

PAPER 102 – MATERIAL SUSTAINABILITY IN NIGERIAN CONSTRUCTION ORGANIZATIONS: A PATHWAY TO ECONOMIC SUSTAINABILITY

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ABSTRACT

Research on Material Sustainability in construction has been extended in literature to the public domain by examining how various constructs relate with the environmental dimension of sustainability. Meanwhile, the current linear consumption of construction materials is economically unsustainable in the midst of growing financial fears. Given the crucial importance of construction firms in sustaining materials, this study aimed to examine the mediating effect of two extreme dimensions of organizational culture (OC) on material sustainability constraints (MSC) influencing the economic sustainability of construction projects (ESCP). A total of 359 responses from a cross-sectional survey from Nigerian construction firms were analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM). The proposed research model was formulated largely under the premise of the Circular Economy (CE) theory. The main contribution of this study is to confirm the hypothesis that Hierarchical Culture (HC) diminishes the relationship between MSC and ESCP. This substantiates the need for construction firms to develop and adopt a more innovative culture, such as the Development Culture (DC), in order to drive circular practices and eventually contribute to the economic sustainability of Nigerian construction projects. The study also makes valuable contributions with regard to understanding the behavioral disposition of construction firms towards attaining sustainable outcomes.

KEYWORDS: Material Sustainability; Sustainable Material Management; Organizational Culture; Circular Economy; Economic Sustainability; Nigeria

3. INTRODUCTION

Being undoubtedly one of the rapidly urbanizing countries in sub-Saharan Africa, almost 50% of Nigeria's population now reside in urban settlements indicating the need for more infrastructure (Isa et al., 2013). Consequently, a lot of material resources are expected to become scarcer and hence expensive to use and a considerable number of these resources may not even be available for future utilization. The growing concern on population growth and resource scarcity has resulted in the concept of sustainability becoming more imperative over the past decades (Santoro, 2019). Being the foundation for most economic activities, the construction industry is hence plunged into the key role of ensuring sustainability. The current level of sustainability awareness is undoubtedly a crucial factor influencing the architectural tendencies and high resource consumption observed in developing countries (Kukah et al., 2022). Hence, this consumes a lot of energy and adds a lot of money to the construction process because it necessitates the importation of supplies and specialized labour. This is a problem given the ever increasing financial dilemma in Nigeria, where shortage of funds to execute construction projects (Taiwo & Misnan, 2020) is often highlighted.

Employing the use of "sustainable materials" in our construction practices to substitute "traditional materials" is believed to improve global dimensions of sustainability thereby reducing the ecological and economic effects in the course of the building's lifespan (Bribián et al., 2011). Additionally, it extends distinctive utility benefits to both clients and users. Nevertheless, most building endeavours still only patronize the so-called traditional materials as the use of sustainable materials in the industry is clearly enveloped by obstacles of adoption (Saleh & Alalouch, 2015; Darko & Chan, 2017). The question of sustaining materials viz-a-viz introducing new innovative ones is crucial due to the modern stride of high-tech innovations in every business domain (Esposito et al., 2018). According to Ritzén and Sandström, (2017), it is necessary to start from within the organization to understand the barriers faced by sustainable initiatives. The globally recognized idea of Organizational Culture (OC) of these organizations is at the heart of this argument. OC has been shown in prior research to be a background element or social context that impacts an organization's learning methods in acquiring and applying specialized expertise (Teräväinen et al., 2018). According to Owolabi et al., (2019), one of the primary impediments to creative applications in the Nigerian construction sector is the OC. Previous study in the Nigerian construction sector did not focus on the relationship between material sustainability in construction and economic

sustainability entirely in a way that integrated OC. Hence, this paper sought to address three major research questions to this effect: RQ1: What is the relationship between Material Sustainability Constraints (MSC) and OC in the Nigerian Construction industry RQ2: What is the relationship between MSC and Economic Sustainability of Construction Projects (ESCP) in the Nigerian Construction industry? RQ3: To what extent does OC mediate the relationship between MSC and ESCP in Nigeria?

4. THEORETICAL ANALYSIS

The world has relied on a linear economy ever since the advent of the industrial revolution (Esposito *et al.*, 2018). Earth has become a "take, make, and dispose" realm as a result of our consumerist mentality and "single use" lifestyles. This indicates a linear progression of innovation: we obtain our inputs from the natural world, use them in the production of mass-produced items that we purchase, use once, and then throw away. Over the past three decades, there has been a growing movement toward increased circularity in many nations around the globe, which can now profit from increased incorporation and consistency. A number of researchers (Ghisellini *et al.*, 2016; Geissdoerfer *et al.*, 2017) sanction the initiation of the study of CE to Pearce and Turner, (1989). By examining the ways in which natural resources serve as both inputs for production and a sink for waste products, the authors demonstrated how modern economic systems combine linear and non-linear elements. According to Zadeh *et al.*, (2016), empirical evidence that aids in the evaluation of sustainable methods will tremendously assist clients and can go a long way in paving the way for future sustainable products. Although the path to attainment of this objective is clearly identified by specified strategies, the process is quite often hindered by periodic constraints. This formed the basis for conceptualizing the relationship between the independent variable (MSC) and the dependent variable (ESCP). This concept is further explicated by Figure 1 below.

This study chose the development culture (DC) and hierarchical culture (HC) dimensions as mediating variables in order to effectively achieve the objectives set. The DC is one that strategizes on acclimatization to external forces by pre-empting the need to apply creative solutions (Patyal *et al.*, 2019). Its main feature is the flexibility to adapt to the naturally ever-changing consumer requirements (Zu *et al.*, 2010). In contrast, the HC is well known for its qualities of bureaucracy, tendency for rigidity, tight restrictions and internal focus (Pakdil & Leonard, 2015). Innovative solutions wither in such environs. Hence, these culture types are deemed the most suitable to address MSC in the Nigerian construction sector. The conceptualization of the study variables also gave rise to the following research hypotheses;

- H1: Material sustainability constraints have a negative impact on construction firms' development culture.*
- H2: Material sustainability constraints have a negative impact on construction firms' hierarchical culture.*
- H3: Material sustainability constraints have a negative impact on economic sustainability of construction projects.*
- H4: Development culture has a positive influence on economic sustainability of construction projects.*
- H5: Hierarchical culture has a positive influence on economic sustainability of construction projects.*
- H6: Development culture mediates the relationship between material sustainability constraints and economic sustainability of construction projects.*
- H7: Hierarchical culture mediates the relationship between material sustainability constraints and economic sustainability of construction projects*

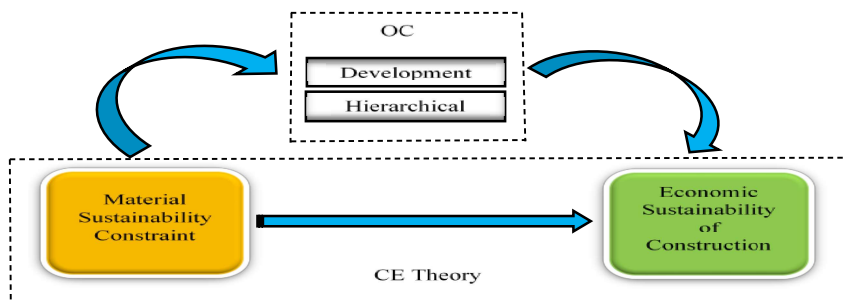


Figure 1: Research Framework

5. METHODOLOGY

3.1 Data Collection Process

For this study, the Positivist approach and Quantitative techniques were adopted as philosophy and design respectively in order to ascertain the mediating effects of OC on the relationship between MSC and ESCP in the Nigerian construction industry. This is to effectively analyze the causal relations and ascertain the level of direct and indirect relationship among all variables. A survey technique was used to ensure that the stated goals are satisfied. As a result of the background and scope provided, the target population for this study was all contracting and consulting firms in the study area. In total, 550 survey questionnaires were distributed to Construction Contracting and Consulting Companies in Nigeria, of which 390 were returned. Out of the returned questionnaires, 359 were used for data analysis. Data were obtained from Principal partners, Partners, Management staff, Project Managers and Regular staff of these organizations through the survey instruments.

3.2 Measurements

The measurement for MSC (7 items), OC (11 items) and ESCP (10 items) was done using a 5-point Likert scale. The Likert scale for MSC adopted ranged from “very less severe” denoted by 1, to “very highly severe” denoted by 5. The Likert scale for OC ranged from “strongly disagree” denoted by 1, to “strongly agree” denoted by 5. The Likert scale for ESCP indicators ranged from “very low” denoted by 1, to “very high” denoted by 5.

6. RESULTS AND DISCUSSION

4.1 Direct Relationships

Bootstrapping with a resample rate of 5000 was run to test the hypotheses of the study. To attain p-values, t-values and bootstrapped confidence intervals, Hair et al., (2019) suggested bootstrapping. Results for the five tested direct hypotheses are presented below in Table 1. Four hypotheses (H1, H2, H3, and H5) were found significant while H4 was not significant. Specifically, green job analysis and description with sustainable performance were not significant ($\beta = 0.100$, $t = 1.581$, $p = 0.057$, $BCILL = -0.024$, $BCIUL = 0.190$), explaining that development culture in Nigerian construction organizations is not significant thereby exposing it as responsible for not bringing the required sustainable economic performance to construction projects in the industry. Moreover, beta value is not significant, t-value is less than threshold value i.e., 1.645 and there is zero between upper and lower limit confidence intervals. Because this culture has the most tendency to support technology savvy or risk prone organizations due to their nature, where control is quite minimal due to demands for members to be experienced and enabled, its absence jeopardize the drive towards being entrepreneurial, creative and innovative to accommodate the dynamism, individuality and risky terrain of such organizations (Pakdil & Leonard, 2015; Patyal et al., 2019). Based on the above discussion, H4 is rejected.

Table 1: Hypothesis Testing for Direct Relationships

Hypothesis	Relationships	Std. Beta	T-values	P- values	BCI LL	BCI UL
H1	MSC -> DC	-0.308	7.573	0.000	-0.367	-0.234
H2	MSC -> HC	0.203	3.891	0.000	0.103	0.277
H3	MSC -> ESCP	-0.088	1.653	0.049	-0.169	0.006
H4	DC -> ESCP	0.100	1.581	0.057	-0.024	0.190
H5	HC -> ESCP	-0.219	3.800	0.000	-0.297	-0.110

4.2 Indirect Relationships

H6 was developed to investigate the mediating effect of DC on the relationship between MSC and ESCP. Analysis of the results revealed that the mediating effect of DC was found to be insignificant ($\beta = -0.031$, $t = 1.524$, $p = 0.064$, $BCILL = -0.060$, $BCIUL = 0.008$). Being a progressive culture, this implies that the concept of sustaining construction materials by organizations has not been fully embraced (Jones & Comfort, 2018). Hence, the justification for the outcome of this hypothesis can be explained in the scarcity of certain criteria necessary to attain minimum requirement to achieve a CE-based construction industry in Nigeria (Daniel et al., 2018; Ogunmakinde et al., 2019). Based on the discussion above H6 is rejected.

H7 was developed to investigate the mediating effect of HC on the relationship between MSC and ESCP. Analysis of the results revealed that the mediating effect of HC was found to be significant ($\beta = -0.044$, $t = 2.925$, $p < 0.05$, $BCILL = -0.070$, $BCIUL = -0.022$). This is a rational outcome and is in agreement with the findings of Büschgens et al., (2013), who reflect the difficulty of the HC to accommodate new inventions in its stringent and highly controlled setting. The results which are presented in Table 2 below also confirms that the current low state

of economic sustainability in the study area can be attributed to the most prevalent culture types in construction firms in the area; hierarchical culture. Based on the discussion above, H7 is accepted.

Table 2: Hypothesis Testing for Indirect Relationships

Hypothesis	Relationship	Std. Beta	T -values	P -values	BCILL	BCIUL
H6	MSC -> DC -> ESCP	-0.031	1.524	0.064	-0.060	0.008
H7	MSC -> HC -> ESCP	-0.044	2.925	0.002	-0.070	-0.022

7. CONCLUSIONS

For a while, policy makers and stakeholders have expressed interest in developing a sustainable model in the building industry. This trend hints to the questions of how construction firms (contracting and consulting) can adopt sustainable practices towards attaining sustainable material performance. Another question is whether OC mediates the relationship of the studied constructs within the Nigerian construction industry. The key contribution of this study is verification of MSC's influence on ESCP, and the discovery of partial effects of OC on ESCP in the Nigerian construction industry. As a mediator, HC lessens the link between MSC and ESCP. This signals that firms need to develop and switch to a more innovative culture like the DC to be able to drive sustainable practices and eventually contribute to economic sustainability of construction projects in Nigeria. Previous literature has highlighted these firms' reluctance in engaging these ideologies (Jones and Comfort, 2018) citing their organizational disposition as a probable reason for this shortcoming (Owolabi et al., 2019; Ritzén and Sandström, 2017). Based on the findings of this study, it is imperative on firm administrators to spearhead an organizational paradigm shift from the current stringent culture to a more flexible and innovative culture for the desired objective to be achieved. This could be done simultaneously with investments in innovations, sustainable skills and technology acquisitions to increase the economic performance of construction projects. When this is achieved, a more flexible and innovative culture (DC) will emerge within the industry and facilitate the attainment of ESCP in Nigeria.

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