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Enhancing Energy-Saving Efficiency in Light of Sustainability Practices in Five-Star Hotels in Sharm El-Sheikh City, Egypt

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Keywords

Sustainability Practices;
Energy Saving Efficiency;
Sustainable Lighting Practices;
Sustainable Water Practices;
Sustainable Trash Practices;
Sustainable Purchasing Practices.

Abstract

The purpose of this research is to enhance the level of energy saving efficiency in light of sustainability practices (lighting, water, trash and purchasing) in hotel sector. Accordingly, this research was based on the analytical approach. The research population is the staff of Sharm El-Sheikh hotels in Egypt. A random stratified sample including managers and employees of five-star hotels was selected. Out of the approximately 770 questionnaires that were sent out, 532 were returned, and 238 were deemed invalid. The results of this research demonstrated the high implementation level of energy-saving efficiency. In addition, there is a very high level of sustainable lighting practices implementation; similarly, there is a high level of sustainable practices implementation related to water, trash, and purchasing. When comparing sustainable practices of lighting, water, trash, and purchasing; sustainable purchasing practices are more closely connected with energy-saving efficiency. Moreover, the level of sustainable lighting practices is correlated with sustainable water (production & consumption), and purchasing practices. Conversely, there is no correlation between the level of sustainable lighting practices and the level of sustainable trash practices. Accordingly, five-star hotels are required to continuously adopt sustainability practices to enhance the level of energy saving efficiency. Finally, this research presents sustainable operational practices to improve the level of sustainable energy-saving efficiency in hotel industry.

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1. Introduction

Adopting eco-friendly practices helps hotels increase revenue in general by improving customer satisfaction (Anuwichanont *et al.*, 2011), improving reputation, having positive brand effects (Chen & Chen, 2012), reducing waste, energy, and water usage (Eldemerdash & Mohamed, 2013), and standing out from the competition (Hays & Ozretić-Došen, 2014). Therefore, energy saving is one of the most important needs for sustainable hotels (Hanna and Farouh, 2012). Hotels can achieve their goals by implementing energy-saving practices, which reduce capital costs, reduce emissions, enhance customer satisfaction, increase profitability, and reduce the use of non-renewable energy resources (Saad *et al.*, 2012). Even if the hotel sector uses the most energy (Georgei & Bombeck, 2012), due to their significant and excessive energy and resource consumption, hotels are among the leading drivers of environmental pollution (Mbasera *et al.*, 2016). Eco-friendly practices aid in gaining a competitive edge and profitability in hotel sector (Abdel-aal and Kouzmal, 2016). Moreover, using state-of-the-art energy management systems can help hotels save up to 65% on energy costs (Hassan, 2017). Specifically, different hotel categories vary in energy efficiency, with higher-category hotels being more committed, such as five-star hotels having carbon audits and energy management programs (Wang *et al.*, 2018). Thus, lodging establishments must pay attention and start putting eco-friendly practices into place, like cutting back on solid waste, cutting power, and using less water (Sayed, 2021). Finally, energy and water are interconnected, with energy used for food preparation, heating, cooling, lighting, and pool operations, and water usage increasing. Investing in energy-efficient usage can save energy consumption and operational expenses through an energy-saving plan, which is used as the most effective energy-saving practice (Sharif *et al.*, 2022).

For a number of reasons, academics have been paying more and more attention to energy conservation in recent years (Wang *et al.*, 2018). For instance, as more people become conscious of the damage being done to the environment and the excessive use of energy, water, and resources, hotel patrons' concerns are growing (Bohdanowicz, 2006). Moreover, over 75% of environmental contamination is caused by hotels' excessive use of energy, water, and materials (Bohdanowicz and Martinac, 2007). As a result, hotels rank in the top five for energy consumption among commercial buildings (Karagiorgas *et al.*, 2007). Consequently, growing pressure from governments and stakeholders, as well as the cost of energy resources, drove hotel operators to improve energy efficiency (Bohdanowicz, 2006; Erdogan & Baris, 2007; Ali *et al.*, 2008). In particular, the energy waste problem is primarily due to staff members' misinterpretation of energy-saving practices and their disregard for specific energy usage across hotel departments (Scanlon, 2007; Ali *et al.*, 2008). The hotel industry has evolved to become more eco-friendly, in response to increasing public awareness and the need for sustainable practices (Hu *et al.*, 2010). In contrast, hotels lack energy-saving environmental quality systems due to insufficient funding, labor shortages, lax laws, and employee misuse, leading to energy waste (Saad *et al.*, 2012). Finally, global environmental concerns have led businesses to shift their products and services towards sustainability (Jolink & Niesten, 2015).

Egypt's lack of environmental awareness on energy-saving measures is causing harm to the ecosystem and water and energy usage. Hotels should monitor energy consumption, promote renewable energy, implement energy management programs, and use organic waste for cooking fuel (Shackley, 1999; Barakat *et al.*, 2003; Saad *et al.*, 2012). For example, Georgei & Bombeck (2012) discovered that Sharm El-Sheikh hotels fail to meet environmental standards due to a lack of publicly available data on energy use and their reluctance to disclose such information. In addition, Saad *et al.* (2012) stated that the primary cause of potential energy waste in Sharm El-Sheikh hotels is the inappropriate use of devices and equipment by staff members. They have lack knowledge and concepts about environmental standards, resulting in significant energy consumption (Hassan, 2017). Employees are less dedicated to green practices and are more likely to quit because they have to put in more work and receive more training (Sharif *et al.*, 2022). Another case, Hurghada's five-star hotels consume more water and power than other customers, indicating that consumers who don't understand the benefits of conserving these resources use more energy than necessary (Amer *et al.*, 2023). Therefore, selecting hotel leaders should be related to their performance level (Moftah *et al.*, 2023). Based on the preceding analysis, energy saving is a key worldwide economic concern for sustainable development and environmental preservation. The first research gap relates to the lack of energy-saving efficiency in hotels. Consequently, the purpose of this research is to enhance the level of energy saving efficiency in light of sustainability practices (lighting, water, trash and purchasing) in five-star hotels in Sharm El-Sheikh city.

2. Literature Review

2.1. Energy Saving Efficiency

In the hotel sector, electricity makes up the majority of overall energy consumption with an average of 84% of total energy, especially when it comes to air conditioning (Deng & Burnett, 2000). Energy-related issues persist in all establishments, and lowering carbon emissions necessitates concentrating on energy efficiency and renewable energy sources (Nakata *et al.*, 2011). The energy imbalance has grown significantly, reaching 52% in 2018 and now accounting for 60% of the trade deficit, primarily due to resource loss and rising oil prices (Lu *et al.*, 2013). According to Becchio *et al.* (2016), building sector (e.g., hotels) is responsible for one-third of greenhouse gas (GHG) emissions and almost 40% of global final energy use. In addition, urbanization contributes for raising 70% of greenhouse gas emissions to more than 75% by 2030. In addition, water and energy rising living conditions and customer demand for commodities have led to an increase in consumption (Marinopoulos & Katsifarakis, 2017). Energy efficiency, which includes all economic sectors, is one of the main pillars of European energy policy (Bianco, 2017). Consequently, Parpairi (2017) stated that the global trend towards environmental preservation and renewable energy sources is gaining popularity, emphasizing the need for sustainable design practices in conjunction with renewable energy technology (RET).

Energy saving is currently one of the main objectives of energy policy in many countries. Therefore, the only way to make a nation's economy less energy-intensive and more ecologically friendly is to reduce the energy consumption of structures such as hotels (Chwieduk, 2017). In addition, reducing energy usage, utilizing highly efficient technologies, and improving hotel operations are all necessary to raise a hotel's energy efficiency (Buso *et al.*, 2017). In general, tourism has a major influence

on the overall load profile and energy consumption of towns with isolated energy systems (Beccali, 2018). In specific, global warming benefits businesses by reducing energy use due to temperature variations, promoting energy-saving practices, and promoting renewable energy generation (Pablo-Romero, 2019). There are significant variations in the energy and water usage patterns of hotels in the Mediterranean region between hotel categories, with five-star hotels exhibiting higher levels of consumption (Mechri & Amara, 2021). Moreover, the concept of zero-carbon buildings is gaining popularity as the construction industry, including hotels, is crucial for transitioning to a carbon-free economy (Crespi *et al.,* 2021). Therefore, there is an urgent need for academic research to find out more about practical strategies for lowering the significant carbon footprint that five-star hotels generate (Salehi, 2021). Finally, hotels use more energy to run than residential or commercial buildings do, including electricity, gas, and water. The usage of resources in hotels is influenced by both staff and customers; although practices to reduce energy utilization are generally begun by the staff (MacAskill *et al.*, 2023).

2.2. Sustainable Energy-Saving Practices in Egypt

Energy waste is a chronic and significant issue for Egypt's hotel industry. For example, Shackley (1999) found that minimizing energy consumption and switching to renewable energy sources is becoming more and more important, because of the growing price of conventional fuels. Barakat *et al.* (2003) recommended that hotels monitor and reduce their energy consumption as a result. Fossil fuels are the main energy source; roughly 22.2% of hotels heat their water only using solar power. Develop energy management programs, utilize organic waste for methane gas production, and educate hoteliers about renewable energy benefits (Saad *et al.,* 2012). The energy resources utilized are shown in table (1) and the energy consumption of different operations in the three- and four-star hotels in Sharm El-Sheikh is shown in table (2).

Table 1: Energy Resources Usage in Four Star Hotels in Sharm El-Sheikh

No.	Energy Resources	Usage %
1	LPG	60.8
2	Diesel Oil	81
3	Natural Gas	25.7
4	Electricity	99
5	Renewable Energy	21.6
6	Other Energy	0

Source: Saad *et al.*, (2012).

Table 2: Energy Consumption in Sharm El-Sheikh Hotels

No.	Operations	Energy Consumption Level (%)	
		Three-Star Hotels	Four-Star Hotels
1	HVAC	50	50
2	Kitchen	70	24.8
3	Laundry	19.1	17.7
4	Water Heating	20	20
5	Lighting	20	20.4
6	Other Sectors	15	7.2

Source: Saad *et al.*, (2012).

Sharm El-Sheikh hotels do not adhere to environmental standards, as evidenced by the dearth of documented and widely known information about energy use in hotels and the hotels' reluctance to offer it (Georgei & Bombeck, 2012). The Egyptian government is reducing energy waste by reducing subsidies for electricity, natural gas, and LPG, the primary fuels used by the hotel industry in the short to medium term (EBRD, 2013). Specifically, in Cairo and Alexandria hotels, the yearly energy consumption of hotel buildings is decreased by about 20% when there is a Window-to-Wall Ratio of 0.20 and correctly shaded windows (Hanna and Farouh, 2014). Most hotels in Sharm El Sheikh and Hurghada lack knowledge and understanding of environmental behaviors and how to leverage them. Consequently, these hotels use a tremendous amount of electricity. Therefore, investments in more energy-efficient use may result in a large reduction in energy bills, operational expenses, and consumption (Hassan, 2017). In addition, Abdou *et al.* (2020) mentioned examples of green hotel practices: installing water-efficient devices to cut down on water usage; recycling greywater; installing energy-efficient appliances; and implementing programs for the reuse of linens and towels. It also means implementing waste management and reduction strategies, such as recycling programs and the replacement of disposable items with long-lasting, reusable ones. Sayed (2021) added recycling bins in lobbies and rooms, energy-efficient light bulbs in guest rooms, and green certificates as tourist-accepted green hotel practices. According to Sharif *et al.* (2022), in spite of these practices, hotel employees are less likely to follow green practices and are more likely to resign from their jobs as a result of the higher effort and necessary training. Lastly, Amer *et al.* (2023) stated that Hurghada's five-star hotels utilize solar energy systems, staff training, energy-efficient air conditioners, drought-tolerant gardens, and limited water usage. They also offer eco-friendly luxury products without plastic packaging.

2.3. International Sustainable Energy Saving Practices

The energy issue has drawn the attention of many researchers because of its connection to the sustainability movement. According to Diamantis and Ladkin (1999), the methodical advancement of ecologically sustainable development can be achieved by the use of eco-friendly techniques, such as energy saving. Additionally, Deng & Burnett (2000) mentioned a number of factors are looked at in relation to hotel energy use, such as hotel class and year of construction. In addition, Nakata *et al.* (2011) stated that energy efficiency and renewable energy sources are crucial for lowering the carbon footprint of all economic sectors and building more sustainable societies where economic advancement and environmental preservation may coexist. Moreover, Moiá-Pol *et al.*, (2005), and HES (2011) estimated that ten percent of the energy used by Greek hotels nationwide is produced for the purposes of heating, cooling, and producing hot water. Karagiorgas *et al.* (2007) stated that solar systems were the most regularly used renewable energy technologies (RET) in Greek hotels. Finally, lowering energy, waste, water, emission, and operating/maintenance expenses could be advantageous (Butler, 2008).

In particular, hotels consume a lot of energy due to the variety of services they provide and the fact that they are open 24/7. In hotels in southern Europe, for instance, this figure increases by roughly 25 to 30 percent (Michalena & Lagos, 2011). More specifically, 72–75% of the energy used by Greek hotels is used for the production of hot water and space conditioning (heating and air conditioning); lighting makes up 6-9% and catering accounts for 9–15%. Hotels that employ energy efficiency practices may cut their energy usage by at least 10% to 15% (HES, 2011). In addition, many hotels understand that adopting environmentally friendly practices is a moral decision that also aids in cost reduction, improving brand awareness, setting them apart from competitors, and upholding corporate social responsibility (Radwan *et al.*, 2012). Moreover, using green practices reduce energy savings for any company by up to 20% (Yusof & Jamaludin, 2013), improve the hotel's standing, and increase hotel efficiency related to energy and waste management (Chen and Chen, 2012; Rahman *et al.*, 2012; Punitha and Rasdi, 2013). Finally, Malaysia hotels have primarily adopted green practices concerning energy, trash, and water (Yusof and Jamaludin, 2014).

Hotel industry has a negative impact on the environment that is substantial, which they make excessive use of energy, water, and non-durable goods (Chan *et al.*, 2014; Noor & Kumar, 2014). Because of this, the industry is either directly or indirectly hurting the environment (Noor & Kumar, 2014). In addition, hotel industry finds it challenging to lessen environmental risks and transition into a more ecologically friendly sector due to the ongoing environmental concerns to which they have contributed (Jones *et al.*, 2014). However, there is still a dearth of information and frequent neglect for hotel staff members' environmental conduct and environmental policies (Chou, 2014). Water and energy usage ranked second in importance among costs associated with hospitality, after staff costs (Escalera and Perez, 2014). Although integrating green practices throughout a company is the main objective, employee roles are equally crucial (Lamm *et al.*, 2015). When considered holistically, a hotel's consequences are evident even if it doesn't use a lot of non-renewable resources or significantly harm the environment (Nezakati *et al.*, 2015). Moreover, hotels and resorts have also added water-saving options including smart taps that recycle greywater, medium-flow toilets, low-flow basins, and water-efficient appliances. Finally, converting the kitchen from electricity to gas and teaching staff members, particularly the least educated ones, how to reduce waste and conserve resources are critical (Ihalawatta *et al.*, 2015).

To enhance staff practices, increase awareness, provide training, update SOPs, and incentivize compliance with water-efficient technologies, encourage resort investments in renewable energy systems (Abdel-aal and Kouzmal, 2016). By adopting green practices, the hotel industry may achieve financial gains (Anatasia *et al.*, 2001; Chen & Chen, 2012; Singal, 2014); acquire a competitive advantage, and boost customer satisfaction and loyalty (Pereira-Moliner *et al.*, 2015). Approximately 44% of energy use is attributed to commercial buildings such as hotels (Parpairi, 2017). In addition, environmental hazards remain one of the top five key risks based on likelihood and effect (Bahadure, 2017); and energy use is one of the main factors contributing to environmental degradation (Kalayci and Koksal, 2015); Kapusuzoglu, 2014). Finally, reducing hotel energy use lowers greenhouse gas emissions, which helps with environmental conservation (Said *et al.*, 2017). Table (3) illustrates the hotel's energy usage structure, while Table (4) lists energy-efficient practices.

Table 3: Hotel Energy Consumption Structure

No.	Type of Load	Energy Consumption (%)
1	Cooling source	14.2
2	Heating source	10.7
3	Fan	15.7
4	Water	2.9
5	Hot water supply	9.9
6	Lighting	14.7
7	Outlet	7.7
8	Others	24.2

Source: Said *et al.* (2017).

Table 4: Practices of Energy Efficiency (EE)

No.	Item	Practices
1	Energy management	Assess energy profile.
		Draws up a simple energy policy.
		Adopts good housekeeping practices.
		Ensures periodic serving and maintenance of equipment and device.
		Provide information to staff and guests.
2	Reduction of the Hotels' heating and cooling needs	Improves the thermal insulation of the building.
		Avoids uncontrolled air infiltration.
		Protects the building from the summer heat.
3	Equipment efficiency	Improves Lighting efficiency
		Improves ventilation efficiency.
		Improves space cooling efficiency.
		Improves heating efficiency.
		Better operational use of current equipment.

Source: Said *et al.* (2017).

Energy efficiency practices involve reducing energy usage, conserving energy, lowering operational costs, minimizing carbon emissions, and enhancing competitiveness (Said *et al.*, 2017). Therefore, there has been a reduction in global energy supply and an increase in energy expenditures (Khan and Chang, 2018; Norton *et al.*, 2012). Hotels are reducing energy waste by 42% due to rising costs, customer sustainability awareness, and government pressure, implementing energy-saving practices (Mensah & Blankson, 2013; Cingoski & Petrevska, 2018). Involving staff helps hotels are a green establishments (Klewtong, 2018). In addition, the UNWTO has set a target of a 50% reduction in greenhouse gas emissions from the tourism sector by 2035, as the industry contributes to 4.6% of global emissions, of which the hotel industry accounts for more than 20% (UNWTO, 2018). Hotel industry must optimize energy efficiency and utilize renewable energy resources and technology in order to meet this goal and adhere to EU environmental legislation (Bohdanowicz, 2006; Vourdoubas, 2018; Zientara *et al.*, 2020). It lowers energy consumption and carbon emissions (Sayegh *et al.*, 2021); invests in energy-efficient lighting fixtures to attract eco-conscious customers (El-Sayed and Abed, 2021). Finally, Sharif *et al.* (2022) stated that energy saving can be achieved by replacing outdated electronics with modern technology, providing resources, creating a sustainability policy, adopting energy-efficient equipment, and turning off lights before leaving the office.

2.4. Sustainable Lighting Practices

Hotel energy efficiency growth is significantly aided by the implementation of hotel energy consumption quotas, which accurately measure the actual energy consumption (Zhao, 2012). The majority of all energy used (84%), is made up of electricity, where the energy consumption intensities (EUIs) of the four graded hotels are 280.1, 237.7, 186.3, and 143.6 kWh/m2/year. In addition, the average energy usage per guest room is 26.7, 25.0, 14.6, and 9.4 MWh/room/year (Wang, 2012). In addition, Xin *et al.* (2012) stated that Hainan's luxury hotels' energy consumption quota ranges from 69.23-96.75 kWh/m2, with guestroom count and electricity being key factors determining a hotel's total energy efficiency. According to Lu *et al.* (2013), double glazing windows significantly impact energy usage, necessitating financial and energy-efficient retrofitting of nearly-zero energy buildings (nZEBs) to achieve their goal. Moreover, it is stressed how important it is to combine additional Renewable Energy Technologies (RET) with sustainable design (Parpairi, 2017). Accordingly, Bianco (2017) suggested recommendations to enhance a swimming pool and its surroundings to achieve a 13% primary energy reduction by 2030 through financially feasible energy efficiency measures. Finally, Chwieduk (2017) stated that lowering energy needs in a hotel requires thermal modernization and restoration, which involves installing new cladding, thickening insulation, or adding thermal insulation to enhance the building's thermal quality.

Hotels can enhance their energy efficiency by utilizing advanced equipment to reduce energy consumption, ensuring superior comfort for guests, thereby reducing investment costs (Buso *et al.*, 2017). For instance, Sheng (2018) estimated energy use intensity (EUI) intervals for the cold zone, hot summer/cold winter zone, and hot summer/warm winter zone in five-star hotels in China, that are respectively, 100–155, 140–245, and 136–213 kWh/(m2•a). In these climate zones, this means that hotels' energy consumption is higher by 54%, 13%, and 27% than the upper limits of EUI intervals. In addition, Beccali (2018) stated that solar energy systems can reduce hotel energy use and control seasonal fluctuations, while thermal or electric energy storage and building automation control systems can be utilized effectively. According to Mechri & Amara (2021), prior understanding of the energy and water patterns of the hotel and lodging industry is necessary for creating and implementing an appropriate energy plan. Moreover, Crespi *et al.*, (2021) stated that the high energy consumption of comfort-based hotel operations makes it challenging to achieve the zero-carbon targets. Finally, Salehi (2021) stated that to improve the low energy and carbon efficiency of luxury hotels in Iran, practices such as easing sanctions, creating alternative energy sources, enhancing corporate energy conservation goals, and promoting best practices.

2.5. Sustainable Water Practices

Water treatment processes can be made much more efficient by incorporating state-of-the-art technologies like nanotechnology and sophisticated filtering systems (Marinopoulos & Katsifarakis, 2017). Water practices are critical for promptly identifying leaks, effectively reducing water loss, and limiting damage. The successful implementation of sustainable solutions to global water quality and availability concerns requires effective collaboration between researchers, policymakers, and industrial stakeholders (Mechri & Amara, 2021). In addition, the water management program has taught valuable lessons, such as reinforcing soak pit foundation

structures, recommending dry season tank construction, and adjusting tank size based on funding availability (Sugesti *et al.*, 2023). Moreover, there was some variation in the amount of guest nights and the efficiency of water-saving measures. This raises more questions about the characteristics of various water-saving techniques, such as redesigning rooms, and how they affect customer behavior, which may alter the intended decrease in water use (Antonova, 2023). Finally, interacting with consumers to cut back on unnecessary water use is expected to result in greater cost savings than cutting back on gas and electricity (MacAskill *et al.*, 2023).

2.6. Sustainable Trash Practices

Hotels often neglect environmental responsibilities and struggle to implement sustainable solid waste management strategies, making it challenging for them to effectively manage their waste (Radwan *et al.*, 2010; Radwan *et al.*, 2012). In addition, better waste management in hotels addresses social, economic, and environmental issues by reusing and recycling food waste, reducing plastic usage, and treating soil for natural fertilizers (Rawal & Takuli, 2021). The hotel and restaurant industries produce a variety of waste kinds, contributing to the estimated 35 million tons of solid rubbish generated annually by the hospitality sector (Juvan *et al.*, 2023). Thus, sustainable hotel management involves reducing single-use items, composting, recycling, minimizing food waste, and disposing of hazardous waste to support environmental conservation and save money (Trikon, 2023). Further study is needed for food waste control in developing countries' five-star hotels, focusing on kitchen operations, policies, service planning, and disposal through donation, reuse, recycling, and disposal (Kattiyapornpong *et al.*, 2023). The hospitality sector's waste poses a significant challenge to the sustainability of tourist sites, with employee training being the most effective method for waste reduction (Diaz-Farina *et al.*, 2023). Moreover, hotel managers should implement sustainable food operations best practices to improve food waste management and operational efficiency (Abdelmawgoud, 2023). Finally, hotel businesses can enhance sustainability through efficient waste management practices, audits, waste reduction, recycling, composting, hazardous waste management, staff training, stakeholder involvement, and continuous improvement (Sobti *et al.*, 2024).

2.7. Sustainable Purchasing Practices

The concept of supply chain sustainability has attracted the attention of academics and practitioners from various industries across the globe. Green practices in waste management, health and safety, and green certification have a substantial impact on the sustainable performance of hotel supply chains (Hussain *et al.*, 2019). For example, Spain is still in the early stages of sustainable procurement in the hotel business, as noted by Morales-Contreras *et al.* (2019). In addition, environmental responsibility enhances hotel efficiency in terms of boosting energy efficiency and waste management. Improved green performance results from hotel management's focus on improving the application of green buying policies and collaboration with suppliers, which increases operational efficiency while reducing waste (Tarigan *et al.*, 2020). The choice of environmentally friendly suppliers has a good and considerable impact on the adoption of environmentally friendly purchasing in five-star hotels (Astawa *et al.*, 2020). Tourists' green shopping behavior supports the positive association between green purchasing and hotel financial success (Galeazzo *et al.*, 2021). Moreover, the advantages of adopting sustainable practices in purchasing process management have a major positive influence on the adoption of sustainable

practices, while the difficulties of adopting sustainable practices in star hotels in Cairo have a major negative influence on the adoption of sustainable practices (Hassan *et al.*, 2022). Finally, when the green purchasing program is implemented correctly, it supports a sustainable environment and helps the neighborhood (Rismayanti *et al.*, 2023).

3. Methodology

3.1. Research Approach

The aim of this research is to enhance the level of energy saving efficiency in light of sustainability practices (lighting, water, trash and purchasing). Accordingly, this research is based on the analytical approach.

3.2. Questionnaire Layout

Two sections make up the research questionnaire. The first section deals with public information and asks about the following: job, department, gender, age, and qualification. The second section includes research variables, which are based on the scales of Parpairi (2017). These variables include energy-saving efficiency (54 items); sustainable lighting practices (7 items); sustainable water production practices (28 items); sustainable water consumption practices (9 items); sustainable trash practices (5 items); and sustainable purchasing practices (5 items). In addition, the variable of energy-saving efficiency consists of all items of sustainable practices (lighting, water production, water consumption, trash, and purchasing). Moreover, a five-point Likert scale ranging from one (very low) to five (very high) was used to measure each item for research variables. Finally, the purpose of the questionnaire form is to collect data on the research variables.

3.3. Research Population and Sample

The staff of hotels in Sharm El-Sheikh makes up the research population. The staff at five-star hotels serves as a sample. Because the sample covers categories of managers and employees in data collection, a random stratified sample was used. In addition, five-star hotels were picked because, in comparison to other hotel categories, they consume more energy for numerous services and operations. Sharm El-Sheikh, a popular beach resort in Sinai, is a top tourist destination in Egypt. Its high temperatures and humidity during summer and winter increase demand for energy, primarily due to cooling needs (Georgei & Bombeck, 2012). Furthermore, because there is a lack of environmental consciousness, hotels in Sharm El-Sheikh do not adequately implement energy-saving techniques (Saad *et al.*, 2012; Hassan, 2017; Sharif *et al.*, 2022). The population of Sharm El Sheikh is thought to be infinite as data on the total number of hotel staff (managers and employees) are not available. As a result, the sample size is determined using the statistical equation that follows.

$$n = \frac{Z^2 \times \hat{P}\,(1-\hat{P})}{\varepsilon^2} = \frac{1.96^2 \times 0.5\,(1-0.5)}{0.05^2} = 384.16 \approx 385$$

Where:

- $\hat{P}$= Probability of achieving the studied characteristic in the population (0.5)
- z = Confidence Level of 95 % (1.96)
- ε = Error Proportion (0.05)

- n = Sample Size (385)

This indicates that in order to have a 95% confidence level that the true value is within ± 5% of the measured/surveyed value, 385 or more questionnaires must be completed. Since the predicted percentage of the population's response to the questionnaire is 50%, the number of disseminated questionnaires will be double the size of the sample. 770 questionnaires have been delivered as a result.

3.4. Data Collection

The questionnaire was sent out on paper form between August 2023 and December 2023, a period of five months, with the purpose of gathering data from five-star hotels in Sharm El Sheikh. A total of 770 questionnaires were distributed; 238 were deemed invalid and 532 were returned.

3.5. Data Analysis Techniques

Based on the main aim, this research proposed the following hypotheses:

- **H1:** Sustainable lighting practices (SLP) have a significant effect on energy saving efficiency (ESE).
- **H2:** Sustainable water consumption practices (SWCP) have a significant effect on energy saving efficiency (ESE).
- **H3:** Sustainable water production practices (SWPP) have a significant effect on energy saving efficiency (ESE).
- **H4:** Sustainable trash practices (STP) have a significant effect on energy saving efficiency (ESE).
- **H5:** Sustainable purchasing practices (SPP) have a significant effect on energy saving efficiency (ESE).
- **H6:** Sustainable water consumption practices (SWCP) have a significant effect on sustainable lighting practices (SLP).
- **H7:** Sustainable water production practices (SWPP) have a significant effect on sustainable lighting practices (SLP).
- **H8:** Sustainable trash practices (STP) have a significant effect on sustainable lighting practices (SLP).
- **H9:** Sustainable purchasing practices (SPP) have a significant effect on sustainable lighting practices (SLP).

To test these proposed hypotheses, correlation and regression tests are used to determine the nature of the relationships between the research variables.

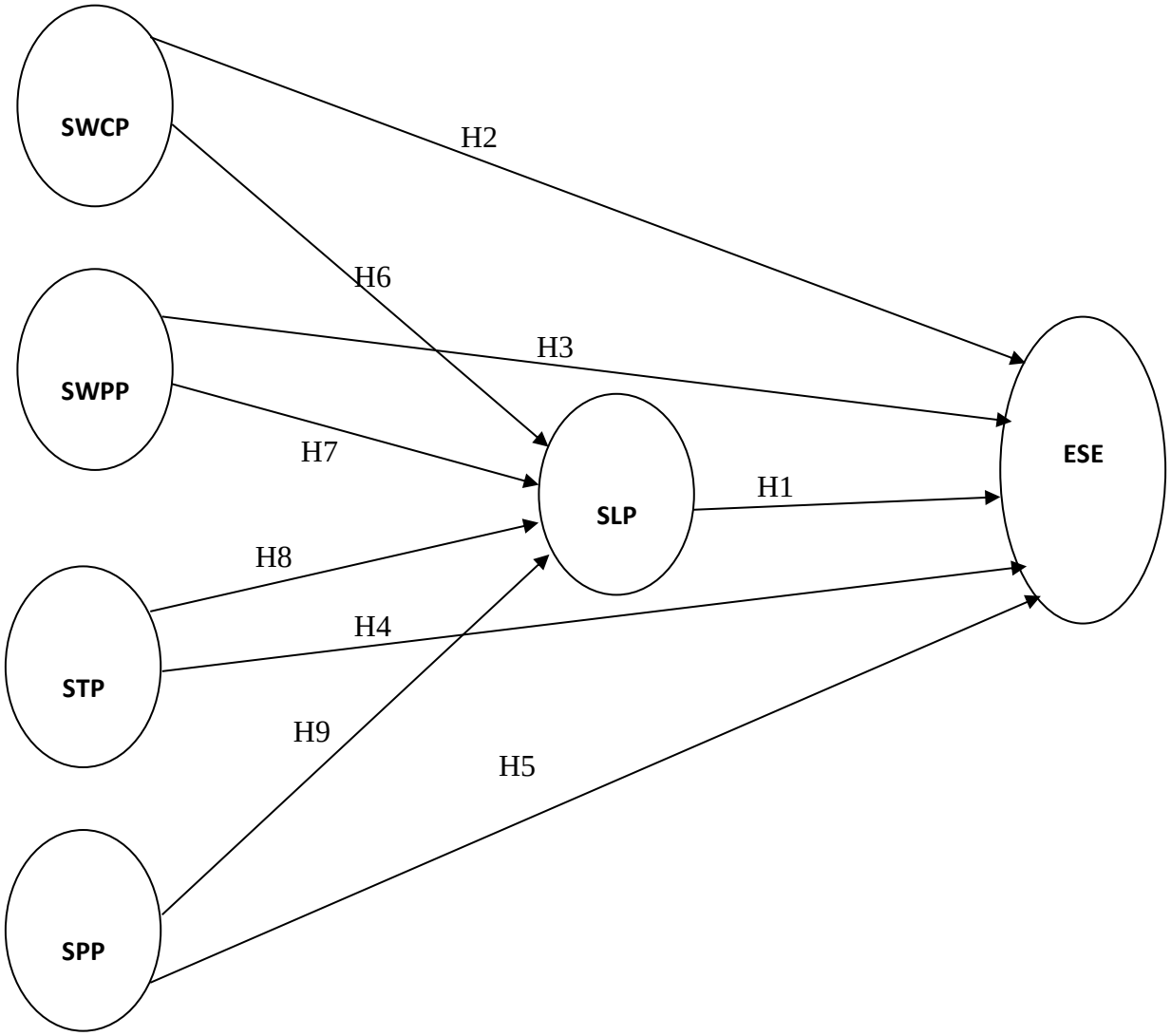

Figure (1): Conceptual Framework of Research Variables

3.6. Data Validity and Reliability

3.6.1. Data Validity

Table 5: Data Validity of Energy Saving Efficiency Using Factor Analysis

No	Variables		
	Communalities	Initial	Extraction
1	SLP1	1.000	0.608
2	SLP2	1.000	0.849
3	SLP3	1.000	0.745
4	SLP4	1.000	0.838
5	SLP5	1.000	0.889
6	SLP6	1.000	0.918
7	SLP7	1.000	0.905
8	SWCP1	1.000	0.858
9	SWCP2	1.000	0.876
10	SWCP3	1.000	0.882
11	SWCP4	1.000	0.844
12	SWCP5	1.000	0.818
13	SWCP6	1.000	0.870
14	SWCP7	1.000	0.860
15	SWCP8	1.000	0.623
16	SWCP9	1.000	0.787
17	STP1	1.000	0.841
18	STP2	1.000	0.874
19	STP3	1.000	0.776
20	STP4	1.000	0.801
21	STP5	1.000	0.777
22	SPP6	1.000	0.885
23	SPP7	1.000	0.823
24	SPP8	1.000	0.849
25	SPP9	1.000	0.783
26	SPP10	1.000	0.832
27	SWPP1	1.000	0.930
28	SWPP2	1.000	0.898
29	SWPP3	1.000	0.910
30	SWPP4	1.000	0.884
31	SWPP5	1.000	0.838
32	SWPP6	1.000	0.809
33	SWPP7	1.000	0.796
34	SWPP8	1.000	0.786
35	SWPP9	1.000	0.745
36	SWPP10	1.000	0.838
37	SWPP11	1.000	0.807
38	SWPP12	1.000	0.768
39	SWPP13	1.000	0.751
40	SWPP14	1.000	0.678
41	SWPP15	1.000	0.712
42	SWPP16	1.000	0.810
43	SWPP17	1.000	0.580

44	SWPP18	1.000	0.814
45	SWPP19	1.000	0.842
46	SWPP20	1.000	0.596
47	SWPP21	1.000	0.804
48	SWPP22	1.000	0.796
49	SWPP23	1.000	0.872
50	SWPP24	1.000	0.758
51	SWPP25	1.000	0.791
52	SWPP26	1.000	0.718
53	SWPP27	1.000	0.827
54	SWPP28	1.000	0.714
Total		**1.000**	**0.805**

According table (5), the energy saving efficiency variable's extraction value (0.805) is higher than the recommended threshold of more than 0.40, according to Table (5). This proved the energy saving efficiency variable, which was derived from the component analysis by factor analysis, to be statistically valid. As a result, the energy-saving efficiency variable data is reliable. In addition, the energy saving efficiency variable's components all fell between 0.580 and 0.930, exceeding the recommended cutoff point of more than 0.40. As a result, each component is valid.

Table 6: Data Validity of Research Variables Using Factor Analysis

Variables			**Variables**		
Communalities	**Initial**	**Extraction**	**Communalities**	**Initial**	**Extraction**
SLP1	1.000	0.666	SWPP1	1.000	0.929
SLP2	1.000	0.580	SWPP2	1.000	0.902
SLP3	1.000	0.597	SWPP3	1.000	0.905
SLP4	1.000	0.656	SWPP4	1.000	0.884
SLP5	1.000	0.770	SWPP5	1.000	0.820
SLP6	1.000	0.828	SWPP6	1.000	0.797
SLP7	1.000	0.807	SWPP7	1.000	0.686
Sustainable Lighting Practices (SLP)	**1.000**	**0.701**	SWPP8	1.000	0.736
SWCP1	1.000	0.616	SWPP9	1.000	0.787
SWCP2	1.000	0.827	SWPP10	1.000	0.862
SWCP3	1.000	0.835	SWPP11	1.000	0.816
SWCP4	1.000	0.849	SWPP12	1.000	0.604
SWCP5	1.000	0.733	SWPP13	1.000	0.714
SWCP6	1.000	0.876	SWPP14	1.000	0.636
SWCP7	1.000	0.850	SWPP15	1.000	0.817
SWCP8	1.000	0.407	SWPP16	1.000	0.650
SWCP9	1.000	0.590	SWPP17	1.000	0.623
Sustainable Water Consumption Practices (SWCP)	**1.000**	**0.731**	SWPP18	1.000	0.810
STP1	1.000	0.890	SWPP19	1.000	0.805

STP2	1.000	0.932	SWPP20	1.000	0.570
STP3	1.000	0.756	SWPP21	1.000	0.829
STP4	1.000	0.805	SWPP22	1.000	0.786
STP5	1.000	0.815	SWPP23	1.000	0.836
Sustainable Trash Practices (STP)	**1.000**	**0.839**	SWPP24	1.000	0.756
SPP1	1.000	0.781	SWPP25	1.000	0.769
SPP2	1.000	0.680	SWPP26	1.000	0.780
SPP3	1.000	0.599	SWPP27	1.000	0.779
SPP4	1.000	0.640	SWPP28	1.000	0.618
SPP5	1.000	0.736	**Sustainable Water Production Practices (SWPP)**	**1.000**	**0.768**
Sustainable Purchasing Practices (SPP)	**1.000**	**0.687**			

According to table (6), factor analysis is used in this study to establish exploratory validity, which is a helpful step in refining the study's components. The extraction values for all variables and dimensions are reported to be greater than the recommended cutoff of more than 0.40. This proved the latent variables' statistical validity, which was derived from the component analysis, and their important role in helping to understand the research's constructs.

Table 7: KMO and Bartlett's Test

No.	Variables	Tests			
		Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		Bartlett's Test of Sphericity	
		Value	Level	Approx. Chi-Square	Sig.
1	Sustainable Lighting Practices (SLP)	0.732	Middle	317.842	0.000
2	Sustainable Water Consumption Practices (SWCP)	0.808	Adequate	525.748	0.000
3	Sustainable Trash Practices (STP)	0.672	Mediocre	239.850	0.000
4	Sustainable Purchasing Practices (SPP)	0.765	Middle	249.755	0.000
5	Sustainable Water Production Practices (SWPP)	0.756	Middle	1841.999	0.000
6	Energy Saving Efficiency (ESE)	0.750	Middle	4330.277	0.000

According to table (7), the KMO test is also used to evaluate if the data in this study are appropriate for factor analysis by looking at the sample size and sampling adequacy for each variable. The results indicate that there is a significant degree of common variance among the variables in the research dataset, with KMO measurement quality assurance test scores ranging from 0.672 to 0.808.

3.6.2. Data Reliability

Table 8: Data Reliability Using Cronbach Alpha Test

No	Variables	Items	Cronbach Alpha Value	Validity Coefficient*
1	Sustainable Lighting Practices (SLP)	7	0.866	0.931
2	Sustainable Water Consumption Practices (SWCP)	9	0.802	0.896
3	Sustainable Trash Practices (STP)	5	0.791	0.889
4	Sustainable Purchasing Practices (SPP)	5	0.884	0.940
5	Sustainable Water Production Practices (SWPP)	28	0.728	0.853
Total (Energy Saving Efficiency)		54	0.814	0.902

* Validity Coefficient = √ Reliability Coefficient

Table (8) indicates that a reliability test using the Cronbach alpha score is a crucial research step to ensure measurement consistency and stability among questionnaires and to sustain trust in the instrument's results over time. The scales' satisfactory internal reliability was indicated by Cronbach alpha values, which ranged from 0.728 to 0.884. Furthermore, the validity coefficient—also known as squared multiple correlations or commonalities—is a crucial factor in assessing the reliability of the research.

4. Data Analysis & Results Discussion

A total of 770 questionnaires were sent out to employees of five-star hotels in Sharm El-Sheikh; 238 forms were deemed invalid, while 532 forms were returned and considered valid for study. The following findings were obtained:

4.1. The Descriptive Statistics of Sample Demographic Data

Table 9: The Frequency of Demographics Data

No.	Factors	Items	Frequency	Percent
1	Job	Managers	120	22.6
		Employees	412	77.4
2	Department	Top Management	32	6.0
		Rooms Division	184	34.7
		Food and Beverage	158	29.7
		Human Resources	114	21.4
		Maintenance & Engineering	38	7.1
		Other	6	1.1
3	Gender	Male	367	69.0
		Female	165	31.0
4	Age	20 or less	286	53.8
		21-29	6	1.1
		30-40	171	32.1
		41-64	63	11.9
		65 and over	6	1.1
5	Qualification	Secondary	139	26.2
		University	292	54.8
		Postgraduate	101	19.0

Table (9) illustrates the frequency of demographic data for the research respondents. It turns out that most of the respondents are male (69%), 20 or fewer years (53.8%), university graduates (54.8%), employees (77.4%), and rooms' division department (34.7%).

Table 10: Descriptive Statistics of Energy Saving Efficiency (ESE)

No.	Tests		Energy Saving Efficiency
1	Mean	Statistic	3.92
		Std. Error	0.07
2	95 % Confidence Interval for Mean	Lower Bound	3.78
		Upper Bound	4.05
3	Variance		0.398
4	Standard Deviation		0.63
5	Normality Test	Statistic	0.13
		Sig.	0.001

The descriptive data regarding the level of energy-saving efficiency in five-star hotels are displayed in table (10). The level of energy saving efficiency is 3.9 out of 5, which is regarded as a high mean. This outcome is in line with the trend of hotels being more environmentally friendly (Hanna and Farouh, 2012) and hotel operators wanting to increase energy efficiency (Ali *et al.*, 2008). In addition, Buso *et al.* (2017) suggested that hotels cut back on their energy use; Saad *et al.*, (2012), Abdel-aal & Kouzmal (2016), and Hassan (2017) asserted that energy-saving measures are critical since they enhance hotels'

ability to meet their objectives as an organization. It was suggested by Pablo-Romero (2019) that hotels adopt energy-efficient practices. Moreover, there are financial advantages for the hotel sector (Anatasia *et al.*, 2001; Chen & Chen, 2012; Singal, 2014). Finally, adopting green practices can provide you a competitive edge as well as boost consumer satisfaction and loyalty (Goodman, 2000; Pereira-Moliner *et al.*, 2015).

Putting energy-saving practices into place improves hotels' aesthetic appeal, boosts customer comfort, and lowers the chance of power system breakdowns (Sharif *et al.*, 2022). In contrary, according to studies by Georgei & Bombeck (2012), MacAskill *et al.* (2023), Chen & Chen (2012), and Sharif *et al.* (2022), hotels consume a lot of energy and pollute the environment. Additionally, customers aren't encouraged to adopt energy-saving techniques or renewable energy sources because of the low cost of energy (Georgei & Bombeck, 2012). Furthermore, according to Saad *et al.* (2012), there are no energy-saving environmental quality solutions in place at hotels. Georgei & Bombeck (2012) claimed that Sharm El-Sheikh hotels do not follow numerous environmental criteria, such as the paucity of public and registered data on energy use in hotels, and the refusal of hotels to submit such data. Hassan (2017) claimed that hotels use a lot of energy since they don't know enough about environmental regulations, while Sharif *et al.* (2022) found that staff members aren't as devoted to eco-friendly procedures.

Table 11: Descriptive Statistics of Sustainable Lighting Practices

No	Statements	Mean		SD	Level
		Statistic	Std. Error		
1	Installation of lighting sensors in corridors and public bathrooms. Time control can turn lights on and off at preset times. Photovoltaic cell controls can switch or dim lights according to the daylight level.	4.14	0.116	1.066	High
2	Dimmer controls.	4.49	0.089	0.814	Very High
3	Clean lighting surfaces for maximum efficiency.	4.26	0.105	0.958	Very High
4	Moderate decorative lighting. Turn it off in public when guests go to their rooms (at night).	4.29	0.102	0.939	Very High
5	Maximize the use of natural light indoors. Do not turn on artificial lighting when daylight is sufficient.	4.45	0.085	0.782	Very High
6	Turn off the lights in secondary spaces and hotel offices when not in use (boiler rooms, storage rooms, etc.).	4.45	0.089	0.813	Very High
Sustainable Lighting Practices		**4.35**	**0.09**	**0.89**	**Very High**

The descriptive data for the implementation level of sustainable lighting practices is displayed in table (11). The level is 4.35 out of 5 (Std. 0.89), this is considered a very high level. This outcome is consistent with the literature review and aligns with Sayed's (2021) suggestion for energy preservation. As a result, customers are less concerned

about environmental degradation (Bohdanowicz, 2006). In addition, the majority of energy used in hotels is electricity, which accounts for about 84% of total energy consumption (Wang, 2012). More precisely, the generation of hot water and space conditioning (heating and air conditioning) consumes 75–75% of the energy consumed by Greek hotels; lighting and catering contribute 9–15% and 6-9%, respectively. After personnel costs, water and energy usage are the second most important hospitality-related expenses. Lastly, as energy use ranks second in importance among hospitality expenses, adopting sustainable lighting methods at a high level is a crucial operational procedure (Escalera and Perez, 2014).

Table 12: Descriptive Statistics of Sustainable Water Production Practices

No.	Statements	Mean		SD	Level
		Statistic	Std. Error		
1	Solar PV Systems: A compact PV system that can store electricity during the day and use it at night for common area lighting.	2.63	0.131	1.20	Moderate
2	Biomass boilers (wood chips, wood pellets).	2.60	0.127	1.163	Moderate
3	Solar panels on the ground (when the site provides enough space) or on the roof to produce hot water.	2.65	0.135	1.237	Moderate
4	Small wind turbines (portable also available) to produce electricity.	2.58	0.135	1.234	Low
5	Floor heat of ordinary heat pumps (hot / cold air and hot water).	2.61	0.131	1.203	Moderate
6	Seawater air conditioning in seaside resorts, or those close to a lake or riverbank, taking advantage of the advantage of low water temperature.	2.83	0.137	1.260	Moderate
7	Set the hot water boiler to 50 ° C (instead of 60 ° C) and the air conditioner to 26 ° C in summer and 20 ° C in winter.	3.60	0.122	1.121	High
8	Connect dishwashers and washing machines to a warm water supply.	4.02	0.102	0.931	High
9	Limiting the use of air conditioning units that increase the circulation of fresh air and use cold outside air when available.	3.71	0.105	0.964	High
10	Use of natural ventilation when available.	4.61	0.349	3.196	Very High
11	Installation of ceiling fans.	3.92	0.114	1.044	High
12	Installation of shading devices.	3.93	0.108	0.991	High
13	Use trees and landscaping to reduce heating load during the warmer months.	3.96	0.105	0.963	High
14	Improve the window glass and make it (double glazing).	4.18	0.099	0.907	High
15	External thermal insulation (including	4.65	0.615	5.634	Very

	roof).				High
16	Pool covers to reduce evaporation and heat loss.	4.33	0.362	3.316	Very High
17	Division of hotels according to guest occupancy (turn off heating/cooling in unoccupied places or floors).	3.73	0.123	1.123	High
18	It is important not to allow heating and cooling to turn on at the same time in the room. When opening windows and doors, heating / cooling systems should be closed immediately.	3.89	0.110	1.006	High
19	Use programmable thermostats, reduce the thermostat controls by guests (maximum change is 2 ° C from the set temperature).	3.74	0.109	0.995	High
20	Key cards (connecting energy use with room occupancy). During check-out, all equipment in the room (TV, HVAC, alarm clock, etc.) must be completely closed, except for the minibar.	4.29	0.075	0.687	Very High
21	Door lintels are installed on exterior doors. Close windows to avoid heat loss.	4.04	0.096	0.884	High
22	The main entrance door remains closed or installs motorized doors.	4.07	0.095	0.875	High
23	Restrict smoking in the building to reduce the need for increased ventilation.	4.20	0.094	0.861	Very High
24	Timers installed in the Jacuzzi and sauna heating system.	4.12	0.090	0.827	High
25	Highly energy efficient appliances (catering equipment, refrigerators and freezers, dishwashers, laundry, and office equipment, etc.).	4.23	0.095	0.869	Very High
26	Dishwashers, washers, and dryers should be turned on only when they are full. Keep refrigerators away from high-temperature cooking areas.	4.77	0.613	5.617	Very High
27	Periodic maintenance of all systems and insulation of boilers, pipes, and air ducts. Regularly clean the air filters of the air conditioning system and fan coil units. Remove dust from the air ducts.	4.15	0.090	0.829	High
28	BEMS (Building Energy Management System) to systematically check all system processes to ensure the best possible output.	3.81	0.106	0.975	High
Sustainable Water Production Practices		**3.78**	**0.16**	**1.49**	**High**

The descriptive data for the implementation level of sustainable water production practices (SWPP) are displayed in table (12). With a mean score of 3.8 out of 5 (Std. 0.63), the level is regarded as high. Consequently, hotels should also raise the bar for these practices: solar PV systems, a small-scale PV system that can store energy during the day and use it at night for lighting common areas; biomass boilers (wood chips, wood pellets); solar panels to generate hot water, either on the roof or on the ground, depending on the available space on the property. The use of saltwater air conditioning in seaside resorts or those near lakes or rivers to take advantage of the low water temperature, as well as small wind turbines (portable versions are also available) to generate electricity. Energy is used for several purposes, such as heating and cooling hot water, cooking, lighting, and swimming pool maintenance. Implementing sustainable water production practices at a high level is an important procedure, as adopting water-saving practices can lead to a reduction in energy consumption (Sharif *et al.*, 2022). Finally, staff costs are the most significant expense related to hospitality, followed by water and energy usage (Escalera and Perez, 2014).

Table 13: Descriptive Statistics of Sustainable Water Consumption Practices

No.	Statements	Mean		SD	Level
		Statistic	Std. Error		
1	Towel and linen reuse program supported by guest participation in the hotel's environmental strategy.	4.45	0.095	0.870	Very High
2	Water-saving devices in bathrooms / showers (tubs and showers, low-flow bathrooms).	4.42	0.099	0.908	Very High
3	Push button showers and infrared sensors (motion sensors) for taps in public places.	4.21	0.119	1.087	Very High
4	Water-saving devices used in washing.	4.33	0.110	1.010	Very High
5	Gray water from bathrooms, sinks, showers, and kitchens, is reused for watering gardens or cleaning bathrooms.	4.07	0.133	1.220	High
6	Rainwater collection, filtering, storage in tanks and use in baths and gardens.	2.29	0.156	1.428	Low
7	Defrost ice makers, cool water from water-cooled cooling equipment and condensate water from reused air conditioning systems for irrigation.	2.38	0.158	1.447	Low
8	Repair of pipe leaks.	4.07	0.117	1.073	High
9	Native plants watered early in the day or late at night are used to reduce evaporation in hot weather.	3.20	0.155	1.421	Moderate
Sustainable Water Consumption Practices		**3.71**	**0.127**	**1.163**	**High**

The descriptive statistics regarding the implementation level of sustainable water consumption practices are displayed in table (13). The level is 3.7 out of 5 (Std. 1.163), this is considered a high level. This finding supports Sayed's (2021) assertion that conserving water is crucial. This lowers total costs for hotels by using less water (Eldemerdash & Mohamed, 2013). As a result, customers are less concerned about

environmental degradation (Bohdanowicz, 2006). Heating, cooling, and hot water production account for 10% of the energy consumed by Greek hotels countrywide (Moiá-Pol *et al.*, 2005; HES, 2011). In addition, to be more precise, 72–75% of the energy consumed by Greek hotels goes toward heating and air conditioning as well as the generation of hot water; 6-9% goes toward lighting, and 9–15% goes toward catering (Escalera and Perez, 2014). As opposed to reducing gas and energy use, there is a larger potential for financial savings by interacting with visitors to limit wasteful water usage (MacAskill *et al.*, 2023). Additional practices include performing accurate dye tests to find any plumbing system breaches and listening for the sound of water flowing from underground pipes using ground-based acoustic leak detection sensors. These practices provide a comprehensive and exhaustive approach to leak detection (Marinopoulos & Katsifarakis, 2017). Finally, these practices are essential for controlling damage, efficiently minimizing water loss, and quickly locating leaks (Mechri & Amara, 2021).

Table 14: Descriptive Statistics of Sustainable Trash Practices

No.	Statements	Mean		SD	Level
		Statistic	Std. Error		
1	Recycling (aluminum, paper, cardboard, printer cartridges, plastic, glass, batteries, lamps, electronic devices, soap, shampoos, lotions, cooking oils).	4.10	0.105	0.965	High
2	Compost organic waste to produce compost for the garden.	4.05	0.108	0.993	High
3	Reuse bottles, containers, etc.	4.21	0.494	4.531	Very High
4	Use 100% recycled toilet tissues, napkins, copy paper, etc.	3.15	0.148	1.358	Moderate
5	Use glass cups in all guest rooms and mugs for all staff. Avoid disposable utensils or cutlery.	3.02	0.142	1.299	Moderate
Sustainable Trash Practices		**3.71**	**0.19**	**1.82**	**High**

The descriptive data for the implementation level of sustainable trash practices is displayed in table (14). With a mean score of 3.71 out of 5 (SD 1.82), this is regarded as a high level. This outcome is in line with Sayed's (2021) suggestion to decrease solid waste. Customers' worries regarding environmental degradation are lessened as a result (Bohdanowicz, 2006). For green hotels, less waste could be a benefit (Butler, 2008). Thus, implementing sustainable solid waste management practices would be quite difficult for hotels (Radwan *et al.*, 2011). In addition, improved trash management not only reduces energy use in hotels but also helps with social, economic, and environmental problems. Moreover, reusing and recycling food waste, cutting back on plastic utensils, and treating the soil to create natural fertilizers are all good strategies (Rawal & Takuli, 2021). Finally, the hotel and restaurant business produces a wide range of waste products, which add to the 35 million tons of solid waste produced by the tourism and hospitality sector each year (Juvan *et al.*, 2023).

Trash management is crucial for sustainable hotels, promoting environmental conservation through single-use product reduction, composting, recycling, food waste reduction, and proper hazardous waste disposal (Trikon, 2023). In addition, the hotel industry's waste contributes significantly to the sustainability of tourist destinations, with staff training being the most effective waste reduction strategy due to its preventive effect (Diaz-Farina *et al.*, 2023). Finally, effective waste management practices in hotel businesses involve systems, audits, waste reduction, recycling, composting, hazardous waste management, staff training, stakeholder involvement, and continuous improvement (Sobti *et al.*, 2024).

Table 15: Descriptive Statistics of Sustainable Purchasing Practices

No.	Statements	Mean		SD	Level
		Statistic	Std. Error		
1	Non-toxic detergents are biodegradable.	3.98	0.112	1.029	High
2	Do not use spray cans (sprays).	3.71	0.131	1.198	High
3	Sustainable food service (locally produced and recyclable products).	3.90	0.122	1.115	High
4	Purchase in appropriate quantities to reduce transportation and waste.	4.00	0.122	1.119	High
5	Purchase recyclable products in recycled packaging.	4.07	0.113	1.039	High
Sustainable Purchasing Practices		**3.93**	**0.12**	**1.1**	**High**

The descriptive data for the implementation level of sustainable purchasing practices is displayed in table (15). With 3.93 out of 5, the level is regarded as a high level. This result is consistent with literature review, according to Tarigan *et al.* (2020), hotel management's emphasis on improving the implementation of green procurement policies and collaborating with suppliers' results in improved green performance, which increases operational efficiency and reduces waste. In addition, Astawa *et al.* (2020) reported that the adoption of environmentally friendly purchasing in five-star hotels is positively and significantly influenced by the selection of environmentally friendly suppliers. The positive correlation between green purchasing and hotel financial success is reinforced by the green shopping habits of tourists (Galeazzo *et al.*, 2021). While the challenges of implementing sustainable practices in Cairo's five-star hotels have a significant negative impact on the adoption of sustainable practices, the benefits of implementing sustainable practices in purchasing process management have a significant positive influence (Hassan *et al.*, 2022). Finally, a sustainable environment is promoted and the community benefits when the green purchasing program is done correctly (Rismayanti *et al.*, 2023).

Table 16: Correlation and Regression Analysis of Energy Saving efficiency

Values	Dependent Variable: Energy Saving efficiency				
	Independent Variables				
	Sustainable Water Production Practices	Sustainable Water Consumption Practices	Sustainable Lighting Practices	Sustainable Trash Practices	Sustainable Purchasing Practices
R	0.617**	0.720**	0.630**	0.703**	0.750**
R^2	0.381	0.518	0.397	0.494	0.562
β	0.617	0.720	0.630	0.703	0.750
a	1.765	1.624	2.231	2.570	1.874
b	0.569	0.617	0.379	0.364	0.519
Sig	0.000	0.000	0.000	0.000	0.000

**Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis between the research variables is displayed in table (16). The findings showed that, at the significant level of 0.000 (2-tailed), there is a strong positive correlation between the level of energy-saving efficiency and sustainable practices in terms of sustainable purchasing, sustainable water consumption, sustainable trash, sustainable lighting, and sustainable water production. In addition, the regression analysis is displayed in table (16), with the findings indicating the values of the standardized coefficients (Beta) for the dimensions of energy-saving efficiency: sustainable lighting practices (0.630), sustainable trash practices (0.703), sustainable purchasing practices (0.750), and sustainable water production practices (0.617). According to literature review, water and energy are closely related; because they are interconnected. Consequently, adopting water-saving practices can also lead to a reduction in energy consumption (Sharif *et al.*, 2022).

Table 17: Regression Analysis of Sustainable Lighting Practices

No.	Independent Variable	Dependent Variable	R	R^2	β	a	b	Sig
1	Sustainable Water Consumption Practices (SWCP)	Sustainable Lighting Practices (SLP)	0.225*	0.050	0.225	3.260	0.320	0.040
2	Sustainable Water Production Practices (SWPP)		0.265*	0.070	0.265	2.914	0.407	0.015
3	Sustainable Trash Practices (STP)		0.200	0.040	0.200	3.812	0.172	0.068
4	Sustainable Purchasing Practices (SPP)		0.382**	0.146	0.382	2.717	0.441	0.000

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

The relationship between research factors and sustainable lighting practices is displayed in table (17). The findings showed that, at the significant level of 0.000 (2-tailed), there is a correlation between the level of sustainable lighting practices and the sustainable practices of purchasing, water production, water consumption, and trash. In addition, table (17) shows the regression analysis, where the results stated the value of standardized coefficients (Beta) for research variables as follows; sustainable purchasing practices (0.382), sustainable water production practices (0.265), sustainable water consumption practices (0.225), and sustainable trash practices (0.200). Based on the above analysis, this research suggested the following empirical framework;

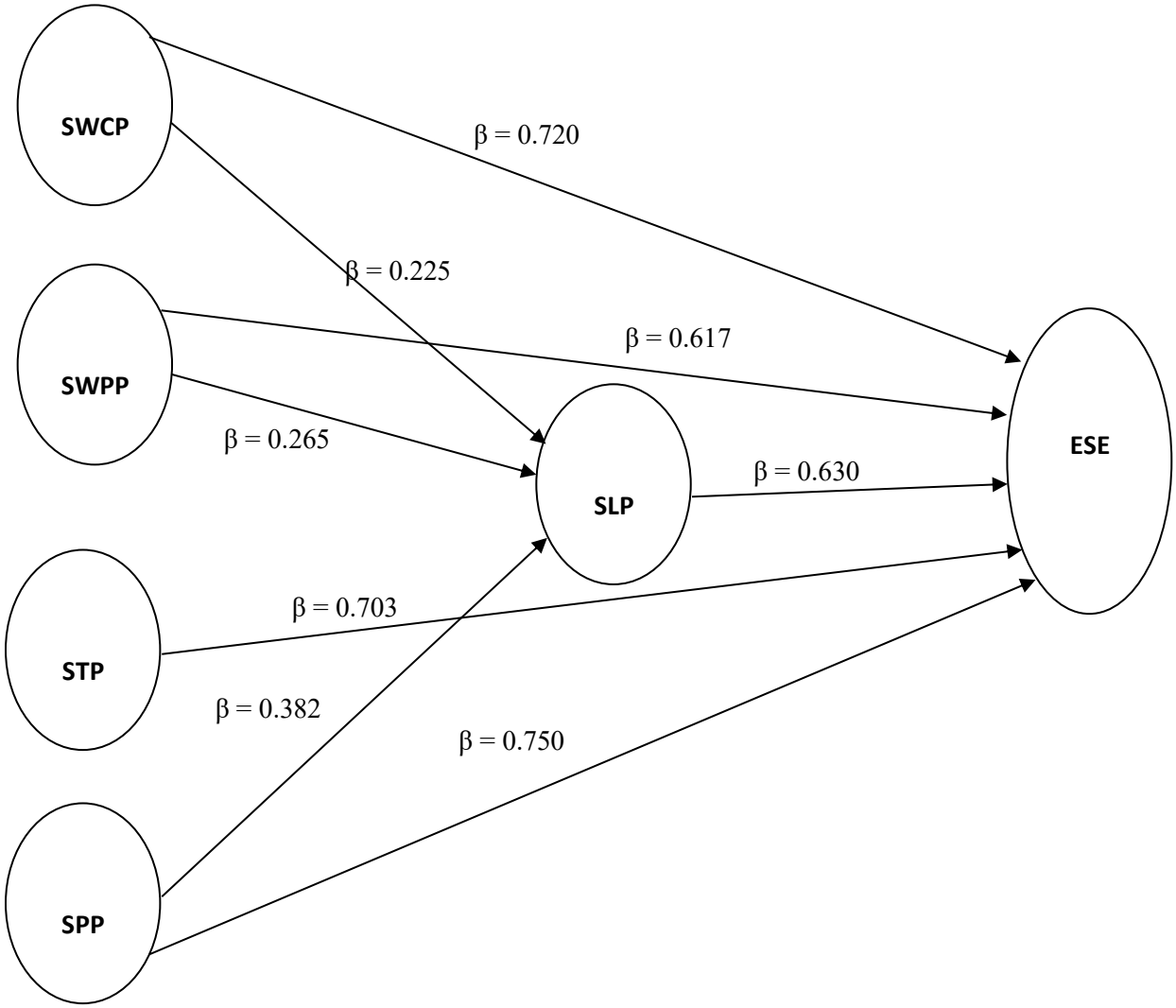

Figure (2): Empirical Framework of Research Variables

5. Conclusion

Improving energy efficiency in the context of sustainable practices (lighting, water, trash, and purchasing) is the aim of this research. Consequently, the analytical approach forms the foundation of this research. The staff of Sharm El-Sheikh hotels makes up the research population. A random stratified sample of managers and employees in five-star hotels is chosen. Approximately 532 of the 770 questionnaires that were distributed were returned, and 238 were found to be erroneous. The research's findings showed a high level of energy-saving efficiency. In addition, there is a very high implementation level of sustainable lighting practices. Similarly, sustainable water, trash, and purchasing practices are implemented to a high level. When comparing sustainable practices of lighting, water, trash, and purchasing; sustainable purchasing practices are more directly associated with energy-saving efficiency. Additionally, there is a correlation between sustainable lighting practices and sustainable water practices (both production and consumption) and purchasing behaviors. On the other hand, there is no relationship between the level of sustainable lighting practices and sustainable trash practices.

The majority of sustainable purchasing, water, electricity, and trash practices were implemented to a high level in Sharm El-Sheikh's five-star hotels. Therefore, hotel management must always improve the implementation of sustainability practices to an extremely high level since it produces good performance outcomes for the hotel establishment, employees, and customers. To attain exceptional performance outcomes, it is imperative to increase staff awareness of sustainable practices and encourage customers to take sustainability into account when selecting hotel products and services. Regularly tracking sustainable practices and the level of performance reached is also necessary. To guarantee the execution of sustainable practices, energy saving, and rationalization of water usage, a collection of practices, guidelines, and tactics tailored to the hotel's staff, customers, and management must be created. This is due to the fact that there will be an impact on the expenses, revenues, and profits of hotels' financial performance. When sustainability practices for purchasing, trash, water, and lighting are integrated, the amount of sustainable energy saving is significantly improved. Furthermore, the use of sustainable practices related to water (production and consumption) and the purchasing process improves the implementation level of lighting-saving practices. Consequently, five-star hotels must consistently implement sustainable practices in order to raise the level of energy efficiency. In conclusion, this research offers sustainable operational strategies to raise the hotel industry's level of sustainable energy-saving efficiency.

6. Recommendations

Based on the results of this research, it presents the following recommendations:

First: Recommendations for Egyptian Ministry of Tourism and Antiquities:

- Adopting a strategy to rationalize energy saving in hotels.
- Implementing a training project to enhance hotel workers' awareness of sustainable practices related to energy saving.

Second: Recommendations for Hotel Establishments:

- Continuous improvement is required in the implementation of sustainable energy saving practices.
- Integration is required in the implementation of sustainability practices related to electricity, water, trash and purchasing.

- Continuous monitoring of the implementation of sustainable energy saving practices is required.
- The implementation level of sustainable energy-saving practices must be increased to a very high level, which requires using these options that enhance sustainable energy efficiency:
    - Solar PV systems: A compact PV system that can store electricity during the day and use it at night for common area lighting.
    - Biomass boilers (wood chips, wood pellets).
    - Solar panels on the ground (when the site provides enough space) or on the roof to produce hot water.
    - Small wind turbines (portable also available) to produce electricity.
    - Floor heat of ordinary heat pumps (hot / cold air and hot water).
    - Seawater air conditioning in seaside resorts, or those close to a lake or riverbank, taking advantage of the advantage of low water temperature.
    - Rainwater collection, filtering, storage in tanks and use in baths and gardens.
    - Defrost ice makers, cool water from water-cooled cooling equipment and condensate water from reused air conditioning systems for irrigation.
    - Native plants watered early in the day or late at night are used to reduce evaporation in hot weather.
    - 100% recycled toilet tissues, napkins, copy paper, etc.
    - Glass cups in all guest rooms and mugs for all staff. Avoid disposable utensils or cutlery.

7. Limitations and Future Research

The main research constraint exclusively pertains to the staff, comprising managers and employees, of five-star hotels situated in Sharm El-Sheikh, Egypt, for the months of August 2023 through December 2023. According to this research, academics studying hospitality should focus on evaluating energy-saving practices from the perspective of customers. They might also look at the effects on customer satisfaction and repeat business of implementing sustainable energy-saving practices. They might also look at the ways that different categories of hotels are putting sustainable energy-saving practices into effect. Finally, they investigate the techniques, policies and strategies pertaining to sustainable energy saving in the hospitality sector.

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الملخص العربي

تعزيز كفاءة حفظ الطاقة في ضوء ممارسات الاستدامة في فنادق الخمس نجوم بمدينة شرم الشيخ، مصر

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المستخلص:

يهدف هذا البحث إلي تعزيز مستوى كفاءة حفظ الطاقة في ضوء ممارسات الاستدامة (الإضاءة والمياه والنفايات الصلبة وعملية الشراء) في قطاع الفنادق. وبناء على ذلك، يعتمد هذا البحث على المنهج التحليلي. ويتمثل مجتمع البحث في العاملين بفنادق شرم الشيخ. تم اختيار عينة عشوائية طبقية تضم مديرين وموظفين فنادق ذات الخمس نجوم، من بين حوالي 770 استبيانًا تم إرسالها، تم إرجاع 532 استبيانًا، وتم اعتبار 238 منها غير صالحة للتحليل. أظهرت نتائج هذا البحث مستوى مرتفعًا من كفاءة حفظ الطاقة. إضافةً إلى ذلك، هناك مستوى مرتفع جدًا من تنفيذ ممارسات الإضاءة المستدامة؛ ومستوى مرتفع من تنفيذ ممارسات المياه والنفايات الصلبة والشراء المستدامة. وعند مقارنة الممارسات المستدامة للإضاءة والمياه والنفايات الصلبة والشراء؛ ترتبط ممارسات الشراء المستدامة بشكل وثيق بكفاءة حفظ الطاقة. يرتبط أيضا مستوى ممارسات الإضاءة المستدامة بممارسات المياه المستدامة (الإنتاج والاستهلاك) وممارسات الشراء. على العكس من ذلك، لا يوجد ارتباط بين مستوى ممارسات الإضاءة المستدامة ومستوى ممارسات النفايات المستدامة. وعليه، فأن الفنادق ذات الخمس نجوم ملزمة بتبني ممارسات الاستدامة بشكل مستمر لتعزيز مستوى كفاءة حفظ الطاقة. وأخيرًا، يقدم هذا البحث ممارسات تشغيلية مستدامة لتحسين مستوى كفاءة حفظ الطاقة المستدامة في صناعة الفنادق.

الكلمات الدالة: ممارسات الاستدامة؛ كفاءة حفظ الطاقة؛ ممارسات الإضاءة المستدامة؛ ممارسات المياه المستدامة؛ ممارسات النفايات المستدامة؛ ممارسات الشراء المستدامة.