Green Construction Practices: Ensuring Client Satisfaction Through Health and Safety Performance

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Abstract

Studies have proved that Client Satisfaction (CS) is greatly affected by the nature of construction practices carried out on site. However, not much attention has been given to CS in projects that adopt green construction practices (GCPs). This study examines the effect of GCPs on CS, and the means by which CS can be achieved through health and safety performance (HSP). This study also analyses how the relationship between HSP and CS could vary depending on the level of GCPs adopted. A questionnaire with 27 items drawn from literature was used in collecting data from class A contractors in Nigeria. The study's hypotheses were tested using the Partial Least Squares Structural Equation Modeling (PLS-SEM) technique. The findings of the study reveal that GCPs has a positive effect on CS. HSP proved to only partially mediate the relationship between GCPs and CS. The findings also show that the effect of HSP on CS is moderated by GCPs with the stronger effect from projects with low adoption of GCPs. The study findings highlight the pivotal role of HSP in ensuring CS in construction projects that adopt GCPs while also making theoretical and practical contributions to guide policy makers, scholars, and contractors.

1. Introduction

The construction sector has been one of the main contributors to the environmental problems been witnessed today due to the adoption of traditional construction methods. These environmental problems have been on the upward trend due to rapid urbanization resulting from rural-urban migration (Ekins & Zenghelis, 2021; Meng et al., 2021). However, the construction sector contributes enormously to the economy of any country. In order to solve the environmental issues arising from construction activities, the adoption of Green Construction Practices (GCPs) has become imperative (Lu et al., 2021; Tavana et al., 2021). In fact, CCP has received special attention from researchers, contractors, and governments because it is one of the most important and effective means for reducing environmental problems (Badi & Murtagh, 2019).

Due to the importance of GCPs in reducing environmental problems and ensuring environmental sustainability, various environmental laws and rating systems have been developed in different countries. In the USA, the Leadership in Energy and Environmental Design (LEED) was developed, the United Kingdom has the Building Environmental Assessment Method (BREEAM), Australia developed the Green Building Council of Australia Green Star (GBCA), Japan has Comprehensive Assessment System for Built Environment Efficiency (CASBEE), while Singapore has Singapore Green Mark Scheme (Zhang et al., 2019), all geared towards promoting the adoption of GCPs. Currently, Nigeria does not have a green rating tool (Atanda & Olukoya, 2019). However, due to the need for environmental protection, Federal Environment Protection Agency (FEPA) was created by the federal government of Nigeria in 1988. FEPA is saddled with the responsibility of providing guidelines and minimum standards for environmental protection (FEPA, 1991). The guidelines and standards provided by FEPA cover issues such as waste management, water quality, management of harmful substances, and air quality. Subsequently, additional environmental regulations and standards were enacted with the primary aim of environmental

protection. These include the National Policy on the Environment in 1989, the National Environmental Standards and Regulations Enforcement Agency Act 2007, and the National Building Energy Efficiency Code of 2017.

Though these environmental laws and regulations were designed to ensure that GCPs are adopted, the satisfaction of the client is often neglected (Bai & Satir, 2020). It should be noted that although the emphasis of GCPs basically considers the environmental impact of construction activities, the social aspect of sustainability in which Client Satisfaction (CS) is a vital part must not be ignored (Murtagh et al., 2020). Hence, the importance of CS in the adoption of GCPs was emphasized by Athapaththu and Karunasena (2018). Athapaththu and Karunasena (2018) stated that contactors rarely opt to adopt GCPs except if the client insists it should be adopted. Therefore, the crucial role played by CS in GCPs adoption is not in doubt. In view of the above, Shurrab et al. (2019) advocate that investigation ought to be conducted to determine the impact of GCPs on CS.

GCPs may lead to negative, positive, or no effect on CS. However, the strength, direction, and nature of this relationship have not been tested empirically in previous studies (Shurrab et al., 2019; Suganthi, 2019). Also, studies such as Cianciarullo (2019), Zhou et al. (2015), and Khan et al. (2021) have pointed to the possible positive effect of CCP on the Health and Safety Performance (HSP) of construction projects, while El-Sayegh et al. (2019) and Karakhan and Gambatese (2017) observed a positive effect of HSP on CS, yet the previous studies have not comprehensively analyzed the possibility of the mediating effect of HSP on the relationship between GCPs and CS. In other words, the mechanism through which GCPs could lead to CS has not been tested. Thus, this study introduces HSP in the analysis of the GCPs – CS relationship. Furthermore, studies have revealed that the strength and direction of the effect of HSP on CS could differ depending on the level of GCPs adopted (Wuni et al., 2019), but this has not been verified and proven statistically. Hence, in order to contribute theoretically to existing literature, this study considered GCPs as a moderator in the relationship between HSP and CS. Overall, this research is aimed at examining the effect of GCPs on CS, the mediating effect of HSP on the relationship between GCPs and CS, and the moderating effect of GCPs on the HSP – CS relationship.

The contributions and significance of this paper are threefold. Firstly, it presents the direct and mediating (indirect) effects of how GCPs and HSP influence CS, thereby allowing us to have an all-encompassing view of the intricacies that guarantee CS on projects that adopt GCPs. Secondly, the study explores the moderating effect of GCPs on the relationship between HSP and CS, thus giving contractors and academic scholars a holistic view of how CS resulting from HSP could differ depending on the level of GCPs adopted. Lastly, the results of this study will trigger the formulation of effective policies and programs by the government to encourage contractors to adhere to HSP guidelines while adopting GCPs for optimal CS. Precisely, the findings of this paper will be of benefit to contractors, clients, and other stakeholders involved in the adoption of GCPs on construction project sites.

The remainder of this paper is structured as follows. Section 2 contains the literature review, hypotheses generation, and the conceptual model. Section 3 presents the research methods. Section 4 presents the

data analysis and results. Section 5 contains the hypothesis testing for the various relationships established in this study. The discussion of the results is contained in Sect. 6, while Sect. 7 presents the conclusion of the study. Lastly, the study's limitations and recommendations for future research are presented in the 8th section.

2. Literature Review And Study Hypotheses

2.1. Concept of Green construction practices

The terms "green construction", "cleaner construction", and "sustainable construction", are frequently used interchangeably (Shurrab et al., 2019). GCPs can be defined as practices undertaken with the intention of ensuring construction quality and safety, resources are conserved, and reducing the harmful effect of construction activities on the environment through energy management, land management, water savings, and materials management (Iqbal et al., 2021; Jiang et al., 2019; Rahman et al., 2021). Additionally, Jiang et al. (2019) define GCPs as an all-encompassing view of sustainable development in the construction industry. Similarly, Shurrab et al. (2019) refer to GCPs as the use of onsite practices aimed at minimizing the negative environmental impact of construction activities.

The idea behind GCPs transcends the construction of buildings without posing any negative effect on the natural environment since it seeks to create conditions that ultimately lead to the improvement in the quality of the environment (Wu et al., 2019). Simply put, GCPs are a combination of attempts geared towards building in a responsible manner, while reducing waste, controlling material usage, managing energy use, managing stormwater, and preserving the environment. GCPs takes into consideration conservation needs and utilizes resources more efficiently than conventional construction practices (Ofek et al., 2018).

2.2 Green construction practices and Client satisfaction

CS is the accomplishment of the expectations the client had, before the start of the project, and the actual performance which can be measured at the various phases of the construction project (Li et al., 2013). CS has gained popularity in the measurement of project performance as an addition to the traditional performance criteria of cost, quality, and time (Davis, 2016).

CS is of utmost importance in the adoption of GCPs (Presley & Meade, 2010). However, many clients today do not fully appreciate the benefits of GCPs due to their seeming lack of understanding of its merits (Shan et al., 2020). This has led to a situation whereby clients become doubtful concerning the capacity of GCPs to satisfy their needs (Zhao et al., 2018). This is in tandem with the findings of Windapo (2014) who opined that clients are not likely to adopt GCPs for the purpose of environmental protection without government pressure and any financial benefits accruable to them. Even though the number of clients accepting to adopt GCPs has been on the increase, their choice to adopt these practices is passive, since they are been compelled by the government to do so (Shan et al., 2020). This could lead to a situation whereby they may not be satisfied as they ought to be when such practices are been

adopted on their projects due to cost overrun, delays, increase in complexity, and risks (Onubi et al., 2019).

Adopting GCPs has been reported to be associated with an increase in the scope, increase in complexity, and the use of novel technologies in construction projects which may increase project costs and decrease the anticipated profit of the client (Ofek et al., 2018), thus negatively impacting on CS. Consequently, there has been a seeming lack of interest by clients in GCPs (Venkataraman & Cheng, 2018). Additionally, most clients intend saving money in every project regardless of whether GCPs are adopted or not, however, most of the green construction projects' cost surpasses the original contract sum (El-Sayegh et al., 2019; Zhao et al., 2020), hence creating an inverse relationship between GCPs and CS. A similar study conducted in the tourism sector on the effect of green practices on CS reported that there exists no significant effect (Assaker, 2020).

The importance of schedule performance in any construction project and the role it plays in CS cannot be overstated. Gurgun and Koc (2020) report that compliance to schedule requirements was topmost among clients' performance criteria in GCPs. However, it has been proven that projects adopting GCPs are often more susceptible to schedule overruns compared to conventional construction projects (Bakchan et al., 2019), thus impacting negatively on CS on green construction projects. In view of the leanings from the literature reviewed, it is hypothesized as follows:

H1

GCPs has a negative significant effect on CS.

2.3 Mediating effect of health and Safety performance on the relationship between Green construction practices and client satisfaction

A construction project's HSP is a measure of the level to which both the primary and secondary stakeholders of the project are been exposed to or affected by accidents, get injured, and/or are susceptible to other health-related issues resulting from construction activities (Ammad et al., 2020). The HSP of construction workers is considered a vital part of green construction (Hinze et al., 2013). However, early studies related to safety in green construction have reported that the adoption of GCPs poses greater safety risks to construction workers compared to conventional construction methods (Hwang et al., 2018). Also, Dewlaney and Hallowell (2012) found that the unfamiliar tasks, new materials, innovative technologies, and processes involved in GCPs are responsible for the safety risks reported in previous studies. Similarly, Karakhan and Gambatese (2017) observed that the severity of safety risk and exposure to hazards of construction workers is heightened when GCPs are adopted.

Contrary to the above, Cianciarullo (2019) opined that GCPs can lead to HSP with adequate planning and experienced construction workers. For example, Zhou et al. (2015) opined that HSP can be achieved in these projects if necessary measures are taken at the design stage of the projects. Similarly, Karakhan and Gambatese (2017) opined that the safety issues associated with GCPs can be prevented through

strategies adopted during design. As such, many green building rating tools such as LEED have included credits for the prevention of safety issues through design (Karakhan & Gambatese, 2017). In view of the increased quest and measures taken towards HSP in projects that adopt GCPs, Khan et al. (2021) report that there has been significant improvement in the HSP during CCP adoption. Yusliza et al. (2020) report that CCP are largely expected to lead to HSP. Also, Sang et al. (2018) acknowledged that the technology involved in GCPs is complex but not highly unsafe.

The HSP benefits resulting from the adoption of GCPs are anticipated to yield both monetary and non-monetary benefits such as cost benefits, schedule performance, increased project quality, and greater workers' productivity (Howarth & Watson, 2010). Due to the merits of completing the project within schedule, without cost overruns, without accidents, and complying with government environmental regulations, the clients are expected to be satisfied with the project delivery process (El-Sayegh et al., 2019). Also, since GCPs techniques and methods have usually been considered to be more expensive, more time consuming, more complex than the traditional construction methods thus leading to client dissatisfaction and reluctance to adopt these practices (Zhao et al., 2020), it is anticipated that the guaranteed HSP emanating from the adoption of GCPs as stated earlier would reduce the cost burden originating from safety issues, risks, less delay due to fewer accidents and less absenteeism thus leading to CS. In other words, GCPs can lead to CS through HSP. Consequently, we hypothesize as follows:

H2

HSP mediates the relationship between GCPs and CS.

2.4 Moderating effect of green construction practices on the relationship between health and safety performance and client satisfaction

In the preceding section (Sect. 2.3), previous studies had shown that HSP has a positive effect on CS. However, we contend that the nature and the magnitude of the effect will differ considerably depending on the level to which GCPs are been practiced on the construction projects. In a study carried out in Nigeria, Oladokun et al. (2020) found out that construction professionals view GCPs adoption as the major determinant for CS in the country. Client demand has been tagged as the major driver that propels contractors to adopt GCPs (Athapaththu & Karunasena, 2018). Similarly, Shurrab et al. (2019) opined that clients are in the know of the merits of GCPs as a means of preserving the environment and are willing to pay the required cost. Ochieng et al. (2014) assert that CS is a measure of sustainability on construction projects as clients are increasingly demanding that contractors adopt GCPs. All these show that construction clients acknowledge the importance of adopting GCPs and demand for it. To the best of our knowledge, no study in the construction field has examined the moderating effect of GCPs on the relationship between HSP and CS. But in the tourism sector, Lee et al. (2018) reported a negative significant moderating effect of green practices on the relationship between service quality and CS. However, from the insights gotten from past studies, the positive effect of HSP on CS will be stronger with a higher GCPs adoption relative to projects with a low level of adoption of GCPs. Building on these arguments, it is hypothesized that:

H3

The effect of HSP on CS will be stronger when GCPs adoption is high.

The conceptual model of the study containing the study's hypotheses is shown in Fig. 1.

3. Methodology

3.1 Research survey

To determine the effect of GCPs on CS, and the mediating role of HSP on the relationship between GCPs and CS, a survey of 206 construction projects of class A contractors completed between 30th March 2015 to 28th February 2019 using 1 questionnaire per project with 168 useable responses received, accounting for an 81.55% response rate. The 168 useable responses received are adequate according to the minimum sample size requirement of 160 samples using the inverse square root method recommended by Kock and Hadaya (2018).

The survey method was adopted in the data collection and only projects executed by contractors graded as "class A" were considered. It should be noted that "class A" is the highest class of contractors in Nigeria as per the Bureau of Public Procurement (BPP) grading, and all selected projects had adopted GCPs. It is worth noting that the BPP grades registered contractors into four levels (class A, Class B, Class C, and class D), with class A having no monetary limit to the cost of projects they can undertake.

3.2 Research Questionnaire and measures

The questionnaire has four parts. The first part has 5 items focusing on the respondents' profile. The second part had 12 items focusing on GCPs adopted on the construction site adapted from Ajayi et al. (2016), Collins et al. (2017), and Eaton (2018). The third part contained 5 items concerning HSP adapted from Kwon (2013), while the fourth section had 5 items related to CS adapted from Berssaneti and Carvalho (2015). In the second and third sections of the questionnaire, the respondents were asked to indicate their responses on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) while the fourth section's responses were collected using a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Also, an additional question termed "global item" representing a general response to all the items in the constructs were asked per construct as recommended by Hair et al. (2017) for the purpose of redundancy evaluation. The adoption of different Likert scales (5 and 7 points) was to minimize the likelihood of common source bias (CSB) occurring using procedural remedies during data collection as recommended by Podsakoff et al. (2003). Details of the questionnaire items and their respective sources are contained in Table 1.

Table 1
Questionnaire items and source

CONSTRUCTS	SOURCE
Green Construction Practices (GCPs)	
Waste management	
Waste recycling was practiced (GCPs1)	Ajayi et al. (2016)
Construction materials were reused on the project (GCPs2)	Ajayi et al. (2016)
Waste reduction practices were adopted (GCPs3)	Ajayi et al. (2016)
Construction materials were delivered just in time (GCPs4)	Ajayi et al. (2016)
Energy management	
Site practices were improved to save energy (GCPs5)	Collins et al. (2017)
Adopting the practice of using renewable energy on the construction site (GCPs6)	Collins et al. (2017)
Energy efficient equipment and appliances were used on construction site (GCPs7)	Collins et al. (2017)
Practicing the use of automated systems to regulate energy usage (GCPs8)	Collins et al. (2017)
Stormwater management	
Permeable pavement (GCPs9)	Eaton (2018)
Grass swales were used for stormwater management (GCPs10)	Eaton (2018)
The natural topography of the construction site was preserved (GCPs11)	Eaton (2018)
The practice of harvesting rainwater was adopted on the site (GCPs12)	Eaton (2018)
Health and Safety Performance (HSP)	
Hazard prevention measures were implemented on the project (HSP1)	Kwon (2013)
Safety performance was in line with the experience level of the workers (HSP2)	Kwon (2013)
Safety of the public was not compromised during construction works (HSP3)	Kwon (2013)
Safety performance was in line with anticipated safety targets (HSP4)	
All relevant safety guidelines were adhered to (HSP5)	Kwon (2013)
Client Satisfaction (CS)	
Client(s) was satisfied with the project (CS1)	Berssaneti and Carvalho (2015)

CONSTRUCTS	SOURCE
The client was satisfied with the level of compliance with technical specifications (CS2)	Berssaneti and Carvalho (2015)
No rework was needed on the project (CS3)	Berssaneti and Carvalho (2015)
Failure of fixtures and fittings recorded was minimal (CS4)	Berssaneti and Carvalho (2015)
Clients were satisfied with the standards achieved (CS5)	

Since the data for all the study's constructs were collected from the same respondents, there is a possibility of CSB in the study which could result in misleading findings (Craighead et al., 2011). Therefore, aside from the procedural methods adopted previously, two statistical methods were adopted to examine CSB. First, the full collinearity variance inflation factor (FCVIF) recommended by Kock (2015) was used and the result showed that the FCVIF value of 1.325 was obtained which is below the 3.3 threshold value recommended by Kock (2017). Secondly, the Harman single factor test (Harman, 1960) was conducted and yielded a percentage variance of 5.492% which is substantially lower than the 50% cut-off value recommended by Harman. Thus, CSB is not an issue in this study.

4. Data Analysis And Results

The partial least squares structural equation modeling technique (PLS-SEM) was adopted in the data analysis for this study using the warpPLS 7 software. The PLS-SEM technique was used because the study involved theoretical framework testing from a predictive standpoint, and the data for this study were not normally distributed as evidenced from the results of Shapiro–Wilk test which was found to be significant at 0.000 (Hair et al., 2019). The moderation effect was analysed using the two-stage approach since the model for this study contains constructs that are all measured as formative and has a moderator (Fassott et al., 2016). For the analysis of the mediator, the transmittal approach recommended by Rungtusanatham et al. (2014) was adopted. Hence, only the indirect effect is considered in the mediation analysis as suggested by Hayes and Rockwood (2017).

4.1 Demographic profile of respondents

The results obtained for the demographic profile of the respondent indicates that most of the respondents (29.2%) had a masters' degree while those with a doctorate degree (Ph.D.) were the least making up 5.4% of the respondents. For the years of working experience, most respondents had between 11 to 15years of working experience accounting for 28.6% of the study sample. Additionally, most of the respondents were site managers and made up 48.2% of the study sample. Regarding the number of full-time employees in the contractors' organization, most of the contractors had over 200 full-time workers accounting for 36.3% of the respondents.

4.2 Measurement model

In the analysis of the formative measurement model, the following are assessed: convergent validity, assessment of the model for collinearity issues, significance and relevance of formative indicators. Table 2 shows that the convergent validity of all three constructs are greater than 0.7, which indicates that the level of convergent validity in the formative constructs is adequate (Hair et al., 2017). Regarding the multicollinearity between the indicators in the model, the values of the variance inflation factor (VIF) for all the indicators as shown in Table 2 are less than the 3.3 cut-off values suggested by Kock (2014) which signifies that collinearity in the model is within acceptable limits. For the significance and relevance of indicator weights, the results show that all indicators have significant weights apart from GCP4, GCP7, GCP9, GCP11, and HS4. However, the results presented in Table 2 shows that all the nonsignificant weights have indicator loadings that are greater than 0.5, therefore the indicators are retained in the formative construct (Hair et al., 2017). After the analysis of the formative constructs, it is concluded that the model satisfies all the requirements for a formative measurement model.

Table 2
Formative measurement model evaluation results

Constructs	Convergent Validity	Weights	P-value	VIF	Loadings
Green Construction Practices (GCP)	0.832				
Stormwater management					
GCPs 1		0.272	< 0.001	1.685	0.908
GCPs 2		0.162	0.016	1.592	0.909
GCPs 3		0.368	< 0.001	2.775	0.882
GCP 4		0.111	0.070	1.541	0.801
Waste Management					
GCPs 5		0.158	0.018	1.600	0.839
GCPs 6		0.157	0.020	1.088	0.902
GCPs 7		0.019	0.403	1.049	0.839
GCPs 8		0.214	0.003	1.046	0.364
Energy Management					
GCPs 9		0.042	0.290	1.045	0.910
GCPs 10		0.173	0.011	1.076	0.392
GCPs 11		0.027	0.364	1.181	0.889
GCPs 12		0.243	< 0.001	1.152	0.436
Health & Safety Performance (HSP)	0.841				
HSP 1		0.257	< 0.001	1.650	0.867
HSP 2		0.204	0.003	2.086	0.881
HSP 3		0.243	< 0.001	1.654	0.902
HSP 4		0.083	0.137	1.710	0.903
HSP 5		0.370	< 0.001	2.508	0.901
Client Satisfaction (CS)	0.831				
CS1		0.240	< 0.001	1.242	0.802
CS2		0.127	0.047	1.062	0.812

Constructs	Convergent Validity	Weights	P-value	VIF	Loadings
CS3		0.268	< 0.001	1.369	0.619
CS4		0.275	< 0.001	1.268	0.813
CS5		0.248	< 0.001	1.125	0.718

4.3 Structural model

Prior to evaluating the structural model, the VIF was used to test for lateral collinearity among all the constructs. The VIF value for all three constructs ranges from 1.208 to 1.671, thus satisfying Diamantopoulos and Siguaw (2006) 3.3 threshold value. Hence, lateral collinearity is not a concern in the study (Hair et al., 2017).

Table 3
Assessment of Lateral Collinearity

Constructs	VIF
Green construction practices	1.208
Client Satisfaction	1.671
Health and safety performance	1.386

The structural model is presented in Fig. 2 and contains the coefficient of determination (R^2) and the path coefficient (β). An R^2 value of 0.45 was obtained in this study indicating that the model explains 45% of the variances in GCPs and HS. Also, the R^2 value of 0.45 is more than 0.26 recommended by Cohen (1988) which signifies a substantial model. Additionally, the predictive relevance, Q^2, values of 0.032 and 0.447 obtained are substantially greater than zero, signifying that the model has adequate predictive relevance (Hair et al., 2017).

5. Hypotheses Testing

5.1 *Hypothesis testing for direct effect*

The results of the hypothesis testing for the study's relationships are presented in Fig. 2 and Table 4. The result for the direct effect of GCP on CS is positive and statistically significant (β = 0.347, P < 0.001) but does not support the first hypothesis (H1) since the study hypothesized a negative significant effect. The effect size (f^2) of 0.15 obtained for this relationship is indicative of a medium effect going by Cohen (1988) guideline.

Table 4
Hypotheses Testing Results

Hypothesis	Relationships	P-value	Path Coefficient(β)	Effect size(f^2)	Decision/Notes
H1	GCPs ◊CS	< 0.001	0.347	0.148	Not Supported
	GCPs ◊HSP	0.022	0.152	0.023	
	HSP ◊CS	< 0.001	0.491	0.272	
H2	GCPs ◊HSP◊CS	0.031	0.141	0.032	Supported
H3	GCPs*HS◊CS	0.009	-0.177	0.031	Not Supported
(GCPs = Green construction practices, CS = Client Satisfaction, HSP = Health and safety performance)					

5.2 *Hypothesis testing for mediating effect*

For the mediating effect, the results presented in Table 4 indicate that the mediating relationship is significant (β = 0.141, P = 0.031) with a small f^2 of 0.032. Thus, supporting the second hypothesis (H2). Additionally, the type of mediation present in this study is partial mediation since both the direct (GCPs ◊CS) and indirect (GCPs ◊HSP◊CS) relationships are significant (Rucker et al., 2011). This implies that HSP has absorbed only a fraction of the direct effect of the independent variable (GCPs) on the dependent variable (CS).

5.3. *Hypothesis testing for moderating effect*

The results of the hypothesis testing for the moderating effect are presented in Table 4, and Fig. 2. The results in Fig. 2 show that the moderating link is significant (β= -0.117, P = 0.009), but negative with projects with low adoption of GCPs having the stronger effect relative to projects with high adoption of GCPs (see Fig. 3). This does not support the third hypothesis (H3). The effect size (f^2) is interpreted differently as suggested by Kenny (2016). In the analysis of a moderating effect, 0.005, 0.001, and 0.0025 should be used as representative values for small, medium, and large effect sizes (Kenny, 2016). Hence, the f^2 for the GCPs*HS◊CS relationship is deemed to be large (> 0.025).

6. Discussion Of Results

This study examined the effect of adopting GCPs on CS, the mediating effect of HSP on the relationship between GCPs and CS, and the moderating effect of GCPs on the relationship between HSP and CS. The findings of this study show that GCPs has a significant positive effect on CS which does not support the first hypothesis (H1), HSP partially mediated the relationship between GCPs and CS lending support for the second hypothesis (H2), while it was found that GCPs significantly moderates the relationship between HSP and CS with the stronger effect coming from projects with low GCPs adoption which does not support the third hypothesis (H3).

The significant positive effect of GCPs on CS observed in this study can be attributed to the monetary and non-monetary benefits associated with the adoption of GCPs such as better project quality and greater productivity of construction workers (Karakhan & Gambatese, 2017). It has been reported that the non-adoption of GCPs could result in fines been imposed on the client, and could eventually lead to sealing off of the project site (Onubi et al., 2019), thus leading to extra cost and schedule overruns. Therefore, the positive effect of GCPs on CS could be due to greater economic performance and schedule performance associated with its adoption. The compliance with government regulations associated with the adoption of GCPs may also be the reason for the significant positive effect of GCPs on CS obtained in this study. The study's findings differ from those of Venkataraman and Cheng (2018) who reported a general lack of interest from clients on the adoption of GCPs, while El-Sayegh et al. (2019) attributed the lack of interest to the perceived high cost of adoption which leads to poor CS. The finding of this study is also in contrast with those of Assaker (2020) and Lee et al. (2018) who reported a no effect and insignificant effect respectively.

The result of the mediation analysis indicates that HSP partially mediates the relationship between GCPs and CS. This implies that clients can be satisfied with the adoption of GCPs irrespective of the HSP of the projects. In other words, there is a 50% chance of CS with the adoption of GCPs if such practices result in HSP. This finding could be due to other benefits associated with the HSP of projects that adopted GCPs. These benefits include cost savings resulting from fewer accidents and legal disputes, and increased project quality (Howarth & Watson, 2010), which could partly lead to CS.

Also, the positive significant mediating effect observed in this study could be due to the improvement in HSP in projects adopting GCPs as reported by Khan et al. (2021). Furthermore, they may have been a change in the way GCPs are been adopted as the adoption of the "prevention through design concept" has become increasingly popular (Zhou et al., 2015). This may have resulted in the safe adoption of GCPs and CS, hence the results obtained in this regard. Additionally, the experience level of the construction workers in GCPs may have increased over the years with its continuous adoption and more training which translates into better HSP to the satisfaction of the clients (Cianciarullo, 2019). However, the findings of this study is in contrasts with that of Hwang et al. (2018) who opined that the adoption of GCPs is usually characterised by greater safety risks due to the use of unfamiliar construction methods, new technologies, hazardous materials, and complexity of the entire construction process. This results in greater construction costs and a lack of CS (Karakhan & Gambatese, 2017).

Regarding the moderating effect of GCPs on the relationship between HSP and CS (H3), the result shows that there exists a negative significant moderating effect with the stronger effect emanating from projects with a low GCPs adoption. The discussion and interpretation of the nature of the moderating effect will be done with the aid of Fig. 3. Figure 3 shows that the line of the graph for both high GCPs adoption and that for low GCPs adoption slope upward from left to right. This means that CS increases with an increase in HSP across both sets of projects. Nevertheless, the line of the graph for low GCPs adoption is steeper than that with high GCPs indicating a stronger effect from low GCPs projects.

This finding is conflicting with the findings of Ochieng et al. (2014) who stated that clients take GCPs very seriously as a measure of their satisfaction to the extent that they demand for it from contractors. This suggests that the level of CS will be higher with a high level of GCPs adoption. Similarly, the results of this study differ from the findings of Shurrab et al. (2019). Shurrab et al. (2019) opined that clients are aware of the advantages of adopting GCPs and are ready to pay for it. By implication, though HSP would lead to CS, CS will be stronger when the level of adoption of GCPs is high relative to when it is low since the clients do not mind the perceived high cost of adoption. Ochieng et al. (2014) also views GCPs as a viable means of improving the project delivery process. All these findings by previous studies are contrary to the findings of this present study. The likely reason for the stronger effect of low GCPs adoption on the HSP◊CS relationship obtained in this study could be due to the value clients in the study area attach to GCPs. This could be a problem of value proposition whereby contractors offer to adopt GCPs and the clients may not value it (Lindič & Da Silva, 2011). Therefore, even with low adoption of GCPs, the CS would be high since the value they attach to high GCPs is low. The finding is however similar to that obtained by Lee et al. (2018) in the tourism sector where a negative moderating effect of green practices on CS was reported with low adoption of green practices having a stronger impact on CS than high adoption.

7. Conclusion

Determining the effect of GCPs on CS, and investigating the likely role of HSP in achieving CS on projects that adopt GCPs is of utmost importance in providing the much-needed guidance to contractors on how to significantly satisfy their clients through deliberate efforts towards HSP when adopting GCPs. As GCPs continues to evolve, there is a growing need to prevent safety issues on construction sites to ensure CS. This study analysed the effect of GCPs on CS, the mediating effect of HSP on the relationship between GCPs and CS, and the moderating effect of GCPs on the relationship between HSP and CS. The results showed that one of the three hypotheses(H2) was supported while H1 and H3 were significant but not supported. The managerial implications and theoretical contributions are presented next.

7.1 Managerial Implications

The findings of this study make contributions that would be of great benefit to clients, contractors, and other construction industry stakeholders. This study's finding shows that GCPs has a positive effect on CS which is contrary to the results of most previous related studies. This finding will encourage contractors to continually strive to adopt GCPs as clients do not mind the extra cost they may incur from its adoption since it is a major determinant of their level of satisfaction. Emphasis should be placed by contractors on GCPs since it is a panacea for repeat business and referrals to to-be clients.

The partial mediating effect of HSP on the relationship between GCPs and CS highlights the all-important role HSP plays in ensuring CS in construction projects. It is recommended that contractors accord great attention to HSP since it serves as a link towards ensuring CS. The finding of this study regarding the mediating role of HSP shows that aside from the indirect role it plays in achieving CS, it could also bring

about other deliverables such as lower construction cost, and greater quality in project delivery which will ultimately lead to CS.

Lastly, the negative moderating results obtained imply that the relationship between HSP and CS is stronger when the adoption of GCPs is low relative to projects where the level of GCPs adoption is high. This provides crucial guidance to firms with low GCPs adoption that improving HSP can lead to greater CS.

7.2 Theoretical Contributions

This study makes several theoretical contributions. Although studies such as Karakhan and Gambatese (2017), Zhou et al. (2015), and Dewlaney and Hallowell (2012) examined how HSP can be achieved in projects that adopt GCPs at the design stage, this current study goes further by providing additional insight on the impact of HSP on CS. This study also builds on the study of Hinze et al. (2013) by going beyond how construction HSP can be integrated into green construction projects, to determining how HSP could lead to CS. Additionally, this study contributes to green construction literature by focusing on the satisfaction of the client who is a key stakeholder in the construction industry, thus contributing theoretically to the study of Zhao et al. (2020) who studied the job satisfaction of project managers in green construction projects.

8. Limitations And Future Study Directions

Though this study has many strengths, there are some limitations that can be addressed in future studies. First, the study was conducted in Nigeria, a developing country in Africa. Due to the restricted geographical nature of the data collected, generalizing the research findings beyond the Nigerian context should be done with caution. However, this study's findings could be relevant to other countries with similar characteristics like Nigeria. It is recommended that similar studies be replicated in other countries and the results compared with those gotten in this study. Secondly, this study adopted the quantitative method using a questionnaire for data collection. As such, the respondents were limited to the options provided in the questionnaire. Future studies can adopt a qualitative research method to obtain more in-depth findings on how to improve HSP on projects that adopt GCPs. Lastly, HSP was used as a mediator in this study and it was found to partially mediate the GCPs – CS relationship. Nevertheless, other factors such as economic performance and schedule performance could be considered as mediators in future studies in addition to HSP to obtain more insights.

Declarations

Ethics approval and consent to participate: This study involved human participant. Ethics approval was granted by Jawatankuasa Etika Penyelidikan Manusia Universiti Sains Malaysia (JEPeM-USM) with study protocol code USM/JEPeM/18090438 on 9th May 2019.

Consent for publication: Not applicable

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests" in this section.

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Figures

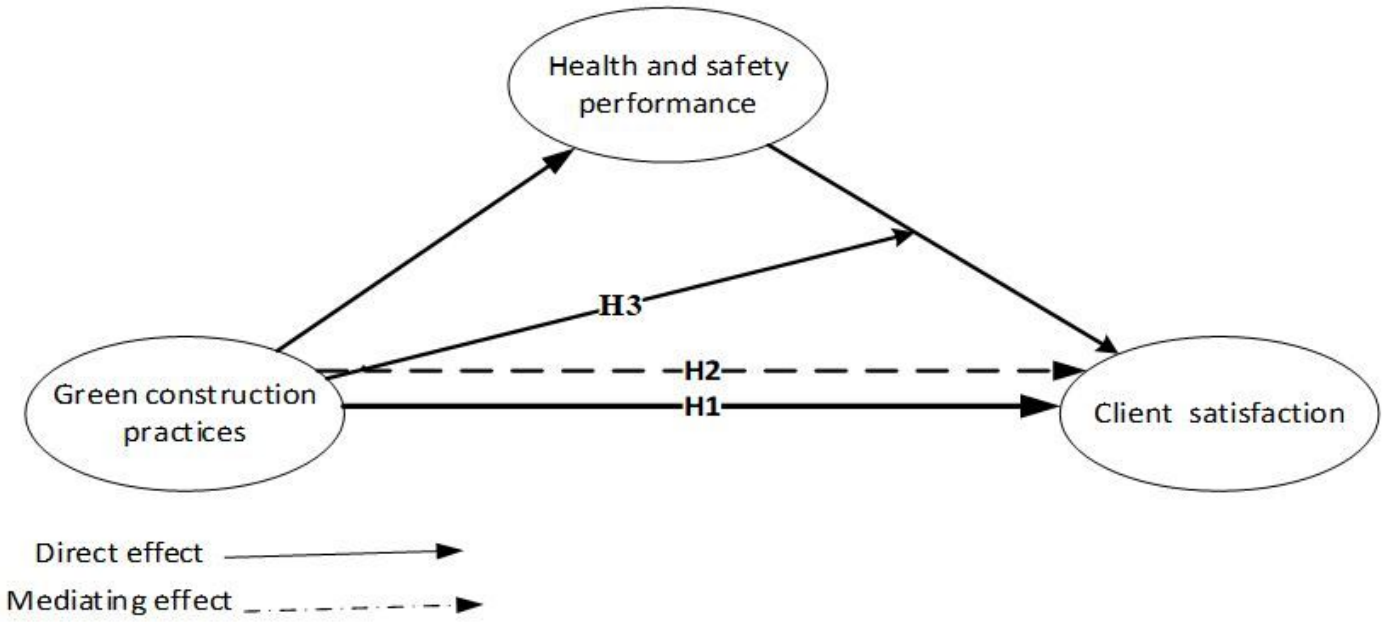

Figure 1

Conceptual model

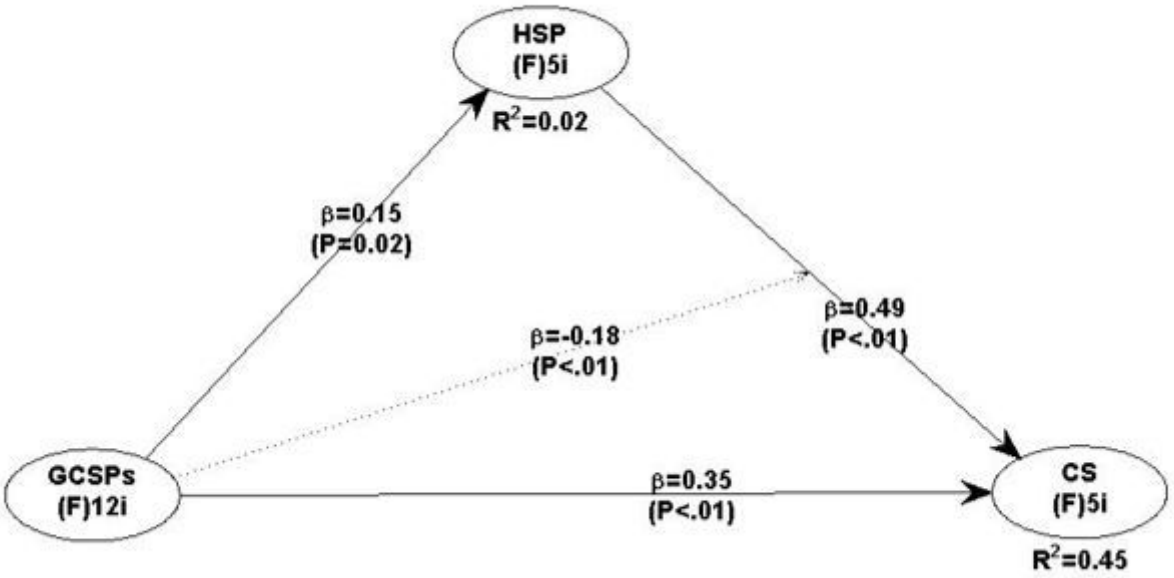

Figure 2

PLS path model

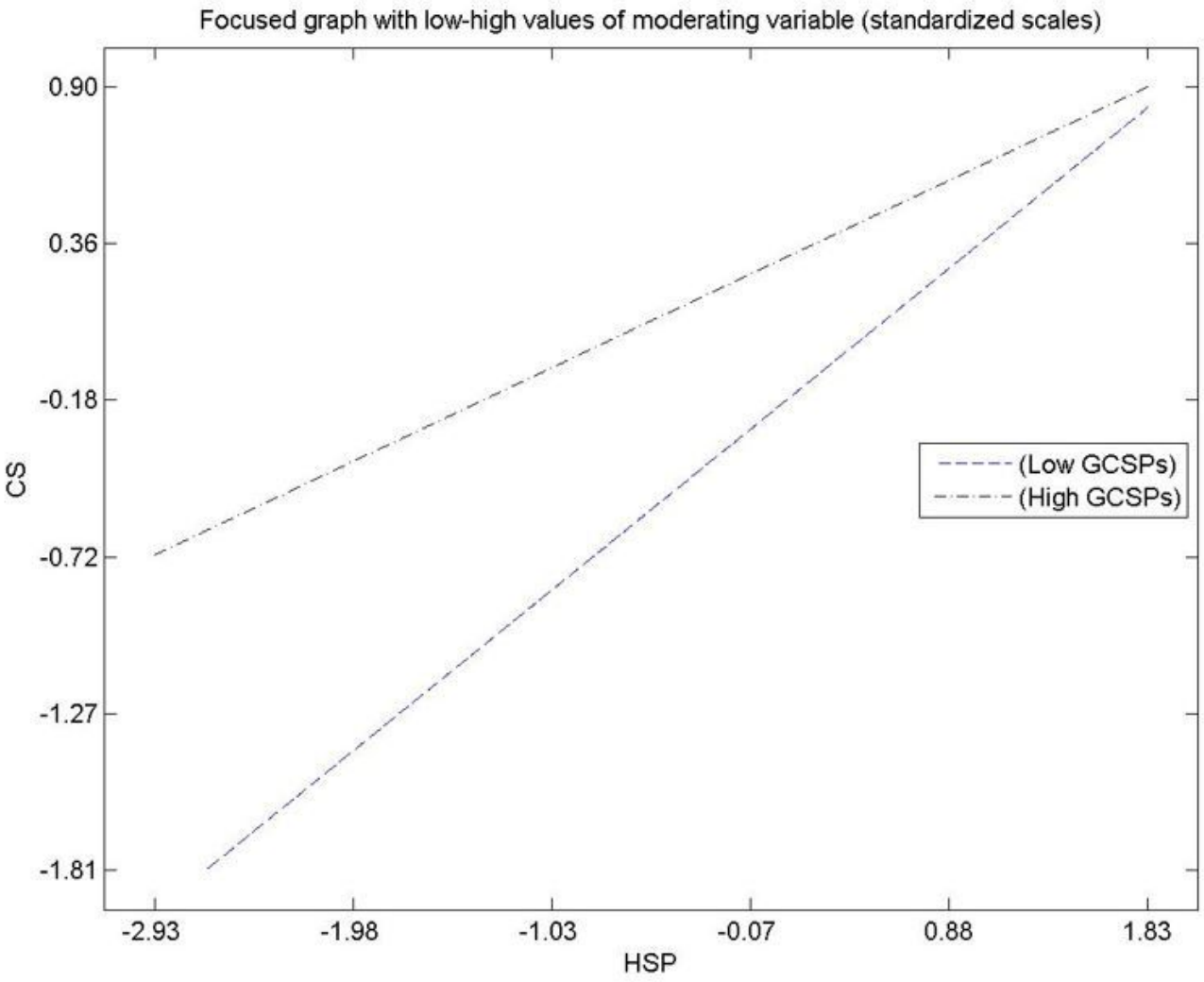

Figure 3

Moderating effect of GCPs on the HSP -> CS relationship