References

Abbas, S. Z., Kousar, A., Razzaq, S., Saeed, A., Alam, M., & Mahmood, A. (2018). Energy management in South Asia. *Energy Strategy Reviews*, *21*, 25-34.

https://doi.org/10.1016/j.esr.2018.04.004

Adejumo, O. O. (2020). Environmental quality vs economic growth in a developing economy: complements or conflicts. *Environmental Science and Pollution Research*, *27*(6), 6163-6179.

https://doi.org/10.1007/s11356-019-07101-x

Afthanorhan, W. M. A. B. W. (2013). A comparison of partial least square structural equation modeling (PLS-SEM) and

covariance based structural equation modeling (CB-SEM) for confirmatory factor analysis. *International Journal of Engineering Science and Innovative Technology*, *2*(5), 198-205.

Ahmad, I., Arif, M. S., Cheema, I. I., Thollander, P., & Khan, M. A. (2020). Drivers and barriers for efficient energy management practices in energy-intensive industries: a case-study of iron and steel sector. *Sustainability*, *12*(18), 7703.

https://doi.org/10.3390/su12187703

Akhtar, T., Rehman, A. U., Jamil, M., & Gilani, S. O. (2020). Impact of an energy monitoring system on the energy efficiency of an automobile factory: A case study. *Energies*, *13*(10), 2577.

https://doi.org/10.3390/en13102577

Amer, M., & Daim, T. U. (2010). Application of technology roadmaps for renewable energy sector. *Technological Forecasting and Social Change*, *77*(8), 1355-1370.

https://doi.org/10.1016/j.techfore.2010.05.002

Assalahi, H. (2015). The philosophical foundations of educational research: A beginner's guide. *American Journal of Educational Research*, *3*(3), 312-317.

Cagno, E., Moschetta, D., & Trianni, A. (2019). Only non-energy benefits from the adoption of energy efficiency measures? A novel framework. *Journal of Cleaner Production*, *212*, 1319-1333.

https://doi.org/10.1016/j.jclepro.2018.12.049

Chen, W. M., Kim, H., & Yamaguchi, H. (2014). Renewable energy in eastern Asia: Renewable energy policy review and comparative SWOT analysis for promoting renewable energy in Japan, South Korea, and Taiwan. *Energy Policy*, *74*, 319-329.

https://doi.org/10.1016/j.enpol.2014.08.019

Clark, A. M. (1998). The qualitative-quantitative debate: moving from positivism and confrontation to post-positivism and reconciliation. *Journal of Advanced Nursing*, *27*(6), 1242-1249.

https://doi.org/10.1046/j.1365-2648.1998.00651.x

Fernando, Y., & Hor, W. L. (2017). Impacts of energy management practices on energy efficiency and carbon emissions reduction: a survey of Malaysian manufacturing firms. *Resources, Conservation and Recycling*, *126*, 62-73.

https://doi.org/10.1016/j.resconrec.2017.07.023

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., & Thiele, K. O. (2017). Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods. *Journal of the Academy of Marketing Science*, *45*, 616-632.

https://doi.org/10.1007/s11747-017-0517-x

Haiyun, C., Zhixiong, H., Yüksel, S., & Dinçer, H. (2021). Analysis of the innovation strategies for green supply chain management in the energy industry using the QFD-based hybrid interval valued intuitionistic fuzzy decision approach. *Renewable and Sustainable Energy Reviews*, *143*, 110844.

https://doi.org/10.1016/j.rser.2021.110844

Hasan, A. M., Tuhin, R. A., Ullah, M., Sakib, T. H., Thollander, P., & Trianni, A. (2021). A comprehensive investigation of energy management practices within energy intensive industries in Bangladesh. *Energy*, *232*, 120932.

https://doi.org/10.1016/j.energy.2021.120932

Klemke-Pitek, M., & Majchrzak, M. (2022). Pro-ecological activities and shaping the competitive advantage of small and medium-sized enterprises in the aspect of sustainable energy management. *Energies*, *15*(6), 2192.

https://doi.org/10.3390/en15062192

Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.

Lee, D., & Cheng, C. C. (2016). Energy savings by energy management systems: A review. *Renewable and Sustainable Energy Reviews*, *56*, 760-777.
https://doi.org/10.1016/j.rser.2015.11.067

Lee, K. H. (2015). Drivers and barriers to energy efficiency management for sustainable development. *Sustainable Development*, *23*(1), 16-25.
https://doi.org/10.1002/sd.1567

May, G., Barletta, I., Stahl, B., & Taisch, M. (2015). Energy management in production: A novel method to develop key performance indicators for improving energy efficiency. *Applied energy*, *149*, 46-61.
https://doi.org/10.1016/j.apenergy.2015.03.065

Naveed, M., Zia, M. Q., & Cangialosi, N. (2022). The nexus of job resources and turnover intentions with the mediating role of employees' work engagement in the hospitality industry. *Consumer Behavior in Tourism and Hospitality*, *17*(3), 282-296.
https://doi.org/10.1108/CBTH-09-2021-0217

Nehler, T., & Rasmussen, J. (2016). How do firms consider non-energy benefits? Empirical findings on energy-efficiency investments in Swedish industry. *Journal of Cleaner Production*, *113*, 472-482.
https://doi.org/10.1016/j.jclepro.2015.11.070

Onwuegbuzie, A. J., & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International Journal of Social Research Methodology*, *8*(5), 375-387.
https://doi.org/10.1080/13645570500402447

Purwania, I. B. G., Kumara, I. N. S., & Sudarma, M. (2020). Application of IoT-Based System for Monitoring Energy Consumption. *International Journal of Engineering and Emerging Technology*, *5*(2), 81-93.

Purwanto, A., Asbari, M., Santoso, T. I., Paramarta, V., & Sunarsi, D. (2020). Social and Management Research Quantitative Analysis for Medium Sample: Comparing of Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS. *Jurnal Ilmiah Ilmu Administrasi Publik: Jurnal Pemikiran dan Penelitian Administrasi Publik*, *9*(2), 518-532.

Pusnik, M., Al-Mansour, F., Sucic, B., & Gubina, A. F. (2016). Gap analysis of industrial energy management systems in Slovenia. *Energy*, *108*, 41-49.
https://doi.org/10.1016/j.energy.2015.10.141

Qamar Zia, M., Naveed, M., Iqbal, A., & Ghauri, S. (2022). Predictors and outcomes of self-directed development: an investigation of individual and contextual factors. *International Journal of Training Research*, *20*(3), 195-214.
https://doi.org/10.1080/14480220.2021.1991834

Rafique, M. M., & Rehman, S. (2017). National energy scenario of Pakistan–Current status, future alternatives, and institutional infrastructure: An overview. *Renewable and Sustainable Energy Reviews*, *69*, 156-167.
https://doi.org/10.1016/j.rser.2016.11.057

Sajjad, A., Ahmad, W., Hussain, S., Chuddher, B. A., Sajid, M., Jahanjaib, M., ... & Jawad, M. (2023). Assessment by Lean Modified Manufacturing Maturity Model for Industry 4.0: A Case Study of Pakistan's Manufacturing Sector. *IEEE Transactions on Engineering Management*.
https://doi.org/10.1109/TEM.2023.3259005

Salahuddin, M., & Gow, J. (2019). Effects of energy consumption and economic growth on environmental quality: evidence from Qatar. *Environmental Science and Pollution Research*, *26*, 18124-18142.
https://doi.org/10.1007/s11356-019-05188-w

Sander, T., & Teh, P. L. (2014). SmartPLS for the human resources field to evaluate a model. *In proceedings of New Challenges of Economic and Business Development*. Riga, University of Latvia.

Saunders, M., Lewis, P. & Thornhill, A. (2007). Research methods. *Business Students 4th edition Pearson Education Limited, England*, 1-268.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach*. John Wiley & sons.

Shrouf, F., & Miragliotta, G. (2015). Energy management based on Internet of Things: practices and framework for adoption in production management. *Journal of Cleaner Production*, *100*, 235-246.
https://doi.org/10.1016/j.jclepro.2015.03.055

Shrouf, F., Ordieres, J., & Miragliotta, G. (2014, December). Smart factories in Industry 4.0: A review of the concept and of energy management approached in production based on the Internet of Things paradigm. In *2014 IEEE international conference on industrial engineering and engineering management* (pp. 697-701). IEEE.
https://doi.org/10.1109/IEEM.2014.7058728

Silaparasetti, V., Rao, G. V. R., & Khan, F. R. (2017). Structural equation modeling analysis using smart pls to assess the occupational health and safety (OHS) factors on workers' behavior. *Humanities & Social Science Reviews, eISSN*, 2395-7654.

Sola, A. V., & Mota, C. M. (2020). Influencing factors on energy management in industries. *Journal of Cleaner Production*, *248*, 119263.
https://doi.org/10.1016/j.jclepro.2019.119263

Syed, M., & McLean, K. C. (2022). Disentangling paradigm and method can help bring qualitative research to post-positivist psychology and address the generalizability crisis. *Behavioral and Brain Sciences*, *45*, e32.
https://doi.org/10.1017/S0140525X21000431

Vijayabanu, C., & Arunkumar, S. (2018). Strengthening the team performance through personality and emotional intelligence: Smart PLS approach. *Scientific Annals of Economics and Business*, *65*(3), 303-316.

Wong, K. K. K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin*, *24*(1), 1-32.

Yaacob, N. A., Ab Latif, Z., Mutalib, A. A., & Ismail, Z. (2021). Farmers' intention in applying food waste as fertilizer: Reliability and validity using Smart-PLS. *Asian Journal of Vocational Education and Humanities*, *2*(2), 27-34.
https://doi.org/10.53797/ajvah.v2i2.5.2021

Zhang, B., Wang, Z., & Lai, K. H. (2015). Mediating effect of managers' environmental concern: Bridge between external pressures and firms' practices of energy conservation in China. *Journal of Environmental Psychology*, *43*, 203-215.
https://doi.org/10.1016/j.jenvp.2015.07.002

Zia, M. Q., Decius, J., Naveed, M., Ahmed, S., & Ghauri, S. (2023). Committed, healthy, and engaged? Linking servant leadership and adaptive performance through sequential mediation by job Embeddedness and burnout. *Journal of Leadership & Organizational Studies*, *30*(3), 327-340.
https://doi.org/10.1177/15480518231158861

Žukauskas, P., Vveinhardt, J., & Andriukaitienė, R. (2018). Philosophy and paradigm of scientific research. *Management Culture and Corporate Social Responsibility*, *121*(13), 506-518.
https://doi.org/10.5772/intechopen.70628