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Adopting Sustainable Practice: the Benefits to the Nigerian Construction Industry

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ABSTRACT

The negative impacts of construction activities on the environment have become a global concern, which has caught the attention of researchers worldwide. One medium to encourage the adoption of sustainable construction practices and curb this global menace is the identification of their benefits. Thus, this research seeks to explore the benefits of adopting sustainable practices in the Nigerian construction industry. A total of (26) benefits were extracted from an extensive review of relevant literature which was then used to formulate a well-structured questionnaire distributed to construction professionals in Lagos State, Nigeria. A total of 216 responses were received and found usable for analysis. The responses were analyzed using mean scores, factor analysis, and reliability tests. The findings showed that the major benefits of adopting sustainable construction practices in Nigeria are improved environment, clients and user satisfaction, enhanced quality of life, improved productivity, and reduced cost. The study concluded that, when the project lifecycle is taken into account, sustainable construction tends to save 18% of the total project cost, making it less expensive than conventional construction. Therefore, it is proposed that governments and construction stakeholders educate clients about the benefits of sustainable practices during building operations, as highlighted in this study, in order for them to be implemented effectively.

Keywords: Benefits; Construction Industry; Sustainable Development; Sustainable Practices; Reduced cost

1. Introduction

The primary driver of the Nigerian economy has been the construction sector, with a consistent growth of 19% within the last ten years, which has been in the form of infrastructural developments such as schools, roads, hospitals, stadia, commercial and residential properties (National Bureau of Statistics, 2017). The construction industry (CI) also contributes to the country's sustainable development (SD) in the form of job creation and good relationships like other sectors that assist wealth growth and income redistribution (Adamuet al., 2015). In fact, it plays a vital role in meeting basic social needs by providing housing and producing consumer goods.

Despite the contributions of the CI to infrastructural development, income redistribution, and wealth generation, its negative contributions to the environment through large water consumption, high raw materials, and increased energy usage are still a huge concern (Durdyevet al., 2018). Previous researchers have indicated that the conventional method of construction focusing on returns and customer satisfaction poses serious adverse consequences such as soil erosion, deforestation, eutrophication, destruction of the ecosystem, desertification, depletion of fisheries, toxic waste, water pollution, air pollution, climate change, and depletion of the ozone layer on the environment and society at large (Aghimienet al., 2019).

Global resolution to the problem of environmental degradation brought about the adoption of the term 'sustainable development'. The Brundtland Report, which asserts that current demands should be addressed without jeopardizing future generations's ability to satisfy their needs, is one of the most recognized definitions of sustainable development (Kibert 2013). This means that sustainable development is a continual process that must be strictly adhered to in order to achieve a state of sustainability. Thus, finding a balance between human expectations and environmental viability is a continuous process. Hence, the adoption of sustainable construction can help solve the global issue of the degradation of the ecosystem. However, the realization of the importance of sustainable construction and understanding the associated benefits is pivotal to its adoption. Therefore, the current study seeks to evaluate the benefits of adopting sustainable construction practices in the Nigerian construction industry.

2. Overview of Sustainable Practices in Construction

The need for the adoption of SD has been largely advocated to address the negative effects of global warming, water and air pollution, the depletion of natural resources, and land degradation, among others. The CI, which has a relationship with other sectors of the economy, has been identified as the major lead in thederangement of the earth's ecology (Opoku & Ahmed, 2014). Sustainable construction (SC) is the CI's answer to minimize or avert the continued disruption of the earth's ecology, while sustainable construction practices refer to the application of concepts and principles of SD to the strategies and operations of institutions functioning in this industry. These concepts are applied from inception to completion of the construction process, including waste management, operation, maintenance, and deconstruction.

According to Tan et al., (2011), six SC practices can be adopted by different construction organizations. The first practice is to ensure that construction stakeholders comply with legislation related to society, business, and environmental sustainability that is strictly enacted by the government. The second targets increasing the project's value by adopting green designs and establishing a supply chain that encourages their integration. The third practice advocates organizational restructuring to make sustainable strategies and policies more adoptable, and the fourth practice promotes the use of innovation and technology to increase the sustainability of the structures and processes created by construction firms. The fifth practice deals with people's understanding and awareness of sustainability, which may be included in key ways. Therefore, businesses and corporations should give it their fullest thought to train and educate their workers on SC. The last technique is developing a measuring system using existing standards to analyze a company's social and environmental performance.

The inseparability of technology from humans and the use of both through the extraction of resources to achieve a better environment make this study focus on the fourth of the practices listed, which involves the use of technology and innovation to improve SD in the CI. Valdecasas and Wheeler (2018) contend that using technology to exploit the advantages of the environment has had devastating results. In order to produce goods or services that benefit both the environment and the social and economic well-being of people, it is necessary to create technologies that support sustainability.

As the need for the implementation and subsequent application of SD principles in many industries has grown, new concepts and technologies have emerged to help speed up the adoption of sustainability in construction projects. Biomimicry and nanometers are some of the scientific and philosophical concepts that have emerged as a result of the sustainability paradigm shift (Kibert, 2013). Lean construction (LC) and value management (VM) are the innovations mentioned to improve Cl sustainability (Hussinet et al., 2013;

Mossman, 2009; Kibert, 2013). To achieve the benefits of sustainability, such as higher resource usage, a decrease in harmful gas emissions, and energy conservation, more technologies are emerging and existing ones are being improved upon via continuing study.

3. Benefits of adopting sustainable practices

According to Aigbavboa et al., (2016), using contemporary technology during construction is a component of sustainable construction practices (SCP). The procedures ensure that projects are completed with the least amount of expense while retaining their worth and functionality. According to Sev and Ezel (2014), the sustainable approach should not be seen as a fast fix or a way to cut costs for projects, but rather as a cost-saving measure that lowers a project's operating and maintenance expenses when the project's whole life cycle is taken into account. The main advantage of sustainable practices (SP), according to Babuka (2016), is its encouragement in the removal of superfluous expenses, which in turn increases the project's value. Buck (2017) and Sarhan et al., (2017) stated that the goal of sustainable practices is to improve construction project performance and consider resources other than cost.

Sustainable practices guarantee that all team members comprehend the project's needs and endeavour to meet them. Additionally, it provides project participants with the tools they need to improve the physical environment, which eventually opens up the possibility of accelerating progress (Aghimien and Oke, 2015; Aghimien et al., 2018). In order to give the most value at the lowest cost, sustainable building comprises approaches to design production processes that reduce waste in terms of resources, time, and human effort (Oke et al., 2018). It focuses on a comprehensive pursuit of concurrent and ongoing advancements in building project planning, execution, activation, maintenance, salvage, and recycling (Nahmens & Ikuma 2012). Instead of seeking to proactively mitigate the negative impacts of loss, sustainable practices promote understanding the core causes of waste, eliminating those sources using appropriate tools and procedures, and promoting waste avoidance (Mossman, 2009).

According to Forbes and Ahmed (2011), adopting sustainable practices like lean construction can improve working conditions at construction sites by lowering physical and mental stress while increasing the quality and productivity of projects by about 77%. Babuka (2016) reported that adopting sustainable practices has significant advantages for energy storage and production both inside and outside of buildings. This may lead to an increase in current energy gains and the creation of new power sources. Additionally, it could provide fresh ways to gather energy, such as enhanced battery performance or hydrogen storage devices.

Sev and Ezel (2014) estimate that buildings use close to 50% of the world's total energy production. Then there are several uses of sustainable practices in enhancing the material qualities and developing new materials that may greatly lower the building's energy usage. Insulation is one of the most efficient strategies to lower this energy usage (Babuka, 2016). A new ultra-thin wall insulation made of a hydrophobic aerogel structure that repels water and prevents mold growth is a promising energy concept. The use of those nanoparticles in glazing technology, which might result in super-insulating windows, is another option. By doing this, buildings' energy loss via their walls and windows may be greatly reduced, and the efficiency of their energy storage and solar gains can be improved, resulting in a drop in their overall energy use. Additionally, using materials like light-emitting diodes (LED) or quantum caged atoms (QCA) might significantly reduce the amount of energy needed for lighting (Ogunbuyiet al., 2014).

One of the primary methods for achieving sustainable construction is to produce energy from renewable sources, such as the sun (Lurie-Luke, 2014). Current silicon-based solar cell technologies are both costly and have relatively modest conversion efficiency. However, the use of contemporary sustainable practices offers creative answers to the costs associated with the use of currently available silicon-based solar energy, such as the creation of silicon nanocrystalline ink that could be used to produce flexible solar panels at a low cost and with a high level of efficiency (Lurie-Luke, 2014). Sustainable practices may also serve to lessen reliance on fossil fuels and enhance the sustainability of buildings (Sev & Ezel, 2014; Lurie-Luke, 2014). Improved efficiency for traditional rechargeable batteries, innovative "super capacitors," and advancements in thermovoltaics for converting waste heat into power are all contributors to the future of energy storage. The adoption of sustainable practices, according to Nahmens and Ikuma (2012), can have a significant impact on the environment by reducing material waste by 64%, a significant impact on society by reducing or eliminating key safety hazards like excessive force, bad posture, and struck-by accidents, and a significant impact on the economy by cutting production hours by 31%.

In terms of the environment, sustainable building has both immediate and long-term advantages (Okeet al., 2017). Additionally, Samer (2013) noted that the adoption of sustainable principles by the idea of green construction has significantly improved the lifestyle and living conditions of those who use these buildings. Sarhan et al. (2017) concluded that individuals tend to be more productive when they live and work in sustainable buildings, which ultimately results in an economic advantage since they are more "environmentally friendly" because they do not emit harmful chemicals or toxins and also have adequate natural light and ventilation, which aids in reducing stress for dwellers.

Mane (2017) reported that the three fundamental pillars that guide sustainable practices are economic prosperity, social well-being, and environmental protection. Mane (2017) added that the literature explains the various advantages of adopting sustainable practices in terms of energy and water savings, decreased maintenance costs, increased property value, higher occupant satisfaction, improved productivity, health advantages, and decreased CO_2 and waste emissions. Sustainable structures, according to Vincent and Bart (2016), optimize the use of construction techniques and efficient building materials, improve the use of local resources, increase the use of renewable energy sources, and offer pleasant and sanitary interior working conditions. According to Zari (2008) and Kellert et al. (2008), sustainable practices are important in the application of

Table 1: Benefits of adopting sustainable construction practices

Codes	Benefits	References
BSC1	Reduced waste generation	Buck (2016); Nahmens and Ikuma (2012); Oke et al., (2018); Sahan et al., (2017)
BSC2	Reduced energy consumption	Nahmens and Ikuma (2012); Oke et al., (2018); Sev and Ezel (2014)
BSC3	Improved air quality	Sev and Ezel (2014)
BSC4	Improved water quality	Mane (2017); Sev and Ezel (2014)
BSC5	Reduced emission of greenhouse gases	Nahmens and Ikuma (2012), Zari (2008)
BSC6	Increased protection of ecosystem	Vincent and Bart (2016)
BSC7	Reduced reliance on non-renewable resources	Babuka (2016); Vincent and Bart (2016)
BSC8	Reduction in the structure's carbon footprint	Oellert et al.H (2008)
BSC 9	Increased demand for green construction materials	Buck (2016); Sahan et al.H (2017)
BSC 10	Increased use of green construction materials	Babuka (2016); Vincent and Bart (2016)
BSC 11	Improved building performance	Buck (2016); Sahan et al.H (2017)
BSC 12	Increased productivity of building occupant	Forbes and Ahmed (2011); Mane (2017); Samer (2013); Vincent and Bart (2016)
BSC 13	Reduction in construction time	Mossman (2009); Oke et al.H (2018)
BSC 14	Positively impacts property value	Aigbavboa et al.H(2016); Babuka (2016); Mane (2017)
BSC 15	Reduction in maintenance costs	Aigbavboa et al.H(2016); Babuka (2016); Mane (2017) Sev and Ezel (2014)
BSC 16	Reduced operating costs	Aigbavboa et al.H(2016); Babuka (2016) Sev and Ezel (2014)
BSC 17	Enhances competitiveness	Ogunbuyi et al.H(2014); Sarhan et al.H (2017)
BSC 18	Enhances sustainable economic growth	Aghimien and Oke (2015); Aghimien et al.H (2018)
BSC 19	Creates market for green products and services	Lurie-Luke (2014); Sev and Nzel (2014)
BSC 20	Optimises life-cycle economic performance	Aghimien anT Oke (2015); Aghimien et al. H(2018); Nahmens and Ikuma (2012)
BSC 21	Enhances project efficiency	Lurie-Luke (2014); Sev and Ezel (2014)
BSC 22	Enhances project quality	Aigbavboa et al.H(2016); Babuka (2016); Forbes and Ahmed (2011)
BSC 23	Higher customer satisfaction	Mane (2017); Samer (2013); Vincent anT Bart (2016)
BSC 24	Improves site health and safety	Forbes and Ahmed (2011); Mane (2017); Sarhan et al.H (2017)
BSC 25	Improves the overall quality of life	Forbes and Ahmed (2011); Samer (2013); Sarhan et al.H (2017)
BSC 26	Promotes the use of local sustainable materials	Lurie-Luke (2014); Sev and Ezel (2014)

4. Research Methodology

4.1 Questionnaire Design

According to Kothari (2004) and Matherset et al., (2007), a questionnaire can be described as "a self-report form that assists researchers in gathering information from respondents through recorded responses to the subject. It is characterized by its ease of accessibility by respondents, unbiasedness, and freedom to respond at their convenience." A closed-ended questionnaire was used for this study, which consists of two (2) parts. The first part contains the demographic information of the respondents, while the second part consists of the benefits of adopting SCPs, which were gathered from a review of relevant literature. The respondents were asked to rate the extent of the listed twenty-six benefits on a Likert scale of 5, ranging from "1" (no extent), "2" (small extent), "3" (moderate extent), "4 (large extent), and "5 (very large extent).

4.2 Sampling and data collection

This study was carried out in Lagos State, which is the most populous state with the largest economy in Nigeria. (Dania et al., 2014; National Bureau of Statistics, 2017). The choice of Lagos as the study area was because the state has never ceased to be the country's center for commerce and economy, coupled with an increasing population and the highest population of construction professionals (Saidu & Shakantu, 2017). At the time of the study, the Nigerian Institutes of Architects (NIA) had 1102 members in Lagos chapters, and the and the Nigerian Institute of Civil Engineers had 674 members. The number of registered quantity surveyors is 781. The list of registered builders in the state from the Nigerian Institute of Building (NIOB) is 456. The total population of these professionals was 3013. This study adopted the formula method to compute the sample size. The sample size formula according to Tanis and Hog (2008) was used to establish the respondents selected from the total population:

$$n = \frac{m}{1 + \left(\frac{m - 1}{N}\right)} \qquad (1)$$

where n is the limited population, m is the unlimited population, and N is the available population. Computation of "m" can be done using equation 2:

$$m = Z^2 \text{ x } P \text{ x } \left(\frac{1 - P}{e^2}\right) \qquad (2)$$

where P is the value of the population percentage being estimated, Z (1.96), the statistical value for the confidence level employed, and e is the sampling error or confidence interval of the point estimate.

McClaveet al. (2008) recommended a cautious estimate of 0.50 since the value of P is known. In this study, 95% level of confidence and a 10% margin of error were used. These calculations led to the computation of a 336-survey sample, which included 88 architects, 79 builders, 84 civil engineers, and 85 quantity surveyors. In order to guarantee that each participant in the survey sample had an equal chance of being chosen, to minimize bias, and to increase representation, the research questionnaire was administered using a stratified random procedure. Two hundred and sixteen (216) of the 336 questionnaires distributed were found valid for analysis. This indicates an approximate 64% response rate.

4.3 Data analysis

The demographic information of the respondents was analyzed using a frequency table and percentage. The twenty-six benefits of adopting SCPs derived from the extensive review of literature were first evaluated by mean score and standard deviation. Secondly, exploratory factor analysis (EFA) was adopted in categorizing the benefits into different groups. A reliability test with a Cronbach alpha value of 0.7 was also used to test the internal consistency of the derived clusters and components. All analyses were done with SPSS version 27.0.

5. Results

5.1 Demographic information

The result shows that (13.0%) respondents have Diploma (OND & HND), (44.0%) respondents have Bachelor's Degree, (37.0%) respondents have Master's Degree, (6.0%) respondents have Doctorate Degree. This indicates that the respondents are formally educated to provide valid inferences to measure the objective of the study. On professional discipline, 29.2% of the total respondents are quantity surveyors, 29.6% of the respondents are architects, 23.1% of the respondents are civil engineers, and 18.1% of the respondents are builders. Furthermore, approximately 73% of the respondents have more than 5 years of working experience in the construction industry. Also, approximately 71% of the respondents have been involved in more than three sustainable construction projects. This implies that the respondents are professionally qualified to provide valid information to measure the objective of the study.

5.2 Mean score for the benefits of adopting sustainable construction practices

The 26 benefits gleaned from the examination of literature were ranked on a five-point Likert scale. For each of the variables, the five-point scale was transformed into a mean item score (MS), as shown in Table 2. The rankings of each item were then calculated using the indices. Cross-referencing the relative relevance of the factors as decided by the respondents was made feasible by the ranking. The sum of all weighted replies was used to compute the relative MS, which was then compared to the total responses:

$$MIS= \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 +1n_1}{n_5 + n_4 + n_3 + n_2 +n_1} \quad (3)$$

The evaluation of the benefits of adopting sustainable construction as ranked by the respondents ranges from 3.422 to 3.754. The top 3 ranked benefits with their respective mean values have improved the overall quality of life (3.754), improved building performance (3.743), and higher customer satisfaction (3.640). The result shows that these stated variables are paramount benefits of adopting sustainable construction, as they are above the mean value of 3.500. The least ranked benefits, as shown in Table 2, were a reduction in construction time (3.302), a reduction in the structure's carbon footprint (3.293), and enhanced competitiveness (3.244).

Table 2: Mean analysis for the benefits of adopting sustainable construction practices in the Nigerian construction industry

Code	Benefits	Mean	SD	Rank
BSC25	Improves the overall quality of life	3.754	0.825	1
BSC11	Improved building performance	3.743	0.722	2
BSC23	Higher customer satisfaction	3.640	0.771	3
BSC1	Reduced waste generation	3.632	0.808	4
BSC22	Enhances project quality	3.611	0.776	5
BSC24	Improves site health and safety	3.611	0.877	6
BSC2	Reduced energy consumption	3.602	0.818	7
BSC26	Promotes the use of local sustainable materials	3.561	0.849	8
BSC21	Enhances project efficiency	3.540	0.800	9
BSC15	Reduction in maintenance costs	3.507	0.960	10
BSC6	Increased protection of ecosystem	3.494	0.998	11
BSC18	Enhances sustainable economic growth	3.488	0.873	12
BSC3	Improved air quality	3.476	1.002	13
BSC19	Creates market for green products and services	3.453	0.823	14
BSC14	Positively impacts property value	3.452	0.909	15
BSC20	Optimizes lifecycle economic performance	3.440	0.775	16
BSC7	Reduced reliance on nonrenewable resources	3.440	0.928	17
BSC12	Increased productivity of building occupant	3.419	0.951	18
BSC5	Reduced emission of greenhouse gases	3.417	1.062	19
BSC9	Increased demand for green construction materials	3.412	1.048	20
BSC4	Improved water quality	3.400	0.979	21
BSC16	Reduced operating costs	3.375	0.852	22
BSC10	Increased use of green construction materials	3.367	0.862	23
BSC13	Reduction in construction time	3.302	0.861	24
BSC8	Reduction in the structure's carbon footprint	3.293	0.950	25
BSC17	Nnhances competitiveness	3.244	0.872	26

5.3 Scale items, factor loading, and alpha values for the benefits of adopting SCPS in the Nigerian construction industry

Although the mean score has shown the weighted rank of the twenty-six benefits of adopting SCPS in the Nigerian construction industry, EFA was further used to determine the correlation between the variable and the total derived components. The sample size for this study was 216, which is far above the prescribed value of 50 samples suitable for factor analysis (Nunayonet al., 2020; Famakinet et al., 2020). Barlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were used to determine whether the data distribution was suitable for EFA. According to Field (2009), a data set with a KMO index of 0.50 and a Bartlett's test of sphericity with a value of p 0.05 is suitable for factor analysis. The Bartlett's test of sphericity is significant (p = 0.000), and the KMO index is equal to 0.847, which is above 0.5. These outcomes show that the sample was sufficient for EFA.

To ascertain the extracted component, an eigen value of 1 and above was employed. The eigen value is a property of a matrix that can be used mathematically to determine how many factors to extract as well as to calculate how much variance is accounted for by a particular dimension (Dainty et al., 2003). Five factors had at least an eigen value of 1 and were retained. The correspondence eigen values are 11.282, 2.678, 1.789, 1.341, and 1.226, which explain 43.394%, 10.301%, 6.882%, 5.159%, and 4.715% of the variance, respectively. These five factors extracted account for 70.45% of the total variance and indicate the relevance of the 26 variables assessed. The reliability test was conducted on the five clusters, and the result ranges from 0.756 to 0.956, which is above the minimum accepted Cronbach's alpha value of 0.7 (Pallant & Manual, 2007). Hence, the five derived components were accepted for inclusion. The details of the factors, the loaded components, and the Cronbach alpha test that showed the internal consistency of the loaded variables are shown in Table 3.

Table 3: Scale items, factor loading, and alpha values for the benefits of adopting sustainable practices

Factors	Items	Descripton	Factor loading	!lpha (α)
1 Improved environment	1	Reduction in the structure’s carbon footprint	0.836	0.953
	2	Reduced reliance on nonrenewable resources	0.823	
	3	Reduced emission of greenhouse gases	0.815	
	4	Increased protection of ecosystem	0.691	
	5	Improved air quality	0.653	
	6	Reduced energy consumption	0.641	
	7	Reduced waste generation	0.608	
	8	Increased use of green construction materials	0.593	
	9	Optimizes lifecycle economic performance	0.514	
2 Clients and user satisfaction	10	Higher customer satisfaction	0.877	0.912
	11	Enhances project quality	0.724	
	12	Enhances competitiveness	0.721	
	13	Reduction in construction time	0.687	
	14	Improves site health and safety	0.572	
	15	Enhances project efficiency	0.541	
	16	Enhances sustainable economic growth	0.514	
3 Enhanced quality of life	17	Improves the overall quality of life	0.732	0.886
	18	Improved water quality	0.713	
4 Improved productivity	19	Increased productivity of building occupant	0.731	0.843
	20	Creates market for green products and services	0.651	
	21	Positively impacts property value	0.651	
	22	Increased demand for green construction materials	0.521	
5 Reduced cost	23	Reduced operating costs	-0.773	0.745
	24	Reduction in maintenance costs	-0.766	

6. Findings and Discussions

The exploratory factor analysis for the twenty-six (26) benefits of adopting SCPS extracted from the extensive review of literature was reduced to twenty-four variables because the factor loading of two variables was less than 0.5. Also, the factor analysis returned five (5) factors, which are: improved environment, client and user satisfaction, enhanced quality of life, improved productivity, and reduced cost.

6.1 Improved environment

This factor was named improved environment because of the internal coherence that exists among the clustered variables, which are related to energy efficiency to improve the environment. This factor accounts for 43.394% of the variance, and the nine (9) items loaded on this section were reduction in the structure's carbon footprint, reduced reliance on non-renewable resources, reduced emission of greenhouse gases, increased protection of the ecosystem, improved air quality, reduced energy consumption, reduced waste generation, increased use of green construction materials, and optimizing life-cycle economic performance with factor loadings of 0.836, 0.823, 0.815, 0.691, 0.653, 0.641, 0.608, 0.593, and 0.514, respectively. Becoming energy efficient is one way of reducing environmental impacts and mitigating risks. Adopting sustainable construction helps become more energy efficient by using less energy or switching to more energy sources, like renewable energy sources. Electricity used in powering homes and offices is generated from the burning of fossil fuels such as coal, oil, and gas in other places around the world (Aghimien et al., 2019). This leads to global warming by emitting greenhouse gases like carbon dioxide (Zari, 2008). Sustainable construction can reduce the need for burning fossil fuels, which translates to a reduction in the reliance on non-renewable resources, increased protection of ecosystems, and a healthier environment.

6.2 Clients and user satisfaction

This factor was named client and user satisfaction because of the internal coherence that exists among the variables clustered on the component. This factor accounts for 10.301% of the total variance. A total of seven (7) factors were loaded on this factor, which were higher customer satisfaction, enhanced project quality, enhanced competitiveness, reduction in construction time, improved site health and safety, enhanced project efficiency, and enhanced sustainable economic growth, with factor loadings of 0.877, 0.724, 0.721, 0.687, 0.572, 0.541, and 0.514, respectively. Modern technologies are introduced to designs and ensure that buildings meet the project objectives, which are achieved when expected customer satisfaction and project quality are achieved (Oke et al., 2017). Another factor that also constitutes part of building user satisfaction and also determines project performance is the users' well-being and health (Ogunbuyi et al., 2014). This invariably means that the users don't only feel comfortable but also healthy in a sustainable building. The realization of these important benefits will increase the adoption of SCP in the study area.

6.3 Enhanced quality of life

The sustainable economy accounts for 6.882% of the total variance for the benefits of adopting SCP in the Nigerian construction industry. This factor was named sustainable economy because the items loaded have internal coherence with improved construction methods, which results in a better environment and standard of living. The two (2) factors in this section are improved overall quality of life and improved water quality, with factor loadings of 0.732 and 0.713 respectively. Economy benefits are derived when there are improvements in the methods of construction and production of energy-efficient structures. This lessens the burden on the environment and encourages restoration. Improvements in water quality and promotion of the use of local sustainable materials have great impacts on reducing resource consumption and global warming (Pearce, 2012; Ametepey & Aigabavboa, 2014). The end benefit of these impacts is improved quality of life for end users (Ametepey & Aigabavboa, 2014).

6.4 Improved productivity

Improved productivity accounts for 5.159% of the total variance for the benefits of adopting SCP in the Nigerian construction industry. The four (4) factors loaded in this section are increased productivity of building occupants, creating a market for green products and services, positively impacting property value, and increased demand for green construction materials, with factor loadings of 0.731, 0.651, 0.651, and 0.521.

Sustainable construction increases the productivity benefits of the occupants. A friendly working environment increases the inertia energy of the workers towards work, thereby reducing absenteeism (Sarhan et al., 2017). A perfect environment induces the concentration, effectiveness, and efficiency of workers towards the completion of tasks.

6.5 Reduced cost

The factor loading revealed that reduced costs account for 4.715% of the total variance for the benefits of adopting SCP in the Nigerian construction industry. This factor has two items loaded, which are reduced operating costs with a loading factor of -0.773 and reduced maintenance costs with a loading factor of -0.766. According to Pallant (2011) and Burns and Grove (1993), negative factor loadings indicate that the variables are to be interpreted in the opposite direction and do not exclude them from the constructs. Hence, the inclusion of negative loadings in this study. An introduction of technology at the early stage of building is becoming more important because the cost benefits are throughout the building lifecycle. Operating and maintenance appear to be the most important benefits of sustainable construction because they are long-term benefits (Aigbavboa et al., 2016). For example, building information modeling (BIM) can help accurately model the operational efficiency and potential energy costs of a building from the inception of the building. The early realization that sustainable construction is less costly than convectional building will increase its adoption. A report by the British Assessment Bureau (2021) indicated that sustainable building brings up to a 2% increase in the construction cost if compared with traditional building, but a reduction of 20% on the total construction cost, saved from the operational and maintenance costs if the whole lifecycle of the building is to be considered.

7. Conclusions and Recommendations

Construction operations are causing the ecosystem to deteriorate at an alarming rate, which is detrimental to both the environment and human health. One of the ways to eliminate this global issue is to realize the benefits of adopting SCPs that fall into the technology and innovation categories. This study highlighted twenty-six (26) benefits of adopting SCPs through an extensive review of the literature. The benefits were ranked by the construction professionals in Lagos State, Nigeria, through the administration of questionnaires. The result shows that all the highlighted benefits are above the mean score of 3.0, which indicates their level of importance. Also, the exploratory factor analysis that was further carried out indicates improved environment, client and user satisfaction, enhanced quality of life, improved productivity, and reduced cost as the important benefits of adopting SCPs in the Nigerian construction industry.

The study found that, when the project lifecycle is taken into account, sustainable construction tends to save 18% of the total project cost, making it less expensive than conventional construction. The study also identified that an inevitable benefit of SC is an enhancement in productivity because SC creates a friendly working environment, which induces workers' effectiveness and efficiency. It is therefore recommended that to increase the construction cost benefits, reduce the environmental negative impacts of construction activities, and increase the quality of life, the important benefits of adopting sustainable construction identified in this study should be the subject of training of skilled laborers, unskilled laborers, and the general public by the government and construction stakeholders.

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