



ASSESSMENT OF ADOPTION OF SUSTAINABLE CONSTRUCTION PRINCIPLES IN RECONSTRUCTION OF ABUJA-KADUNA-KANO HIGHWAY

¹ISA IBRAHIM HASSAN, ²ISA SANI MOHAMMED, ³UWEMEDIMO NYONG WILSON, ⁴MMODU JOSEPH ESUGA, ⁵SURAJO ABUBAKAR WADA AND ⁶ABDULAZIZ AHMAD

^{1,2&3}Department of Civil Engineering, Nigeria Defence Academy, Kaduna

⁴School of Post Graduate Studies, Nigeria Defence Academy, Kaduna

^{5&6}Department of Civil Engineering, Ahmadu Bello University, Zaria

Correspondence Email: iihassan@nda.edu.nd

Abstract

This study assessed sustainable construction practices adopted during the reconstruction of the Abuja-Kaduna- Kano Highway. The objectives were evaluate the selection of service providers, examine the implementation of sustainable construction practices and identify constraints to their adoption. Data were collected through questionnaires involving key project stakeholders, including clients, consultants, and contractors. Of the 56 questionnaires distributed, 50 valid responses were received. The collected data were analyzed using mean scores and standard deviations based on a 5-point Likert scale. The findings indicated that the most significant criterion for selecting service providers was the requirement in procurement documents to employ qualified construction professionals, with a mean score of 4.70. The study further revealed that the most important sustainable construction practice was the testing and verification of project outputs by competent third parties in collaboration with project owners and users, which recorded a mean score of 4.90. Lack of awareness emerged as the major constraint to the implementation of sustainable construction practices, with the highest mean score of 4.96. The study concludes that sustainable construction is currently perceived as a quality assurance tool rather than a core value. Its implementation is paralyzed by widespread ignorance, and the most effective lever for change is revising procurement laws to mandate sustainable compliances. It recommends incorporating competency requirements in procurement documents and promoting awareness programs to enhance the adoption of sustainable construction practices in road infrastructure projects.

Keywords: Sustainable Construction, Abuja to Kano Highway, Likert scale, Procurement documents

1. Introduction

Road construction is a critical component of human activities. The development of economic activity would be difficult without extended road networks. The economic and social benefits of roads are numerous: (1) enhancing economic growth, (2) reducing travel time and transportation cost, (3) provide access to a variety of critical goods and services and (4) offer new employment opportunities (Kehagia 2009). The realization of transport infrastructure produces significant effect on the ecosystem, the economy and thus on social productivity, given the considerable consumption of non-renewable resources (environmental, energy, etc.). The lack of adoption of sustainable practices integrated in the design of roads resulting in impossibilities to make choices that leads to sustainable use of resources needed. Thus, the idea and the need for the formulation and subsequent implementation of a system defining and assessing sustainability techniques useful for the design, construction, operation and maintenance of road construction was born. (Ferdinando & Angela, 2002). The Abuja-Kaduna-Kano highway is a critical "Trunk A" road serving as a major economic artery linking Nigeria's Federal Capital Territory with the North West and North East geopolitical zones

(Daily Trust, 2024). As a key corridor for the movement of agricultural produce, manufactured goods, and passengers, its condition directly impacts regional trade, food security, and transportation costs. The road's reconstruction, initiated in December 2017 under the then President Muhammadu Buhari, represents one of Nigeria's most significant infrastructure investments, with contract values escalating from an initial N155.5 billion to over N1 trillion amid scope changes, contractor disputes, and technological redesigns (Leadership, 2024). The Federal Executive Council (FEC) approved the reconstruction contract on December 20, 2017, awarding it to Julius Berger Nigeria Plc. at an initial sum of N155,470,626,078.07 with a 36-month completion timeline (TheCable, 2025). The 375km highway was divided into three sections: Section I (Zuba Junction to Kaduna Western Bypass, 165km), Section II (Kawo Bridge Junction to Zaria, 73.40km), and Section III (Zaria to Kano, 137km) (Rahman, 2026). The project was to be funded through the Presidential Infrastructure Development Fund (PIDF), a dedicated financing mechanism established to fast-track critical national assets (Daily Trust, 2025). The reconstruction was officially flagged off on June 26, 2018, by then-Minister of Works Babatunde Raji Fashola in Kano (Renewed Hope Ambassadors, 2026). Within two years of commencement, legislative pressure led to demands for road expansion. On February 10, 2020, the FEC approved Yolas Consultants to handle engineering design for converting the highway from four to six lanes at a cost of N867.263 million (AllAfrica, 2024). A more significant transformation occurred in March 2021, when Minister Fashola presented a memo to the FEC changing the project scope from "renovation" to "complete reconstruction" (Leadership, 2024). This revision escalated the project cost to N797.2 billion, representing an increase of N642.2 billion from the original contract sum. The new scope incorporated: Full reconstruction of the main carriageway, construction of trailer parks and weigh bridges, toll stations installation and additional side lanes in built-up areas across the FCT, Niger, Kaduna, and Kano states (AllAfrica, 2024). The project is now executed by Infioquest International Limited, with over 300 heavy-duty machines deployed to ensure timely completion (Federal Ministry of Works, 2025a). Hitech Africa Construction Ltd as technical subcontractor for a 38 km pilot phase. This was originally awarded to Dangote industries Ltd and Julius Berger Plc still involved but their role has been reduced, they are now reportedly handling only an 82 km section (Leadership 2024).

The concept of sustainability in the construction industry has grown in importance in the last few decades, for example, following increasing awareness promoted by the United Nations World Commission on Environment and Development about the need to minimize the negative impact of development activities on the environment and society (WCED, 1987). Generally, sustainability in construction refers to the application of sustainability principles (Sustainable Design, Durability, Energy Efficiency, Waste Reduction, Indoor air quality, Water conservation and Sustainable construction materials) in the construction practices. It has several dimensions, which include dealing with economic, social and environmental concerns in the construction process and its results. Other dimensions include the technical dimension (Hill and Bowen, 1997; Pawlowski, 2008), and cultural and managerial considerations (Ofori, 1998; CIB, 1999). However, Elkington (1997) 'triple bottom line' concept of sustainability, which focuses on the economic, social and environmental dimensions, has remained dominant. The dimensions of sustainable development are not independent but instead intertwined in the trade-offs that are inherent in any engineering decision in general and the highway design in particular. Sustainable development however, is an approach to the economic development of a country without compromising the quality of the environment for future generations.

Basic principles as the minimization of use of non-renewable energy and natural resources, the minimization of negative impact on the environment, the development of sustainable technologies, the economic valuation of the impacts of road projects and the trade-offs between the costs and benefits of different choices operate as available tools to implement sustainability on highway construction. The role of the highway engineer (Civil Engineers who plan, research and help construct thousands of miles

of roads each year) is to integrate science, technology, experience and innovation into highway construction in order to develop a more sustainable road project. (Kehagia 2009). Sustainable development of road network has to meet the three main purposes of sustainability, i.e., to reduce or at least to stabilize a harmful impact on climate change, human health and biological diversity (Virgaudas *et al*, 2016).

Meanwhile, it is observed that in recent times that base on the construction principles adopted in highway construction, there are a lot of negative effects on the economy, environment and social life of the people living within and outside the area where the construction is ongoing. This problem ranges from damage of habitat and bio-diversity, erosion, sedimentation, and soil compaction, storm water pollution, increased greenhouse gases emission and global warming, noise and visual disturbance and so on (Kehagia, 2009)

This research aim at assessment of adoption of sustainable construction principles in reconstruction of abuja-kaduna-kano highway which can be achieved through the following **objectives:** (1) Evaluation **Implementation** of selection of construction workers as service provider, (2) assessment of implementation of sustainable construction and (3) Identification of constrains to implementation of sustainable construction.

2. Literature Review

The concept of sustainability in the construction industry is complex; several studies have shown that individuals or societal action towards sustainability is based on both factual and values elements. Authors such as Carew & Mitchell (2008); Ciegis *et al.*, (2015) and Berardi (2013) also point out that sustainability in construction works is considered through context and value components. Amongst the various elements of sustainability and construction, values play a significant role in the motivation and actions of people and organizations. 'Values', here, refers to adhering to a prescriptive conviction about desirable behavior and goals (De Vries & Petersen., 2009), which is connected to the understanding and perception of different actors. The present chapter overviews literature to understand the construction practices in Nigeria to gain insight into the underpinning factors that influences the actions of construction organizations in the industries.

Although there is abundant literature on sustainability with empirical evidence of variation in the ways experts and non-experts conceive or understand the concept of sustainability, this variation appears to be connected to values and context perspectives of sustainability (Baumgartner & Ebner, 2010). Apart from the universal acceptance of the importance of sustainability, there are important differences between specific institutions, individual and academic approaches in respect of theoretical formulations, policy prescriptions and conceptualization of the subject itself. The term 'sustainability' has been the subject of much debate in recent times (Ciegis *et al.*, 2015), and most of the debate in the literature takes the form of philosophical arguments in favor of a particular view or application of sustainability (Carew & Mitchell, 2008; Berardi, 2013). The existence of different perceptions of 'sustainability' is not surprising because the concept is comparatively complex and abstract, and it rests on both factual and value-based components. The proliferation of the definition of sustainability therefore, could be attributed to different underpinning value-based assumptions which would naturally contribute to the variation in the way sustainability is understood and applied (Carew & Mitchell, 2008).

The academic and technical literature on sustainable highway construction has grown substantially over the past decade, encompassing life-cycle cost analysis (LCCA), green construction technologies, and sustainable earthwork principles. Within the Nigerian context, studies have focused on pavement performance modeling, material optimization, and comparative cost analysis. Offor, et al., (2025) applied the Real Cost 3.0 software to compare pavement alternatives on the Abuja-Keffi highway. Their analysis revealed that while asphalt pavement may present higher Net Present Value, its durability and reduced maintenance frequency can yield favorable long-term economic outcomes. However, the research emphasized that discount rate assumptions and local cost data significantly influence comparative results. Ogum et al., (2025) developed a Life Cycle Improvement Model (LCIM) for Nigerian highway pavements incorporating resurfacing and embankment protection measures. Applied to the Auchi-Okene highway, their model demonstrated that although LCIM required 17% higher initial investment, it produced superior long-term sustainability through enhanced structural resilience. Over a 50-year analysis period, the conventional LCCA approach projected ₦2.83 billion in total costs, while the LCIM projected ₦3.6 billion, the higher figure representing proactive investment rather than reactive maintenance. Lu (2026) examined green construction principles for highway reconstruction and expansion, identifying key approaches including wastewater collection and recycling, waste material regeneration, material optimization, and renewable energy substitution. Implementation barriers identified include initial cost premiums, contractor capacity limitations, and inadequate regulatory enforcement. Jefferson, et al., (2016) provided a comprehensive review of sustainable approaches in transportation infrastructure geotechnics, emphasizing that ground improvement activities, earthworks, and material selection significantly influence sustainability outcomes through energy consumption, carbon emissions, and resource depletion. The research framework prioritizes minimizing energy and CO_2 production while maximizing material reuse and recycling, principles directly relevant to the Abuja-Kaduna-Kano reconstruction's approach of milling and reusing existing asphalt layers.

2.1 Concept of Sustainability

In order to understand the debate and diverse views about sustainability, it is important to recognize the evolution of the concept of sustainability in the literature (Williams & Millington, 2004). The concern for the wise use of natural resources and the planet emerged in the early 1960s based on the book 'Silent spring' (Carson, 1962). This concern became prominent following the publication of 'The Limits to Growth' by the club of Rome in the early 1970s, when the adverse consequences of human impact on the environment became widely recognized (Meadows et al., 1972). As a result of the publication of 'The Limits to Growth', more-serious enquiry into the limitations of the planet in dealing with the impact of population growth and level of consumption came to the forefront (Gowdy, 2007). A theoretical framework was based on the notion that there is a mismatch between what is required of the earth, and what the earth can produce (Fitzpatrick and Cahill, 2002). This theory sparked debate which led to the first major international gathering to discuss sustainability at the global scale, resulting in the establishment of the United Nation World Commission on Environment and Development (WCED), Ciegis et al., (2009); Silvius et al., (2013). WCED was mandated to determine ways to address the concern of resource depletion (Barlett, 2012). Indeed, the challenge of how to conjoin the demand and supply of resources to meet societal needs defines what is meant by the process of sustainable development (Ciege et al., 2009). However, the challenge produces diverse and debated meanings of 'sustainable development', because it can be addressed in different ways. Different schools of thought such as the 'weak', 'strong' and 'moderate' sustainability provide views as to how to address the challenge of sustainable development (Ciegis et al., 2009; Berardi, 2013).

The contemporary literature definition of sustainability refers to a balance or harmony of the economic, social and environmental concerns (Berardi, 2013; Silvius et al., 2013), however, disregarding any one of these aspects could undermine sustainable practices (Ciegis et al., 2015), and this is often the case as most projects or activities have specific drivers resulting to inevitable trade-offs. Sustainability, as conceptualized in infrastructure development, refers to meeting present needs without compromising the ability of future generations to meet their own needs, a definition originating from the Brundtland Commission and widely adopted in construction engineering (Jefferson et al., 2016). In highway engineering, sustainability is operationalized through design decisions that account for whole-life performance rather than minimizing initial construction costs. This life-cycle perspective requires systematic evaluation of material extraction, construction processes, maintenance requirements, rehabilitation interventions, and eventual decommissioning (Ogum et al., 2025). For the Abuja-Kano reconstruction, the concept of sustainability is explicitly articulated by the Minister of Works, David Umahi: "We are building roads that will stand the test of time, roads that will last between 50 and 100 years, save public funds, and promote economic growth" (Federal Ministry of Works, 2025b).

2.1.1 Dimensions of sustainability

The concept of sustainability has been broadly categorized into environmental, social and economic dimensions (Elkington, 1997; WCED, 1987), with increasing attention paid to cultural and political dimensions (Scoones, 2007). Despite the practical scope, the conceptualization of the different dimensions has disaggregated the concept of sustainability, leading to several misunderstandings (Baumgartner & Ebner, 2010; Keeys, 2012 & Berardi, 2013). Sustainability means different things to different people. To the ecologist sustainability is about biodiversity conservation and environmental preservation; the economist sees sustainability as economic growth or increase income without diminishing the opportunities for future income; the sociologist defines sustainability as development that preserves society, respecting human rights and equality (Ciegis et al., 2009). However, the Civil Engineer sees sustainability as a set of economic, environmental and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality or the availability of economic, environmental and social resources. The sustainability framework for transport infrastructure comprises three interdependent dimensions: environmental, economic, and social (Jefferson et al., 2016; Lu, 2026). Environmental sustainability in highway construction addresses greenhouse gas emissions, energy consumption, water use, waste generation, and ecosystem disturbance (Lu, 2026).

2.2 Interpretation of Sustainable Construction (SC)

Similar to the interpretative difficulties associated with sustainability and construction, the concept of sustainable construction has been a subject of much debate in recent times, with differing interpretations and strategies for achievement (Berardi, 2013; Carew & Mitchell, 2008). The terms 'construction' and 'sustainability' are both complex concepts with a much debate about their scope and meaning. Placing these two terms together to form a new phrase 'sustainable construction' further magnifies the interpretation crisis (Du Plessis, 2007). It is however, not new that the concept of sustainable construction has been a subject of much debate (Berardi, 2013; Carew & Mitchell, 2008).

Du Plessis (2007) however stated that SC involves a holistic process to install and maintain harmony between the natural and built environments as well as create settlement that affirms human dignity and also encourages economic equity. Berardi (2013) argued that SC is a path characterized by constraints and uncertainty due to the time, scale, domain and social constraints, therefore, it is difficult to have an agreed definition of SC. SC covers a broad range of concerns; it involves a balance between the various

competing goals and requires simultaneous pursuits of economic prosperity, environmental quality and social equality (Silvius et al., 2013). This is referred to as the 'triple bottom line of sustainability' (Elkington, 1997). Various models or diagrams are used to illustrate the way these three-bottom line (sub-systems) relate to one another. Dania et al., (2013) represented the three sub-system in three progressive circles with the view that the environmental systems represent the ultimate limit, the social systems sat within the environmental systems, and the economic systems are seen as a sub-set of the social systems. Figure 1 below shows the triple bottom line of sustainability.

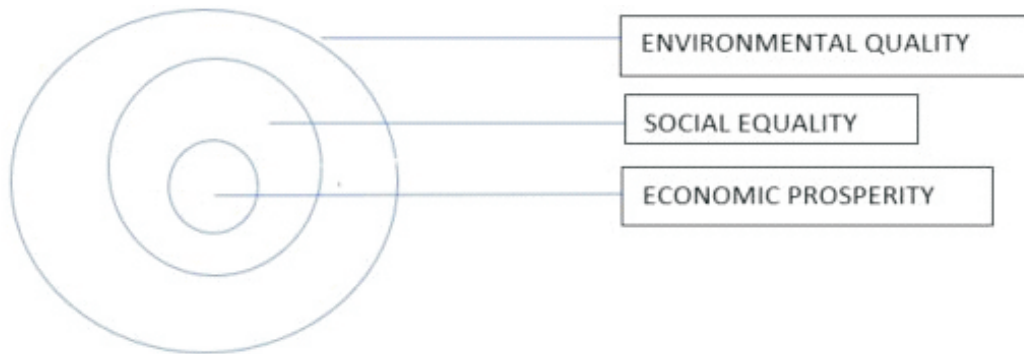


Figure 1: The Triple Bottom Line of sustainability (Esezobor, 2016)

Despite the depiction of the concept of sustainability into these three inter-related subordinate concepts, there are still difficulties in creating an agreed definition for sustainable construction (Ciegies et al., 2009; Baumgartner and Ebner 2010; Berardi, 2013). Consequently, various assessment tools were developed and used to determine what constitutes sustainable construction (CIB, 2010).

These assessment systems contribute to the increase in awareness of the objectives and criteria for sustainability, and have become a framework of reference for sustainable construction practice (Berardi, 2013). Construction organizations are pressured to adopt proactive sustainable strategies through these frameworks in the lifecycle of the construction process (CIB, 2010; GRI, 2011; Akadiri et al., 2012). However, these assessment criteria are limited, as they focus mainly on the environmental perspective (ISO, 2008) with less emphasis particularly on the social dependencies (Berardi, 2013; Silvius et al., 2013). Given that sustainability involves a long-term evaluation, multi-scale impact and multi-domain criteria, a new paradigm of sustainable construction is emerging, and this represents a significant evolution from the simple environmental approach.

The international council for research and innovation in building and construction (CIB, 2010) interpreted a vision of sustainable construction which was originally adopted after the international conference. Based on the interpretation, ten new principle of sustainable construction practice has been declared and is stated as follows:

1. Apply the general principle of sustainability, and hence, promote continual improvement, equity, global thinking and local action, a holistic approach, long term consideration of precaution and risk, responsibility, and transparency.
2. Involve all interested parties through collaborative approach, so that it can meet occupant's needs individual and collective social needs through partnership in design, construction and maintenance processes.
3. Be completely integrated into the relevant local plans and infrastructure, and connect into the existing services, networks, urban and suburban grid in order to improve stakeholder's

satisfaction.

4. Be designed from a lifecycle perspective, covering planning, design, construction, operation and maintenance, renovation and end of life, considering all other phases during the evaluation of performance at each phase.
5. Have its environmental impact minimized over the (estimated or remaining) service life. This takes into consideration regional and global requirement, resource efficiency together with waste and emissions reduction.
6. Deliver economic value over time, taking into account future lifecycle cost of operation, maintenance, refurbishment and disposal
7. Provide social and cultural value over time and for all the people. Sustainable construction should provide a sense of place for its occupants, be seen as a means of work status improvement for worker and be integrated to the local culture.
8. Be healthy, comfortable, safe and accessible for all. Health criteria includes indoor air quality, whereas comfort criteria include acoustic, thermal, visual and olfactory comfort. It must allow safe working condition during its construction and service life, and fully accessible to everyone.
9. Be user friendly, simple and cost effective in operation, with measurable performance over time. Operation and maintenance rule must be available for both operators and users at any time.
10. Be adaptable throughout its service life and with an end-of-life strategy. The design has to allow adaptation by changing performance and functionality requirements, in accordance with new constraints (CIB, 2010).

With the above summary of principles or interpretation of sustainable construction practice, these implies that sustainable construction practice refers to the methods or processes of implementing construction projects that involves less harm to the environment, which is beneficial to the society, and profitable to organizations and the economy (Akadiri & Olomolaiye, 2012; Tseng et al., 2013).

3. Methodology

Research design: Research design according to Cohen and Marion (2011) is simply a plan that specifies how data should be collected and analyzed. Questionnaire survey design was used in this research.

Population: project stakeholders, including clients (10), consultants (10), contractors (50),

Sample size: The required sample size was determined using the Slovin's for calculating sample size as, $n = \frac{N}{1 + N(e)^2}$, clients (10), $n = \frac{10}{1 + 10(0.10)^2} = 9$, consultants (10), $n = \frac{10}{1 + 10(0.10)^2} = 9$, contractor, $n = \frac{50}{1 + 50(0.10)^2} = 33$, i.e $9 + 9 + 33 = 51$

Sampling technique: the sample technique adopted in drawing the sample is the simple random sampling because of the fairly heterogeneous nature of the research population and for fairness.

In the conduct of this study, primary data was generated with the aid of a questionnaire tool. The primary data comprises of facts gathered in the field of study. The questionnaire was structured, and distributed using the 5-points Likert's rating scale where; 5 - represents strongly agree, 4 - represents agree, 3 - represents undecided, 2 - represents disagree and 1 - represents strongly disagree. The medium of data collection was both in an offline and online method which accommodates the best way to gather information from the stakeholders, i.e., clients, consultants, and contractors.

Assessment of Adoption of Sustainable Construction Principles in Reconstruction of Abuja-Kaduna-Kano Highway

3.1 Questionnaire Survey

The questionnaire comprises of two parts. The first part retrieved data about the respondent's demographic information. The second part consist of questions designed to assess the implementation of selection of service providers, sustainable construction and constraints of sustainable construction implementation on the re-construction of the Abuja-Kano highway using the 5-point Likert scale as earlier described. Table 1 presents the profile of the survey respondents.

Table 1: Profile of the Survey Respondents

Variable	Categories	Frequency/statistics	Percentage
Gender	Male	43	86
	Female	7	14
Age	18-25years	2	4
	26-50 years	42	84
	51-above years	6	12
Education level	Secondary	4	8
	graduate	46	92
	Tertiary		
Respondent's occupational status	Employed	50	100
	Self employed	0	0
	Student	0	0
	Others	0	0
Profession	Site manager	1	2
	Engineer	24	48
	Technology	14	28
	Technician	8	16
	Foreman	3	6
Years of Working experience	1-5	8	16
	6-10	11	22
	11-15	19	38
	16 and above	12	24

From the results of the data analysis presented above, it can be summarized that there were more of male than the female respondents with percentage of 86% to 14 % respectively. Greater percentage of the respondents falls between the age group of 26 to 50 years constituting 84%, indicating that majority of them are in their active and productive stage in life. Majority of the respondents are educated up to tertiary level constituting 92%, only 8% are secondary graduate. The respondents are all employed, with 48% of them being engineers and greater percentage of them having working experience between 11-15 years representing 38% of the total respondents.

3.1.1 Reliability and ANOVA Assumption Tests

SPSS 22.0 was adopted to carry out the statistical analysis. The internal consistency and reliability of the questionnaire were tested using Cronbach's alpha. The alpha values for the three dimensions in the consisting of implementation of selection of service providers, implementation of sustainable construction and constraints of sustainable construction implementation are 0.888, 0.928, and 0.948, respectively. All of the values are higher than 0.7 threshold in the Cronbach's alpha test denoting that the questionnaire is internally consistent and reliable (George and Mallery 2003).

The one-way ANOVA was conducted to determine whether significant differences existed across respondents' perceptions of the actual performance measured by these factors. The adopted significance level for the analyses was 5%. Firstly, a Kolmogorov-Smirnov (KS) test confirmed that each data group was normally distributed. Secondly, the homogeneity of the variance test results indicated that different samples shared equal variance. In addition, the samples were independent of each other. Hence, the data meet all assumptions for one-way ANOVA.

3.1.2 Analysis of Mean Scores and Dimension Ranking

Table 3 : Implementation of Sustainable Construction

S/No	Indicators	SA	A	UD	D	SD	X	σ	Decision
1	The contractor implements environmental management system in construction work	15	30	2	3	0	4.14	2.03	Accept
2	The contractor implements occupational health and safety management system in construction work	20	30	0	0	0	4.40	2.22	Accept
3	The contractor develops the concept of minimal construction waste produced during construction work	40	10	0	0	0	4.80	2.56	Accept
4	The contractor involved sub-contractors and suppliers who support sustainable principles	40	10	0	0	0	4.80	2.56	Accept
5	The construction work target is set under the capacity of the contractor	37	10	3	0	0	4.68	2.46	Accept
6	The construction work progress is in accordance with what is stated in the contract document	20	8	10	10	2	3.68	1.75	Accept
7	Track project progress and always update it through a weekly checklist	28	13	9	0	0	4.38	2.21	Accept
8	Review each construction work target to see if it meets the design document	10	15	25	0	0	3.70	1.76	Accept
9	Test all of the project results to see if they comply with the requirements contained in the contract document	42	7	1	0	0	4.82	2.58	Accept
10	Testing of all project results is carried out by competent third parties together with the owners and users	45	5	0	0	0	4.90	2.65	Accept
11	Project owners and users maintain the construction work from the beginning	5	10	18	15	5	2.96	1.58	Reject
12	Project owners and users acquire adequate training to utilize sustainable infrastructure before handover	5	3	30	12	0	3.02	1.58	Accept
13	The contractor documents all the project processes that occur during the construction phase	38	12	0	0	0	4.76	2.52	Accept
14	The contractor prepares a final report on construction execution, including a manual for sustainable infrastructure utilization and maintenance	20	28	2	0	0	4.36	2.19	Accept
15	The contractor controls the construction execution through a checklist of integrated results between activities	19	13	18	0	0	4.02	1.95	Accept

Assessment of Adoption of Sustainable Construction Principles in Reconstruction of Abuja-Kaduna-Kano Highway

Table 4 : Constraints of Sustainable Construction Implementation

Indicators	SA	A	UD	D	SD	X	σ	Decision
Additional project development costs	45	5	0	0	0	4.90	2.65	Accept
Lack of resources that support technological change	10	30	10	0	0	4.00	1.94	Accept
Lack of partner's understanding of the benefits of sustainable development	22	27	1	0	0	4.42	2.24	Accept
Lack of green technology support and technical guidelines for implementing sustainable construction	8	38	1	3	0	4.02	1.95	Accept
Lack of coordination of resources for sustainable construction development	13	20	9	3	5	3.66	1.74	Accept
Lack of skilled labor for sustainable construction development	41	8	1	0	0	4.80	2.56	Accept
Contractor weaknesses on strategy, leadership and corporate culture that support sustainable construction	30	7	13	0	0	4.34	2.18	Accept
Resistance to change, lack of government's commitment and perceived high cost	27	21	0	2	0	4.46	2.27	Accept
Lack of awareness	48	2	0	0	0	4.96	2.70	Accept
Poor perception due to bad experience	5	28	15	2	0	3.72	1.77	Accept

The mean scores and standard deviation for the investigation of sustainable construction principles in the re-construction of Abuja-Kano Highway is presented in Table 2, 3 and 4 respectively. The analysis shows that implementation of the selection of service providers (that is, selection of construction workers) with the indicator; procurement document contains instructions to employ competent construction workers in their respective fields has the highest mean value score of 4.70 and hence best answers the statement. However, the implementation of sustainable construction with the indicator; testing of all project results is carried out by competent third parties together with the owners and users has the highest mean score of 4.90 and is considered as the main indicator for the implementation of sustainable construction. Finally, the constraints of sustainable construction with the indicator; lack of awareness has the highest mean score of 4.96 and is therefore considered the main indicator.

Table 2: Implementation of Selection of Service Providers

S/No	Indicators	SA	A	UD	D	SD	X	σ	Decision
1	Procurement documents contain instructions to employ competent construction workers in their respective fields	35	15	0	0	0	4.70	2.47	Accept
2	Procurement documents contain instructions to employ construction workers who must have certificates in their fields	28	19	3	0	0	4.50	2.30	Accept
3	Procurement documents contain instructions regarding equal risk responsibility for the main parties who are involved in the construction project	30	10	10	0	0	4.40	2.20	Accept

Source: Field Survey (2022)

Summary of Finding

From the results of the data analysis presented above, it can be summarized that there were more of male than the female respondents with percentage of 86% to 14% respectively. Greater percentage of the respondents falls between the age group of 26 – 50 years constituting 84%, indication that majority of them are in their active and productive stage in life. Majority of the respondents are educated up to tertiary level constituting 92%, only 8% are secondary graduate. The respondents are all employed, with 48% of them being engineers and greater percentage of between 11-15 years respectively 38% of the total respondents.

The analysis shows that implementation of the selection of service providers (i.e., selection of construction workers) with the indicator, procurement document contains instructions to employ competent construction workers in their respective fields has the highest mean value of 4.70 and hence best answer the statement.

However, the implementation of sustainable construction with the indicator testing of all project results was carried out by competent third parties together with the owners and users has the highest mean of 4.90 and is considered as the main indicator for the implementation of sustainable construction.

Finally, the constraints of sustainable construction with the indicator; lack of awareness has the highest mean of 4.96 and is therefore considered the main indicator.

1. Conclusion

This research concentrated on sustainable construction practices in the reconstruction of Abuja-Kano Highway. The questionnaire was analyzed using Likert scale and statistical parameters which include: mean and standard deviation. It was observed that in the implementation of the selection of service providers, the indicator; procurement document contains instructions to employ construction workers in their respective fields has the highest mean value of 4.70 and hence, best answers the statement.

Also, the implementation of sustainable construction with the indicator; testing of all project results is carried out by competent third parties together with the owners and users has the highest mean of 4.90 and is considered as the main indicator for the implementation of sustainable construction.

Finally, the constraints of sustainable construction with the indicator; lack of awareness has the highest mean of 4.96 and is therefore considered the main indicator.

5. Recommendations

The following recommendations among others are to be considered in sustainable construction practices;

1. Construction workers with competency in their respective fields must be employed
2. During the course of the construction, test must be conducted by competent bodies to ensure work is being done according to specification and standards
3. Awareness must be created at all levels on the need for sustainable construction practices

6. References

- Akadiri, P.O. & Olomolaiye, P.O. (2012). Development of sustainable assessment criteria for building materials selection. *Engineering, Construction and Architectural Management*, 19(6), pp.666-687.
- AllAfrica. (2024, November 6). Nigeria: FG approves redesign of sections of Abuja-Kaduna dual carriageway. *allAfrica.com*. <https://allafrica.com/stories/202411070628.html>
- Bartlett, A.A. (2012). The meaning of sustainability. *Teaching Clgh. Science Social Education. Newsletter*, 31, pp.1-14.
- Baumgartner, R.J. & Ebner, D. (2010). Corporate sustainability strategies: sustainability profiles and maturity levels. *Sustainable Development*, 18 (2) (2010), pp. 76–89.
- Berardi, U., (2013). Clarifying the new interpretations of the concept of sustainable building. *Sustainable Cities and Society*, 8, pp.72-78.
- Carew, A.L. & Mitchell, C.A. (2008). Teaching sustainability as a contested concept: capitalizing on variation in engineering educators' conceptions of environmental, social and economic sustainability. *Journal of Cleaner Production*, 16(1), pp.105-115.
- Carson, R. (1962). *Silent Spring*. Houghton Mifflin, Boston, MA.
- CIB (1999). *Agenda 21 on sustainable construction*. Rotterdam: CIB
- CIB, Conseil International du Bâtiment. (2010). *Towards sustainable and smart-eco buildings. Summary report on the EU-funded project smart-ECO buildings in the EU*. Rotterdam: CIB.
- Ciegis, R., Ramanauskiene, J. & Martinkus, B. (2009). The concept of sustainable development and its use for sustainability scenarios. *Inzinerine Ekonomika-Engineering Economics*, (2), pp.28-37.
- Ciegis, R., Ramanauskiene, J. & Martinkus, B. (2015). The concept of sustainable development and its use for sustainability scenarios. *Engineering Economics*, 62(2).
- Daily Trust. (2024, October 16). FG, be decisive on Abuja-Kaduna highway. *Daily Trust*. <https://dailytrust.com/fg-be-decisive-on-abuja-kaduna-highway/>
- Daily Trust. (2025, November 11). 39km completed on Abuja–Kaduna–Kano highway – FG. *Daily Trust*. <https://dailytrust.com/39km-completed-on-abuja-kaduna-kano-highway-fg/>
- Dania, A. A., Larsen, G. D. & Yao, R. (2013). Sustainable construction in Nigeria: understanding firm level perspectives. In *Sustainable Building Conference Coventry University* (pp. 37-46).
- De Vries, B. J. & Petersen, A. C. (2009). Conceptualizing Sustainable Development: An assessment methodology connecting values, knowledge, worldviews and scenarios. *Ecological Economics*, 68(4), 1006-1019.
- Du Plessis, C. (2007). A strategic framework for sustainable construction in developing countries. *Construction Management and Economics*, 25(1), pp.67-76.
- Elkington, J. (1997). *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*. Capstone Publishing, Oxford.
- Esezobor, E. (2016). *Sustainability and Construction: A study of the transition to sustainable construction in Nigeria*.
- Federal Ministry of Works. (2025a, November 9). FG decries road vandalism, reaffirms commitment to record completion of Abuja-Kano expressway. <https://www.fmw.gov.ng/read/3354>
- Federal Ministry of Works. (2025b, October 29). Tinubu building roads that can last 50 to 100 years- Says Umahi. https://fmw.gov.ng/index.php/readall/title_show_echo_01zz/11?page=41
- Ferdinando, C. & Angela R. (2012). *Procedia - Social and Behavioral Sciences* 53, pp. 39– 48.
- Fitzpatrick T & Cahill M (2002). *Greening the welfare state* Palgrave, London.
- George D., & Mallery P., (2003). *SPSS for windows step by step. A simple guide and reference*. 11.0

update (4th ed.). Boston

- Gowdy, J. (2007). Avoiding self-organized extinction: Toward a co-evolutionary economics of sustainability. *The International Journal of Sustainable Development & World Ecology*, 14(1), pp.27-36.
- GRI (2011). Sustainability reporting guidelines: Version 3.1. Amsterdam.
- Hill, R. C. & Bowen, P.A. (1997). Sustainable construction: principles and framework for attainment, construction management economics, vol. 15 no. 3, pp. 223-239.**
- ISO 15392 (2008). International Organization for Standardization Sustainability in building construction - general principles.
- Jefferson, I., Hunt, D. V. L., Birchall, C. A., & Rogers, C. D. F. (2016). A review of sustainable approaches in transport infrastructure geotechnics. *Transportation Geotechnics*, 7, 21-28. <https://doi.org/10.1016/j.trgeo.2016.03.002>
- Keey, L. A. (2012). Enabling sustainable development strategy in projects; *Theoretical framework, Project Management Journal*, vol. 1(11), Pp.1-8.
- Kehagia F. (2009). The Implementation of Sustainability in Highway Projects (Vol. 4, No. 1).
- Leadership. (2024, November 6). Federal gov't approves redesigning of Abuja-Kaduna road. Leadership Newspapers. <https://leadership.ng/federal-govt-approves-redesigning-of-abuja-kaduna-road/>
- Lu, Z. (2026). 高速公路改扩建项目绿色施工实现路径研究 [Research on green construction implementation paths for highway reconstruction and expansion projects]. *科技风*, 8, 54-56.
- Meadows, D.H. Meadows, D.L., Randers, J. & Behrens, W.W., III, (1972). *The Limits to Growth*. Potomac Associates/Universe Books. New York.
- Offor, I. G., Muoka, A., Dayyabu, A., Kolo, M. U., Ado, M., & Mambo, A. D. (2025). Life cycle cost analysis of a highway pavement using Real Cost 3.0 software (The Abuja-Keffi highway as a case study). *Nile Journal of Engineering and Applied Science*. <https://www.nilejeas.com/Amno=188734>
- Ofori, G. (1998). Sustainable construction: principles and a framework for attainment - comment. *Construction Management and Economics*, 16 (2), 141-145.
- Ogum, P. C., Wasiu, J., & Ibrahim, A. O. (2025). Life cycle improvement model for pavement structure of the Auchi-Okene highway, Nigeria. *Uniosun Journal of Agriculture and Renewable Resources*, 7(2). <https://doi.org/10.64980/ujees.v7i2.439>
- Pawlowski, A. (2008). How many dimensions does sustainable development have? *Sustainable Development*, 16 (2), 81-90.
- Rahman, T. (2026, May 9). From Zuba to Dutse: A litany of legacy projects. The Eagle Online. <https://theeagleonline.com.ng/from-zuba-to-dutse-a-litany-of-legacy-projects-by-tunde-rahman/>
- Renewed Hope Ambassadors. (2026, May 8). Tinubu delivering transformative projects in North. The Sun Nigeria. <https://thesun.ng/tinubu-delivering-transformative-projects-in-north-renewed-hope-ambassadors/>
- Scoones, I. (2007). Sustainability. *Development in Practice*, 17(4-5), pp.589-596.
- Silvius, A.G., Schipperb, R. & Nedeskia, S. (2013). Sustainability in Project Management: Reality Bites1.

*Assessment of Adoption of Sustainable Construction Principles in Reconstruction
of Abuja-Kaduna-Kano Highway*

- TheCable. (2025, October 11). Umahi: Contractors on Abuja-Kaduna-Kano road project to work double shifts for faster completion. TheCable. <https://www.thecable.ng/umahi-contractors-on-abuja-kaduna-kano-road-project-to-work-double-shifts-for-faster-completion/>
- Tseng, M.L., Tan, R.R. & Siriban-Manalang, A.B. (2013). Sustainable consumption and production for Asia: sustainability through green design and practice. *Journal of Cleaner Production*, 40, pp.1-5.
- Virgaudas P., Svarpliene & Braga A. (2016). Measures for sustainable development of road network, 6th transport research arena.**
- Williams, C.C. & Millington, A.C. (2004). The diverse and contested meanings of sustainable development. *The Geographical Journal*, 170(2), pp.99-104.
- World Commission on Environment and Development (WCED) (1987). *Our common future*. Oxford University Press, Oxford.