SUSTAINABLE BUILDING CONSTRUCTION PRACTICES AND OCCUPANTS' LEVEL OF SATISFACTION

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ABSTRACT

The construction industry consumes enormous energy and emits greenhouse gases (GHG) due to the intensity of its activities. This study assesses the level of incorporation of sustainability in the design and construction of buildings and the extent to which sustainable construction practices influence occupants' level of satisfaction. Through a cross-sectional research design, a survey of one hundred (100) construction professionals was conducted. A structured questionnaire was developed and used as an instrument for primary data collection. A total of eighty (80) questionnaires were successfully retrieved and the data were used for the study. The data were processed and analysed with the aid of Statistical Package for Social Sciences (SPSS) version 26.0 and R programming language. Frequency tables and relative implementation index (RII) were used for the descriptive statistic while the ggpairs plot and Spearman correlation analysis were utilised to analyse the study's hypothesis. The results show that the ease of access in and out of building construction sites and downsizing on the use of incandescent bulbs and replacing them with energy-saving bulbs are the most often implemented sustainability practices in building design and construction phases respectively. There is a significant positive correlation between sustainable practices and the satisfaction of building occupants. The study concludes that the current sustainability practices on construction projects are economically driven. The study recommends the advocacy and enlightenment of construction stakeholders on the need to sustain efforts at incorporating sustainability features in the design and construction of buildings.

Keywords: construction industry, buildings, sustainability, stakeholders, sustainable construction.

1. INTRODUCTION

The importance of the construction industry in a developing country, such as Nigeria cannot be overemphasized. In 2011, the building and construction sector's contribution to Nigeria's GDP was 3.32%. The building and construction sector in Nigeria are very active with several concurrent activities daily. These activities are driven by resources, making the building and construction activities one of the topmost sectors in the consumption of both natural and artificial resources. Randolph, Masters, Randolph, and Masters (2018) opine that building construction and allied activities account for 40% of energy, 25% of water and 40% of other global resources that are used each year around the world. Baloi (2003) posits that construction activities make extensive use of resources such as energy and water as building construction alone consumes40 percent of raw stones, gravel and sand and 25 percent of virgin wood yearly.

Nwokoro and Onukwube (2011) explain that the construction industry is a complex one due to the involvement of its numerous stakeholders and their divergent interests. Notwithstanding its complexity, the construction industry plays a critical role in the economic, social and

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environmental sectors of the nation. The level of activities and the huge resources requirement of the construction and building sector suggests that there is a need for resource optimization and implementation of global best practices in the industry. The process by which such resource optimization and environmental preservation are pursued while the set project goal is achieved is termed sustainability (Kuhlman and Farrington, 2010).

Sustainability then refers to the process of maintaining well-being over a long or indefinite period (Kuhlman and Farrington, 2010). Baloi (2003) explains that sustainable construction can be seen as a sub-set of sustainable development within the confines of the construction industry. Also, Khalfan, Noor, Maqsood, Alshanbri and Sagoo (2015) posit that sustainable construction can be defined as the creation and responsible management of a healthy built environment based on resourceefficiency and ecological principles. Sustainable construction entails the effective application of the principles of sustainable development to the comprehensive construction cycle of a building. This would enhance optimum comfort and viable use of a building through its lifetime (Rahim, Yusoff, Zainon, Wang, and Lumpur, 2014).

There are criteria by which a building or construction project is evaluated for sustainability compliance. These criteria are recognised as the metrics of sustainability (Loman, 2014). The US Green Building Council (2009) posits that sustainable building development entails the construction of buildings in a manner that it effectively meets the metrics of resource efficiency, water efficiency, innovation in design, energy efficiency, improved indoor and environment air quality as well as a reduction in the emission of greenhouse gases. Although Elmualim and Alp (2016) opine that the construction industry should be the main sector in which the requirements of sustainability are met, far from that expectation is the present reality especially in developing countries. In Nigeria, for example, buildings are oftentimes constructed using the traditional construction practice in which the goal is to complete construction activities as quickly as possible while little or no attention is paid to the consequential impact of the activities on the environment.

Challenges mitigating the adoption and implementation of sustainable practices range from economic and social challenges to regulatory challenges (Elmualim and Alp, 2016). The practice of sustainable construction is further seen to be at infancy in Nigeria with a low level of awareness of construction professionals on the key concepts of sustainable building development (Nduka and Ogunsanmi, 2015). Besides, construction professionals are generally reluctant to embrace the totality of the practices of sustainability on construction projects (Nwokoro and Onukwube, 2011). This study, therefore, investigates sustainable practices and the frequency at which they are implemented in the design and construction of building projects and the extent to which building occupants are satisfied with the level of sustainability features in their buildings.

1.1. Objective of the Study

To investigate sustainable practices and the frequency at which they are implemented in the design and construction of building projects and the extent to which building occupants are satisfied with the level of sustainability features in buildings.

1.2 Research Hypothesis

Ho: There is no significant relationship between sustainable construction practices and the satisfaction of building occupants in Lagos state.

2. LITERATURE REVIEW

Literature has established that there are three dimensions of sustainability namely: social, economic and environmental dimensions (Kuhlman and Farrington, 2010; Pancovska, 2017). The process of achieving sustainable construction involves the optimisation of design, tendering, site planning, organisation, material selection, recycling and waste minimisation. Globally, the incorporation of sustainable practices across different fields has become an increasing trend that is aimed at scaling down the negative impact of man's activity on the environment. In the construction industry, a project is considered sustainable only when all the basic principles of sustainability are compatible with each other (Mateus andBragança, 2011). It is in this regard that Ilesanmi (2015) describes the concept of sustainability as the attempt towards simultaneously achieving the goals of a better economy, improved environment, and a more participating society. Also, Du Plessis et al. (2001) posit that the construction of a sustainable building is a concept aimed at creating harmony between the natural and built environment. This involves all processes initiated during construction that satisfies economic, environmental and social issues throughout the service life of a building (Basiago, 1999).

The practices of sustainability are a fast-rising trend amongst countries especially the developed ones as it has become the pivot around which all other activities depend (Miranda andMarulanda, 2002). This is because the earth's resources are under severe pressure due to the increase in population and economic expansion (Ametepey, Aigbavboa, and Ansah, 2015). Sustainable development of any building or construction projects is characterisedby the major goal of creating a healthy built environment based on efficient use of resources and smart ecological design (Shofoluwe, 2013). The elements and key features of sustainability comprise of energy efficiency, resource or material efficiency, healthy indoor environmental quality, utilising clean and renewable energies, environmental degradation followed by greenhouse gas emission, sustainability in designs and contracts and water conservation (TaheriattarandFarzanehrafat, 2014).

Schwarz, Beloff and Beaver (2002) explain that there are five basic indicators of sustainability metrics for construction projects. These indicators include: material utilisation, energy utilisation, water utilisation, toxic emissions and pollutant emissions. Furthermore, Robert, Parris, and Leiserowitz (2005) add that the entire exercise of sustainability compliance aims at achieving a leadership role in greenhouse gas emissions reduction, energy efficiency, renewables, and waste treatment and handling. One of the known agents promoting sustainability in the construction industry is the Leadership in Energy and Environmental Design (LEED). LEED is a third-party certification program and an internationally accepted benchmark for the design, construction, and operation of high-performance sustainable buildings (Canada Green Building Council, 2017). LEED provides sustainability metrics for benchmarking the design and construction of buildings across five areas comprising sustainable site development, water efficiency, energy efficiency, material selection, and indoor environmental quality. This study adopts all the metrics of sustainability highlighted in the literature that was reviewed in the investigation of sustainable practices in the construction of buildings in Lagos state.

Furthermore, the implementation of sustainable practices on a project largely depends on the knowledge, perception, and involvement of all stakeholders on the project. It is also of importance that these stakeholders have an appreciable understanding of the consequences of their actions (Plessis and Africa, 2012). However, Abidin (2010) reveals that the overall awareness and knowledge of construction stakeholders on sustainability concepts in developing countries are below satisfactory, taking the case of Malaysia as an example. The case in Nigeria is not so far from that of Malaysia as the practice of sustainability in the Nigerian construction industry is yet to be pronounced.

Previous studies (Mensah and Castro, 2004; Abolore, 2012; Loman, 2014; AbisugaandOyekanmi, 2014) have highlighted the potential benefits of sustainable construction practices in the built environment and eco-system through the protection of natural resources and efficient energy utilisation. The studies posit that sustainable practices significantly increase financial profit, delivers long term competitiveness, maximum utilisation of land, optimised energy input and decrease in the possible impacts of risks for the global and local environment. Furthermore, Nwokoro and Onukwube (2011) opine that the practice of sustainability in buildings also impacts on the satisfaction and safety of occupants through the attainment of visual and thermal comfort, and satisfactory indoor air quality. This study adopts the criteria of visual comfort, thermal comfort and indoor air quality as variables for assessing the satisfaction of the respondents on sustainable practices within the study area.

3. METHODOLOGY

This study was delimited to Lagos state located in the south-western region of Nigeria. The choice of Lagos State was because Lagos state is the economic nerve centre of Nigeria with the largest concentration of industries, financial institutions, and a major seaport. The human population of the state is over 9 million people (National Population Commission, 2009). This rank the state among the fastest growing cities in Nigeria with a significant level of construction activities which enhanced the collection of data for this study.

A structured questionnaire was developed and administered as the principal instrument for collecting data for the study. A sample frame of 101 building construction firms was populated from the online database of building contractors in Lagos State (https://www.businesslist.com.ng/companies/building-contractors).The simplified formula for proportions (Yamane, 1967) was used to determine the sample size for the study at a 95% confidence level and a 0.05 precision level. The proportionate sample size of 80 was obtained.

Using the simple random sampling technique, a total of one hundred (100) questionnaires were administered to each of the sampled construction firms. A total of eighty (80) questionnaires were retrieved. Retrieved questionnaires were scrutinized for errors, omissions, completeness, and consistencies and were found to be adequately completed and suitable for analysis. The returns represent an 80% response rate. The data were processed and analysed with the aid of Statistical Package for Social Sciences (SPSS) version 26.0 and R programming. Frequency tables and relative implementation index were used for the descriptive statistic while the ggpairs plot and Spearman correlation analysis were utilised to test the hypothetical statement formulated for the study.

4. RESULTS AND DISCUSSION

Table 1 shows the characteristics of respondents for this study. The table shows that about 23% of the respondents were architects, 35% were Builders, 25% were Civil Engineers while 20% belong to other professions. The other profession category comprised of other professionals that were involved in the management of building construction projects within the study area.

Table 1: Demographic Data of Respondents

DemographicData	Frequency	Percentage
Years of Experience		
Below 5 years	38	47.5
6 – 10 years	32	40
11 – 15 years	6	7.5
16 – 20years	2	2.5
Above 20 years	2	2.5
Total	**80**	**100.0**
Profession of Respondent		
Architect	18	22.5
Builder	28	35
Civil Engineer	18	22.5
Others	16	20
Total	**80**	**100.0**
Academic Qualification		
OND	4	5
HND	14	17.5
B.Sc.	40	50
M.Sc	22	27.5
Total	**80**	**100**
Nature of Organization		
Building Contracting	12	15
Building and Civil Contracting	36	45
Building and Civil Consulting	20	25
Others	12	15
Total	**80**	**100**

Furthermore, Table 1 reveals that 15%of the respondents work in building contracting firms, 45% work in building and civil contracting firms, 25% work in building and civil consulting firms and 10% work in other types of firms. Also, the years of experience of respondents show that 47.5% of the respondents had working experiences below 5 years, 40 percent had work experiences ranging between 6 to 10 years, about 8% of the respondents had work experiences ranging between 11 to 15 years, about 3% of the respondents had work experiences of between 16 to 20 years and about 3% had work experiences above 20 years. The general outlook of the length of working experiences of the respondents implies that the respondents are conversant with construction processes and have ample experiences on construction activities. This suggests that the majority of the respondents have the requisite experience to answer questions on the practices of sustainable construction and were able to provide valuable responses in line with the objective of this study.

This study assessed sustainable practices that were frequently implemented in the design and construction of buildings in Lagos state. In evaluating sustainable practices that were often incorporated into the design of buildings, a list of sustainable practices that should be incorporated into the design and construction of buildings were extracted from literature into the questionnaire and presented to the respondents. The respondents were asked to rate their responses on a 5-point Likert scale ranging from 1= never to 5= always. This was intended to elicit information on how often each of the sustainable practices was incorporated into the design and construction of buildings in Lagos State. The data collected were analysed using the relative implementation index (RII) formula. The RII is expressed as:

$RII = \sum W / (A*N)$ …………..equation 1

Where:
W= weight given to each sustainability practices by the respondents
A = is the highest weight
N = is the total number of respondents

The calculated RII values were interpreted using the scale $RII \geq 0.76$ means most often implemented, $0.67 \leq RII \leq 0.75$ means often implemented, $0.45 \leq RII \leq 0.66$ means rarely implemented and $RII \leq 0.44$ means not implemented (Waziri andVanduhe, 2013; MagutuandKamweru, 2015). The resulting analysis is presented in Table 2.

Table 2: Frequency of Implementing Sustainable Practices in Building Design

Sustainable Practices	N	RII	Rank	Remark
Ease of access in and out of site	80	0.97	1	MOI
Health, welfare, and satisfaction of occupants	80	0.92	2	MOI
Effective prevention of water pollution.	80	0.89	3	MOI
Improved indoor air quality using the daylighting system and passive ventilation	80	0.88	4	MOI
Minimization of waste	80	0.84	5	MOI
Efficient use of water in the building during and after construction	80	0.83	6	MOI
Optimization of energy during and after construction.	80	0.82	7	MOI
Comfortable thermal environment	80	0.81	8	MOI
Cost efficiency	80	0.78	9	MOI
Reduction in the whole life cost of the building	80	0.77	10	MOI
The use of passive and efficient ventilation system to improve indoor air quality	80	0.73	11	OI
Visual comfortability	80	0.71	12	OI
The proximity of site and effective land utilisation	80	0.69	13	OI
Control of pollution and abatement of noise	80	0.69	14	OI
Use of recyclable and renewable materials to effect cost-efficiency	80	0.57	15	RI

Sustainable Practices	N	RII	Rank	Remark
Reduction of environmental impact through sustainable site allocation	80	0.44	16	NI
Conservation of existing natural areas and promoting biodiversity	80	0.44	17	NI
Efficient utilisation/consumption of energy within building overtime	80	0.43	18	NI
Conserving energy through renewable and recyclable materials	80	0.42	19	NI

Note: MOI = Most often incorporated, OI = Often incorporated, NI=Not incorporated

Table 2 shows that the sustainability practices that were often incorporated into the design of buildings in Lagos state include; efficient use of water in the building during and after construction, optimization of energy during and after construction, comfortable thermal environment, cost efficiency and reduction in the whole life cost of the building. However, reduction of environmental impact through sustainable site allocation, conservation of existing natural areas and promoting biodiversity, efficient utilisation or consumption of energy within building overtime and conserving energy through renewable and recyclable materials were sustainable practices that were not incorporated in the design of buildings within the study area. The results suggest that building designers and construction professionals within the study area incorporate sustainable practices that impact the project overall cost than those that impact the environment in which the buildings were constructed.

This result implies that not all the possible sustainability practices are incorporated in the design of buildings in Lagos state. Building construction activities in the state, therefore, have potential negative consequences on the environment. This implication buttresses the concern of Baloi (2003) that the lack of recognition in the design process for the extensive use of natural resources, various sources of energy, and water demand of a building would often result in severe consequences on the environment. Furthermore, Ofori, Gyadu-Asiedu, and Assah-Kissiedu (2015) explain the importance of conceiving sustainability right from the design of building projects. The authors posit that the future of sustainable construction has its roots in past and present actions and the future depends on the awareness of the consequences of construction stakeholders’ acts and deeds.

This study also assessed the sustainable practices that are implemented during the construction of buildings in Lagos state. In assessing this, a 5-point Likert scale ranging from 1= never to 5= always was presented to the respondents. The data collected was analysed using the relative implementation index (RII) formula. The calculated RII values were interpreted using the scale RII ≥ 0.76 means most often implemented, 0.67 ≤ RII ≤ 0.75 means often implemented, 0.45 ≤ RII ≤ 0.66 means rarely implemented and RII ≤ 0.44 means not implemented (Waziri andVanduhe, 2013; MagutuandKamweru, 2015). Table 3 shows the result of the analysis.

Table 3: Frequently Implemented Sustainable Practices during Building Construction

Sustainable Practices	N	RII	Rank	Remark
Downsizing the dominant use of incandescent bulbs and replacing them with energy-saving bulbs (i.e. CFLs and LEDs)	80	0.89	1	MOI
Innovative wastewater technologies to reduce wastewater generation	80	0.83	2	MOI
Use of efficient insulating wall materials to enhance indoor air quality	80	0.83	3	MOI
Innovative water management to increase water efficiency	80	0.82	4	MOI
Application of daylighting to increase visual comfort	80	0.82	4	MOI
Use of low energy cooling system to enhance Indoor Air Quality (IAQ)	80	0.80	6	MOI
Use of effective acoustics materials	80	0.78	7	MOI
On-site application of renewable technology	80	0.67	8	OI

Note: MOI = Most often implemented, OI = Often implemented, NI=Not implemented

The results in Table 3 show that the downsizing of the dominant use of incandescent bulbs and replacing them with energy-saving bulbs (i.e. CFLs and LEDs) to achieve energy optimization is the most often implemented sustainable practice (RII= 0.89) during the construction of buildings. Innovative wastewater technologies to reduce wastewater generation and the use of efficient insulating wall materials to enhance indoor air quality jointly ranked as the second most implemented sustainable practices (RII= 0.83) during the construction of buildings. These were closely followed by innovative water management to increase water efficiency and the application of daylighting to increase visual comfort (RII= 0.82). Use of low energy cooling system to enhance IAQ (RII= 0.80) and the use of effective acoustics materials (RII= 0.78) ranked as the second to the last and last most often implemented sustainable practices respectively. This result aligns with the findings of (Degefa, 2010; Natural Resources Defense Council, 2012; Apanavičiene, Daugeliene, Baltramonaitis, andMaliene, 2015) that significant cost savings can be achieved in the cost of energy through the use of energy-saving bulbs.

The study assesses the level of satisfaction of building occupants on the features of sustainability in their buildings. This was done by asking the respondents of this survey to rate the feedback of occupants on the parameters of sustainability in their buildings. A 5-point Likert scale ranging from 1=very dissatisfied to 5= very satisfied was provided to the respondents for the assessment. Table 4 shows the result of the analysis.

Table 4: Occupants Satisfaction on the Level of Sustainability Features in Buildings

Sustainability Features	N	Mean
Indoor ventilation and air quality	80	4.08
Visual comfort and lighting	80	4.05
Thermal comfort in periods of cold and heat	80	4.03
Sound and acoustic designs to minimize noise and echoes	80	3.68
Daylighting complimenting electric lighting	80	3.63

Table 4 shows that the building occupants were satisfied with all the five sustainability features in their buildings. The level of satisfaction was in the order: indoor ventilation and air quality (4.08), lighting and visual comfort (4.05), thermal comfort (4.03), acoustic comfort (3.68) and the use of daylight as a complement to artificial lighting (3.63) respectively.

4.1 Test of the Research Hypothesis

H_o- There is no significant relationship between sustainable practices and the level of occupants' satisfaction with sustainable features.

H_1- There is a significant relationship between sustainable practices and the level of occupants' satisfaction with sustainable features.

In analysing the hypothesis, a data visualization analysis was processed using R programming. The ggpairs() function of GGally package in R programming was used to produce a scatterplot matrix for the variables of sustainable practices and occupants' level of satisfaction with sustainable features. The resulting scatterplot matrix is shown in Figure 1:

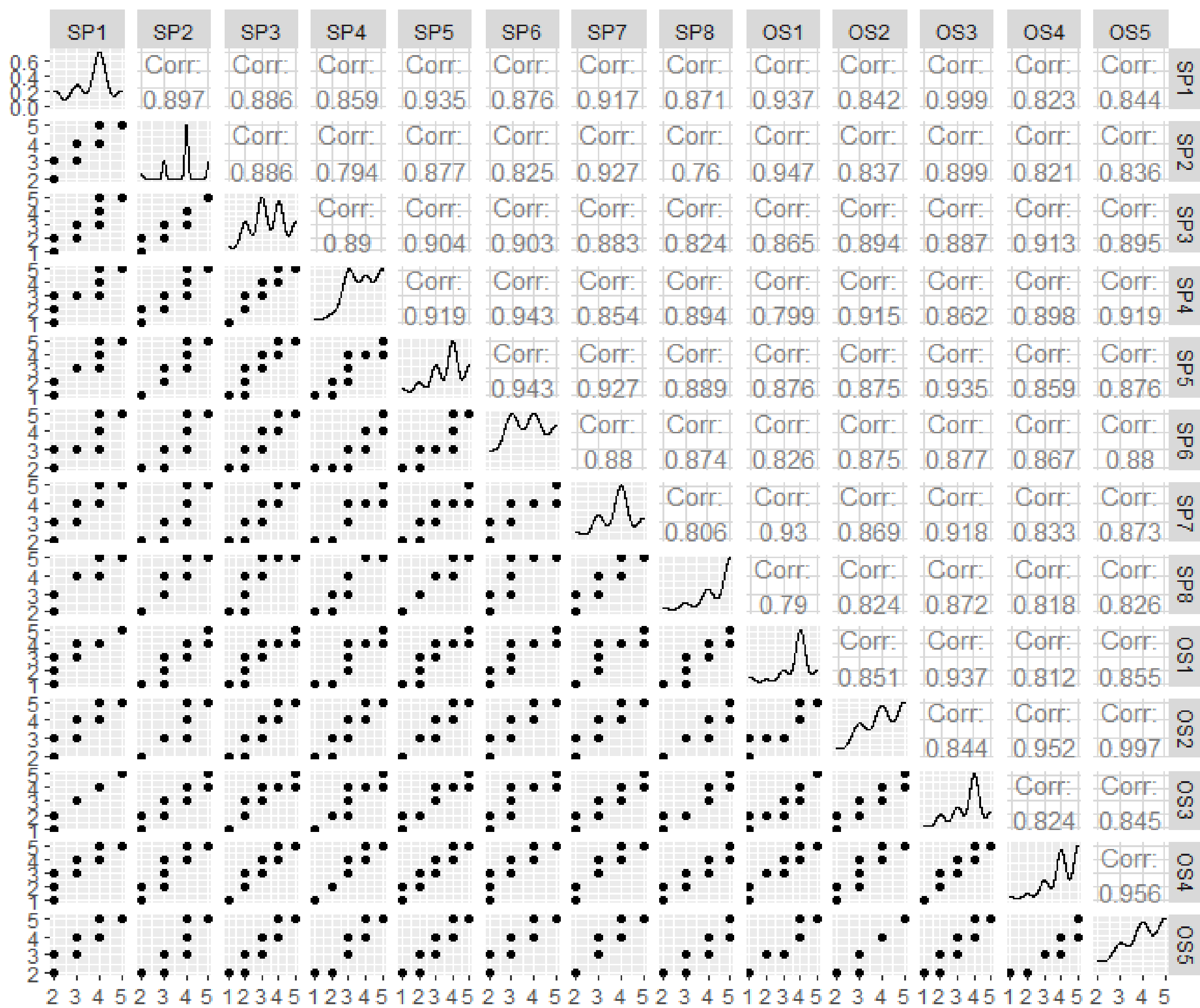

Figure 1: Scatterplot matrix for sustainable practices and occupants' level of satisfaction.

Note: SP means sustainable practice while OS means building occupants' level of satisfaction. SP1= efficient insulating walls, SP2= wastewater technologies, SP3= application of renewable technology, SP4= application of daylighting, SP5= effective acoustics design, SP6= low energy cooling system, SP7= water reduction technology, SP8= use of energy-saving bulbs, OS1= acoustic design satisfaction, OS2= visual comfort satisfaction, OS3= lighting design satisfaction, OS4= indoor air quality satisfaction, OS5= thermal comfort satisfaction.

From the results of the ggpairs scatterplot in Figure 1, positive linear patterns were observed between each of the eight variables of sustainable practices (SP1, SP2,…SP8) and the five variables of building occupants' level of satisfaction (OS1, OS2,…OS5). The result implies that there is a positive correlation between the pairs of sustainable practices and occupants' level of satisfaction variables respectively.

To establish the magnitude and the significance of the relationship between the variables, the postulated hypothesis was further analysed using the spearman rank correlation. The result of the spearman correlation is shown in Table 5:

Table 5: Spearman Correlation Matrix between Sustainability Practices and Building Users' Satisfaction

		SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	OS1	OS2	OS3	OS4	OS5
SP1	*r*	1												
	p													
SP2	*r*	.897**	1											
	p	.000												
SP3	*r*	.886**	.886**	1										
	p	.000	.000											
SP4	*r*	.859**	.794**	.890**	1									
	p	.000	.000	.000										
SP5	*r*	.935**	.877**	.904**	.919**	1								
	p	.000	.000	.000	.000									
SP6	*r*	.876**	.825**	.903**	.943**	.943**	1							
	p	.000	.000	.000	.000	.000								
SP7	*r*	.917**	.927**	.883**	.854**	.927**	.880**	1						
	p	.000	.000	.000	.000	.000	.000							
SP8	*r*	.871**	.760**	.824**	.894**	.889**	.874**	.806**	1					
	p	.000	.000	.000	.000	.000	.000	.000						
OS1	*r*	.937**	.947**	.865**	.799**	.876**	.826**	.930**	.790**	1				
	p	.000	.000	.000	.000	.000	.000	.000	.000					
OS2	*r*	.842**	.837**	.894**	.915**	.875**	.875**	.869**	.824**	.851**	1			
	p	.000	.000	.000	.000	.000	.000	.000	.000	.000				
OS3	*r*	.999**	.899**	.887**	.862**	.935**	.877**	.918**	.872**	.937**	.844**	1		
	p	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000			
OS4	*r*	.823**	.821**	.913**	.898**	.859**	.867**	.833**	.818**	.812**	.952**	.824**	1	
	p	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		
OS5	*r*	.844**	.836**	.895**	.919**	.876**	.880**	.873**	.826**	.855**	.997**	.845**	.956**	1
	p	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	

Note: **. Correlation is significant at the 0.01 level (2-tailed), SP means sustainable practice while OS means building occupants' level of satisfaction. SP1= efficient insulating walls, SP2= wastewater technologies, SP3= application of renewable technology, SP4= application of daylighting, SP5= effective acoustics design, SP6= low energy cooling system, SP7= water reduction technology, SP8= use of energy-saving bulbs, OS1= acoustic design satisfaction, OS2= visual comfort satisfaction, OS3= lighting design satisfaction, OS4= indoor air quality satisfaction, OS5= thermal comfort satisfaction.

Table 5 shows the results for the correlation coefficient (r) and significance level (*p*) for the variable matrix. From the result, the correlation coefficient values (r) for each of the paired matrix were greater than 0.3 and the corresponding significant *p*-values are less than 0.01. The results mean that there is a statistically significant positive relationship between sustainable practices and building occupants' level of satisfaction with sustainable features in their buildings. The statistically significant positive linear correlation result implies that the null hypothesis is rejected**.** Hence, there is a significant relationship between sustainable practices and the level of occupants' satisfaction with sustainable features.

4.2. DISCUSSION OF FINDINGS

The study assesses the level at which sustainability is practised on building construction projects. The result of the survey shows that sustainability practices that are often incorporated into building designs include: the ease of access in and out of site, health, welfare and satisfaction of occupants related design considerations, effective use of water during and after the construction project, consideration for pollution control, optimization of resources and cost-efficiency. The results suggest that building construction firms prioritise the consideration for access in and out of the buildings, prevention of water pollution and the optimization of resources at the point of the design. The result supports the study of Khalfan, Noor, Maqsood, Alshanbri and Sagoo (2015) and Ofori et al (2015) that there are improvements in the degree at which construction firms are incorporating sustainability practices in the design of buildings.

Furthermore, the results show that the efforts at promoting sustainability in construction are not limited to the building designers' desk as it transcends the designing, planning and construction phases of a building construction project but dovetails into the occupancy, operation and maintenance phases respectively. Therefore, the findings of this survey show that significant efforts are made at the construction phase of the building project. The top three sustainability practices that are often implemented during the construction of buildings include a reduction in the use of incandescent bulbs, innovative wastewater management and the use of efficient insulating wall materials.

The results further suggest that construction firms are making efforts at adopting optimal construction solutions in terms of materials selection, building orientation and siting, costs optimization and choosing an energy-efficient lighting system. This result aligns with those of previous studies (Blok et al., 2007; Degefa, 2010; Heberling, 2013) on the need to increase the use of lighting bulbs that are energy efficient and to embrace technological solutions for effective wastewater management in buildings that could promote the sustainability of the environment. Also, the strong positive correlation between sustainable practices and the satisfaction of building occupants agrees with the findings of Asmar, Chokor, and Srour (2014) that the satisfaction of building occupants is often influenced by good space layout, good indoor air quality, and high lighting level.

5. CONCLUSIONS AND RECOMMENDATIONS

The study investigates sustainable practices and the frequency at which they are implemented in the design and construction of building projects. It further examines the extent to which the level of satisfaction of building occupants is influenced by sustainability practices that are implemented during the construction of buildings. The study concludes that efforts are being made at incorporating sustainability into the design and construction of buildings. The most often implemented sustainability practices at the design and construction phases of building projects are the ease of access in and out of building construction sites and downsizing on the use of incandescent bulbs and replacing them with energy-saving bulbs respectively. Furthermore, the study concludes that as the implementation of sustainable practices on building construction projects increases, so does the level of occupants' satisfaction. The study, therefore, recommends advocacy activities that could further drive sustained orientation on the need for improved and continuous implementation of sustainable design and construction practices. Stakeholders in the construction industry should be further enlightened on the benefits of incorporating sustainable concepts in the designs and construction of buildings. This would improve their awareness, particularly that of the clients on the potential benefits of sustainable buildings and consequently promote instances where clients of building construction projects would express their project requirements within the criteria of social, economic and environmental sustainability.

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