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Development of a Management Framework for Energy Efficiency for Sustainability of Hotels in Jeddah, Saudi Arabia Using Structural Equation Modelling

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ABSTRACT

The paper examined the utilized critical factors that affect hotel building sustainability in Jeddah, Saudi Arabia and developed a framework to identify the suitable operational and technical for improving the energy performance of hotel constructions. The mixed methods for collecting energy used data from twenty-four established hotel buildings have been adopted in Jeddah, Saudi Arabia. The survey method was applied in the forms of questionnaires to collect data for the research. The surveying work was carried out on a population of hotel buildings employees with various academic qualification levels and age including engineers, developers, and managers. Structural equation modeling, analysis based on the validation survey, was used to examine the dependencies and interdependencies of the critical factors. The IBM, SPSS 22 and AMOS 23 were used on the basis of maximum likelihood estimates for exploratory factor analysis and confirmatory factor analysis resulting in validated measurement and structural models. This study utilized seventeen critical factors influencing building energy performance in Jeddah, Saudi Arabia. The model identified energy performance building indicators; and established causality as standard metrics for building energy efficiency evaluation and benchmark between building energy performance, management policy, operations, and strategic driver. This recognized strong interdependent relations in the template between the four constructs. The stronger results were: strategic drivers on the energy performance model and management policy on strategic drivers highlighting the importance of energy-saving constructs.

1. Introduction

The need to make economic development compatible with social and environmental development is becoming increasingly evident, not only for public administrations and society but also for companies. At the same time, the relationship between sustainable business management from the triple economic, social and environmental point of view and the creation of long-term value is becoming clearer [24]. The tourism sector in general is one of the most dynamic sectors and one that has experienced the greatest growth in Saudi Arabia in recent decades, so that due to the volume

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of employment of human resources and sales produced, it can be affirmed that it constitutes one of the significant engines of the regional economy, and locally, of many of the Jeddah, Saudi Arabia region. In this area, hotel establishments are a key part of the Jeddah, Saudi Arabia tourism industry and bring together a wide range of technical disciplines aimed at optimizing their resources and setting up a quality and efficient facilities [29]. Among other resources, hotel establishments use a considerable amount of energy to provide the services and comfort they offer their clients. That is why the imperatives of demand control and energy-saving become commitments that the hotel sector must take on, where there is still great potential for energy savings. In general, these establishments do not strictly control energy consumption, and in some cases do not know in detail the hotel's energy facilities [17]. Therefore, although energy consumption is one of the main costs of the establishment, many of the hotels have relatively low energy efficiency levels. Sometimes, the fact of not making energy-saving measures is linked to a lack of knowledge on the part of professionals in the sector of technological solutions for the reduction of consumption, which in some cases is very simple [2]. Obviously, energy expenses are unavoidable, but it is possible to optimize this consumption and minimize expenses. That is why it is needed to equip people with tools or solutions for that purpose. Between the measures to obtain the energetic efficiency and that incite in the saving in the energetic invoice, people can apply some very simple ones in scopes like the climate, illumination or isolations. But it is essential to apply technological measures and solutions that include monitoring and telemetry systems. This type of solution means betting on efficiency. The control of consumption in a continuous and detailed way allows adopting solutions that provide efficiency and optimization of said energy consumption. With all the advantages that this implies [2].

Effective management of energy utilization and saving in buildings remains a challenge in the construction industry with the ongoing global economic uncertainty. The conventional construction of buildings in Jeddah, Saudi Arabia is not energy efficient and lacking in the focus of clean technology [3-7]. As a matter of fact, building construction affects the sustainability of the environment in a way that massive energy applications and greenhouse gas release can accelerate the process of global warming and thin of the ozone layer. With a dire consequence of environmental pollution of greenhouse gases as a result of building construction, there is a need to ensure the design and construction of buildings are done in a sustainable manner with utmost consideration in optimizing energy usage and full utilization of green materials. As such, strategies of cleaner production must be outlined for the design and construction of buildings in the sense that environmental pollution can be minimized without compromising the excessive application of energy. This study concentrates on developing a management framework for the energy efficiency of hotel buildings with the goal to uphold sustainability in building the construction industry in Jeddah, Saudi Arabia. Hotel buildings are chosen for the study because they are important commercial structures in Saudi Arabia [29].

The configuration of hotels varies enormously, being able to classify them by their location, size, number of employees, customers, but the energy consumption is a factor common to all. On average, a hotel spends between 25% per year on costs derived from the use of energy. Thus, it is essential to integrate savings within the management of the hotel as it is one of the most economical and direct impacts on costs to mitigate climate change, in addition to increasing competitiveness. But how to save energy? It has to start with correct planning. It must understand the energy needs of hotels in order to establish objectives and actions that can be achieved and measured. A simple way to do this is by measuring consumption, for example, based on seasonality. In seasons of high occupancy, it varies enormously compared to other times of the year, as well as if it is in hot, cold, humid climates [21]. People must be able to predict these changes and adjust the configuration of the equipment [19- 24].

Saving energy is already a reason in itself. But if People take into account that these types of businesses (Hotels) are among those that consume the most energy, the reason is obvious. People are not talking about an office where the lights are in common areas for all employees. A hotel is not a company with limited hours. People refer to places where there are countless rooms and clients in private mode. That is to say, nobody controls the consumption of the client. It can be found customers are very aware of sustainability but, unfortunately, other guests are unconcerned about saving or environmental issues. So, if people are their energy consumption from a double perspective. On the one hand, good practices linked to sustainability and environmental respect. Secondly, for their economic savings and the profitability that this will represent for their hotel. No matter the order of importance people gives to both reasons. The important thing is that people start applying measures for energy efficiency [7- 21- 33].

There are many types of hotels form the smallest and most intimate, to those big buildings with hundreds of rooms. Therefore, consumption varies a lot. But there is a middle term of consumption: 25% when the energy consumption is excessive, this implies that energy expenses represent the second largest expense behind the payroll of employees. Regarding the environmental impact, energy consumption translates into 60% of the CO_2 emissions that hotels generate. That is why hotels consider energy consumption not as a fixed expense, but as an opportunity to reduce their costs without large investments. This translates into an increase in the profitability of the company. With professional energy efficiency measures, people could reduce the bill for energy consumption in a hotel by 20% [2]. And this could be equivalent to increasing the hotel reserves of that establishment around 5%. Energy efficiency should be a priority in the hotel sector because it means making better use of energy. Therefore, good energy practices should be encouraged and employees and customers should be made aware of this need. To this end, hotel managers must promote sustainable energy policies through behavior and work methods that reduce energy consumption without reducing the comfort of the hotel. The benefits that energy efficiency brings to this business sector are the following:

i. The commitment of hotels for energy efficiency promotes values of sustainability and environmental respect
ii. A company responsible for the environment generates opportunities to enter new markets
iii. It increases the favorable perception on the part of the public opinion and one of the own clients
iv. Maintaining a neglected system in the facilities and equipment generates a negative perception in the guests, but also in the employees
v. On the contrary, implanting technological systems and solutions adapted to the care of the facilities increase the productivity of employees.

The study is significant as the outcomes will bring impact for the establishment of guidelines that can be used to define low carbon hotel buildings in Jeddah, Saudi Arabia. Besides, feasible green technologies for the implementation of energy saving strategies in the hotel buildings can also be identified and evaluated for their potentiality of reducing the impact of carbon emission from the buildings to the atmosphere. This helps to promote the environmental and economic sustainability of energy usage in the hotel buildings.

2. Research Methodology

The research methodology is an aspect of research that dictates the methods used in carrying out research. There are various types of data collection methods that are used in research to obtain results from different perspectives. Data collected is analyzed, compared, and contrasted for consistency. In this paper, various aspects of methodology which include the strategy used in conducting research, tools and equipment used in data collection and tools used in data analysis will be discussed in detail. The results obtained from research provide the solution to a problem at hand. Therefore, when carrying out research, it is crucial to choose the most effective data collection methods, data analysis, and interpretation tools to obtain accurate results [18-26].

The research aimed at assessing the identification of the latent and observed variables that affect the energy performance and developing a conceptual framework model that connects the latent variables to the energy efficiency of hotel buildings in Jeddah, Saudi Arabia. For this research, hotels in Jeddah, Saudi Arabia were identified where the research would be taken. The key purpose was to collect information on clean energy use in hotels. More importantly, the key issues that compel these hotels to adopt clean energy were to be identified. Considering the above aims, the best research strategy that would provide the best research framework for the attainment of the objectives and aims had to be chosen. The study employed quantitative research strategy methods because they. This enabled the researcher to gauge and reduce the chances of collecting incorrect data [30].

The plan is designed such that it presents general assumptions to finer details of all the procedures such as data collection, data analysis and interpretation. It is a master plan strategy that guide, direct and determine the accuracy of the answers from the research questions [12].

A total of 24 hotels were selected under the following categories: 5 stars (10 hotels), 4 stars (10 hotels), and 3 stars (4 hotels) since the hotels had diverse methods of energy use as well as different methods of saving energy**.** This research area was chosen due to the numerous advantages it had compared to other areas where similar data could be obtained. The hotel industry comprises of a heterogeneous population. The hotels in Jeddah, Saudi Arabia have people from different races, backgrounds, gender, and education level among others. The researcher focuses on high educated staff, for example (engineers, Managers & developers). It has Engineers who are responsible for engineering duties. In addition, it has highly educated personnel who provided advice to the engineers on what they ought to do for the benefit of the industry. It eases the work of a researcher by reducing the elephantine population to a small group, which can easily be managed. For this study, for the collection of precisely accurate and unbiased data, the researcher employed the used probability sampling. This method was paramount as it reduced the possibility of biases hence top-notch results.

3. Probability Sampling

Probabilistic sampling is a sampling method that uses forms of random selection methods. The most important requirement of probabilistic sampling is that everyone in a population has the same opportunity to be selected. The study sample was obtained from diverse hotels in Jeddah, Saudi Arabia through the probability sampling method by grouping the employees working in the organization in accordance with the posts that they hold in the organization. The method ensured that the data collected came from all the ranks in the different hotels. Moreover, after grouping the workers. The researcher selected the total number of employees to represent the whole population of workers in the organization [19].

Probability sampling is applicable if the population of hotels which has known and equal chances of being selected (homogenous population). This method is suitable if the research objectives are focused on certain staff. The type of probability sampling was stratified sampling, this is a method in which a large population is divided into several smaller groups, which generally do not overlap, but instead represent the entire population as a whole. During sampling, these groups can be organized and after these, a sample of each group can be obtained separately. It organized or classify the samples by hotels and later by post, that is, two strata. This method divides subjects into mutually exclusive groups and then uses simple random sampling to choose group members. The members of each of these groups must be different so that all members of all groups have the same opportunity to be selected using simple probability. Simple random sampling, as the name implies, is a completely random method used to select a sample. This sampling method is as easy as assigning numbers to individuals (sample) and then randomly choosing numbers between numbers through an automated process. Finally, the numbers that are chosen are the members that include the sample [11].

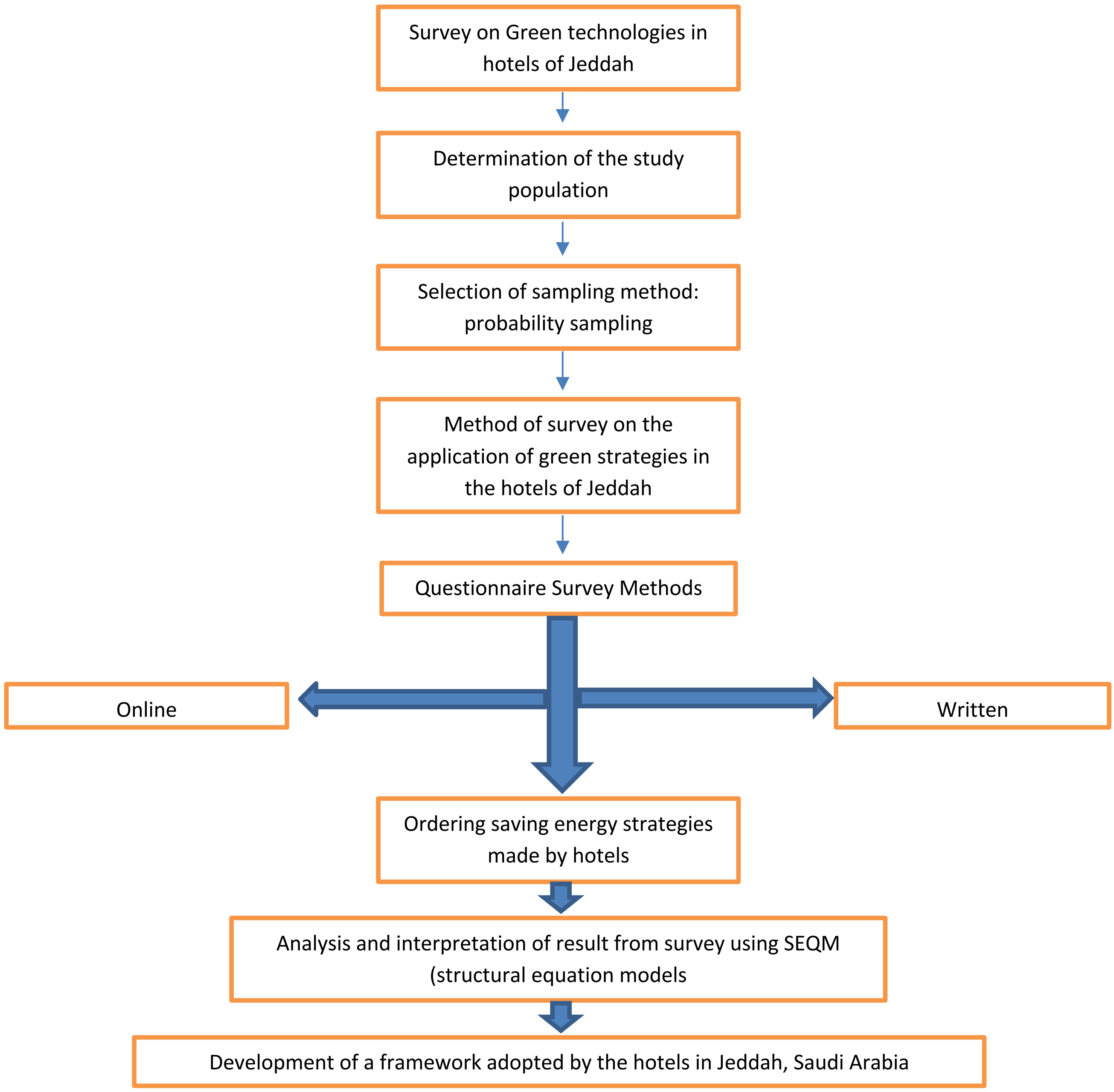

Fig. 1. Research methodology

4. Data Collection Method

Data collection methods are means by which data can be obtained from the field. The correct choice of methods for collecting data is very crucial. Questionnaire is the surveying methods utilized in this research work. Questionnaires were used whereby the selected samples were required to give their personal answers to the questions. This involved administering questionnaires to respondents who filled in the appropriated data. The only difficult part of questionnaires as a means of data collection is formulating questions and designing the questionnaire. In addition, another method used to collect data was observed. Tangible data was observed and noted down in notebooks. The observation was the easiest method used in the field as it provided accurate information. Questionnaires were administered to several respondents in the study field. The respondents were required to fill each questionnaire with one’s point of view without consulting other people. The questionnaires administered were of two types. The first one was a closed questionnaire, whereby answers were provided in each question and the respondents were only required to tick only the answers provided and write nothing more. Apart from this, there were open-ended questionnaires provided. In open-ended questionnaires, the respondents are free to write answers of their choice as long as they are relevant to the question asked as opposed to closed questionnaires. Some methods of data collection such as interviews do not require instruments [16- 20].

Structural Equation Modeling for the study SEQM regression analysis is used to examine the relationship between several factors affecting the building energy performance. It helps to analyze the theoretical model of analysis, which could clarify the relationship among contextual variables. The correlation between these factors may suggest causal relationships, because of other exogenous (third) variables. Hence, the SEQM-based multivariate analysis is used in identifying possible causal relationships and co-axial associations (correlations) amongst critical factors that propel BEE (Hu). Procedures for SEM Analysis [35].

The IBM AMOS 23 has been used for the current study to implement SEQM due to the strong communicative force, the graphical method was adopted in this study. The graphical representation with variables shown as circles (or eclipses) and squares (rectangles), potential causal connections (as arrows), and covariance (as two-headed arrows). Whilst, the undertaken procedure was explained (in Appendixes A).

5. Model Fit Indices

There are divergent views on acceptable minimum fit index parameters, with several studies having different requirements for the best fit model. Hence, the need for standardized reporting metrics, including associated thresholds, is therefore appropriate. Therefore, a fit threshold table based on best practice in previous studies was formulated in the current study. The threshold table was designed on the basis of several authors ' combination of recommendations [21]. For construct validity of the study models, standardized factor loading, average extracted variance (AVE) and construct reliability (CR) have been used. The size of all observed variables in the factor loading (FL) indicates their strength on the associated constructs. FL represents a factor's relationship with its indicator. This also contributes to constructing validity as FL is considered weak and unacceptable below 0.50 [21]. The measurement error for an observed variable implies another difference. CR also shows convergent validity and CR at 0.70 and above, indicating good reliability. While AVE is also a convergent validity indicator and a value > 0.50 suggests sufficient convergence. [21].

Fig. 2. Fountain inside the hotel

Fig. 3. LED Lights

Fig. 4. LED motion sensor

6. Validity and Reliability Test

Validity is defined as the degree to which equipment does what it is supposed to do accurately. For instance, if an instrument is used to collect numerical data about a given entity, then it captures all numerical data accurately. The primary sources of data used to collect data were valid. Questionnaires used to gather data presented precise and clear questions and answers. In addition, the questionnaires were free from ambiguity. The observation forms were well designed, and data was collected and recorded as stipulated. Secondary sources of information, which included a literature review of previous books and other materials, had up to date information. The reliability of data collection instruments can be termed as the extent of consistency of data collected. If the equipment is consistent in measurements with no variations on repeated measurements, then it is referred to as a reliable instrument. The instruments used to collect data were reliable and provided consistent data. The questionnaires used, for instance, provided clear data with minimal variations which can be attributed to the difference in respondents filling the questionnaires. In order to determine the reliability of the data collection instruments used in the research study, the following measurements were carried out. The observation was one of the principal methods used to gather data in the field. The consistency of the observation was measured by examining the extent of consistency of data provided by different respondents. Data collected seemed to be matching and consistent. Consistency was also determined by performing a test-retest of data collected, which includes evaluation of consistency over a given period of time. Reliability test for parallel forms was carried out on questionnaires to test the consistency of two similar forms. Questionnaire forms tested proved to be consistent and can be relied upon. Reliability was determined using Cronbach's Alpha test [23- 34- 35].

7. Results and Discussion

The findings of the demographic characteristics of age are shown in Figure 5 below. The study found that people between 31-40 years (44.5%) were the majority of participants, followed by people aged between 20-30 years (33.5%). People over 40 years were the minority in the survey. The age distribution showed that most respondents are youths. This is an indication that the hotel industry and energy sector in Jeddah, Saudi Arabia has a bright future as it is dominated by young people.

It is important to include the education level category of each respondent to the characteristics of the study respondents since it was probably going to greatly influence how the respondents would contribute to the results of the study. The researcher ratified that a highly educated staff would better understand the scope of the questions and their responses would represent the energy-efficient procedures situation in Jeddah, Saudi Arabia.

According to the results, the majority of participants 143 were Bachelor degree holders (71.5%), 28 of the participants were Master degree holders (14.0%), 20 were Diploma (10.0%) and 9 were PhD (4.5%). These findings show that construction industry in Saudi Arabia has a satisfactory level of education that can promote and require a clear understanding of the issues posed in the questionnaire and provide positive feedback based on their experience. The future of Jeddah's construction industry is still bright because majority of employees are middle aged and have advance their education so as they get hands into experience within the industry. Again, there's a substantial variety of young professionals who may be promoted just in case old ones retire. The high educated employees have a vast knowledge of energy-efficient procedures in buildings and how the construction industry in Jeddah perfectly fits to address the challenges facing the country [1-4].

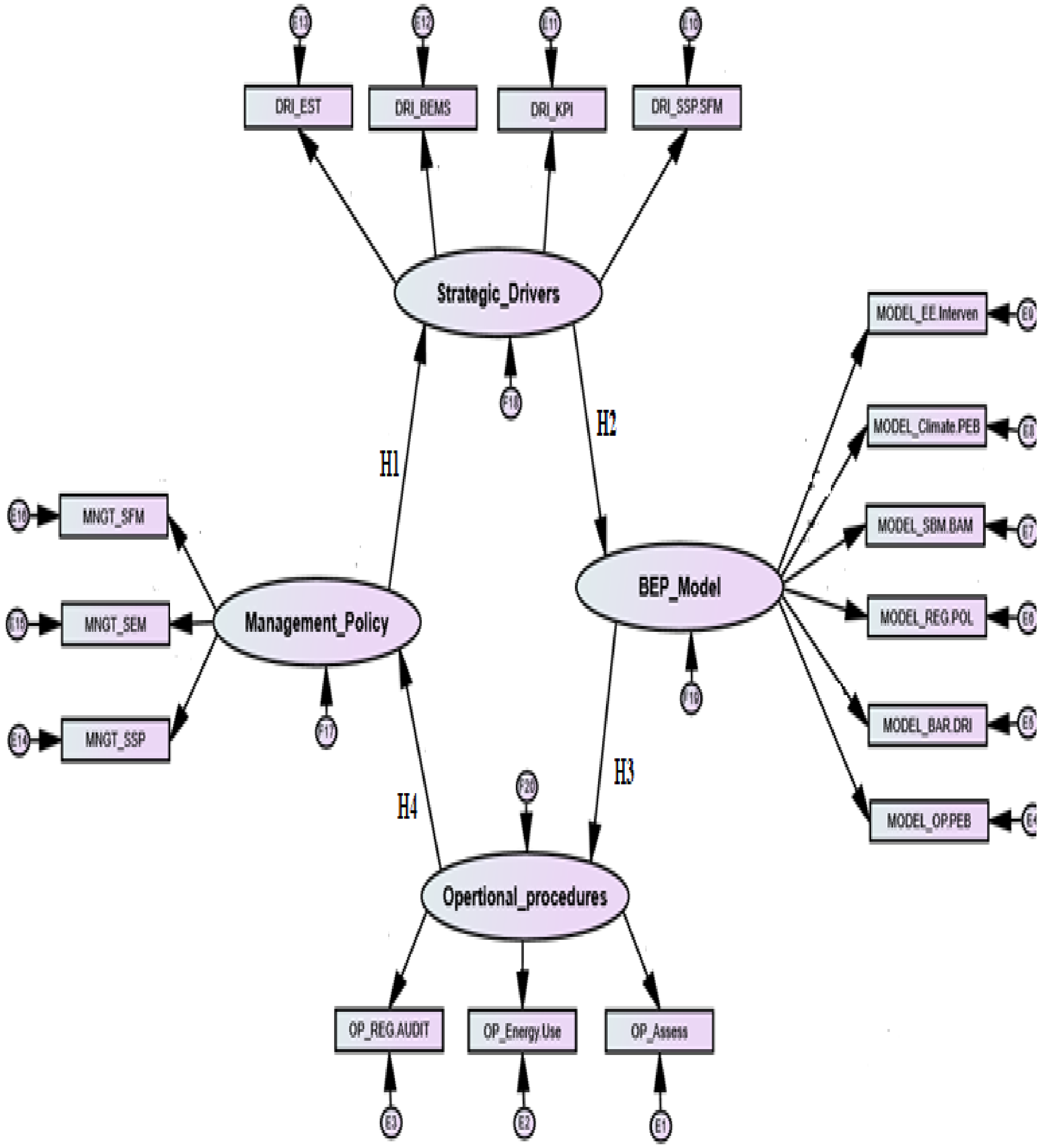

Fig. 5. Study theoretical model

The results show that the scale meets the requirement of reliability. The output values of Cronbach's Alpha test were higher than 0.70, which means all factors were reflective due to their indicators were highly correlated and largely interchangeable. The reliability Figures are shown in Table 1 below. The reliability of a scale indicates how free it is from random error and two frequently used indicators of a scale's reliability are test-retest reliability (also referred to as "temporal stability" and internal consistency (Pallant), in this study was applied only 'the reliability assessed by internal consistency, which according to Pallant is the degree to which the elements or items that make up the scale are all measuring the same underlying attribute (id Est, the extent to which the elements "hang together".

Table 1
Reliability statistics for the four factors

Factor label	Cronbach's Alpha	N of Items
Operational procedures	0.869	3
Management Policy	1.8.0	.
Strategic drivers	1.7.0	5
Model_BEP	1.870	6

Cronbach's alpha was 0.869, 0.831, 0.791 and 0.871 for Operational procedures, Management Policy, Strategic drivers and Model BEP, respectability. In this respect, George and Mallery indicated that there is no established interpretation of what is an acceptable alpha value and a rule of thumb that is applied in most of the situations is that alpha values greater than 0.9; 0.8; 0.7; 0.6; 0.5 and less than 0.5 are excellent, good, acceptable, questionable, poor and not acceptable, respectively. So, the Cronbach alpha obtained for these factors has good reliability [13-18].

8. Confirmatory Factor Analysis (CFA)

Based on the results of the exploratory factor analysis, the performance of building energy included the four latent factors which are: performance of building energy model, operational procedures, management policies and strategic drivers. Each latent factor was represented by three observed variables or more. To examine the construct validity, the confirmatory factor analysis technique-CFA was used via IBM Amos. In addition, the confirmatory factor analysis requires the absence of extreme numbers (not too big nor too small). Figure 6, illustrates that the results of CFA for the performance of energy model, that the model is clear of any illogical correlations which reach or exceed the correct value of (1). It confirmed that there is no problem in the CFA of BEP model, which consists of performance of building energy model, operational procedures, management policies, and strategic drivers. According to the previous literature reviews and the predetermined conceptual framework [21].

Table 2
Comparative Fit Indexes in the initial BEP model-1

CMIN/dof	2.824	<0.3	Fit
P-value for the model	.000	>0.005	Fit
(RMR)	0.028	<0.05	Fit
CFI	08.1	>0.90	Accepted
GFI	0.851	>0.90	Not accepted
PGFI	0.625	>0.50	Fit
AGFI	0.797	>0.90	Not accepted
RMSEA	0.096	<0.080	Not accepted
PCLOSE	0.000	<0.05	Fit
NFI	0.842	>0.90	Not accepted
RFI	0.810	>0.90	Not accepted
IFI	0.939	.0.90	Fit
TLI	0.868	Value almost equal to 1.00	Fit
PRATIO	0.833	Value >0.60	Fit

It is clear from Figure 6 as well as the Table 2 that the matching indicators between the BEP model with the data exceeded the standard criterion, that is, there is a mismatch between the BEP model and data, since the value of chi-square was (284.182), degree of freedom (100), significant level

(0.000), minimum discrepancy (chi-square/degree of freedom) (2.841) did not exceeded the standard criterion (5), comparative fit index (0.890) less than the standard criterion (0.90) and RMEAS indicator (0.096) more than the standard criterion (0.80) (Figure 6). This contradiction between the theoretical model and the data emphasizes the need to modify the model of the performance of building energy. To modify the model, correlating the factors is the only solution since all factors are important and have good loading factor.

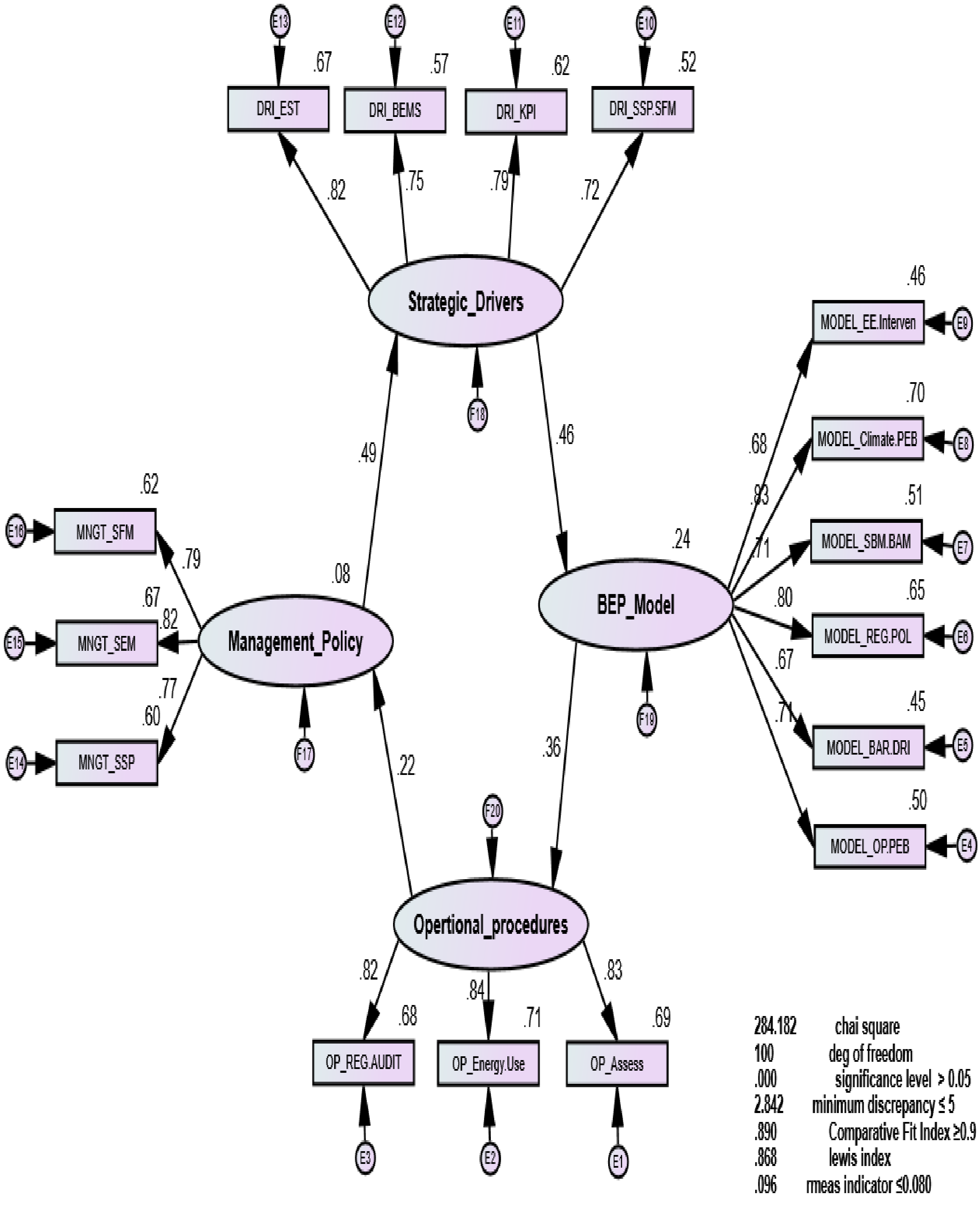

Fig. 6. Study theoretical model

Figure 6 relates to the confirmatory factor analysis for the performance of building energy (modified model). Also, Table 3 shows that the correlation indexes of performance of building energy with the data did not exceed the criterion that means there is a matching between performance of building energy and the data, where the value of chi-square was (189.248), degree of freedom (90), significant level (0.000), minimum discrepancy (chi-square/degree of freedom) (2.103) did not exceeded the standard criterion (5), comparative fit index (0.938) greater than the standard criterion (0.90) and RMEAS indicator (0.74) less than the standard criterion (0.80). This indicates that the BEP model is pervasive in the total population from which the sample is taken. A summary of the meanings of the indicators indicates that there is a correlation between the theoretical models of Performance of building energy and between the collected data.

Table 3
Comparative Fit Indexes in the initial BEP model-2

Model fit Metrics	Structural Model-2	Recommended	Acceptability
CMIN/Dof	2.103	<0.3	Fit
P-value for the model	.000	>0.005	Fit
RMR	0.030	<0.05	Fit
CFI	0.941	>0.90	Fit
GFI	0.904	>0.90	Fit
PGFI	0.598	>0.50	Fit
AGFI	0.855	>0.90	Accepted
RMSEA	0.074	<0.080	Fit
PCLOSE	0.004	<0.05	Fit
NFI	0.895	>0.90	Accepted
RFI	0.860	>0.90	Accepted
IFI	0.942	.0.90	Fit
TLI	0.921	Value ≃ 1.00	Fit
PRATIO	0.750	Value >0.60	Fit
PCFI	0.706	Value>0.60	Fit

All the comparative fit indexes are good or acceptable, this meaning that the modified BEP model fixes the data and can be used to energy saving (Table 3). Figure 6 and Table 4, show that the correlations between latent factors the performance of building energy, operational procedures, management policy, and strategic drivers were statistical significance, were the critical ratio greater than 1.964, significance level (probability value) less than (0.05) and the percentage of the correlations between the four latent factors ranged from (0.26) as a lowest correlation which was between operational procedures and Management Policy to the highest correlation (0.44) which was between management policy and strategic drivers. The correlation value was not less than (0.20) and not greater than (0.90), which leads to discriminant validity among the four latent factors included in the questionnaire. In other words, there is a correlation between the four factors and at the same time includes the discriminant and variation.

Table 4 includes the (share variance -SV) to each correlation between two factors, such as the correlation between the BEP model and operational procedures was (0.38), the (SV) between the two factors equal the square of the correlation value (0.144). Also, the correlation between management policy and strategic drivers was (0.44) and the SV was (0.1936), so for the rest of the correlations between the other factors. The share variance is also useful to study the discriminant validity as will be showing when Fornell –Larcker Criterion is used.

The criterion to assess discriminant validity using the Fornell-Lacker criterion. This method compares the square root of the average variance extracted (AVE) with the correlation of latent constructs. A latent construct should explain better the variance of its own indicator rather than the variance of other latent constructs. Therefore, the square root of each construct's AVE should have a greater value than the correlations with other latent constructs.

Table 4
Estimates, critical ratio and other statistical parameters of modified BEP model

Parameters	Est	SE	C.R	P	R
Management Policy Operational_ procedures	0.34	0.119	2.88	0.004	0.26
BEP_Model Strategic Drivers Opertional_procedures	0.627	0.13	4.83	***	0.38
BEP_Model Strategic Drivers	0.17	0.38	4.66	***	0.38
Management Policy	0.46	0.093	4.93	***	0.44

Referring to Table 5, the CR for all constructs is above 0.83 and the AVE values are within 0.5475 and 0.6930. The discriminant validity was assessed using Fornel and Larcker by comparing the square root of each AVE in the diagonal with the correlation coefficients (off-diagonal) for each construct in the relevant rows and columns. Overall, discriminant validity can be accepted for this measurement model and supports the discriminant validity between the constructs. study of the association among the four latent constructs of the hypothesized working established that important causal association occurs through subscales. The latent constructs are the sub-BEP model for building energy performance, strategic drivers, management policy and operational procedures (Figure 4). the four paths model was created to characterize the causation and their assessment. The goal was to know the influence of each latent construct and variables to explicate the performance in enhancing energy performance in buildings.

Table 5
Composite reliability (CR), the square root of the average variance extracted (AVE) (in bold) and correlations between constructs (off-diagonal)

	CR	AVE	1	2	3	
BEP Model	0.87	0.54	0.73	0.46	0.36	0.51
Strategic Drivers	0.85	0.60	0.46	0.77	0.19	0.46
Opertional_procedures	0.87	0.69	0.36	0.19	0.83	0.26
Management Policy	0.83	0.63	0.51	0.46	0.26	0.79

The hypothesized path (H1) showing that the management policy is influencing strategic drivers. The second path (H2) showing that strategic drivers are influencing the BEP sub-model. The third path showing that the BEP sub-model is influencing operational solutions (H3). While the fourth pathway is showing that the latent variables of operational procedures are influencing management policy (H4) as shown in Figure 6.

The strategic energy management, strategic facilities management, sustainable strategy are necessary indicators of the efficient administration's energy supervision strategy, henceforth, the high factor loading with Management policy. The outcome ratifies the present principle of oversight, which reinforced the need to connect the gap between the operational and strategic grade of energy strategy and valuation of participation, to scale up to expand climate alleviation issues. The strategic sustainable policy and strategic facility management display solid covariance showing incorporation of strategic facility management into the administration's strategic sustainable policy to strengthened energy performance plan.

The factors of latent variable strategic drivers: renewable technologies, key performance indicators, building energy management technologies, energy-saving technologies, and strategic sustainable policy/strategic facilities management got great factor loadings (0.700-0.841). The outcome displays that the pointers evaluated the latent variable strategic drivers and recognized convergent reliability. The drivers are operational properties (assumed structure and recruitment) devoted to improving energy performance in building, using an administration's energy supervision strategy and operational process. The outcome encourages the believers of investment in tactical management, energy efficacy and preservation-dedicated restoration, and carbon management value in buildings.

The EFA outcome recognized six crucial factors for the BEP construct as a sub-model. They are the administration's concern for climate change matter founded on building alleviation and adaptation actions readiness sustainable building management (SBM) strategy founded on BAM strategy operations FM introduced EE drivers and predominant obstacles rules and standards as externalities and present EE involvement installations. All evaluated variables have great factor loadings with the BEP_Model construct: (0.689-0.821). The evaluated pointers recognized convergent validity with no problem of cross-loading. Present studies recognized solid theoretic correlations between these factors henceforth, they were covaried.

The CFA outcome (Table 2), on the other hand, shows that initial model 1 fit statistics were not identical to the threshold. The supreme modification index was utilized to enhance model 1 (Figure 4). Consequently, model 1 was changed to the modified model 2. AMOS adjustment was utilized to covary error variances of: Dri_SSP-SFM (e10) to Mngt_SSP (e14), Mngt_SFM (e16); Dri_KPI (e11) to Mngt_SFM (e16); Mngt_SFM (e16) to Mngt_SSP (e14);MNGT_SSP (e14) to OP_REG_Audit (e3); Model_OP_BEP (e4) TO Model_BAR_DRI (e5), Model_OP_BEP (e4) to Model_EE_Interven (e9); Model_BAR_DRI (e5) to Model_REG_POL (e6), Model_BAR_DRI (e5) to Model_EE_Interven (e9); Model_REG_POL (e6) to Model_SBM_BAM (e7) have been covaried to convert model 1 to themodified model 2. This is sustained by existing publications that have established solid relations between SSP/SFM and EE barriers/drivers and SFM and KPIs. Assessment of the new model-2 shows a satisfactory fit indecies for the model fit statistics (Table 4). There is a significant difference between model 1 and modified model 2 with a decrease in chi-square statistics ($X2$ (90) = 180.248; pvalue = 0.000). The differences between model-1 and model-2 are very significant ($\Delta X2$ (3) = 94.934. Also, RMR (0.030 < 0.05), which shows a satisfactory general hypothesized model. Therefore, the modified model 2 is recognized as an enhanced model and greatest for testing the hypotheses. Other fit index: CMIN/dof = 2.103; pvalue < 0.03; GFI = 0.9043; PGFI = 0.598; CFI = 0.941; RMSEA = 0.074; Pclose = 0.004; IFI = 0.942 and PCFI = 0.706 are inside the satisfactory threshold of decent model fit indices.

Outcomes of observed variable and inter-constructs association assessment for the modified model 2 (Table 3) shows solid significant associations. The correlation between the latent variables of BEP_Model and Operational was very significant with r = 0 361 at the 0.01 significance level. The operational energy assessment has high association with energy audit (r = 0.675) and operational energy_use (r = 0.705). It ratifies the significance of the utilization of energy modeling and auditing for the valuation of BEP. Management policy converts a crucial achievement factor in the select, design and application of involvements for enhancing BEP.

9. Conclusion

On the basis of the research discoveries, below are the concluding points that can be drawn.

i. The highest discovery recognized small energy answers for building energy performance that conforms into a structural model founded on the current study theoretical model.
ii. The exploratory factor analysis and confirmatory factor analysis outcomes have important inference to facilities managers, proprietors and investigators as its proposal a spectrum of energy performance in building factors, their association, and the interdependence between them to energy efficiency experts. For instance, the outcome of the trial of hypotheses structural associations among model routes showed causality and intermediations for the model routes. The strategic driver latent variable was recognized as the lone intermediary between the energy performance latent variables and management policy, and it has causal influences on the general building energy performance framework. This is important as it understood the full cost of the strategic drivers in using the energy efficiency system of buildings as a decision-making method to improve the energy performance of buildings.
iii. The study recognized the crucial route in the general building energy performance model for enhancing energy yield. It recognized solid interdependent associations among the four latent variables in the model. The stronger effects were: Strategic_ Drivers on building energy performance model (0.627) and Management_Policy on Strategic_Drivers (0.460) highlighting the importance of the constructs on energy saving.

In summary, all constructs are necessary to reduce energy consumption. All the four- element have an impact on Strategic Drivers (estimates from 0.70 to 0.80) indicating the importance of DRI_SSP.SFM, DRI_KPI, DRI_BEMS, and DRI_EST for the efficient use of energy. Also, the three elements of Management policy, MNGT_SSP, MNGT_SEM, and MNGT_SFM had a high impact on energy saving (estimates from 0.70 to 0.89). In relation to the operational Procedures construct, all three variables (OP_Energy.Use, OP_REG.AUDIT and OP_Assess) were high and positive (from 0.82 to 0.84) suggesting a very strong effect on BEP model to energy saving. Finally, all the variables (six) of the BEP Model construct had estimates from (0.54 to 0.91) ratifying the importance of them to energy saving

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