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ASSESSMENT OF THE APPLICATION OF VALUE ENGINEERING PRINCIPLES IN CONSTRUCTION PROJECTS IN EBONYI STATE, NIGERIA

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ABSTRACT

This study investigated the application of value engineering (VE) principles in improving construction project outputs in Ebonyi State. Three research questions guided the study. This study adopted a descriptive survey research design. The population of the study comprised 1653 construction professionals such as Architects, Quantity Surveyors, Civil/Structural Engineers, Builders, Project Managers, Contractors, Government Officials and Consultants. The sample size for this study was determined using Bouely's formula and a sample size consisted 322 respondents. The instrument for data collection for this study was a structured questionnaire titled "Value Engineering Adoption and Practice Assessment Questionnaire (VEAPAQ)" The response format was structured using a five-point Likert Scale with the following weightings: Very High Extent (VHE) = 5; High Extent (HE) = 4; Moderate Extent (ME) = 3; Low Extent (LE) = 2; and Very Low Extent (VLE) = 1 The face and content validity of the instrument was established using the expert judgment method. The measure of internal consistency of the questionnaire was determined using Cronbach Alpha method and an overall coefficient value of 0.77 was obtained. Mean and standard deviation was used to answer the research questions. The findings revealed that construction professionals agreed that there is a moderate level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State. It was also found that construction professionals agreed that construction practitioners possess a moderate level of professional competence and training in the application of Value Engineering principles in Ebonyi State, although formal training and educational exposure remain inadequate. Based on the findings, it was recommended that the government and relevant regulatory authorities should take the lead in the development and enforcement of policies that support the effective implementation of Value Engineering in construction projects.

Keywords: Value Engineering, Value Management, Construction Project Performance, Cost Control, Functional Analysis and Ebonyi State

1.0 INTRODUCTION

1.1 Background to the Study

The construction industry is an important sector of the economy because it provides infrastructure for education, healthcare, transportation, housing, and other areas of national development. Oke and Aigbavboa (2017) noted that the industry also contributes significantly to employment generation and economic growth. Despite its importance, the Nigerian construction industry continues to experience problems such as cost overruns, delays, poor quality, low productivity, and inefficient use of resources. Obiegbu (2016) observed that

these challenges often affect the successful delivery of construction projects.

Value Engineering (VE) provides an approach for addressing some of these challenges. Love and Holt (2013) described Value Engineering as a systematic and creative process for achieving the required functions of a project at the lowest overall cost without compromising quality, safety, performance, or functionality. The concept originated from the work of Lawrence D. Miles at General Electric, where Dell'Isola (1997) explained that alternative materials and methods were explored to achieve required functions more economically. VE therefore focuses on identifying project functions and developing alternative solutions that provide better value.

The application of VE involves activities such as information gathering, function analysis, generation of alternatives, evaluation, development, and presentation. Kelly, Male, and Graham (2015) explained that this process encourages collaboration among architects, engineers, quantity surveyors, builders, contractors, and clients in developing cost-effective project solutions. VE can consequently contribute to improved cost control, quality, time performance, and resource utilization.

Although VE is widely used in many developed countries, its application in Nigeria remains relatively limited. Adeleke, Bahaudin, and Kamaruddeen (2016) identified inadequate awareness, shortage of trained professionals, resistance to change, and weak institutional support as some factors limiting its adoption. These limitations are particularly important in states where construction activities are increasing and there is a need to maximize available resources. Ebonyi State has witnessed increased investment in infrastructure, including roads, hospitals, educational facilities, housing, and other public projects. However, challenges relating to project cost, delays, supervision, material selection, and resource utilization can affect project outcomes. Oke and Ogunsemi (2011) emphasized the importance of effective construction management practices in improving project delivery in Nigeria. The systematic application of VE principles could help construction stakeholders in Ebonyi State identify unnecessary costs, evaluate alternative materials and methods, and achieve required project functions more efficiently. As Kelly, Male, and Graham (2015) emphasized, VE promotes interdisciplinary decision-making and encourages the selection of alternatives that provide optimum value rather than simply

reducing cost. Despite the potential benefits of VE, there is limited empirical evidence on its level of awareness and application in construction projects in Ebonyi State. This study therefore focuses on the assessment of the application of Value Engineering principles in construction projects in Ebonyi State, Nigeria, with particular attention to their use in improving project cost, quality, time, and overall performance.

1.2 Statement of the Problem

Construction projects in Ebonyi State are affected by cost overruns, delays, material wastage, poor quality, frequent design changes, and inefficient resource utilization. Obiegbu (2016) identified cost, time, quality, and resource-related problems as major challenges in the Nigerian construction industry. These problems often result in increased project costs, delayed completion, poor project performance, and reduced value for clients.

A major problem is the limited application of Value Engineering (VE) in project planning and execution. Kelly, Male, and Graham (2015) explained that VE can help identify unnecessary costs, evaluate alternative materials and methods, and improve project functionality. However, Adeleke, Bahaudin, and Kamaruddeen (2016) identified inadequate awareness, limited technical expertise, resistance to change, and weak institutional support as barriers to VE adoption. Specifically, there is insufficient information on the level of awareness of VE among construction professionals in Ebonyi State, the extent to which VE principles are applied, the factors limiting their application, and their effects on project cost, time, quality, and functionality. This study therefore assesses the application of Value Engineering principles in construction projects in Ebonyi State, Nigeria.

1.3 Aim and Objectives

The aim of this study was to appraise the application of Value Engineering (VE) principles in improving construction project outputs in Ebonyi State**,** with a view to identifying how the systematic adoption of Value Engineering techniques can enhance cost efficiency, improve project quality, minimize time overruns, and promote sustainable project delivery within the state's construction sector.

Objectives

1. Determine the level of awareness and application of Value Engineering (VE)

principles among construction professionals in Ebonyi State.

2. Identify the level of professional competence and training of construction practitioners in the application of Value Engineering principles in Ebonyi State.
3. Examine the extent to which the application of Value Engineering principles can enhance decision-making, cost control, and design efficiency in construction projects.

1.4 Research Questions

1. What is the level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State?
2. What is the level of professional competence and training of construction practitioners in the application of Value Engineering principles in Ebonyi State?
3. To what extent does the application of Value Engineering principles enhance decision-making, cost control, and design efficiency in construction projects?

4.1 Research Hypotheses

The following null hypotheses were formulated and was tested at 0.05 level of significance at the course of this study:

H_{01}: There is no significant relationship between the level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State.

H_{02}: There is no significant relationship between the level of professional competence and training of construction practitioners and their ability to apply Value Engineering principles effectively in Ebonyi State.

2.0 LITERATUREREVIEW

Construction projects are important to economic and infrastructural development because they provide buildings, roads, hospitals, schools and other facilities required for social and economic activities. However, construction projects often experience problems such as cost overruns, delays, poor quality, material wastage and inefficient resource utilization. Oke and Aigbavboa (2017) noted that effective construction management practices are necessary to improve project delivery and achieve better value from available resources.

Value Engineering (VE) is a systematic approach used to improve the value of a

project by examining its required functions and identifying alternative ways of achieving them at optimum cost. Dell'Isola (1997) explained that VE focuses on achieving the required functions of a project while eliminating unnecessary costs. Similarly, Kelly, Male, and Graham (2015) described VE as a structured process that combines function analysis, creativity and evaluation to achieve the best balance between cost, quality, performance and functionality.

The application of Value Engineering involves several activities, including information gathering, function analysis, generation of alternatives, evaluation, development and presentation of preferred solutions. These activities enable project teams to examine different materials, designs, construction methods and processes before making decisions. According to Dell'Isola (1997), the systematic evaluation of project functions helps identify unnecessary expenditure while maintaining the required performance and quality.

In construction projects, VE can be applied during planning, design, procurement and construction. It may involve selecting alternative materials, simplifying designs, improving construction methods, reducing waste and optimizing the use of labour and other resources. Kelly, Male, and Graham (2015) emphasized that VE also promotes collaboration among architects, engineers, quantity surveyors, builders, contractors and clients, thereby improving decision-making and project value. The benefits of Value Engineering include cost reduction, improved functionality, better resource utilization, reduced waste, improved quality and enhanced project performance. However, its effective application may be affected by inadequate awareness, lack of trained professionals, resistance to change, limited client involvement and insufficient institutional support. Adeleke, Bahaudin, and Kamaruddeen (2016) identified these challenges as important barriers to the wider adoption of VE in developing construction industries.

2.1 Theoretical framework

2.1.1 Systems Theory

Systems Theory, developed by Ludwig von Bertalanffy (1950), views an organization or process as a system made up of interrelated parts working together toward a common goal. It emphasizes that no part functions in isolation, as the performance of one component affects the entire system. Therefore, overall system performance depends on effective integration and coordination of its subsystems. In construction, a project is seen as a system comprising interdependent elements such as

design, procurement, planning, cost control, site operations, and quality management. Failure in any part can negatively affect overall project outcomes in terms of cost, time, quality, and performance (Love et al., 2011). Systems Theory therefore promotes holistic optimization by focusing on the interaction between components rather than improving them separately. This integrated approach enhances overall project efficiency and value.

Value Engineering (VE) is a systematic method that aligns closely with Systems Theory by evaluating how different project components work together to achieve optimal value. VE analyzes materials, processes, and designs to ensure they collectively deliver required functions at the lowest life-cycle cost without compromising quality. From a systems perspective, each project element is part of a larger whole. The VE job plan information, functional analysis, creativity, evaluation, and implementation—supports this by assessing how each component contributes to total project performance. For example, selecting façade materials involves evaluating not only cost but also effects on energy efficiency, durability, maintenance, and aesthetics. This demonstrates systems thinking by ensuring that decisions improve the entire project system rather than isolated parts.

3.0 METHODOLOGY

3.1 Study Area

Ebonyi State is one of the five states in the South-East geopolitical zone of Nigeria, created on 1st October 1996 from the old Enugu and Abia States. It is predominantly inhabited by the Igbo ethnic group, with Abakaliki serving as both the state capital and its largest city. Covering a land area of approximately 5,935 square kilometers, Ebonyi State is strategically located, sharing boundaries with Benue State to the north, Enugu State to the west, Imo and Abia States to the south, and Cross River State to the east. See figure 3.1 and 3.2

The state is popularly referred to as the “Salt of the Nation”, owing to its abundant natural salt deposits, particularly around the Okposi and Nkalagu areas. Agriculture also plays a significant role in the state’s economy, with farming of rice, yam, cassava, maize, and cocoa being predominant. Additionally, Ebonyi State has rich mineral resources such as lead, zinc, limestone, and clay, which are essential for construction and industrial activities. The infrastructure and construction sector in Ebonyi State has seen significant growth in recent years. Major

public projects, including roads, hospitals, schools, and government buildings, as well as private residential and commercial developments, have increased the demand for skilled construction professionals. Despite these developments, many projects still face challenges such as cost overruns, delays, and substandard quality, highlighting the need for efficient project management tools like Value Engineering (VE).

Ebonyi State is also characterized by a young and dynamic workforce, with a growing population that demands sustainable urban planning and infrastructure development. The presence of professional institutions and regulatory bodies, such as the Nigerian Society of Engineers (NSE), Nigerian Institute of Quantity Surveyors (NIQS), and other construction-related associations, ensures that a pool of qualified professionals is available to support construction projects. This combination of strategic location, rich natural resources, active construction sector, and professional expertise makes Ebonyi State an appropriate and relevant setting for investigating the awareness, competence, application, challenges, and strategies for improving Value Engineering practices in construction projects. Studying VE adoption in this context will provide valuable insights for enhancing efficiency, cost-effectiveness, and quality in construction project delivery in the state.

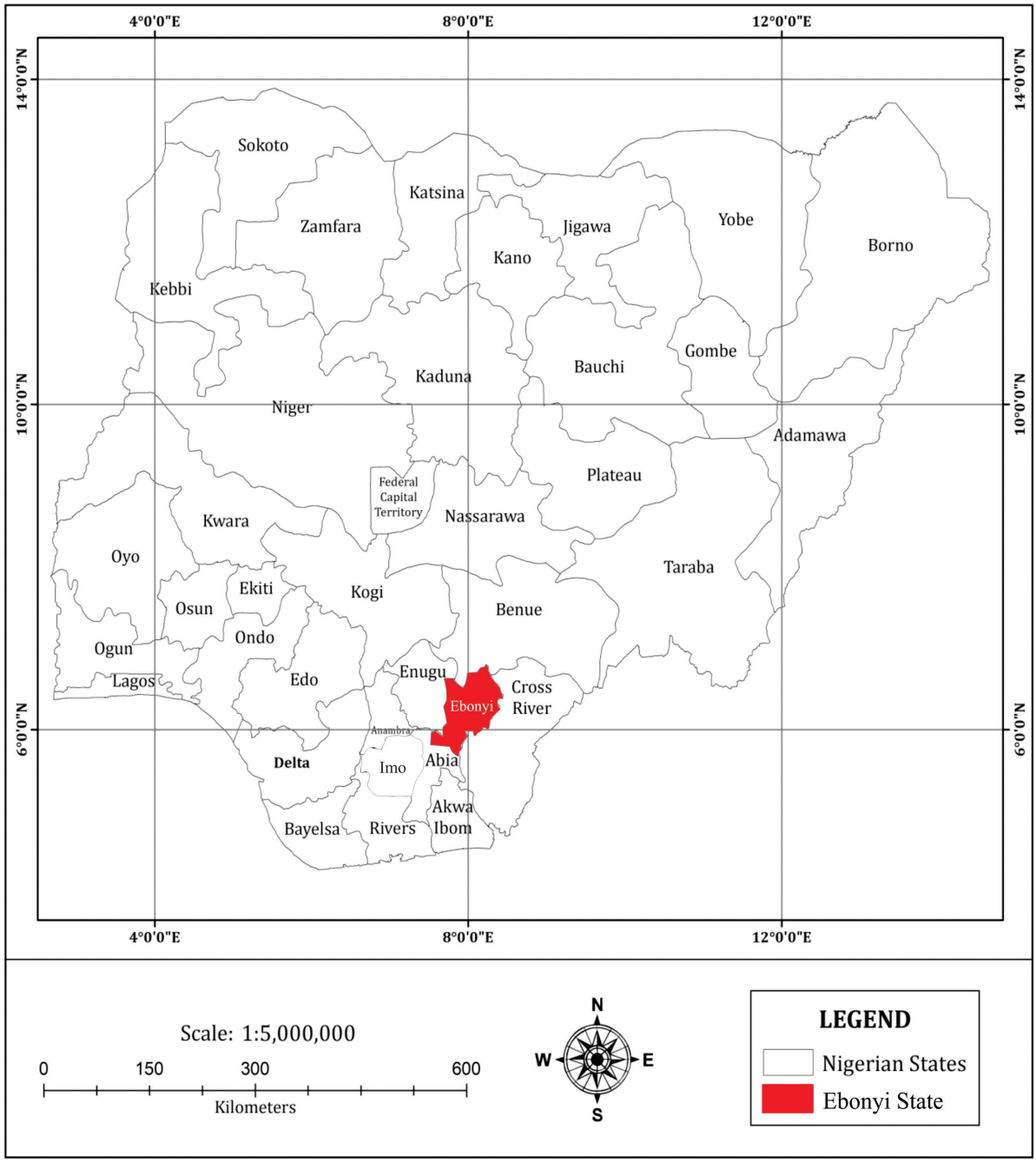


Fig 3.1.1. Map of Nigeria showing the area Ebonyi State

Source*:* Department of Surveying and Geoinformatics, Nnamdi Azikiwe University, Awka. (2025)

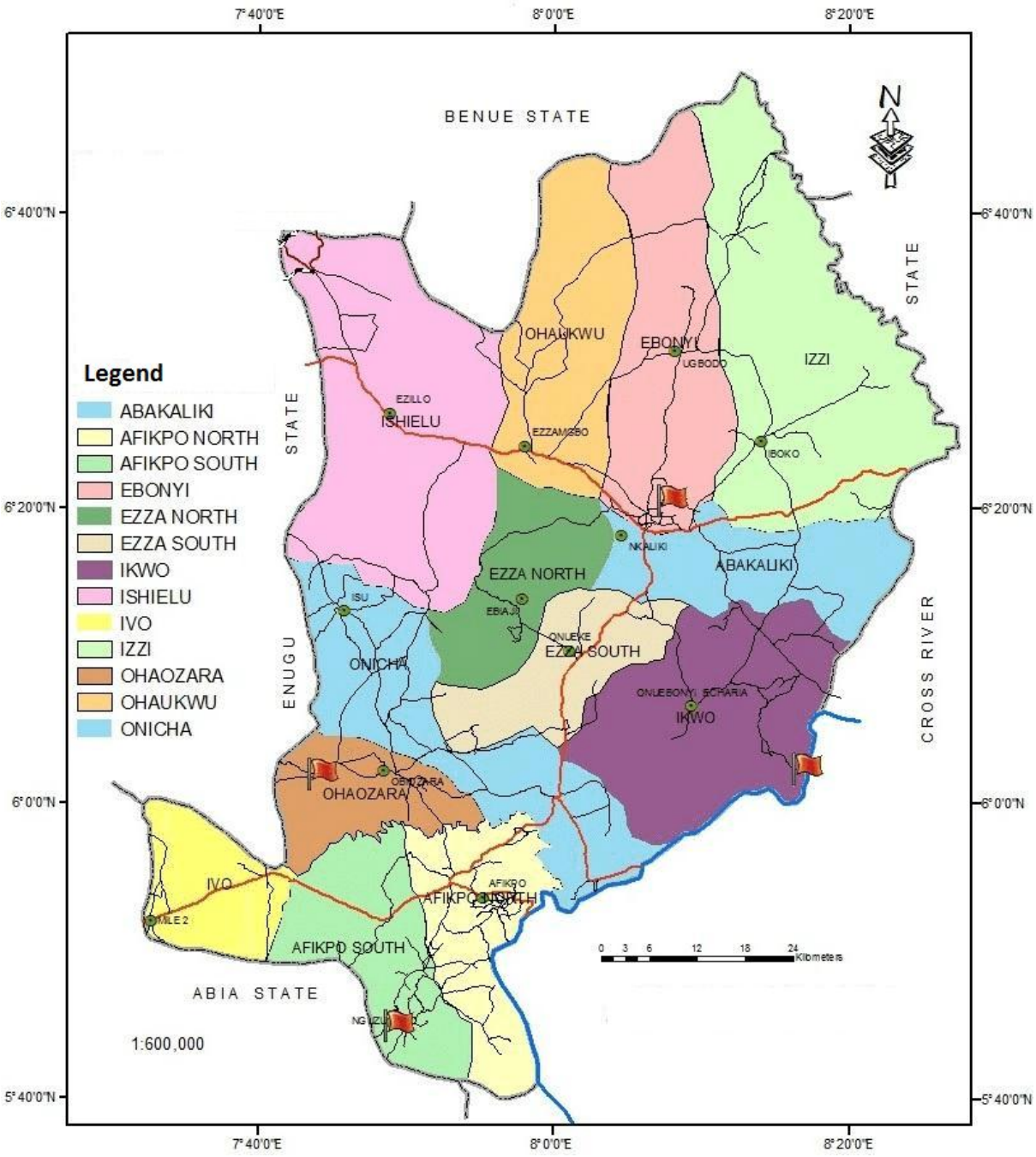


Fig 3.2: Map of Ebonyi State showing its Local Government Areas

Source*:* Department of Surveying and Geoinformatics, Nnamdi Azikiwe University, Awka. (2025).

3.2 Research Design

The study adopted a descriptive survey research design. According to Nworgu (2015), a descriptive survey research design is one in which data are collected from a representative sample of a population to describe existing conditions, practices, opinions, attitudes, and relationships among variables. Similarly, Creswell (2014) explained that descriptive survey research is suitable for studies that seek to describe the

characteristics of a population through the collection and analysis of data obtained using research instruments such as questionnaires and interviews. The descriptive survey design was considered appropriate because it enabled the researcher to collect data from construction professionals on the existing level of awareness, application, competence, challenges, and strategies relating to Value Engineering (VE) in construction projects in Ebonyi State without manipulating any of the study variables.

3.3 Population of the Study

The population of a study refers to the complete set of individuals, objects, or elements that possess the characteristics of interest to the researcher and from which relevant data are collected (Nworgu, 2015). In this study, preliminary survey of the study revealed that there are total of one thousand six hundred and fifty-three (1653) main players within built environment, comprising of one hundred and sixty (160) Architects, one hundred and ninety (190) Quantity Surveyors, two hundred and sixty (260) Civil/Structural Engineers, one hundred and eighty three (183) Builders, one hundred and ninety (190) Project Managers, three hundred and eighty (380) Contractors and two hundred and ninety (290) Government Officials and Consultants involve in public project in the study area. **(**Nigerian Institute of Architects (NIA)**,** Nigerian Society of Engineers (NSE)**,** Nigerian Institute of Quantity Surveyors (NIQS)**,** and the Ministry of Works and Infrastructure Development, Ebonyi State, 2026)

Table 3.1: Population Distribution

S/N	Professions	Number
1	Architects	160
2	Quantity Surveyors	190
3	Civil/Structural Engineers	260
4	Builders	183
5	Project Managers	190
6	Contractors	380
7	Government Officials and Consultants	290
	Total	1653

Source: Nigerian Institute of Architects (NIA)**,** Nigerian Society of Engineers (NSE)**,** Nigerian Institute of Quantity Surveyors (NIQS)**,** and the Ministry of Works and Infrastructure Development, Ebonyi State, 2026)

3.4 Sample and Sampling Techniques

3.4.1 Determination of Sample Size

The sample size for this study was determined using Bouely's formular as cited in Ogunoh (2008).

$$n = \frac{N}{1+N(e)^2}$$

Where n = sample size

N = population

e^2 = Margin of error (assumed 5%)

1 = unity or constant

Therefore $n = \frac{1653}{1+1653(0.05)^2}$

$$= \frac{1653}{1+(1653x0.0025)}$$

$$= \frac{1653}{1+4.1325}$$

$$= \frac{1653=}{5.1325} = 322$$

The sample size of 322 was adopted for this study. To ensure fair representation of all professional categories within the population, the study adopted a stratified random sampling technique. The total population will be first divided into professional strata based on discipline that is Architects, Quantity Surveyors, Engineers, Builders, Project Managers, Contractors, and Government officials. From each stratum, respondents will be selected proportionally according to their population strength using proportionate stratified sampling.

Table 3.2: The sample Distribution is shown below:

	Professional Category	Population (N)	Sample Size (n)
1	Architects	160	29
2	Quantity Surveyors	190	30
3	Civil/Structural Engineers	260	67
4	Builders	183	54
5	Project Managers	190	31
6	Contractors	380	72
7	Government Officials/Consultants	290	39
8	**Total**	1653	**322**

This stratified random sampling approach ensured that each professional group is adequately represented in the study, thereby enhancing the validity, objectivity, and generalizability of the findings.

3.5 Instrument for Data Collection

The instruments for data collection for this study was structured questionnaire developed by the researcher based on insights gained from the review of related literature, empirical studies, and the research

questions guiding the study. The questionnaire was titled "Value Engineering Adoption and Practice Assessment Questionnaire (VEAPAQ)" and was designed to elicit responses from construction professionals in Ebonyi State. The Questionnaire was divided into two major sections:

Section A: Contained items on the demographic information of respondents such as gender, professional discipline, educational qualification, years of experience, type of organization, and professional registration status.

Section B: Contained six clusters (B1–B6) corresponding to the six specific objectives and research questions of the study. Each cluster was designed to gather data on specific variables related to Value Engineering (VE) awareness, competence, application, challenges, and improvement strategies.

The response format was structured using a five-point Likert Scale with the following weightings:

Very High Extent (VHE) = 5

High Extent (HE) = 4

Moderate Extent (ME) = 3

Low Extent (LE) = 2

Very Low Extent (VLE) = 1

The six clusters of Section B were structured as follows:

Cluster B1: Level of awareness and application of Value Engineering principles among construction professionals.

Cluster B2: Level of professional competence and training in the application of Value Engineering principles.

Cluster B3: Extent to which Value Engineering enhances decision-making, cost control, and design efficiency.

Cluster B4: Major challenges hindering the effective implementation of Value Engineering in construction projects.

Cluster B5: Key Value Engineering principles and techniques relevant to construction project outputs.

Cluster B6: Strategies for improving the adoption and practice of Value Engineering in construction projects.

Each of these clusters contained structured items designed to capture both the quantitative and qualitative aspects of the study objectives.

3.6. Nature and Source of Data

3.6.1 Primary Sources

The primary sources of data for this study was based on firsthand information collected directly from construction

professionals, including architects, builders, quantity surveyors, civil engineers, project managers, and site supervisors practicing in Ebonyi State. The data collection instruments under this category will include:

3.6.2 Secondary Data

The secondary data comprised information gathered from both published and unpublished materials relevant to Value Engineering and construction project management. In this research, secondary data were obtained from textbooks and reference materials; Academic journals and peer-reviewed articles; Conference papers, technical reports, and government publications on construction industry practices; dissertations and project reports from Universities and research institutions; Reputable online databases, research repositories, and professional association websites such as the Nigerian Institute of Quantity Surveyors (NIQS), Nigerian Society of Engineers (NSE), and Building and Construction Authority (BCA). These materials were used to strengthen the conceptual and empirical background of the study, support the development of the research instrument, and provide comparative perspectives between global and local Value Engineering practices.

3.7 Method of Data Analysis

Data collected for the study were analyzed using descriptive statistics in line with the descriptive survey research design. The responses obtained from the questionnaire were coded and analyzed using frequency counts, percentages, mean and standard deviation. Frequency counts and percentages were used to summarize the demographic characteristics of the respondents, while mean and standard deviation were used to answer the six research questions. For the four-point Likert scale, the response options were assigned numerical values as follows: 4-point scale (Always = 4, Sometimes = 3, Rarely = 2, Never = 1) and (Strongly Agree = 4, Agree = 3, Disagree = 2, Strongly Disagree = 1) A criterion mean of 3.00 was used as the decision point. Therefore, items with a mean score of 3.00 and above were regarded as having a high or acceptable extent, while items with a mean score below 3.00 were regarded as having a low extent. The results were presented in bar chart, pie chart and tables to facilitate clear interpretation and discussion in relation to the research questions and objectives of the study.

4.0 Data Presentation and Analysis

Distribution of Questionnaire

Table 4.0 Return Rate of Questionnaire

Questionnaire	**Frequency**	**Percentage (%)**
Total No of Questionnaire Administered	322	00.00
No of Questionnaire Received	318	98.75
No of Questionnaire not Received	4	1.24
Total		100%

Source: Field Survey 2026

Table 4.1 shows that, out of the 32 copies of questionnaires distributed based on the sample size earlier obtained for the study, 318 representing 95.75% of the total responds were completed and returned while 4 representing 1.24.% were not recovered. The researcher proceeded with the analysis of the data as 95.75% response rate is regarded as very satisfactory for this study.

4.1 Demographic Analysis of the Respondents

1. Gender Distribution:

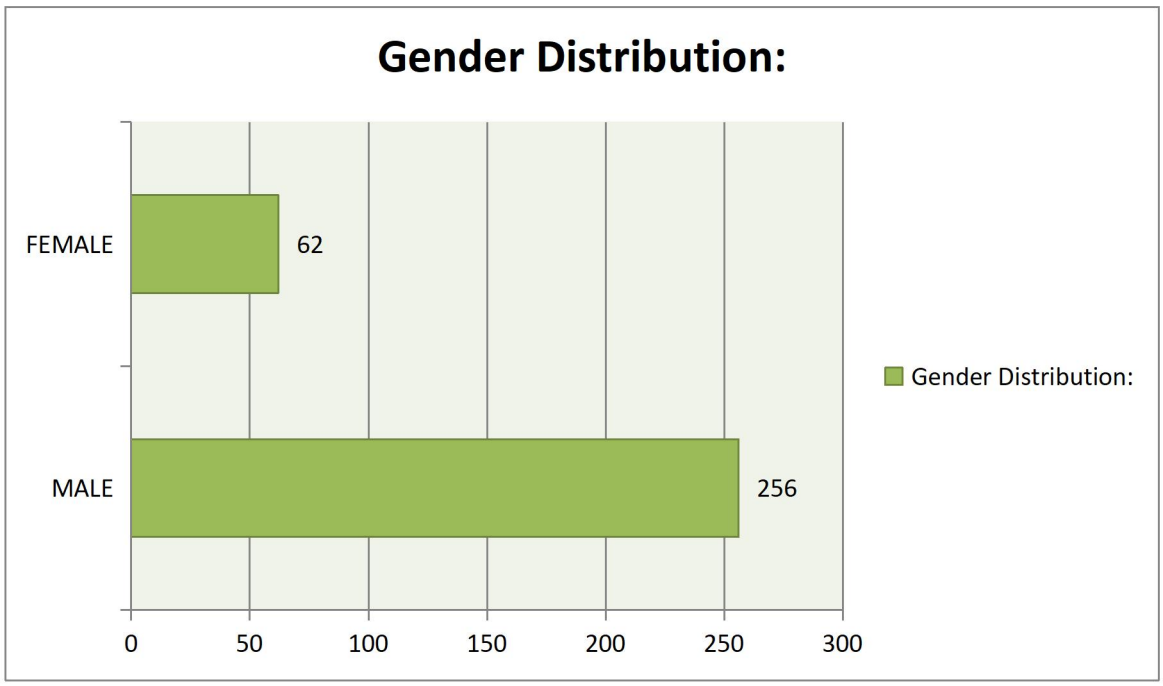


Fig 4.1. Demographic Analysis of the Respondents

The gender distribution among the 318 construction professionals and stakeholders surveyed in Ebonyi State shows that 262 respondents are male, while 56 respondents are female. This distribution indicates a significant gender imbalance within the construction industry. The higher number of male respondents reflects the traditionally male-dominated nature of the construction sector. The disparity suggests that fewer women are actively involved in construction-related professions such as engineering, building, and project management. This may be attributed to cultural perceptions, limited access to technical education, or workplace challenges that discourage female participation. The relatively low number of female respondents highlights the need for increased efforts to promote gender inclusivity and encourage more women to pursue careers in construction and related fields in Ebonyi State.

2. Educational Background:

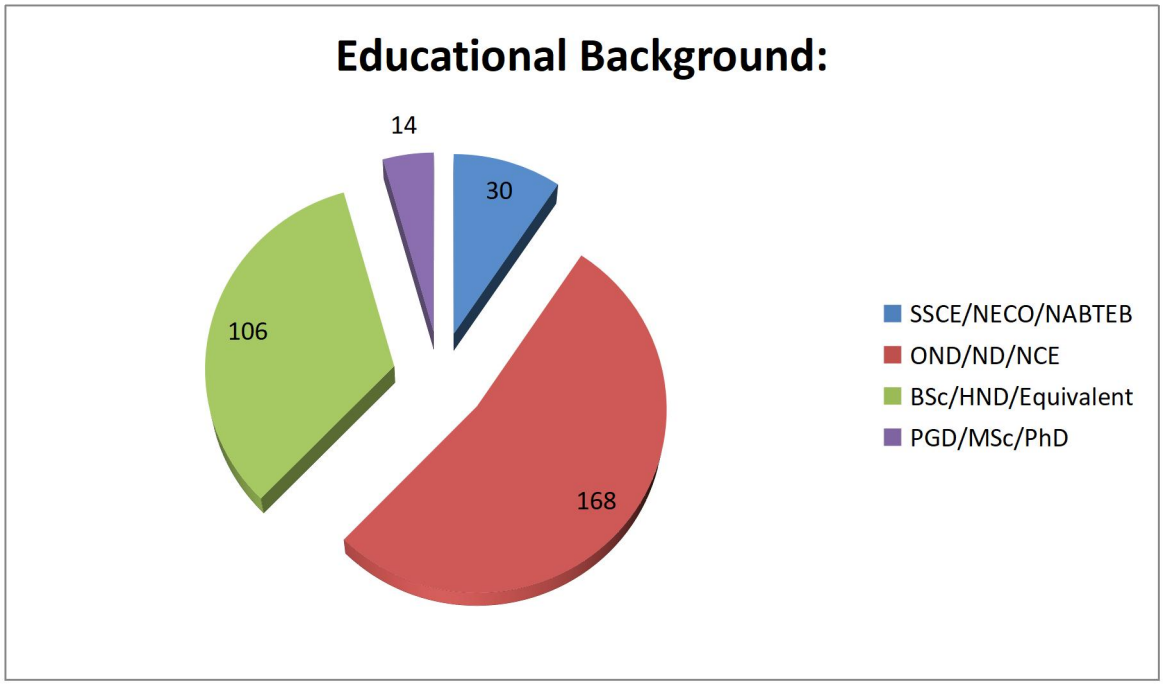


Fig 4.2: Educational Background

The distribution of educational backgrounds among the 318 construction professionals and stakeholders involved in building and civil engineering projects in Ebonyi State reveals a wide range of academic qualifications. The majority of the respondents, consisting of 168 individuals, possess OND/ND/NCE qualifications, representing a significant proportion of the study population. Additionally, 106 respondents hold BSc/HND or equivalent degrees, indicating a strong presence of professionals with higher education. Furthermore, 30 respondents have SSCE/NECO/NABTEB qualifications, reflecting the inclusion of

individuals with secondary education, while a smaller but important group of 14 respondents possess postgraduate qualifications (PGD/MSc/PhD).

This distribution indicates that the construction industry in Ebonyi State is supported by a diverse and well-structured educational base. The dominance of OND/ND/NCE holders suggests a strong representation of technically skilled personnel who contribute practical expertise to construction activities. Meanwhile, the significant number of respondents with BSc/HND qualifications reflects the availability of professionals with advanced theoretical knowledge and professional training necessary for effective project planning and management.

The presence of respondents with SSCE/NECO/NABTEB qualifications highlights the role of semi-skilled and support personnel within the industry, contributing to operational activities on construction sites. Furthermore, the inclusion of individuals with postgraduate qualifications demonstrates that the sector also benefits from highly educated professionals who bring advanced knowledge, research capabilities, and strategic insights into construction practices.

3. Years of Experience:

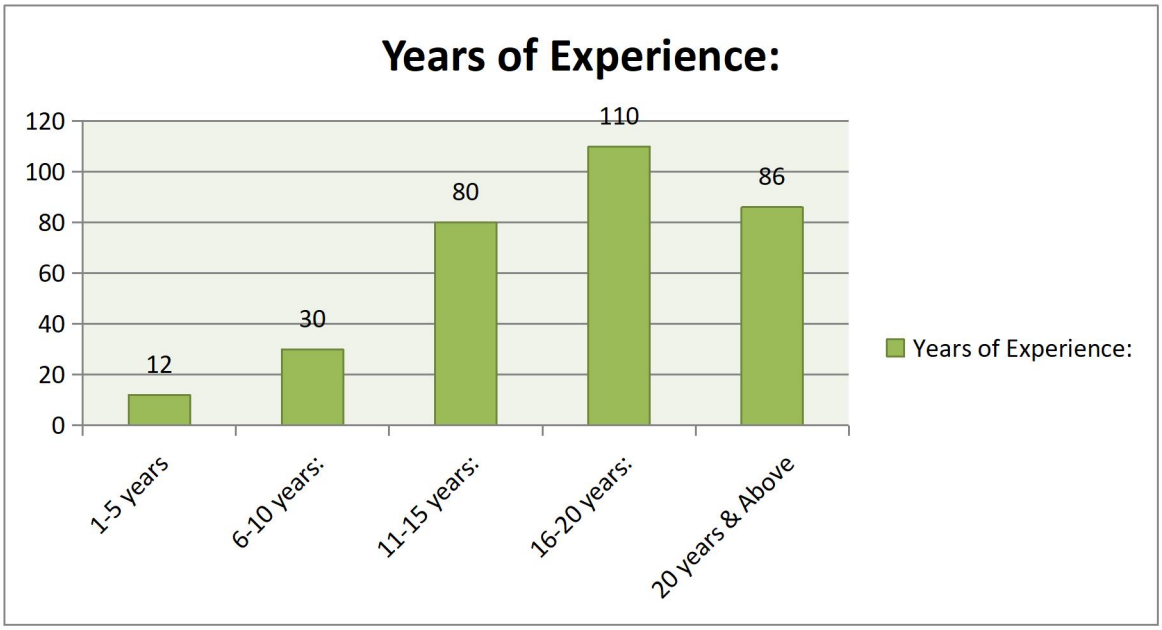


Fig 4.3: Years of Experience

The distribution of years of experience among the 318 construction professionals and stakeholders involved in building and civil engineering projects in Ebonyi State provides valuable insight into their professional backgrounds. The breakdown shows that 12

respondents have 1–5 years of experience, 30 respondents have 6–10 years, 80 respondents fall within 11–15 years, 110 respondents have 16–20 years, while 86 respondents have over 20 years of experience. This distribution indicates a wide range of experience levels among the respondents. While a smaller proportion of respondents are early-career professionals with less than 10 years of experience, a larger proportion have accumulated significant experience over time. Notably, the majority of respondents fall within the 11–15 years, 16–20 years, and above 20 years categories, representing a substantial portion of the sample. The dominance of respondents within these experience brackets suggests that the construction industry in Ebonyi State is largely composed of moderately to highly experienced professionals. This level of experience is critical, as it implies that most respondents possess substantial practical knowledge and industry exposure, which enhances the reliability of their responses regarding the application of Value Engineering principles.

Furthermore, the presence of highly experienced professionals (16 years and above) indicates that the study benefits from informed opinions grounded in long-term industry practice, while the inclusion of less experienced respondents provides a balanced perspective that reflects both emerging and established viewpoints within the construction sector.

4. Field/Discipline:

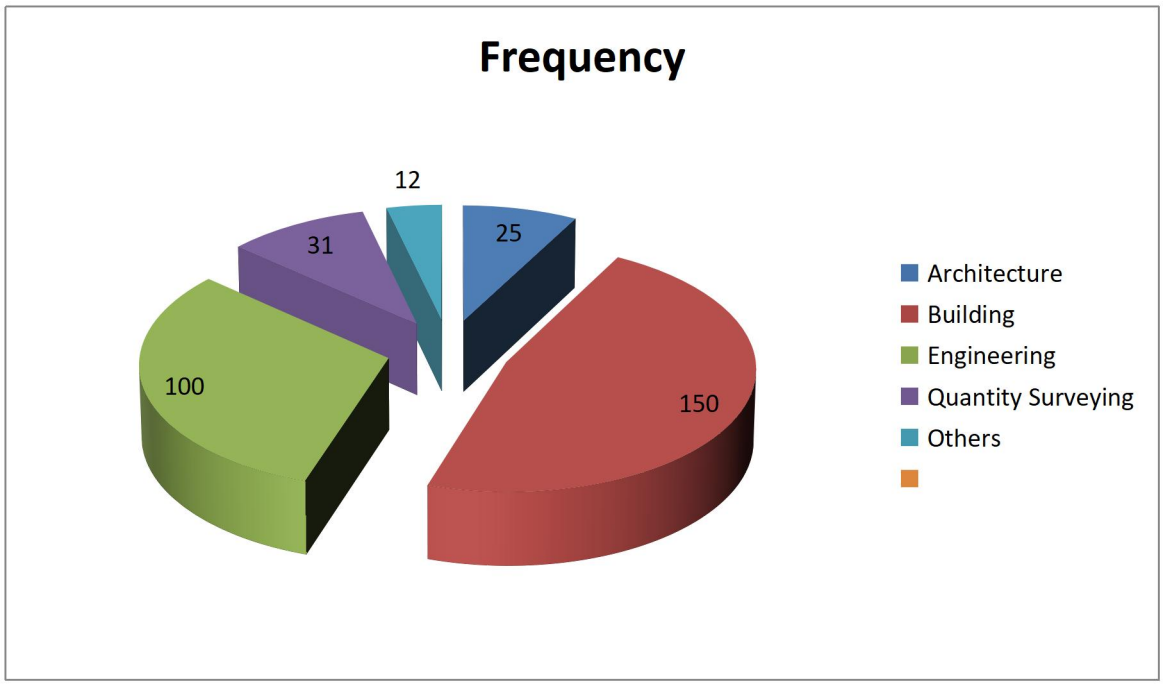


Fig 4.4: Field/Discipline

The distribution of respondents by field/discipline shows that the study involved a total of 318 construction professionals and stakeholders engaged in building and civil engineering projects. The results indicate that professionals in the Building discipline constituted the largest group with 150 respondents, representing the majority of participants in the study. This suggests that builders played a dominant role in the projects examined and were more actively involved in construction activities. Engineering professionals formed the second largest category with 100 respondents, indicating a substantial contribution of engineers to the execution and supervision of building and civil engineering projects. Quantity Surveyors accounted for 31 respondents, reflecting their important role in cost estimation, budgeting, procurement, and financial management of construction projects. Architects constituted 25 respondents, showing their involvement mainly in planning, design, and project coordination. Meanwhile, respondents categorized under Others were 12, representing allied professionals and stakeholders whose contributions supported the successful implementation of the projects.

4.1: What is the level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State?

Table 4.1: Respondents' ratings on the level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State

S/N	Awareness and Application	N	Mean	Std. Deviation	Rank
1	Awareness of benefits of Value Engineering	318	3.35	0.72	1st
2	Awareness of Value Engineering principles in construction practice	318	3.32	0.74	2nd
3	Incorporation of VE in cost reduction strategies	318	3.01	0.80	3rd
4	Application of VE during project planning stage	318	2.85	0.83	4th
5	Use of Value Engineering in design optimization	318	2.76	0.86	5th
6	Integration of VE in project decision-making	318	2.73	0.87	6th
7	Application of VE techniques during construction phase	318	2.69	0.90	7th
8	Adoption of VE across different project types	318	2.47	0.94	8th
9	Use of functional analysis in project execution	318	2.41	0.95	9th
10	Regular use of VE workshops in projects	318	2.28	0.97	10th
	Grand Mean		**2.79**		

Data presented in Table 1 shows that items 1, 2, 3, 4, 5, 6, and 7 with mean scores of 3.35, 3.32, 3.01, 2.85, 2.76, 2.73, and 2.69, respectively, were rated agreed by the respondents

because their mean scores are above the 2.50 benchmark. However, items 8, 9, and 10 with mean scores of 2.47, 2.41, and 2.28, respectively, were rated disagreed because their mean scores are below the 2.50 threshold. The grand mean of 2.79 indicates that there is a high level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State.

4.2 What is the level of professional competence and training of construction practitioners in the application of Value Engineering principles in Ebonyi State?

Table 4.2: Mean Scores Showing the Level of Professional Competence and Training in Value Engineering (VE)

S/N	Professional Competence and Training	N	Mean	Std. Deviation	Rank
11	VE expertise improves project performance	318	3.18	0.756	1st
12	Construction professionals possess adequate VE knowledge	318	3.05	0.801	2nd
13	Experience influences effective VE application	318	2.97	0.823	3rd
14	VE tools and techniques are well understood by professionals	318	2.88	0.845	4th
15	Continuous professional development includes VE training	318	2.74	0.902	5th
16	Professional bodies promote VE training programs	318	2.69	0.918	6th
17	Availability of VE specialists in the industry	318	2.56	0.936	7th
18	I have received formal training in Value Engineering	318	2.42	0.954	8th
19	Educational institutions adequately teach VE concepts	318	2.38	0.968	9th
	Grand Mean		**2.76**		

Data presented in Table 2 shows that items 11, 12, 13, 14, 15, 16, and 17 with mean scores of 3.18, 3.05, 2.97, 2.88, 2.74, 2.69, and 2.56, respectively, were rated agreed by the respondents because their mean scores are above the 2.50 benchmark. On the other hand, items 18 and 19 with mean scores of 2.42 and 2.38, respectively, were rated disagreed because they fall below the 2.50 threshold. The grand mean of 2.76 summarized that the respondents agreed that construction practitioners possess a moderate level of professional competence and training in the application of Value Engineering principles in Ebonyi State.

4.3 To what extent does the application of Value Engineering principles enhance decision-making, cost control, and design efficiency in construction projects?

Table 4.3: Mean Scores on the extent does the application of Value Engineering principles enhance decision-making, cost control, and design efficiency in construction projects

S/N	Impact of VE Application	N	Mean	Std. Deviation	Rank
21	VE improves decision-making in construction projects	318	3.21	0.742	1st
22	VE enhances cost control during project execution	318	3.15	0.768	2nd
23	VE improves project value without compromising quality	318	3.10	0.785	3rd
24	VE promotes efficient design solutions	318	3.06	0.801	4th
25	VE helps eliminate unnecessary project costs	318	3.00	0.829	5th
26	VE supports sustainable construction practices	318	2.94	0.847	6th
27	VE contributes to better resource utilization	318	2.89	0.866	7th
28	VE leads to innovative design alternatives	318	2.84	0.884	8th
29	VE enhances collaboration among stakeholders	318	2.78	0.903	9th
30	VE improves functional performance of projects	318	2.73	0.918	10st
	Grand Mean		**2.97**		

Data presented in Table 3 shows that all the items (21–30) with mean scores of 3.21, 3.15, 3.10, 3.06, 3.00, 2.94, 2.89, 2.84, 2.78, and 2.73, respectively, were rated agreed by the respondents because all their mean scores are above the 2.50 benchmark. The grand mean of 2.97 indicates that the respondents agreed that the application of Value Engineering principles enhances decision-making, cost control, design efficiency, resource utilization, innovation, stakeholder collaboration, and the overall functional performance of construction projects in Ebonyi State.

4.4 Test of Hypothesis

Null Hypothesis One (H_{01})

There is no significant relationship between the level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State.

Table 4.4: Pearson r Test of the Significant Relationship between Awareness and Application of Value Engineering (VE) Principles

	Awareness of VE Principles	Application of VE Principles
Awareness of VE Principles		
Pearson Correlation	1	.412
P-value		.000
N	318	318
Application of VE Principles		
Pearson Correlation	.412	1

N	318	318

Findings in Table 4.7 reveal that the Pearson Product Moment Correlation Coefficient (r) is 0.412. This indicates a moderate positive relationship between the level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State. This implies that as awareness of Value Engineering increases, its application in construction projects also tends to increase. Furthermore, the p-value of 0.000 is less than the stipulated level of significance (0.05), indicating that the relationship is statistically significant. Since the p-value (0.000) is less than 0.05, the null hypothesis (H_{01}) is rejected.

4.5 There is no significant relationship between the level of professional competence and training of construction practitioners and their ability to apply Value Engineering (VE) principles effectively in Ebonyi State.

Table 4.5: Pearson r Test of the Significant Relationship between Professional Competence/Training and Application of Value Engineering (VE)

	Professional Competence and Training	**Application of VE Principles**
Professional Competence and Training		
Pearson Correlation	1	.468
P-value		.000
N	318	318
Application of VE Principles	.468	1
P-value	.000	
N	318	318

Findings in Table 4.8 reveal that the Pearson Product Moment Correlation Coefficient (r) is 0.468, indicating a moderate positive relationship between the level of professional competence and training of construction practitioners and their ability to apply Value Engineering (VE) principles effectively in Ebonyi State. This suggests that as the level of competence and training increases, the effectiveness in applying Value Engineering principles also improves. Furthermore, the p-value of 0.000 is less than the stipulated level of significance (0.05), indicating that the relationship is statistically significant. Since the p-value (0.000) is less than 0.05, the null hypothesis (H_{02}) is rejected.

5.0 DISCUSSION OF RESULTS/FINDINGS

Data presented in Table 1 shows the grand mean of 2.79 indicates that there is a high level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State. The findings of the study revealed that

construction professionals in Ebonyi State possess a high level of awareness of Value Engineering (VE) principles but demonstrate only a moderate level of application in practice. This finding is in consonance with Kelly, Male and Graham (2015) who carried out a study on the practice of Value Engineering in the construction industry. The result of their study revealed that although awareness of Value Engineering is relatively high among construction professionals, its practical application remains limited due to inadequate training, lack of technical expertise, and poor integration into project processes. Supporting the above findings, Oke and Ogunsemi (2011) examined the implementation of Value Management and Value Engineering in the Nigerian construction industry. Their findings indicated that while professionals are aware of Value Engineering concepts, its application is still at a low level due to insufficient training, lack of awareness of systematic procedures, and absence of institutional frameworks to support its practice. This finding is also in consonance with Jaapar, Torrance, and Carr (2012) who investigated the barriers to effective Value Engineering implementation in construction projects.

Relationship between the level of awareness and application of Value Engineering (VE) principles among construction professionals in Ebonyi State. The findings of the study revealed that there is a significant positive relationship between the level of awareness and application of Value Engineering principles among construction professionals in Ebonyi State. The result showed a moderate correlation, indicating that as awareness of Value Engineering increases, its application in construction projects also improves. This implies that awareness plays a critical role in influencing the extent to which VE is utilized in practice. Supporting this, Aigbavboa and Thwala (2014) reported that awareness is a key determinant of Value Engineering implementation, as professionals with higher levels of awareness tend to integrate VE practices into their projects more consistently. They emphasized that lack of awareness often leads to underutilization of VE techniques

Data presented in Table 2 shows that items the grand mean of 2.76 which summarized that the respondents agreed that construction practitioners possess a moderate level of professional competence and training in the application of Value Engineering principles in Ebonyi State. The findings of the study revealed that construction practitioners in Ebonyi State possess a high level of professional competence in the application of Value Engineering (VE) principles, but training particularly formal and institutional

training remains inadequate. This finding is in consonance with Oke and Ogunsemi (2011) who examined the level of awareness and practice of Value Management in the Nigerian construction industry. Supporting the above findings, Iniobong, Olajide and Lawal (2016) investigated the competencies required for effective Value Engineering application and found that successful implementation of VE depends heavily on specialized training, technical skills, and a clear understanding of systematic processes. This finding is also in agreement with Atsrim and Ansah (2021) who reported that the level of professional competence in Value Engineering in developing countries is moderate, but its application is limited due to lack of formal education and insufficient training opportunities. The findings of the study revealed that there is a significant positive relationship between the level of professional competence and training of construction practitioners and their ability to apply Value Engineering principles effectively. This indicates that as competence and training improve, the effectiveness of VE application also increases. This finding is in agreement with Jaapar, Torrance, and Carr (2012) who found that professional competence and specialized training are essential for the successful implementation of Value Engineering. Their study revealed that lack of adequate training limits the ability of professionals to apply VE techniques effectively.

Data presented in Table 3 shows the grand mean of 2.97 indicates that the respondents agreed that the application of Value Engineering principles enhances decision-making, cost control, design efficiency, resource utilization, innovation, stakeholder collaboration, and the overall functional performance of construction projects in Ebonyi State. The findings of the study revealed that the application of Value Engineering (VE) principles enhances decision-making, cost control, and design efficiency to a high extent in construction projects in Ebonyi State. This finding is in consonance with Kelly, et al (2015) who asserted that Value Engineering enhances project performance by improving decision-making through structured evaluation processes. Their study revealed that VE enables project teams to identify the best value options by balancing cost, function, and quality. Supporting the above findings, Al-Yousefi (2011) examined the impact of Value Engineering on construction projects and found that VE significantly improves cost control and design efficiency. They emphasized that the application of VE techniques helps eliminate unnecessary expenditures while maintaining or

improving project functionality. This finding is also in agreement with Barrientos-Orellana, Ballesteros-Perez, More-Melia, Cerezo-Narvaez and Gutierrez-Bahamondes (2023) whose study revealed that Value Engineering contributes to better design optimization and project delivery by encouraging creative problem-solving and functional analysis.

5.1 Conclusion

The study concludes that the application of Value Engineering (VE) principles has significant potential to improve construction project outputs in Ebonyi State. Although construction professionals demonstrate a reasonable level of awareness of Value Engineering and acknowledge its benefits in enhancing decision-making, cost control, design efficiency, and overall project value, its practical application remains inadequate. The findings further reveal that limited formal training, insufficient institutional support, and inadequate integration of Value Engineering into professional practice continue to hinder its widespread adoption. Consequently, many construction projects are unable to fully realize the benefits of improved functionality, reduced waste, and enhanced value for money. Therefore, strengthening professional capacity, promoting Value Engineering education, and institutionalizing its application in construction policies and project delivery processes are essential for achieving more efficient, sustainable, and high-performing construction projects in Ebonyi State.

5.2 Recommendations

Based on the findings of the study, the following recommendations were made:

1. The government and relevant regulatory authorities should take the lead in the development and enforcement of policies that support the effective implementation of Value Engineering in construction projects. This includes establishing clear guidelines that mandate or encourage the use of VE in both public and private construction projects to improve project efficiency, cost control, and quality outcomes.
2. Construction firms should organize and implement continuous professional development programmes, workshops, and seminars for their staff on Value Engineering principles and practices. These training programmes should focus on practical application techniques such as functional analysis, cost optimization, and design evaluation to bridge the gap

between awareness and implementation.

3. Professional bodies such as COREN, NIQS, NIA, and NIOB should actively promote the practice of Value Engineering by certifying VE specialists, organizing training sessions, and incorporating VE standards into professional practice requirements. This will enhance the competence of practitioners and improve the quality of construction project delivery.

5.2 Contribution to Knowledge

This study contributes to knowledge by providing empirical information on the application of Value Engineering principles in construction projects in Ebonyi State. It identifies the level of awareness, extent of application, benefits, and challenges associated with Value Engineering. The findings will provide useful information for construction professionals, clients, government agencies, and researchers on improving cost efficiency, quality, functionality, and overall project performance through effective application of Value Engineering principles.

5.3 Areas for Further Study

Further studies could examine the application of Value Engineering in other states or regions of Nigeria for comparative purposes. Research could also investigate the economic impact of Value Engineering on project cost and lifecycle performance, as well as its application in specific project types such as roads, hospitals, schools, and residential buildings.

5.4 AI Declaration

Artificial Intelligence (AI) tools, specifically ChatGPT, were used solely for editorial support, language refinement, organization, and presentation of the manuscript. All research data, analyses, interpretations, findings, and conclusions were independently generated by the author. The author accepts full responsibility for the accuracy and integrity of the work.

5.5 Conflict of Interest

The author declares that there is no conflict of interest regarding the conduct, analysis, or publication of this research.

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