

Sustainable Supply Chain Management Strategies and Construction Cost Optimization for Project Delivery in South-South Nigeria

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Abstract: The construction industry faces challenges like unsustainable supply chain practices and rising project costs, hindering environmental sustainability and economic efficiency. Despite global advancements, inefficiencies like resource waste and resistance to change exacerbate cost overruns and environmental degradation. This study investigated on Sustainable Supply Chain Management (SSCM) strategies and their influence on construction cost optimization for project delivery in South-South Nigeria. The study focuses on the level of adoption of SSCM strategies, barriers inhibiting the adoption of SSCM, construction cost optimization strategies and the relationship between the level of adoption of SSCM strategies and construction cost optimization. The survey data was obtained through a structured multiple choice questionnaire administered to 495 construction professionals in South-South, Nigeria. Data collected were analyzed using mean item score, Kruskal-Wallis H-Test, and Ordinal regression. The findings of the study revealed the most significant factors for the adoption SSCM are: corporate social responsibility, training on SSCM, information sharing, managers' commitment, sustainable construction, and clean program/production are the top five ranked in descending order. The study further shows that resistance to change, lack of financial incentives, limited sharing of information and knowledge, lack of coordination, limited teamwork, and lack of cooperation and communication among stakeholders are the most significant barriers inhibiting the adoption of SSCM. The study also revealed that construction cost optimization primarily focuses on value engineering, the use of pre-fabricated and modular components, project reviews, project scheduling, and multi-disciplinary team collaboration in that order. The study's revealed a positive relationship between SSCM and cost optimization strategies, with a Nagelkerke R^2 value of 0.981 suggesting a substantial portion of cost optimization variance can be attributed to how well the SSCM is adopted. The study concluded that the adoption of SSCM significantly leads to cost reduction. The study recommends an increase in awareness campaigns through workshops and seminars on the advantages of SSCM.

Keywords: Sustainable, Supply Chain Management, Construction, Cost Optimization, Project

I. Introduction

The social and economic development of any nation lies in its construction industry [26]. The role of the construction industry cannot be overemphasized, as it contributes immensely to the GDP of any nation across the globe. Despite this significant contribution, the construction industry poses a negative impact on its environment. [22]. Opined that the construction industries across the globe depend on resources and energy. These resources and energy aid the delivery of construction projects. The construction industry accounts for 30% of solid [26], and generates 50% of its material resources from nature, thereby increasing energy consumption to 40% and total waste by 50% [9]. In term of sustainability, these kinds of practices could be referred to unsustainable construction. [21]. Postulated that sustainable construction entails efficient usage of construction resources and environmental-based values, relating the life cycle consideration of construction resources through pre-construction, construction, recycling and waste management concerning developing a healthy built environment. While, some construction firms recognise the importance of environmental considerations in their supply chain strategy, other construction firms do not consider sustainable supply chain issues. It is on this background that this research was carried out.

Globally, the demand for trans-formative change in the construction industry has been on the rise and the focus is on how construction operations interact with the natural environment. [21]. Affirmed that sustainable construction among researchers and practitioners has gained interest and harmonising the environment preservation and economic development of the construction industry is now a must for the survival of the industry. [35] Asserted that supply chain management systems are effective for delivering construction projects based on time, cost and quality, thereby assisting in monitoring the flow and progress of construction projects. All construction stakeholders involved in the development of construction projects interface through a supply chain network that aids the delivery of construction projects.

Sustainable construction supply chain management (SSCM) is seems to be an environmental management model that drastically reduce the adverse environmental impact caused by construction activities on the environment. According to [12] and [7] SSCM encourages a sustainable environment, right from product design, product development, procurement and assortment of contractors, delivery of the product, product, and recycling. [20] Observed that construction firms have shown interest in SSCM practices with the view of improving firm optimization problems. In term of SSCM practices on environmental performance and cost optimization, [25]. Affirmed that SSCM is a holistic approach that integrates environmental, social, and economic considerations into the

management of the construction supply chain, and that SSCM can help construction firms in optimize costs, improve efficiency, and reduce the environmental impact of their operations.

II. Brief of the Literature Review

Construction projects typically involve a high volume of transportation activities, including both the transportation of workers and the transportation of materials. About 6-8% of CO₂ emissions are generated during construction projects and are due to the transportation of materials [6]. They further, asserted that reverse logistics are practices that involve the activity of initiating, designing, implementing and managing construction products and material flows. Reverse logistics encompasses material recycling, reuse, re-manufacturing, reducing energy consumption, reducing air and the movement of products from the manufacturers to the consumers ([23], [28]).

Sustainability and sustainable supply chain have been used interchangeably preceding terms' shared objectives were the management of environmental, social, and economic repercussions as well as the promotion of good governance practices throughout projects' life cycles and the provision of services in the literature under the term's sustainable management, SSCM and sustainable supply chain. The preceding terms' shared objectives were the management of environmental, social, and economic repercussions as well as the promotion of good governance practices throughout projects' life cycles and the provision of services. The construction industry is becoming more environmentally conscious. Because government rules have been put in place to reflect this, suppliers are taking on more responsibility in the current business environment to properly design, produce, and recall their goods. Sustainable practices require those suppliers, manufacturers and customers' artwork together within side the supply chain to increase and put into effect better and more sustainable solutions for companies [5]. With this concept, SSCM is taken into consideration as an integration of environmental into logistics and operations. [14] and [36]. Categorised sustainable practices as; sustainable design, sustainable procurement, sustainable manufacturing, sustainable distribution, reverse logistics internal environmental management, eco-design, sustainable purchasing, customer collaboration, and return on investment.

The key practices associated with SSCM includes: reverse logistic practices, transversal practices, sustainable procurement practices, sustainable management and sustainable design. Reverse logistic practice referees to sustainable distribution or sustainable logistics is the first dimension of SSCM. "Reference [16] described Sustainable distribution as all activities aimed at reducing and eliminating environmental and transport waste". In term sustainable logistics, "Reference [17] explained Sustainable logistics as important activities affecting the performance of sustainable supply chain management". Transport proposals between dealers and consumers that have an as little environmental impact as possible are called eco-friendly logistics. It also includes general warehousing, order processing, packing, picking, loading onto vehicles, transportation to consumers, and repacking. "Reference [17] opined that reverse logistics is a key contributor to ensuring customer after-sale satisfaction since its implementation leads to better optimisation of aftermarket processes such as recycling and proper waste disposal". Proper management of reverse logistics can help reduce risk and keep customers happy by helping businesses maintain long-lasting customer relationships [37].

Transversal practices are practices that impact the supply chain including environmentally responsible product innovation and design. All activities lead to new ideas and improvements that address specific sustainability goals [24]. Corporate social responsibility programs, sustainable talent management, standards and the adoption of authentication, the set of three collaborations, and the use of information and communication technology. Collaboration is a common way for companies across the supply chain to share information, form strategic alliances and reduce overall costs, and from a sustainability perspective [4]. Also, the introduction of information and communication technology has had a major impact on SSCM, which is a very young research area within the construction industry. From an economic point of view, this reduces costs and increases productivity.

Sustainable procurement practices are another important part of SSCM. The first step in the value chain is the purchasing function. Sustainable procurement can be defined as integrating environmental aspects and concerns into the purchasing process [39]. Choosing the right supplier is critical to achieving your company's environmental goals, but choosing the right supplier is not enough to improve environmental performance. "Reference [19] argued that large organizations are more environmentally friendly than smaller organizations and that the combination of these practices and environmental awareness is the driving force behind organizational progress". Sustainable procurement creates a competitive advantage, saves resources and improves business performance ([13], [23]).

Sustainable management practices focuses on economic, social, and environmental criteria when refining the long-term performance of the supply chain. These practices associated with SSCM are centered on product design, construction processes, resource sourcing and assortment in delivering the product to a client through end-of-life management of product [33]. The most important factor is striking the right balance between social responsibility, environmental protection, economic growth, and technical advancement [27].

Customer collaboration (CC) includes the willingness to share information, increase knowledge of each other's processes, and define and plan goals for improving the environment between an organization and its customer's collaborations [30]. This aspect includes working with customers to create cleaner production processes that develop environmentally friendly products with environmentally friendly packaging. In this way, companies can reduce their impact on the environment by fully understanding

environmental damage. The purpose of this practice is to provide customers with feedback on their sustainable processes to integrate environmentally friendly aspects into their production, design, and packaging processes [40]. Recently, industrial customers have shifted their focus to SSCM practices. End-consumers are also becoming more environmentally conscious [34]. End-users are therefore interested in understanding how consumer goods are manufactured and disposed of through the global supply chain. This is when companies adopt sustainable practices to maintain their competitive advantage [2]. As the demand for environmentally friendly products increases, supply chains are under intense scrutiny regarding raw material resources, manufacturing processes, and other supply chain-related issues.

Sustainable design is to make building projects environmentally friendly. Eco-design (ED) is an action initiated at the product development stage aimed at reducing the environmental impact of a product throughout its life cycle, from raw material purchase, manufacturing, consumption, and final product release [3]. Eco-design practices include designing products to minimize material and energy consumption. Successful project design requires effective coordination, communication, and long-term relationships between project stakeholders during the design phase.

Barriers inhibiting the adoption of SSCM, there are still a number of obstacles that prevent SSCM from being fully implemented in the construction sector. The fragmented nature of construction industry frequently contributes to communication breakdowns, lack of coordination, and limited teamwork, hindering the implementation of SSCM strategies [38]. The lack of awareness and understanding of the importance and benefits of SSCM, which many construction companies still perceive as an additional cost rather than an investment, is one of the primary barriers inhibiting SSCM strategies in the construction industry.

Further obstacle impeding the implementation of SSCM solutions in the construction sector is the restricted market appetite for sustainable goods and services. The advantages of sustainable construction are still not well known, and many clients and customers do not give sustainability first priority when making purchases. Construction enterprises are frequently dissuaded from investing in SSCM techniques due to the restricted market demand [18]. Significant financial resources are frequently needed for the execution of SSCM methods, including purchases of new technology, education, and certification. Adoption of SSCM methods is hampered by the fact that many construction companies, especially small and medium-sized businesses, sometimes lack the funding necessary to invest in them, lack of traceability and transparency in the industry's supply chain [40]. The effective application of SSCM techniques in the construction sector depends on stakeholder collaboration and communication. However, the adoption of SSCM solutions is hampered by the lack of cooperation and communication among stakeholders, which frequently results in a lack of awareness of sustainability issues and restricted information exchange [38].

The five most important barriers to the successful implementation of sustainable construction in Ghana, according to a recent survey by [1] of 100 construction professionals, are: resistance to cultural change; lack of government commitment; fear of higher investment costs; lack of professional knowledge; and lack of legislation. Their results also demonstrate how the major obstacles may be broadly grouped into the following categories: financial hurdles; political barriers; management/leadership barriers; technical barriers; socio-cultural barriers; and knowledge/awareness barriers. "Reference [29] found that there are several significant obstacles to the implementation of sustainable construction in developing nations, including cost-effectiveness, project delays, a lack of green materials and equipment, a lack of knowledge and awareness, a lack of environmental legislation among others". In their investigation of sustainability knowledge, comprehension, and literacy levels, [32] discovered that practitioners had a solid theoretical grasp and awareness of sustainability. Nonetheless, significant gaps and inconsistencies exist in the actual application of sustainable construction, primarily because of the following: the "tick-box" mentality inherent in sustainability appraisal tools; a lack of communication among decision-makers; and a lack of client awareness.

Several obstacles identified by [15], and [26] including a delayed overspending on project design insufficient cooperation, trust, integration between suppliers and architects and complexity of project design. Absence of enduring interaction was identified by [31]. While disregard for building norms, laws, rules, and codes by [11]. The study adopted [32] considerations of the obstacles impeding SSCM from six (6) industrialised countries.

Theory supported the study is the stakeholder theory. The idea behind stakeholder theory is that organisations should take these stakeholders' interests into account when making decisions by identifying, analysing, and weighing the interests of the various groups and individuals that are impacted by or have an interest in the activities of the organisation. Stakeholder theory serves as the foundation for sustainable supply chain management strategies in building projects, which attempt to balance the interests of various stakeholders, including the economy, society, and the environment.

III. Methodology

In exploring the level of adoption and barriers inhibiting the adoption of SSCM strategies by construction professionals, this study adopted a survey research design in generating quantitative data from construction professionals operating in Akwa Ibom, Rivers and Delta State. Furthermore, the population of the study consists of Architects, Builders, Quantity surveyors and Civil Engineers. These construction professionals were obtained from professional's secretariat within the three states. The sample size of four hundred and ninety five (495) was achieved using Taro Yamane formula. A total of 495 copies of questionnaires were distributed, 324 were retrieved and only 300 were properly filled and this accounts for 60% response rate. The study adopted a questionnaire data collection method. The questionnaire approach is useful in covering a wide range of respondents. The questionnaire consists

of three sections; the first part consists of respondent's characteristics; the second part is focused on adoption of SSCM, and the last section centered on barriers inhibiting the adoption of SSCM. The respondents were required to rate perceived level adoption and barriers inhibiting the adoption of SSCM of a five-point Likert scale, where 1 = very low; 2 = low, 3 = moderate; 4 = high; 5 = very high. Data generated were analysis using the Mean Item Score (MIS) and a nonparametric test called the Kruskal-Wallis H-Test was used to determine whether there was a significant difference between the responses of three or more categories of respondents. The study's pertinent objectives were tested using the Kruskal Wallis H Test at a significance level of 5%. The null hypothesis will be rejected, and the alternative hypothesis will be given preference if the p-value is less than or equal to 0.05 ($p \leq 0.05$); conversely, if the p-value is greater than or equal to 0.05 ($p \geq 0.05$), the null hypothesis will be accepted and the alternative hypothesis will be rejected.

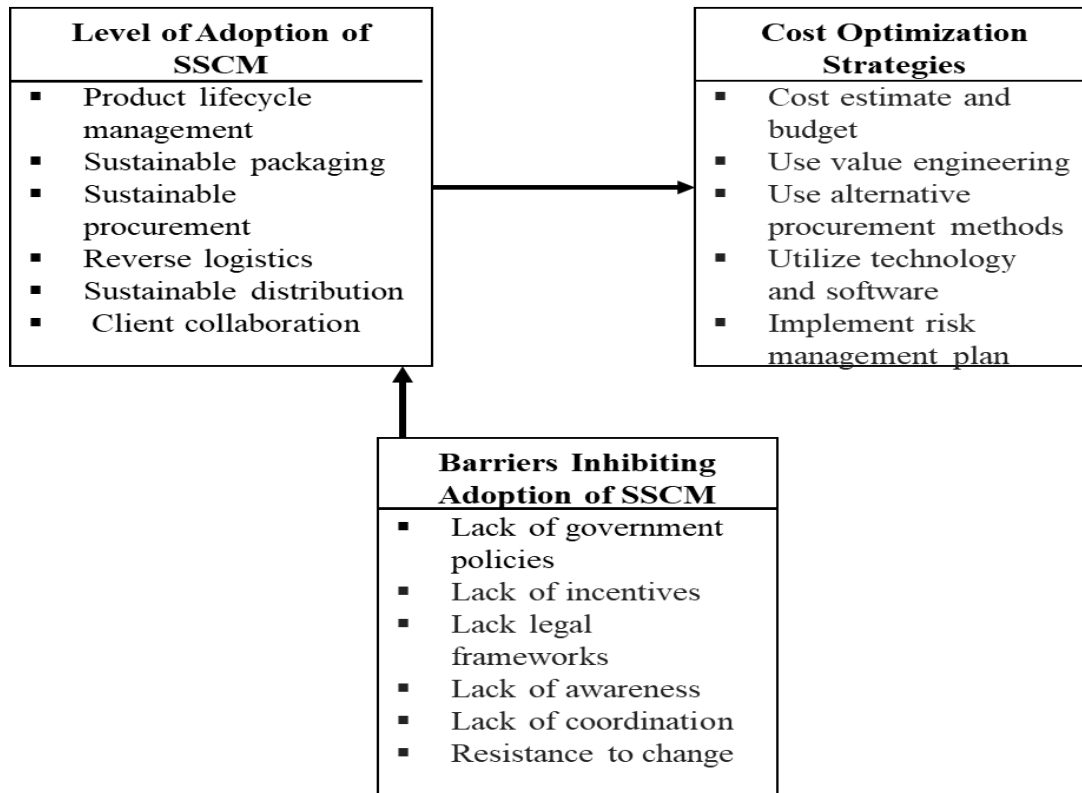


Figure 2.1: Conceptual Framework

Source: Researcher's Conceptual Framework (2024)

The reliability test of the research instrument was carried out by calculating Cronbach's alpha coefficient using Statistical Package for Social Sciences (SPSS). The Cronbach's α value concurred that the value range from 0 to 1 and the degree of reliability of the instrument is more perfect as they tend towards 1. The result obtained for the different measuring scale used indicated that the Cronbach's α value ranged from 0.795 - 0.885. The level of adoption of SSCM strategies has 0.885 Cronbach's α value; the barriers inhibiting the adoption of SSCM has 0.815 Cronbach's α value and the construction cost optimization strategies has 0.795 Cronbach's α value. The Cronbach's α value tend towards 1.0, and can be concluded that the instrument used for the research is significantly reliable.

Data Presentation, Analysis and Discussion of Results

Data Presentation and Analysis

The data supporting the evaluation of SSCM and construction cost optimization strategies in South-South, Nigeria were quantitative and ordinal. The data represents the subjective perceptions of construction professionals in the research environment. In the following sections, the data from the field survey are analyzed and presented based on the research objectives. The results emerging from the data analyses are further elaborated and discussed to infer their implications. A total of 495 copies of questionnaires were distributed, 324 were retrieved and only 300 were properly filled this accounted for a 60% response rate.

Characteristics of the Respondents

The study calculated six characteristics of the respondents, which focused on gender, educational qualification, professional affiliation, professional qualifications, industry experience and location of the respondents as shown in table I below.

Table I: Characteristics of the Respondents

Categories	Variables	Frequency	Percentage
Gender	Male	202	67.3%
	Female	98	32.7%
Educational Qualification	HND/BSc	153	51%
	MSc/PhD	147	49%
Professional Affiliation	NIA	70	23.3%
	NIOB	80	26.7%
	NSE	60	20.0%
	NIQS	90	30.0%
Professional Qualifications	Registered Member/Fellow	194	64.7%
	Probationer (Awaiting Registration)	106	35.3%
Years of Experience in the Industry	0-5years	44	12.1%
	5-10years	93	14.7%
	10-20years	96	31.0%
	Above 20years	67	32.0%
Location of Respondents	Akwa Ibom State	123	30.3%
	Rivers State	115	38.3%
	Delta State	94	31.3%

Source: Author's Field Survey (2025)

Table I, show the educational qualification of the respondents, with 51% having HND/BSc qualifications, while 49% possess MSc/PhD qualifications. These results portrayed that all the respondents were knowledgeable on the subject matter. From a professional affiliations perspective, 23.3% were architects (NIA), 26.7% were builders (NIOB), 20.0% were civil engineers (NSE), and 30.0% were quantity surveyors (NIQS). Furthermore, 64.7% of the respondents are registered members of their professional bodies; this indicated that the information provided can be relying upon. The table also shows the working experience of the respondents of about 63% of the respondents having been in practices over 10year. This indicated that the respondents are well versatile in the field of this study. The results also shows the geographical location of the respondents with 30.4% residing and operating in Akwa Ibom State, 38.3% of the respondents operating in Rivers State, and 31.3% of the respondents residing and operating in Delta State, Nigeria. The respondents possess considerable knowledge and could give reliable information reforms for the study.

The Level of Adoption of SSCM Strategies by Construction Professionals

The study examined the level of adoption of SSCM strategies in South-South, Nigeria. Twenty-seven SSCM strategies were extracted from the literature and were ranked by construction professionals operating in South-South, Nigeria. .

Table II: The Level of Adoption of SSCM Strategies

S/N	SSCM Strategies	1	2	3	4	5	MIS	Ranks	Remarks
1.	Corporate social responsibility	28	60	66	98	48	3.26	1 st	MLA
2.	Training on SSCM	24	54	102	88	32	3.16	2 nd	MLA
3.	Information Sharing	34	76	67	75	48	3.09	3 rd	MLA
4.	Commitment of managers	34	76	67	75	48	3.09	3 rd	MLA
5.	Sustainable construction	36	70	71	86	37	3.06	5 th	MLA

6.	Clean program/production	41	54	94	68	43	3.06	5 th	MLA
7.	Sustainable material management	30	71	89	73	36	3.04	7 th	MLA
8.	Green process	50	54	64	99	33	3.03	8 th	MLA
9.	Product lifecycle management	55	54	69	77	45	3.01	9 th	MLA
10.	Supplier selection	36	57	104	77	26	3.00	10 th	MLA
11.	Reverse logistics	23	74	53	90	60	3.00	10 th	MLA
12.	Investment return	40	79	55	93	33	3.00	10 th	MLA
13.	Sustainable procurement practices	43	75	69	80	33	2.95	13 th	MLA
14.	Employee satisfaction	36	63	102	79	20	2.94	14 th	MLA
15.	Product design/Eco-design	39	71	90	72	28	2.93	15 th	MLA
16.	Sustainable/green transportation	35	75	95	64	31	2.93	15 th	MLA
17.	Environment management system	43	71	78	78	30	2.93	15 th	MLA
18.	Sustainable material selection	35	81	73	93	18	2.92	18 th	MLA
19.	Forward integration	54	77	51	76	42	2.91	19 th	MLA
20.	Sustainable packaging	65	66	44	88	37	2.88	20 th	MLA
21.	Green operation and maintenance	58	59	85	55	43	2.88	20 th	MLA
22.	Sustainable supplier management	42	73	94	70	21	2.85	22 nd	MLA
23.	Total quality	51	77	79	72	21	2.78	23 rd	MLA
24.	Waste management	38	92	95	55	20	2.75	24 th	MLA
25.	Sustainable/green distribution	43	88	89	77	3	2.69	25 th	MLA
26.	Client collaboration	61	76	76	68	19	2.69	25 th	MLA
27.	Internal environment management	68	72	89	52	19	2.60	27 th	MLA

*MLA = Moderate Level of Adoption

Source: Author's Field Survey (2025)

Table II shows the hierarchy of 27 SSCM strategies based on Mean Item Score Table II shows the hierarchy of 27 SSCM strategies based on Mean Item Score (MIS). The study established a decision rule that a mean item score of 2.50 below indicates a low level of adoption; 2.50 - 3.49 a moderate level of adoption, and 3.50 and above indicates a high level of adoption. The result presented in Table 4.2 shows the ranking of the top five significant SSCM strategies, corporate social responsibility is ranked first with an MIS of 3.26, training on SSCM is ranked second with an MIS of 3.16, ranked third are information sharing and commitment of managers with a MIS of 3.09, while sustainable construction and clean program/production is ranked fifth with MIS of 3.06.

Test of Difference in Respondents' Perceptions on the Level of Adoption of SSCM Strategies

The study further tested the level of consistency in the perception of respondents regarding the level of adoption of SSCM strategies among construction professionals in the study area; the study determined the hypothesis, which states that the level of adoption of SSCM strategies in the research environment is not significant. The study applied the Kruskal Wallis H test to measure variation in perceptions and level of agreement in ranking perceptions of respondents about the level of adoption of SSCM among construction professionals. The test was validated using the critical p-values where values greater than 0.05 were accepted and values less than 0.05 were rejected. The results are presented in Table III, shows that the perceptions of construction professionals do vary. The critical p-value $p(0.000)$ is less than 0.05 and the null hypothesis was rejected. In other words, the inter-rater agreement in respondents' perceptions of the level of adoption of SSCM strategies among construction professionals in the study area is consistent. Therefore, there is variation in the rating perceptions of the respondents about the level of adoption of SSCM strategies. This means the level of adoption of SSCM strategies varies based on construction professionals.

Table III: Test of Variation/Agreement in Respondents' Perception among Construction Professionals

Items compared	The extent of difference in perception
No of variables	27
NIA	57.65
NIOB	79.15
NSE	39.70
NIQS	41.50
Chi-Square	27.675
Degree of freedom (df)	3
P-value	0.000
Significance level	0.050
Decision	Reject

Source: Author's Field Survey (2025)

Barriers Inhibiting the Adoption of SSCM Strategies

The study extracted 29 barriers inhibiting the adoption of SSCM strategies individually and collectively from the literature. The results presented in Table IV show the descriptive perceptions of the respondents regarding the severity of these barriers affecting the adoption of SSCM strategies in South-South, Nigeria.

The study established a decision rule that a mean item score below 2.50 indicates insignificant and a mean item score above 2.50 indicates significant. Notably, all validated barriers had a mean item score above 2.50, signifying all variables are significant to inhibiting the adoption of SSCM strategies. The most significant barriers ranging from 4.00 to 4.99, although there is no barrier fell in this band. While the significant barriers ranging between 2.50 to 3.99, all the 29 validated barriers fell in this band. Overall, the severity of barriers inhibiting the adoption of SSCM strategies is significant in all evaluated variables. While the top most barriers evaluated are: resistance to change, lack of financial incentives, limited sharing of information and knowledge, coordination and lack of cooperation and communication among stakeholders emerging as the most important barriers influencing adoption of SSCM strategies.

Table IV: Barriers Inhibiting the Adoption of SSCM Strategies

S/N	Barriers	1	2	3	4	5	MIS	Ranks	Remarks
1.	Resistance to change	5	41	57	115	296	3.79	1 st	Sig.
2.	Lack of financial incentives	10	27	81	128	54	3.63	2 nd	Sig.
3.	limited sharing of information and knowledge	4	40	79	123	54	3.61	3 rd	Sig.
4.	lack of coordination	12	36	91	101	60	3.53	4 th	Sig.
5.	Limited teamwork	11	46	95	85	63	3.47	5 th	Sig.
6.	Lack of cooperation and communication among stakeholders	5	48	98	97	52	3.47	5 th	Sig.
7.	lack of government commitment	25	44	69	108	55	3.45	7 th	Sig.
8.	lack of stakeholder participation	20	47	77	96	60	3.43	8 th	Sig.
9.	Lack of resources	15	35	115	83	52	3.40	9 th	Sig.
10.	lack of laws and regulations supporting SSCM plans	6	52	99	2105	38	3.39	10 th	Sig.

11.	poor commitment from top management	22	51	64	118	45	3.37	11 th	Sig.
12.	high capital project costs	10	61	89	95	45	3.34	12 th	Sig.
13.	inadequate sustainability education in educational institutions	17	33	108	115	27	3.34	12 th	Sig.
14.	lack of coordination and integration among industry stakeholders	20	42	111	72	55	3.33	14 th	Sig.
15.	lack of communication among supply chain partners	11	52	116	80	41	3.29	15 th	Sig.
16.	lack of accountability and responsibility	2	55	119	110	14	3.26	16 th	Sig.
17.	political barriers	24	56	79	100	41	3.26	16 th	Sig.
18.	absence of legal frameworks	26	48	92	91	43	3.25	18 th	Sig.
19.	lack of awareness and understanding of SSCM	22	74	70	82	52	3.22	19 th	Sig.
20.	management/leadership barriers	29	55	83	89	44	3.21	20 th	Sig.
21.	clients' lack of interest and commitment	12	65	105	85	33	3.20	21 st	Sig.
22.	lack of market for recyclable materials,	30	56	75	108	31	3.18	22 nd	Sig.
23.	restricted market appetite for sustainable services	4	82	95	96	23	3.17	23 rd	Sig.
24.	ignorance of environmental impacts	18	61	113	72	36	3.15	24 th	Sig.
25.	limited involvement of stakeholders in the design and decision-making process	30	69	78	85	38	3.10	25 th	Sig.
26.	the short-term focus of many construction businesses	34	61	90	76	39	3.08	26 th	Sig.
27.	lack of traceability and transparency	29	68	94	86	23	3.02	27 th	Sig.
28.	Shortage of skilled labour	38	72	89	77	24	2.94	28 th	Sig.
29.	scalability of sustainable practices	58	77	49	70	46	2.89	29 th	Sig.

*Sig. = Significant

Source: Author's Field Survey (2025)

Test of Difference in Respondents' Perceptions of the Barriers Inhibiting the Adoption of SSCM

To determine the level of consistency in the perception of respondents of the barriers inhibiting the adoption of SSCM strategies in South-South, Nigeria, the study determined the hypothesis, which states that the level of adoption of SSCM in the research environment is not significant. The study applied the Kruskal Wallis H test to measure variation in perceptions and level of agreement in ranking perceptions of respondents about the barriers inhibiting the adoption of SSCM strategies among construction professionals. The test was validated using the critical p-values where values greater than 0.05 were accepted and values less than 0.05 were rejected. The results presented in Table 4.5 show that the perceptions of construction professionals do not vary. The critical p-value p (0.920) is greater than 0.05 and the null hypothesis was accepted. In other words, the inter-rater agreement in respondents' perceptions of the barriers inhibiting the adoption of SSCM among construction professionals in the study area is consistent. Therefore, respondents' perceptions of the barriers inhibiting the adoption of SSCM strategies by construction professionals are similar.

Table V: Test of variation/agreement in respondents' perception on the Barriers among Construction Professionals

Items compared	The extent of difference in perception
No of variables	29
NIA	60.08
NIOB	63.82
NSE	57.53
NIQS	60.57
Chi-Square	0.495
Degree of freedom (df)	3
P-value	0.920
Significance level	0.050
Decision	Accept

Source: Author's Field Survey (2025)

Construction Cost Optimization Strategies

The third objective of the study sought to examine cost optimization strategies for construction projects in South-South, Nigeria. The study extracted 15 cost optimization strategies from the literature. The results presented in Table 4.5 show the descriptive perceptions of the respondents regarding the significance of the cost optimization strategies in South-South, Nigeria.

Table VI: Construction Cost Optimization Strategies

S/N	Cost Optimization Strategies	1	2	3	4	5	MIS	Ranks	Remarks
1.	Use value engineering to identify cost-saving opportunities.	15	39	64	104	78	3.63	1 st	Sig.
2.	Use pre-fabricated and modular components to save time and reduce waste.	17	28	79	123	53	3.55	2 nd	Sig.
3.	Conduct regular project reviews to identify cost overruns and adjust the budget accordingly	12	38	103	91	56	3.47	3 rd	Sig.
4.	Optimize the project schedule to reduce construction time and costs.	24	45	68	96	67	3.45	4 th	Sig.
5.	Use a multi-disciplinary team to ensure all aspects of the project are considered and optimized for cost savings.	19	58	69	89	65	3.41	5 th	Sig.
6.	Negotiate pricing with suppliers and subcontractors	18	41	85	116	40	3.39	6 th	Sig.
7.	Utilize technology and software to improve project management and cost tracking.	33	38	59	118	52	3.39	6 th	Sig.
8.	Develop a detailed cost estimate and budget	10	50	111	81	48	3.35	8 th	Sig.
9.	Conduct post-project analysis to identify areas for improvement and cost optimization in future projects	5	67	94	92	42	3.30	9 th	Sig.

10.	Use alternative procurement methods, such as design-build or construction management, to reduce costs	10	57	106	98	29	3.26	10 th	Sig.
11.	Use sustainable design and construction practices to reduce energy and material costs.	14	74	86	81	45	3.23	11 th	Sig.
12.	Implement a risk management plan to identify potential cost risks and develop mitigation strategies.	36	47	85	76	56	3.23	12 th	Sig.
13.	Utilize competitive bidding to ensure the best possible pricing for materials and services	22	63	89	87	39	3.19	13 th	Sig.
14.	Implement lean construction practices to reduce waste and improve efficiency	12	80	101	69	38	3.13	14 th	Sig.
15.	Focus on quality control and quality assurance to reduce rework and additional costs.	35	82	89	56	38	2.93	15 th	Sig.

*Sig. = Significance

Source: Author's Field Survey (2025)

Table VI shows that the mean item score of all the 15 cost optimizing strategies ranging between 2.93 to 3.63. This indicated that all 15 cost optimizing strategies have impact on the sustainability and cost optimization of construction project delivery. The result revealed that the use of value engineering to identify cost-saving opportunities was ranked first with MIS of 3.63, use of pre-fabricated and modular components to save time and reduce waste was ranked second with MIS of 3.55, conducting regular project reviews to identify cost overruns and adjust the budget was ranked third with MIS of 3.47, while optimize project schedule to reduce construction time and cost was ranked fourth with MIS of 3.45, ranked fifth with MIS of 3.41 is use of multi-disciplinary team to ensure all aspects of the project are considered and optimized for cost savings. Noticeably, 14 out of 15 (93%) cost optimization strategies had MIS above 3.00, despite only one strategy having MIS below 3.00; the particular variable had a significant MIS (2.93). Therefore, all validated optimization strategies are effective in optimizing cost in construction projects.

Test of Difference in respondents' perceptions of Construction Cost Optimization Strategies

The study further tested the level of consistency in the perception of respondents regarding the construction cost optimization strategies among construction professionals in the study area; the study determined the hypothesis, which states that the construction cost optimization strategies in the research environment are not significant. The study applied the Kruskal Wallis H test to measure variation in perceptions and level of agreement in ranking perceptions of respondents about the construction cost optimization strategies among construction professionals. The test was validated using the critical p-values where values greater than 0.05 were accepted and values less than 0.05 were rejected. This indicated that the perceptions of construction professionals do not vary. The critical p-value p (0.405) is greater than 0.05 and the null hypothesis was accepted. In other words, the inter-rater agreement in respondents' perceptions of the construction cost optimization strategies among construction professionals in the study area is consistent. Therefore, respondents' perceptions of the construction cost optimization strategies by construction professionals are similar.

Table 4.6: Test of variation/agreement in respondents' perception among Construction Professionals

Items compared	The extent of difference in perception
No of variables	15
NIA	34.50
NIOB	30.17
NSE	32.93
NIQS	24.40
Chi-Square	2.915
Degree of freedom (df)	3

P-value	0.405
Significance level	0.050
Decision	Accept

Source: Author's Field Survey (2025)

IV. Discussion of Results.

The Level of Adoption of SSCM Strategies

Key strategies used by South-South Nigerian construction experts are revealed by a study on sustainable supply chain management (SSCM) in the area. Corporate social responsibility, SSCM training, information exchange, management dedication, sustainable building, and clean production and programs are some of these tactics. With 11 out of 27 strategies has mean item score above 3.00 and 16 between 3.0 but not less than 2.60. This indicated that most of the strategies are adopted at a moderate level. Also, the null hypothesis was rejected as a consequence of the hypothesis testing, which produced an insignificant P-value (0.000).

Barriers Inhibiting the Adoption of SSCM Strategies

According to the study's findings, the adoption of SSCM strategies is hampered by a number of factors, including stakeholder cooperation and communication, lack of financial incentives, lack of coordination, limited teamwork, and reluctance to change. It is crucial to remember that these obstacles remain serious issues that require attention, even though the hypothesis results show a P-value of 0.920 greater than 0.05, suggesting that there may not be a statistically significant difference among construction professionals on the assessed barriers impeding the adoption of SSCM strategies in South-South, Nigeria.

Construction Cost Optimization Strategies

According to the study's findings, the main strategies for reducing construction costs in South-South Nigeria are value engineering, the use of prefabricated and modular components, project reviews, project scheduling, and multidisciplinary team collaboration. The results of the hypothesis testing, which show a P-value of 0.405 greater than 0.05, indicate that there is not enough evidence to reject the null hypothesis, which is that there is no significant difference in the strategies used for reducing construction costs in South-South Nigeria.

The Relationship between Sustainable Supply Chain Management and Construction Cost Optimization

The results show a Nagelkerke R^2 value of 0.981 (98%). The finding shows that only SSCM1 – SSCM5 do have statistically significant p-values. While statistically significant variables account for 100% of the evaluated variables. This means that SSCM has a direct positive relationship with cost optimization. The high Nagelkerke R^2 value of 0.981 indicates that SSCM strategies have a strong positive relationship with construction cost optimization in South-South, Nigeria. This suggests that adopting SSCM strategies can lead to significant cost savings in construction projects in the region. With 98% of the variance explained, there is substantial room for construction professionals to achieve cost savings through targeted SSCM strategies.

V. Conclusion

The study evaluated SSCM strategies and their influence on construction cost optimization to ensure the efficiency of project performance and sustainability. The study provided survey results of the SSCM strategies adopted in the region. The findings highlight corporate social responsibility, training on SSCM, information sharing, commitment of managers, sustainable construction, and clean program/production as the top strategies. While there is a moderate level of adoption with 11 strategies which, suggests that while progress has been made, there is substantial room for improvement. This underscores the need for increased awareness and support for SSCM practices among firms in the region.

The study further shows that resistance to change, lack of financial incentives, limited sharing of information and knowledge, lack of coordination, limited teamwork, and lack of cooperation and communication among stakeholders are the most significant barriers inhibiting the adoption of SSCM

The study also revealed that construction cost optimization primarily focuses on value engineering, the use of pre-fabricated and modular components, project reviews, project scheduling, and multi-disciplinary team collaboration in that order. The study's revealed a positive relationship between SSCM and cost optimization strategies, with a Nagelkerke R^2 value of 0.981 suggesting a substantial portion of cost optimization variance can be attributed to how well the SSCM is adopted.

The implications of these findings are clear: without overcoming these barriers, the adoption of sustainable supply chain management strategies in South-south, Nigeria will continue to face challenges. To address resistance to change, organizations must invest in change management strategies, communication, and training programs to help stakeholders understand the benefits of sustainable practices and motivate them to embrace new ways of working.

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