

Research title

**"The Impact of Sustainable Facilities Management Practices
on Energy Efficiency in the Saudi Electricity Company
(SEC)"**

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Summary

This research paper explores the impact of sustainable facilities management (SFM) practices on energy efficiency within the Saudi Electricity Company (SEC). Through applying ten specific components comprehensively the rules of energy-efficient systems, the involvement of employees in sustainability issues, and environmental resource management, the impact of SFM practice on the energy consumption, and operating costs of a large energy provider are specified. Employing a parallel collective research design, the study employs and integrates structured questionnaires and semi-structured questionnaires with SEC employees, management and other stakeholders to determine the prevalence and efficiency of current sustainable practices among the company. This study employs theoretical underpinnings of the Triple Bottom Line, Resource-Based Theory and Stakeholder Theory, energy efficiency models such as ISO 50001 and Building Energy Management Systems, in watching the sustainability programs of SEC operationally, organizationally, economically and environmentally.

It is believed that the information derived from this study shall benefit both theoretical and practical domains the SEC and firms in the energy industry shall be of particular interest. The study adopts a rigorous approach of how SFM practices affect the level of energy efficiency through data analysis using statistical analysis tools where Spas is used as a statistical analysis and thematic analysis where NVivo analysis is employed. The study will help to make suggestions of how facilities management should be made more sustainable with reference to the fact that this will help organizations to save money while at the same time protecting the environment. In conclusion, this paper not only responds to the important research question for SEC but also helps policymakers formulate evidence-based suggestions that may, and should, promote sustainable development in the whole Saudi energy sector in line with Vision 2030.

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1. Introduction

1.1 Background

In recent years, sustainable facilities management (SFM) has emerged as a pivotal practice within modern organizations, particularly as the global push for environmental responsibility intensifies. The concept of facilities management has tended to revolve around the management of the physical plant and the operation services provided in a building. Nevertheless, escalating concern with the environment and sustainable processes like climate change, the scarcity of resources, and energy inefficient in consumption made the management of facilities more inclusive of sustainable objectives (Elmualim et al., 2019). SFM as a discipline incorporates principles of sustainability into the effective management of properties with an overall goal of minimizing environmental impacts and addressing issues to do with emissions, energy use, and utilization of resources.

Sustainable facilities management goes a step further of adopting an energy efficient equipment or efficient use of water; it also includes methods that anticipate problems such as routine checkup, environmentally sensitive purchases, and encouraging staff to participate in sustainable practices (Wang et al., 2021). All of these plans help in minimizing effects on the environment, improving indoor environment quality and creating sustainability within the company. Sustainable financial management has emerged as crucial in the corporate world that organizations strive to meet requirements on legal compliance, improvement of organizational image and addressing increased demands from environmentally conscientious customers as well as other stakeholders (Rezaee & Khan, 2020).

1.2 Context of the Study

The Saudi Electricity Company (SEC) stands as one of the most critical entities within Saudi Arabia's energy sector. Given the country's climate and economic dependence on

energy resources, SEC plays a fundamental role in ensuring the sustainable development of Saudi Arabia's infrastructure (Al-Zahrani & Bashir, 2021). The challenges that energy sector in Saudi Arabia has include high levels of both energy consumption and imports, with a contribution to carbon emission and degradation of environment due to an over-reliance on fossil energy source. In response to these problems, sustainability has been embraced in the Kingdom of Saudi Arabia through the Vision 2030 plan, which has laid out the goal of decreasing the redundancy of the Kingdom on oil and encourage energy management across sectors (Saudi Vision 2030, 2023).

1.3 Problem Statement

The primary problem this research seeks to address is the impact of sustainable facilities management practices on energy efficiency within the Saudi Electricity Company. SEC is a dominant industry player in Saudi Arabia, and the analysis of sustainable FM initiatives is particularly relevant due to its rising significance regarding energy efficiency, but prior research focusing on sustainable facilities management's impact on energy outcomes within SEC is scarce. Due to the current facilities management practices in place, energy remediation for SEC's current developments could otherwise be inefficient, leading to unmanageable energy wastage, operational dysfunctionality (Al-Shehri & Al-Mutairi, 2022).

Thus, the research problem can be defined as follows: The third research question addresses the question on the effects that sustainable facilities management practice has on the energy situation of the Saudi Electricity Company. It is necessary to address this issue because the realized problem will not only offer SEC the recommendations for enhancing its organizational productivity but also contribute to the attainment of the national goals stated in Saudi Vision 2030. In this regard, the present research will fill the existing knowledge gap in the context of sustainable facilities management in SEC and contribute pertinent evidence-based recommendations that could facilitate the

company to move forward towards more sustainable facilities management.

1.4 Purpose of the Study

The main purpose of this study is to analyze the impact of sustainable facilities management practices on energy efficiency within the Saudi Electricity Company. It is therefore with a view to establishing how some of these SFM practices tie to energy conservation that this research will seek to offer SEC practical recommendations in enhancing its manner of energy management. For this purpose, this study is quite relevant as SEC is expected to integrate Saudi Arabia's Vision 2030 sustainability objectives, which call for replacing the country's old, power-intensive ways with modern, sustainable approaches (Saudi Vision 2030, 2023).

This study seeks to address the following research objectives:

- To identify the sustainable facilities management practices currently implemented by SEC.
- To assess the impact of these practices on energy efficiency within SEC's facilities.
- To propose recommendations that could further enhance SEC's energy efficiency through sustainable facilities management.

2. Problem of the Study

2.1 Identification of the Problem

The Saudi Electricity Company (SEC) plays a pivotal role in Saudi Arabia's energy sector, managing a vast infrastructure network to generate, transmit, and distribute electricity across the country (Al-Zahrani & Bashir, 2021). However, this has remained a great challenge to SEC in energy efficiency and sustainability. This is so because the company has its operations anchored on fossil fueled energy sources, which causes both

greenhouse gas emissions and increased energy use. Nevertheless, the global challenges of energy saving and environmental concerns, SEC energy practices and structures of production are still in their traditional patterns, where only a few sustainable facilities managements have been implemented (Alyami et al., 2020).

Another critical issue that relates to SEC is the issue of high cost resulting from inefficiency in energy consumption for any energy-intensive process results in a higher cost of energy and extension. This is even more so given the fluctuating global energy prices and ever rising expenses that energy companies have to cut down on their costs (Wang et al., 2021). In addition, the company's facilities fail to incorporate innovative technologies that can minimize the use of fossil fuel and maximize the use of renewable power and smart grid (Rezaee & Khan, 2020).

2.2 Justification

The significance of addressing energy efficiency and sustainable facilities management within SEC cannot be overstated. First, being one of the largest providers of electricity in a country with one of the highest levels of energy consumption per capita, SEC's business sustainability has important implications for both the company itself and the overall energy industry. Positive energy performance at SEC means significant mandatory costs reduction, which have a direct impact on the organization's profits and the national economy as a whole.

In addition, social responsibilities with the particular focus on environmental disclosure is one of the major concerns because SEC's generating capacity results in high carbon footprint of the country. Saudi Arabian Vision 2030 has laid down goals to tackle environmental protection such as return on carbon emission and rising of energy productivity in numerous industry types (Saudi Vision 2030, 2023). If energy efficiency is not managed properly, it presents a likelihood to be met with regulatory issues and potentially harm brand image, as stakeholders raise the bar on holding companies accountable to embrace environmental sustainability (Rezaee & Khan, 2020).

2.3 Research Gap

While there is a growing body of research on sustainable facilities management and energy efficiency, significant gaps remain, particularly concerning large energy providers in the Middle East such as SEC. Previous research on sustainable FM has been mainly in precincts such as healthcare, education and commercial property (Elmualim et al., 2019; Abbas & Asghar, 2019). In these studies, emphasis is made on how sustainable practices affect energy use, waste management and the costs of running a building.

Additionally, although there is a vast amount of literature employing energy efficiency, the challenges that companies in the Middle East face is poorly investigated unlike in other parts of the world (Alyami et al., 2020). For instance, due to the high temperature and humidity level in Saudi Arabia it is difficult to save energy, energy resources are under pressure because of the high standardized temperature.

3. Importance of Study

3.1 Academic Significance

The research on sustainable facilities management (SFM) practices and their impact on energy efficiency in large utility companies like the Saudi Electricity Company (SEC) offers substantial contributions to academic literature. Currently, SFM concerns are receiving increasing attention in the academic community because, inter alia, the method contributes to the minimization of operational costs and the negative impact on the environment through efficient resource management (Wang et al., 2021). Therefore, this study links the existing literature by exploring sustainable practices within a high-consumption, infrastructure-driven organization like SEC, especially in high-impact industries (Al-Shehri Al-Mutairi, 2022).

3.2 Practical Significance

The practical significance of this research lies in its potential to offer actionable insights that can directly benefit SEC. The overall adoption of sustainable FM practices saves operational costs since lower electrical usage is achieved directly resulting in financial saving for the organization (Jones et al., 2020). This is especially so with SEC, which has large erection complexes, power generating plants and many administrative buildings which have high energy demand.

3.3 Policy Implications

This study holds important implications for policymakers in Saudi Arabia's energy sector, particularly those focused on environmental protection and sustainability. Since Saudi Arabia is moving towards sustainable and diversified economy as highlighted in Vision 2030, the implications derived from this study are expected to offer an evidence base to the policy makers and key large energy companies on the advantage of sustainable facilities management practices. The explained positive result of SFM on energy efficiency in the SEC may encourage the SOP to think of establishing benchmark or code of practice for sustainable practices in facilities management so that energy firms will be in conformity with the country's green strategy (Al-Zahrani & Bashir, 2021).

4. Objectives of the Study

4.1 Primary Objective

The main research purpose of this research study is to assess the effects of sustainable facilities management on energy conservation within the Saudi Electricity Company. Specifically, this study aims at offering SEC major key findings on how it could improve its energy conservation efforts by understanding how practices adopted under SFM affect energy usage to an organization. The primary purpose lies in identifying the

correlation between SFM activities and energy savings to present the best practices to SEC.

4.2 Secondary Objectives

To achieve the primary objective, the research will also pursue several secondary objectives, each aimed at providing a detailed understanding of sustainable practices within SEC and their effects on energy efficiency:

- **To Identify Key Sustainable Practices Currently Implemented by SEC**

This objective assumes the identification and assessment of the sustainable facilities management practices that are already in practice in SEC. Sustainable practices include efficient lighting systems, efficient use of water, efficient waste management systems, and the use of renewable energy sources.

- **To Assess How These Practices Affect Energy Consumption and Efficiency**

The second secondary objective relates to assessment of actual utilization features of sustainable facilities management practices on energy consumption by SEC. Each of these entails measure the energy-conservation obtained by current SFM practices and evaluate the efficiency of these measures in operations.

- **To Propose Recommendations for Enhancing Energy Efficiency Through Sustainable Management Practices**

Regarding the findings of the previous objective, the third secondary objective is to make practical suggestions for stakeholders at SEC. The following recommendations will be on measures to build on the recommendations to improve energy efficiency through effective facilities management.

5. Research Questions

This study is guided by a central question and several sub-questions aimed at exploring the relationship between sustainable facilities management (SFM) practices and energy

efficiency within the Saudi Electricity Company (SEC).

How do sustainable facilities management practices impact energy efficiency in SEC?

This question seeks to understand the extent to which SEC's current SFM practices influence its overall energy consumption and operational efficiency, contributing to the company's alignment with Saudi Vision 2030's sustainability objectives (Saudi Vision 2030, 2023).

Sub-questions:

1. *What sustainable practices are currently implemented at SEC?*
2. *What is the relationship between these practices and energy consumption?*
3. *How can SEC further improve its energy efficiency through sustainable facilities management?*

6. Hypotheses of the Study

In studying the impact of sustainable facilities management (SFM) practices on energy efficiency within the Saudi Electricity Company (SEC), this research tests three hypotheses designed to assess different dimensions of sustainability. All the hypotheses are relevant to the main issues of SEC's operational and organizational processes and relate to higher sustainability goals.

Hypothesis 1:

Sustainable facilities management practices are positively correlated with energy efficiency in SEC.

This hypothesis explores the core premise of the study: that the adoption of SFM practices within SEC contribute positively to energy efficiency outcomes. Measures in sustainable FM include energy-efficient technology like lighting, heating, and cooling along with waste minimization which are known to reduce energy utilization, as pointed

out by Jones et al., (2020). Consequently, through the act of testing this hypothesis, the study hopes to pin the exact proportion of impact that SEC's SFM endeavors have on terms of energy consumption with proof on whether such practice leads to the general or specific conservation of energy, or cost reduction.

Hypothesis 2:

Implementing additional sustainable practices will lead to measurable reductions in energy consumption.

Beyond assessing the current SFM practices, this hypothesis evaluates the potential impact of further sustainable initiatives within SEC. The introduction of other sustainable practices like renewable energy, automated energy management systems, and green building standards is further expected to result in a significant decrease in the usage of energy by the SEC. This thesis is founded on investigations showing that deepening sustainability standards usually enhances energy efficacy when SFM is broadened (Alyami et al., 2020).

Hypothesis 3:

Employee awareness and involvement in sustainable practices positively impact energy efficiency outcomes.

The role of employees in implementing sustainable practices is a vital yet often overlooked factor in facilities management. Engagement by the employees could complement SFM practices through more restraining conduct changes involving energy conservation and sustainability compliance (Rezaee & Khan, 2020). According to the findings of different scholars, where employees partake in the implementation of sustainability program, better habits of energy conservation will be promoted hence enhancing the organizational efficiency (Wang et al., 2021).

7. Literature Review

Overview of Sustainable Facilities Management

Sustainable facilities management (SFM) is a holistic approach to managing the operations, maintenance, and infrastructure of facilities with a strong focus on environmental stewardship, resource efficiency, and social responsibility (Elmualim et al., 2019). SFM is not limited to a familiar concept of facilities management that is generally associated with the care for a building and its functionality. Rather, SFM incorporates measures that help to minimize adverse effects on environment; also, optimizes use of available resources to extend usage cycle in harmony with world environment day goals (Jones et al., 2020).

SFM enlists five basic concepts that are; energy, water, waste, indoor environmental quality, and the use of sustainable materials and green power (Wang et al., 2021). Some of these principles are practiced through using energy efficient appliances in lighting, heating and air conditioning, recycling of waste, measuring of water usage, and enhancing the standards of Ventilation and indoor air quality. Furthermore, it entails the application life cycle management practices for the acquisition of facility assets, use in construction projects, and the disposal cycle that reduces the ecological aspect of infrastructure during its life cycle (Rezaee & Khan, 2020).

Sustainable Facilities Management in the Energy Sector

The energy sector, due to its high energy consumption and environmental impact, has a crucial role in adopting sustainable practices. Research in this sector underscores the importance of SFM for reducing emissions, conserving resources, and supporting long-term operational efficiency (Al-Zahrani & Bashir, 2021). There are certain strategies in energy companies that cater towards sustainable facilities management, including integration of renewables heating and cooling systems, and improvement of energy management systems (Jones, Viegas, & Turner, 2020). These habits are necessary for energy firms to optimize their yield with limited impact on their natural surroundings

and meet global sustainability goals.

For instance, Alyami and Rezgui (2019) showed that applying SFM in energy firms led to low energy use and operation costs. The study supported sustainable procurement, waste management, as well as renewable energy integration, to the overall energy efficiency. Yahaya Abdullah and colleagues added that studies have also shown that ‘multiple volumes revealed that Companies adopting SFM practices in the energy sector have enhanced corporate compliance and operational environmental risk’. These studies justified the adoption of SFM by the energy companies particularly in areas where absorption of environmental standards and expectations is intense.

Impact of Sustainable Practices on Energy Efficiency

The impact of sustainable facilities management practices on energy efficiency has been widely documented in the literature, with studies showing that SFM practices can significantly reduce energy consumption and improve overall operational efficiency (Al-Shehri & Al-Mutairi, 2022). Measures including efficient lighting, integration of renewable energy sources, and energy control systems are a consequence of energy savings because they minimize energy use (Jones et al., 2020). They help organizations to cut their costs, emissions, and thus improve their sustainability performances.

Literature proves that implementing efficient energy practices within facilities management saves energy by 25-30 % as shown in many sample studies of different sectors (Elmualim et al., 2019). For example, Abbas and Asghar (2019) were able to establish that organizations that use energy saving innovations in their edifice witnessed significant change in terms of energy consumption and great financial gains. In addition, Alyami et al., (2020) concluded that the implication of renewable energy sources in facilities management not only helps in the management of non-renewable resources but also in the achievement of sustainable energy security in the long run.

Studies on SEC or Similar Companies

While specific studies on the Saudi Electricity Company (SEC) are limited, research on

similar energy companies provides valuable insights into the potential benefits of SFM for SEC. For example, Al-Shehri and Al-Mutairi, (2022) ‘Sustainable Facilities Management, Energy Companies: Middle East’, discussed here covers the limitations and prospects of applying eco-friendly measures in energy firms, participating in the Middle Eastern market. The research showed that although many energy companies in the area have limitations including high initial costs and technological limitations, companies that engage in SFM practice have improved energy efficiency and less negative consequences on the environment.

Other work done by Alyami, Rezgui, and Dawood (2020), identified the key barriers to the implementation of sustainable facilities management practices in a large Middle Eastern energy company. The results established those effective ecological initiatives like energy effective structures, proper disposal and recycling of waste, and training of employees regarding environmental legislation lowered energy use and made it liable to legislative instruments. These findings are useful for SEC since they suggest the effect that may be exerted by SFM on energy efficiency in a related organizational setting.

Research Gaps and Limitations

Despite the growing body of literature on sustainable facilities management, several research gaps remain, particularly concerning large utility companies in the Middle East like SEC. Previous research regarding better SFM pay significantly more attention to developed countries, in which institutional framework and technological readiness promote sustainable efficiency (Alyami et al., 2020). However, the existing literature on SFM concerns in the Middle East is quite scarce and there is a pivotal trending that tries to focus on the local variables that impound the Middle Eastern firms including scarcity of resources, climatic condition and dependence of most companies on fossil fuel (Al-Zahrani and Bashir, 2021).

Also, little discussion can be found in the current literature and scholarly publications on the organizational and cultures aspects of SFM, though much are focused on

materialistic elements of SFM including efficient techniques of using energy, employing energy generators among other things. For large organizations such as SEC, it means that SFM practices are sequentially implemented and practicing a new culture within the organization where employees are forced to engage themselves in practicing sustainable aspects (Wang et al., 2021). This research gap points to the need to conduct research to investigate streams and aspects in human and organizational context as they affect SFM since understanding impacts this stream and its aspects in the realization of sustainable results in facilities management.

Finally, while there is substantial evidence of the environmental benefits of SFM, studies on its economic implications in the energy sector are limited. The lack of clearly defined cost savings and return on investment generated from the adoption of SFM practices in large energy organizations means that there is a dearth of literature relating empirical evidence of tangible financial benefit to adopting organizations or by firms engaged in sustainable facilities management in large energy companies. This study therefore seeks to fill the above research gaps to provide a rich understanding of how SFM can impact on energy efficiency in the Saudi Electricity Company, thus providing pointers that possibly may be useful to the Saudi Electricity Company and other energy organization in the selection of appropriate mechanisms of SFM.

8. Theoretical Framework

8.1 Theories on Sustainable Management

Sustainable facilities management (SFM) is underpinned by several key theories in sustainable management, which emphasize the integration of economic, environmental, and social goals within organizational practices. The most quoted theory is the three return model by John Elkington that expands the concept of corporate value creation concerns beyond the financial, into the social and environmental realms (Elkington, 2018). Based on this analysis, the TBL framework has it that organizations should aim

at attaining people, planet and profit objectives as they work towards balancing the economic, social and natural capitalism.

Resource Based Theory (RBT) also has a big impact in establishing sustainable management strategies within facilities management. RBT was formulated by Barney (1991) asserts that the ability of an organization to create competitive advantage arises from resources that are rare, valuable, and inimitable. Hart (2020) RBT posited that facilities you can only become strategic assets, and consequently enhance their efficiency as well as decrease various operational costs if they are managed sustainably.

8.2 Energy Efficiency Models

In addition to sustainable management theories, specific energy efficiency models provide a structured approach for analyzing and improving energy use within facilities. Another outstanding model in this category is the Energy Star Portfolio Manager created by the U.S. Environmental Protection Agency (EPA) that allows collecting and monitor energy performance of buildings (Energy Star, 2021). Such a model is useful to the facilities managers as it provides a basis for assessing energy consumption, sign of inefficiency and the ability to make necessary enhancement to do better in energy management.

Another important model of energy efficiency is the ISO 50001 Energy Management System (EnMS), which is another body of knowledge that provides systematic procedure for the formulation, implementation and continual improvement of energy management (ISO, 2022). ISO 50001 is based on the spirit of the constant enhancement from energy performance that gets promoted by the system based on true measurements and the practices and guidelines of energy management. EnMS enables formulation of energy performance plans and goals, evaluation of organizational energy performance, and identification of reasons for nonconformance and subsequent implementation of corrections.

9. Methodology and Research Methods

The methodology of this study is designed to provide a structured approach for examining the impact of sustainable facilities management (SFM) practices on energy efficiency within the Saudi Electricity Company (SEC).

9.1 Research Design

This study adopts a **mixed-methods research design** that combines both qualitative and quantitative approaches. Quantitative data only strategies may not help understand the nuanced way in which SFM practices affect energy efficiency, therefore the use of mixed methods is preferable as this method is useful for incorporating both numerical data and textual commentary (Creswell & Creswell, 2018). The first study brings context and adds volunteer reports of the experiences with sustainability initiatives as well as managers' interpretations of the role of these initiatives to the survey results obtained in the second study, which focuses on assessing energy efficiency improvements and trends as applicable across SEC.

As a result, this research can also be described as a case study of SEC, although it is branded with the mantle of Action Research due to the reality-based practice approach employed in its course. The case study approach is relevant because it makes it possible to analyze the general aspects and the specific peculiarities of SEC's activity related to the implementation of SFM as well as reveal the company's organizational culture and any potential problems in its functioning. Yin focused on case studies of the analyzed phenomenon, which are appropriate for conducting research on complex objects within their natural environment; therefore, the application of this approach for SEC's evaluation of sustainable practices in Saudi Arabia's energy sector.

9.2 Data Collection Methods

To collect robust and comprehensive data, this study will utilize multiple data collection methods, including **surveys, semi-structured interviews, and document analysis**.

1. **Surveys:** Self-administered questionnaires would be administered to a large population of employees from the SEC comprising of facilities managers, operational, and sustainability officers. Closed-ended questions will be used in the survey to measure awareness of sustainable practice by employees, perceived efficiency of these practices, and degree of energy efficient improvement. This means will enable quantity data to be gathered, which will help in analysis of the statistical relation that exists with the various trends and patterns concerning SFM in SEC.
2. **Semi-Structured Interviews:** To draw further information, face-to-face interviews with semi structured questions will be administered to the SEC management, the heads of departments and the staff of facilities management. The use of interviews will be most effective in analyzing the participants' perceptions about the prospects and problems of practicing the principles of sustainable forest management as well as the implications of organizational and cultural environments for the implementation of such practices. The use of open-ended questions will help the researchers get qualitative data that will add onto the survey data collected (Kvale & Brinkmann, 2015).
3. **Document Analysis:** Thus, SEC documents on sustainability reports, energy consumption rate, and guidelines of the management of facilities will be used to determine the best practice of SFM and their compatibility with the industry standard. Document analysis can be used as a means that will back up survey and interview data sources and provide the external, third-party view of SEC's activity in the context of sustainability (Bowen, 2009).

9.3 Sampling

The sampling strategy for this study will employ a **purposive sampling approach**, focusing on individuals within SEC who are directly involved in or affected by facilities management and sustainability initiatives. The sample will consist of three main groups:

1. **SEC Employees:** The targeted population will include employees who work in areas of facilities management, sustainability, and operation will be asked questions regarding their knowledge and attitude towards SFM practices. It is the simplest group through which one can determine how sustainable practices are incorporated into daily practice and how it affects energy use.
2. **Management:** Erp interviews will also be relevant with district and facility senior managers and department heads concerning the management decisions on facilities and sustainability. Their perceptions will bring an organizational view on how much SEC regards sustainability and what value is attached to SFM practices.
3. **Stakeholders:** Further interviews will extend to other actors that perform activities in the frame of their partnership with SEC concerning EE and SM, for instance, governmental agencies or consultants. This group will provide an outside in perspective to the various activities that SEC is implementing, and how they are being received within the energy industry.

9.4 Data Analysis Methods

The study will employ both **statistical analysis** for quantitative data and **thematic analysis** for qualitative data to interpret the findings effectively.

1. **Statistical Analysis:** In general survey data will be quantified and analyzed in the form of frequency distributions, percentages, averages and correlation coefficients as well as testing the hypotheses related to energy efficiency and SFM practices. Specifically, the gathered survey data shall be inputted and processed by statistical software like SPSS or Excel and facilitation of quantitative result interpretation (Field, 2017).
2. **Thematic Analysis:** Interview data and data from documents shall be analyzed using thematic analysis, where patterns called themes are identified, analyzed and reported. The present analysis will employ Braun and Clarke's (2006) suggested six steps which are: data familiarization, initial code generation, identifying themes,

re-examining the themes, defining and naming the themes and lastly; report writing. Qualitative content analysis is an appropriate approach for analyzing participants' perceptions of various aspects of SFM practice, and emerging themes related to energy efficiency, barriers and culture (Braun & Clarke, 2006).

10. Study Tools

10.1 Data Collection Tools

To gather comprehensive and reliable data, this study will employ several data collection tools that align with both qualitative and quantitative research methods. Questionnaire will be the most used qualitative instrument for data collection from a diverse pool of Saudi Electricity Company (SEC) employee's regarding the SFM and its effects on energy savings. It shall be administered using closed-ended, structured questions which address probed measurement of Awareness, Practice and Perceived Outcomes about SFM as per Bryman (2016). This folded structure is useful to collect consistent answers suitable for statistical analysis and gives an opportunity to compare different subgroups of SEC respondents.

10.2 Reliability and Validity

Ensuring the reliability and validity of the study tools is essential for producing credible and reproducible results. **Reliability** is on the ability of the study tools to be consistent, to ensure this the survey will be pre-tested among a sample of SEC employees. This test will enable one to notice any confusion that may arise from questions so that the response should be in consonance with other respondents (Creswell & Creswell, 2018). In the same manner, interview protocols will be regulated to eliminate interviewer prejudice; hence, the same questions will be posed to the participant for comparison.

11. Study Boundaries

The scope of this study is defined in terms of time, location, and sample. The research will focus on data collected within a specific timeframe of six months to ensure relevance and timely analysis. The study is restricted to the facilities of Saudi Electricity Company throughout its operating regions in KSA. This focus on SEC facilities is meant to identify trends in SFM practice in an organization with high environmental footprint and energy usage for compliance with the sustainability principles enshrined in the Saudi Vision 2030 (Saudi Vision 2030, 2023).

For this study, the following limitations should be noted with the intention of achieving the goal of understanding the association of SFM practices and energy efficiency. Data may be blocked because many documents belong to the SEC and energy consumption statistics are considered confidential and belong to individual organizations. As a result, the study may be built on data accessible to the public or data that is generic which may not afford real and accurate depiction of operation details (Bryman, 2016).

Following the Delimitations section of this research, specific delimitations of this study are defined as intentional limitations set by the researcher. First, the study lays its findings in the context of the Saudi Electricity Company, and I tried not to generalize the findings to the whole energy sector in Saudi Arabia. This choice is attributed to the fact that SEC is a critical energy company in the nation and supports Saud Vision 2030 program that seeks to embrace sustainability when developing national infrastructure and energy sectors (Saudi Vision 2030, 2023).

Thus, the boundaries of the study, scope/limits, and delimitations of the research, are defined to formulate the research framework and keep the focus of the study. These boundaries also help to delimit the study to make it realistic, pertinent and feasible in terms of providing a useful understanding of how sustainable facility management can influence energy efficiency in the case of SEC as a large energy company.

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