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VALUE ENGINEERING AND PROJECT COST REDUCTION ON PERFORMANCE OF MIKAP NIGERIA LIMITED, BENUE STATE NIGERIA

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ABSTRACT

This study examines the application of value engineering in project cost reduction and its impact on the performance of MIKAP Nigeria Limited, Benue State, Nigeria, through the lens of Lean Theory, with Resource-Based View (RBV) and Systems Theory as supporting frameworks. A survey research design was adopted, with a census sampling technique applied to a population of 122. Data were collected using structured questionnaires, with validity confirmed via factor analysis and reliability through Cronbach Alpha statistics. Descriptive statistics and logit regression analysis were used to analyze the data. The results indicate a significant negative relationship between Process Improvement (PIP) and performance, with a coefficient of -1.235, standard error of 0.484, Wald statistic of 6.505, p-value of 0.011, and an odds ratio of 0.291, reflecting a 70.9% decrease in performance likelihood with decreased process optimization. Lifecycle Cost Analysis (LCA) has a coefficient of -1.733, standard error of 0.564, Wald statistic of 9.444, and a p-value of 0.002, showing an 82.3% decrease in performance odds with poor cost management. Quality Assurance (QUA) shows a positive coefficient of 1.652, standard error of 0.461, Wald statistic of 12.846, and p-value of 0.000, with an odds ratio of 5.216, indicating a five-fold increase in performance odds with improved quality assurance practices. This study highlights the importance of continuous process improvement, lifecycle cost analysis, and quality assurance in enhancing organizational performance and offers valuable insights for project cost reduction strategies.

Keywords: *Value engineering, project cost reduction, organizational performance, lifecycle cost analysis, quality assurance.*

INTRODUCTION

Value engineering (VE) has evolved into a critical tool in project management, designed to optimize project functions while minimizing costs. Originating during World War II to address resource scarcity, VE is now widely applied across industries for enhancing performance, cost efficiency, and competitiveness (Miles, 2015). Through systematic analysis of project functions, VE enables cost savings without compromising quality (Kelly, Male, & Graham, 2014). Its global relevance is particularly evident in developing contexts, where firms seek efficiency and sustainability in increasingly competitive markets. In Africa, the adoption of VE is gaining momentum, driven by the need to maximize limited financial resources in infrastructure and construction projects (Amadi & Ikpor, 2015). Empirical evidence shows that VE enhances cost reduction and project performance (Bamfo-Agyei, Thwala & Aigbavboa, 2022). However, implementation is often hindered by low awareness, limited expertise, and resistance to organizational change. Nonetheless, VE is increasingly recognized as central to achieving sustainable development goals and boosting competitiveness on the global stage (Nkado & Meyer, 2015). In Nigeria, VE is emerging as a strategic approach to address project inefficiencies, high costs, and economic volatility (Olanrewaju, 2017), though its application remains nascent with opportunities for broader integration (Amusan et al., 2018).

This study focuses on the effect of VE on project cost reduction and performance in MIKAP Nigeria Limited, employing three key proxies: process improvement, lifecycle cost analysis (LCCA), and quality assurance. Process improvement seeks to eliminate inefficiencies and optimize workflows, thereby enhancing productivity and reducing costs (Smith & Green, 2022). LCCA extends cost considerations across a project's lifespan, promoting sustainability and long-term efficiency (Johnson & Lee, 2023). Quality assurance ensures projects meet required standards, preventing costly rework and boosting customer satisfaction (Williams & Adams, 2023). Together, these proxies align with strategic goals of cost reduction and performance improvement, offering MIKAP Nigeria Limited a framework for operational efficiency and competitiveness. Despite the proven benefits, gaps remain in the effective integration of VE within Nigerian firms. At MIKAP Nigeria Limited, challenges such as inefficient workflows, rising lifecycle costs, and inconsistent quality assurance appear to constrain performance outcomes. This study seeks to address these gaps by empirically testing the impact of process improvement, LCCA, and quality assurance on firm performance, using hypotheses that each has no significant effect on outcomes. Thus, contextualizing VE practices within the unique environment of Benue State, this research contributes to project management literature, providing evidence-based insights relevant to Nigeria and other developing regions.

The main objective of the study is to examine value engineering and project cost reduction on performance of MIKAP Nigeria Limited, Benue state Nigeria. The specific objectives are to:

i. Examine the effect of process improvement on performance of MIKAP Nigeria Limited, Benue state Nigeria
ii. Ascertain the effect of lifecycle cost analysis on performance of MIKAP Nigeria Limited, Benue state Nigeria
iii. Determine the effect of quality assurance on performance of MIKAP Nigeria Limited. Benue state Nigeria

This study is guided by the following hypotheses:

H_{01}: Process improvement has no significant effect on performance of MIKAP Nigeria Limited. Benue state Nigeria
H_{02}: Lifecycle cost analysis has no significant effect on performance of MIKAP Nigeria Limited. Benue state Nigeria
H_{03}: Quality assurance has no significant effect on performance of MIKAP Nigeria Limited., Benue state Nigeria.

LITERATURE REVIEW

RESOURCE-BASED VIEW (RBV) THEORY

The Resource-Based View (RBV), introduced by Wernerfelt (1984) and expanded by Barney (1991), emphasizes that firms achieve sustainable competitive advantage through resources that are valuable, rare, inimitable, and non-substitutable (VRIN). In relation to value engineering (VE) at MIKAP Nigeria Limited, RBV highlights how internal capabilities such as process improvement, lifecycle cost analysis (LCCA), and quality assurance (QA) can be strategically leveraged to reduce costs and enhance performance. For instance, refining workflows and eliminating inefficiencies can transform processes into strategic assets (Gupta et al., 2021), while LCCA ensures long-term efficiency (Johnson & Lee, 2023), and QA builds inimitable quality standards (Williams & Adams, 2023).

LEAN THEORY

Lean Theory, originating from the Toyota Production System and advanced by Taiichi Ohno in the 1950s, focuses on maximizing value by eliminating waste and improving efficiency (Ohno, 1988; Cudney & Elrod, 2010). Its principles, originally applied in automobile manufacturing, have since been extended to various industries, making it highly applicable to project management at MIKAP Nigeria Limited. Thus, through reducing redundant activities, streamlining processes, and fostering continuous improvement, Lean principles align with VE proxies such as process improvement and quality assurance to deliver cost reductions and enhanced outcomes (Womack & Jones, 2003). However, Lean can

overemphasize cost reduction at the expense of innovation and broader strategic issues (Bicheno & Holweg, 2021). Despite these limitations, Lean remains a practical and relevant framework, offering MIKAP Nigeria Limited an approach for embedding efficiency, strengthening quality, and achieving performance improvements through the integration of VE practices.

SYSTEMS THEORY

Systems Theory, developed by Ludwig von Bertalanffy in the mid-20th century, views organizations as interconnected systems where the performance of the whole depends on the interactions of its parts (von Bertalanffy, 1968). Applied to VE in MIKAP Nigeria Limited, Systems Theory provides a holistic lens for understanding how process improvement, lifecycle cost analysis, and quality assurance interact to influence project efficiency and organizational performance. This approach enables identification of systemic inefficiencies and supports integrated cost reduction strategies, making it particularly relevant to project management (Skyttner, 2005). Although its complexity is a limitation in dynamic firms, Systems Theory offers a valuable framework for aligning VE proxies to achieve sustainable performance, resilience, and adaptability in Nigeria's evolving business environment.

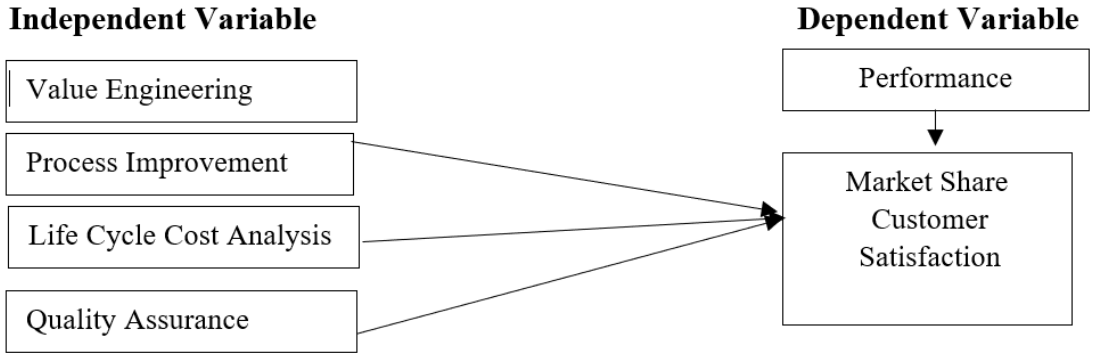
CONCEPTUAL FRAMEWORK

The conceptual framework for the application of Value Analysis (VA) and Value Engineering (VE) in project cost reduction includes a systematic and integrated approach to optimize project outcomes. This framework draws from the foundational principles of VA and VE, emphasizing their collective impact on enhancing value while minimizing costs throughout the project lifecycle.

VALUE ENGINEERING

Value Engineering has its origin at the General Electric Company (GEC). As a result of World 'War II, many materials were in short supply and Miles was associated with a committee to identify substitute materials without sacrifice in quality and performance. He organised a formal methodology in which a team of people examined the functions of products manufactured by GEC. Through team-oriented creative techniques they made changes in products to lower their cost without affecting their utility and quality. This methodology was given the name Value Analysis (VA). Miles who wrote his book in 1961 is generally recognised as the father of Value Engineering. Miles found that many of the substitutes used were providing equal or better performance at lower costs (Ugwu, 2023). Miles defined Value Analysis in his book Techniques of Value Analysis and Engineering (1961) as "an organised creative approach which has for its purpose the efficient identification of unnecessary cost i.e., cost which provides neither quality, nor use, nor life, nor appearance, nor customer features".

Relationship between dependent and independent variable



Source: *Researcher's Idea, 2025*

The dimensions of value engineering namely; process improvement, lifecycle cost analysis (LCCA), and quality assurance (QA), represent complementary approaches to enhancing organizational performance. Process improvement, first introduced by Harrington (1991), is a deliberate, gradual management strategy aimed at systematically enhancing efficiency and effectiveness through methods such as Kaizen, quality management, and logistics, while involving all employees in achieving incremental gains without radically restructuring operations (Brajer-Marczak, 2019; Ugwu, 2023). LCCA, developed in the 1960s by the U.S. Department of Defense, evaluates the total cost of ownership of a project or asset over its entire lifecycle including acquisition, operation, maintenance, and disposal thereby enabling decision-makers to compare alternatives based on long-term cost-effectiveness and sustainability rather than upfront expenditure (Sanodiya & Rathore, 2024). Finally, QA, rooted in total quality management (TQM), is the systematic monitoring of processes to ensure that quality standards are consistently met, focusing on customer satisfaction, prevention of errors, and continuous improvement while also protecting organizational reputation and competitiveness in global markets (Khan & Qazi, 2024).

Collectively, these dimensions emphasizes value engineering's role in driving cost efficiency, sustainability, and quality excellence.

CONCEPT OF FIRM PERFORMANCE

For all firms/organizations and individuals, performance is a critical issue. Holsapple and Wu (2011) posit that the main driver of firm performance is a set of unique resources that are valuable, rare, difficult to imitate, and irreplaceable by other resources. Furthermore, successful organizational performance is the key to gaining a competitive edge. Firm performance is a subjective perception of reality, which explains the multitude of critical reflection on the concept and its measuring instruments. This is proxied by market share and customer satisfaction in this study. Firms with higher market shares often enjoy stronger reputations, bargaining power, and profitability (Grewal, Johnson, & Sarker, 2022). Customer satisfaction reflects the extent to which products or services meet or exceed customer expectations and remains a key driver of loyalty, repeat purchase, and long-term profitability.

REVIEW OF RELATED EMPIRICAL STUDIES

Sudarso (2023) investigated the application of value engineering in the development of the Kalituwuh Bridge in East Java using the VE job plan stages of information, creativity, analysis, development, and recommendation. The study achieved a cost reduction from Rp. 1,610,387,678.72 to Rp. 608,902,000.00, representing a 62% saving. However, it overlooked the qualitative implications of the project such as community and environmental impacts.

Hossam et al. (2023) examined the impact of value engineering on cost reduction in high-rise buildings in Egypt through a questionnaire survey of 196 participants, analyzed statistically and with factor analysis. The findings revealed 18 cost factors, with the most critical being scarcity of experts, lack of awareness, absence of standards, and insufficient investment. The study, though thorough quantitatively, lacked depth in qualitative exploration such as case studies or interviews.

Medhat et al. (2023) presented a case study of educational buildings in Libya, specifically School Model 15 in Al-Khums City, applying value engineering principles to construction. The results indicated savings of 20–30%, with up to 30% of funds preserved for EFA projects. Nonetheless, the work provided limited discussion of the specific techniques employed and their broader effects on project performance.

Oladigbolu et al. (2022) assessed the use of value engineering in Lagos State, Nigeria, through structured questionnaires based on the Yataro (1967) framework. The results showed that while respondents acknowledged the benefits of value engineering, challenges such as skill shortages and assessment issues hindered its effectiveness. The study could have been strengthened by stronger theoretical grounding, real-world case studies, and more robust data methods.

Mthembu (2022) evaluated the role of value engineering in South African construction firms using a mixed-methods approach combining cost analysis with interviews. The findings demonstrated a 12% cost reduction along with improvements in delivery time and stakeholder satisfaction. However, the study was limited to Nsovo Construction, raising concerns about generalizability and possible biases from interview responses.

Suleiman (2021) explored the application of value engineering on the Lagos-Ibadan Expressway project using cost-benefit analysis. The study reported cost savings of 15–20% while maintaining or improving quality. Yet, it failed to incorporate considerations of long-term maintenance costs, which are crucial for infrastructure projects of such magnitude.

Ozcan-Deniz and Ramirez (2021) studied industry applications of value engineering in construction through a combination of literature review, surveys, and interviews with contractors in the Northeastern United States. Their results suggested that value engineering is motivated primarily by cost savings, life cycle value, and enhanced collaboration.

However, reliance on self-reported data may have introduced bias into their conclusions.

Ahmed (2021) examined the role of value engineering in reducing the cost of governmental housing construction using a mixed-methods approach that integrated inductive reasoning and computer-assisted VE analysis. The study achieved 30% savings and a 15% reduction in area while preserving design standards. Its limitation lay in the use of a single housing model, which reduces the applicability of the findings.

Mwangi (2021) investigated the application of value engineering in Kenyan construction firms through quantitative regression and descriptive statistics, focusing on Epco Builders Ltd. The study recorded a 15% cost reduction alongside improved time efficiency and quality. The scope, however, was restricted to one firm, thereby limiting the generalizability of the findings.

Sharma (2020) explored the effectiveness of value engineering in the Indian construction sector, using Gammon India Ltd. as a case. Employing both quantitative financial analysis and qualitative interviews, the study found an 18% reduction in costs through optimized design and material selection. Still, the reliance on interview data introduced subjectivity and potential bias.

Chirag et al. (2020) applied value engineering principles to construction projects using Pareto analysis and the VE job plan to identify high-cost functions. The results emphasized improvements in management efficiency and project outcomes. Despite these insights, the study paid little attention to the long-term implications for sustainability and quality. Olawuyi (2019) investigated value engineering practices in Nigeria through oral interviews and a literature review. The findings indicated that the practice is poorly recognized, with savings often below 25% and a tendency to apply VE reactively rather than proactively. The small interview base, however, raises concerns about whether the findings represent broader industry trends.

Nnolum (2019) examined value engineering applications in Abia State, Nigeria, using triangulated data from questionnaires and case studies. The study found that VE is rarely applied and proposed a BIM-VE framework to automate 4D processes and enhance decision-making. While promising, the framework requires broader validation and adoption in practice.

Olukoya (2018) investigated the impact of value engineering on cost reduction and performance in Nigerian construction projects, focusing on Dutum Company. Through quantitative cost-benefit and performance analysis, the study demonstrated a 20% cost reduction and improved performance. Nevertheless, the findings are limited to one company in Lagos and may not capture the diversity of contexts across Nigeria.

Ahmed et al. (2017) analyzed the role of value engineering in infrastructure projects delivered via public-private partnerships, adopting an inductive approach. They found that while VE offers benefits, its application within PPP projects remains limited. The study called for deeper examination of these limitations but did not propose practical alternatives.
Rane and Attarde (2016) applied value engineering principles to a commercial building project, focusing on new materials and construction techniques. The case study showed improvements in durability, process time, and feasibility. Despite the positive outcomes, the study lacked robust data analysis and discussion of implementation challenges.

Bínová (2014) discussed the use of value engineering in the design and implementation of a logistics centre, analyzing qualitative aspects of project planning. The findings highlighted VE's ability to balance functionality, quality, safety, and cost. Still, the work did not provide empirical data or validation through real-life cases.

Senay and Niyazi (2013) examined the application of value engineering in the Bregana-Zagreb-Dubrovnik Motorway project managed by the BECHTEL–ENKA joint venture. Their analysis revealed savings of \$43 million and a reduction of 12 months in project duration, amounting to 6% financial savings and 17% work time reduction. However, the study did not specify the exact VE techniques responsible for these achievements.

METHODOLOGY

RESEARCH DESIGN

A survey design was used in this study through questionnaire administration. Survey design allows the collection of a large amount of data from a sizeable population in a highly economical way. This design was therefore suitable for explaining the existing status of the variables of this study at the given point in time.

STUDY AREA

The area of study covered is Makurdi metropolis which is the commercial nerve of Benue State. The town was founded about 1927 when the railroad from Port Harcourt (279 miles) and (449 km) South-Southwest was extended to Jos and Kaduna, Makurdi rapidly developed into a transportation and market centre. Makurdi metropolis is one of the biggest commercial towns in Benue State and there are many educational institutions within the town.

POPULATION OF THE STUDY

The population of this study consists of one hundred and twenty-two staff (122) staff of MIKAP Nigeria Limited Makurdi. The choice of the population was informed by the need to have employees who would be in a better position to give credible information and provide reliable answers on the subject matter. The breakdown of the population as presented in Table 1.

Table 1: Population of Staff of MIKAP Nigeria Limited, Makurdi

S/N	Staff Category	Number of Staff
1	Management Staff	9
2	HODs	19
3	Unit Heads	32
4	Others	62
	Total	**122**

Source: Official Staff List of MIKAP Nigeria Ltd, 2019.

SAMPLE SIZE AND SAMPLING TECHNIQUES

In selecting the desired sample size for this research, a census sampling technique was employed since the population is manageable and the entire population of 122 serves as the sample size for the study.

INSTRUMENT OF DATA COLLECTION

Questionnaire was used as the instrument for data collection in this study. The structured questionnaire contained closed ended questions with two sections. The first section gathered information on respondents' personal data while the second section contained questions on the study variables. The questions were designed using a four point Likert-scale for measurement which ranged from strongly agree to strongly disagree (strongly agree=4, agree=3, disagree=2, strongly disagree=1).

VALIDITY OF INSTRUMENT

This study addressed two primary types of validity: content validity and construct validity. Content validity was assessed by gathering input from my supervisors and other expert in the field. Construct validity, on the other hand, was examined through the utilization of factor analysis, which considered statistical measures such as Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity to assess sampling adequacy. A pilot test was conducted using 30 percent of the sample size to establish the validity and reliability of the instrument as shown in Tables 1-4.

Table 2: Kaiser-Meyer-Olkin and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.947
Bartlett's Test of Sphericity	Approx. Chi-Square	6.036
	df	6
	Sig.	.000

Source: *SPSS Version 26 Result, 2024*

The validity of the instrument used in the study on the application of value engineering in project cost reduction on the performance of MIKAP Nigeria Limited, Benue State, Nigeria, is supported by the results of the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. The KMO value of 0.947 indicates an excellent level of sampling adequacy, suggesting that the items included in the instrument are suitable for factor analysis. This result suggests that the items are sufficiently correlated and that factor analysis is appropriate.

Table 4: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.407	35.185	35.185	1.407	35.185	35.185	1.361	34.037	34.037
2	1.256	31.406	66.591	1.256	31.406	66.591	1.302	32.554	66.591
3	.800	20.010	86.601						
4	.536	13.399	100.000						
Extraction Method: Principal Component Analysis.									

Source: *SPSS Version 26 Result, 2024*

Legend: PEF = Performance of MIKAP Nigeria Limited, PIP = Process improvement, LCA = Lifecycle cost analysis, QUA = Quality assurance

The first two components, with initial eigenvalues of 1.407 and 1.256, explain 35.185% and 31.406% of the variance, respectively. Together, these components account for 66.591% of the total variance. This cumulative percentage indicates that a substantial proportion of the dataset's variance can be explained by these two components, suggesting that they capture the majority of the variability in the data. The relatively lower eigenvalues for the third and fourth components, at 0.800 and 0.536, respectively, suggest that these components do not add significant additional explanatory power. Nonetheless, including all constructs in the study ensures a comprehensive assessment of the various dimensions of value engineering and its impact, providing a more holistic understanding of the factors influencing the company's performance.

RELIABILITY OF INSTRUMENT

Table 5: Reliability Statistics

Variables	Cronbach's Alpha
Performance of MIKAP Nigeria Limited (PEF)	0.854
Process improvement (PIP)	0.894
Lifecycle cost analysis (LCA)	0.813
Quality assurance (QUA)	0.838
Total	**0.850**

Source: *SPSS Version 26 Result, 2024*

Legend: PEF = Performance of MIKAP Nigeria Limited, PIP = Process improvement, LCA = Lifecycle cost analysis, QUA = Quality assurance

Performance of MIKAP Nigeria Limited (PEF) has a Cronbach's Alpha of 0.854, indicating a very good level of reliability. This suggests that the items measuring performance are consistently related and produce stable results. The Process Improvement (PIP) variable has the highest Cronbach's Alpha value of 0.894, which reflects excellent reliability. This high value indicates that the items under process improvement are highly consistent in measuring the same underlying construct. Lifecycle Cost Analysis (LCA) has a Cronbach's Alpha of 0.813, which also falls within the range of good reliability. This value indicates that the items assessing lifecycle cost analysis consistently reflect the construct, providing stable and reliable measures. Similarly, Quality Assurance (QUA) has a Cronbach's Alpha of 0.838, suggesting that the instrument's items are consistent in evaluating quality assurance aspects related to value engineering and project cost reduction. The overall Cronbach's Alpha value for the instrument is 0.850, which indicates a high level of internal consistency across all the variables measured. This value exceeds the commonly accepted threshold of 0.7, suggesting that the instrument is reliable.

METHOD OF DATA COLLECTION

Primary data for this study were collected through questionnaire administration. This method was chosen because it is famous and takes a snap shot of a population at certain times thereby permitting conclusion relating to phenomena in an immense population to be drawn. The researcher personally distributed the questionnaire to staff of MIKAP Nigeria Limited, Makurdi. This was done with the aid of two research assistants. The questionnaire was retrieved after successful completion by the respondents.

VARIABLE/ MODEL SPECIFICATION

This study is anchored on two major variables: the explanatory variable (value engineering) and the response variable (performance of MIKAP Nigeria Limited). In this study performance of MIKAP Nigeria Limited was regarded as a function of value engineering. Value engineering is proxied by process improvement, lifecycle cost analysis and quality assurance. Process improvement is measured as a dummy variable 1 if there is improvement and 0 if there is none. Lifecycle cost analysis = 1 if there is and 0 otherwise and quality assurance = 1 and 0 otherwise. The implicit form of the regression formula is represented below:

Implicit model

Logit Model specification

Performance = f (Value engineering) (i)

PEF = f (PIP, LCA, QUA) (ii)

Where:

PEF = Performance of MIKAP Nigeria Limited

PIP = Process improvement

LCA = Lifecycle cost analysis

QUA = Quality assurance

The explicit form of the logit regression model is as shown

$$\frac{\text{Log}\,(P(PEF=1)}{(1-P(PEF=1)} = \beta_0 + \beta_1 PIP + + \beta_2 LCA + \beta_3\, QUA + U_t \text{-} \quad \text{-} \quad \text{-} \quad (1)$$

P(PEF=1) = represents the probability of exceeding the performance benchmark.

β_0 = the intercept (constant)

β_1 - β_3 = Logit regression coefficients

A priori expectations: the signs for all the estimated variables in the model (β_1 - β_3) are expected to be positive.

DATA ANALYSIS TECHNIQUES

The study utilized binary logistic regression to estimate objectives one to three. The study's hypotheses were evaluated using the probability values of the estimates. The subsequent decision rules were implemented to determine the acceptance or rejection of hypotheses. If the probability value of estimate b_i, denoted as $p(b_i)$, is greater than the critical value, we can conclude that the null hypothesis is accepted. This means that we accept the notion that the estimate b_i is not statistically significant at the 5% level of significance. If the probability value of b_i, denoted as $p(b_i)$, is less than the critical value, we can reject the null hypothesis. In other words, we agree that the estimate b_1 is statistically significant at the 5% level of significance. The Hosmer-Lemeshow test will be conducted as a diagnostic test to assess the fitness of the model.

RESULTS AND DISCUSSION

Analysis of specific objective one to two was carried out in this section with the discussion of the logit regression result.

Table 11: Classification Table for Model

Observed		Predicted		
		PEF		Percentage Correct
		.00	1.00	
Step 0	PEF	.00	0	46	20.0
		1.00	0	76	80.0
	Overall Percentage				82.3
a. Constant is included in the model.					
b. The cut value is .500					

Source: SPSS Result, Version 27.0

Legend: PEF = Performance of MIKAP Nigeria Limited, PIP = Process improvement, LCA = Lifecycle cost analysis, QUA = Quality assurance

The classification table presents the results of a logistic regression model's initial classification, where only the constant is included (Step 0). The model predicts that all cases will have high performance (PEF = 1.00), leading to a correct classification of 76 cases with 80% accuracy for the high-performance group. However, it fails to classify any of the 46 cases with low performance (PEF = 0.00), resulting in only 20% accuracy for the low-performance group. The overall accuracy of the model is 82.3%, which is largely driven by the majority of the observations being in the high-performance category.

The implication of this result is that the model, without the inclusion of key predictors such as process improvement (PIP), lifecycle cost analysis (LCA), and quality assurance (QUA), is not effective at distinguishing between different levels of performance. While the overall accuracy may seem high, this is misleading because the model is biased towards predicting the majority outcome (PEF = 1.00). To improve its predictive power and make more meaningful classifications, the inclusion of these independent variables is necessary, as they will help the model better capture the factors that contribute to both high and low performance in MIKAP Nigeria Limited.

Table 13: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	124.706[a]	.261	.356
a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.			

Source: SPSS Result, Version 27.0

Legend: PEF = Performance of MIKAP Nigeria Limited., PIP = Process improvement, LCA = Lifecycle cost analysis, QUA = Quality assurance

Table 13 shows that the -2 Log Likelihood value is 124.706, indicating the goodness of fit for the model; lower values suggest a better fit. The model terminated at the fifth iteration, meaning that the parameter estimates stabilized early in the estimation process, as changes were less than 0.001. The Cox & Snell R Square value of 0.261 and the Nagelkerke R Square value of 0.356 indicate the amount of variation in PEF explained by the independent variables. While the Cox & Snell R Square value suggests that 26.1% of the variability in PEF is explained by the model, the Nagelkerke R Square value, which adjusts for the scale of the model, shows a higher explanatory power of 35.6%. The implications of these findings suggest that the independent variables, such as PIP, LCA, and QUA, provide moderate explanatory power for predicting the performance of MIKAP Nigeria Limited. While the model explains 35.6% of the variance in performance, there is still a some unexplained variability, indicating that additional factors might be influencing the company's performance. For the study, this means that the predictors used in the model contribute significantly to understanding the performance.

Table 14: Hosmer and Lemeshow Test for Model

Step	Chi-square	df	Sig.
1	3.743	6	.711

Source: SPSS Result, Version 26.0

Legend: PEF = Performance of MIKAP Nigeria Limited., PIP = Process improvement, LCA = Lifecycle cost analysis, QUA = Quality assurance.

The Hosmer and Lemeshow Test presented in Table 14 evaluates the goodness of fit for the logistic regression model used in the study. In this case, the Chi-square value is 3.743 with 6 degrees of freedom, and a significance level (p-value) of 0.711. A high p-value, such as this (greater than 0.05), indicates that the model fits the data well, as the null hypothesis that the observed data match the expected data is not rejected. This suggests that the predictors, which include Process Improvement (PIP), Lifecycle Cost Analysis (LCA), and Quality Assurance (QUA), adequately explain the variations in the Performance of MIKAP Nigeria Limited. (PEF). The implications of these findings are significant for the study. Since the model fits well, it implies that the identified predictors (PIP, LCA, and QUA) are appropriate factors for assessing the performance of MIKAP Nigeria Limited. The good fit further indicates that future process improvements, lifecycle cost analysis, and quality assurance measures can be reliably used to enhance organizational performance.

Table 15: Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	36.969	3	.000
	Block	36.969	3	.000
	Model	36.969	3	.000

Source: SPSS Result, Version 26.0

Legend: PEF = Performance of MIKAP Nigeria Limited, PIP = Process improvement, LCA = Lifecycle cost analysis, QUA = Quality assurance

Table 15 presents the results from the Omnibus Tests of Model Coefficients, which assess the overall significance of the logistic regression model used in the study. The Chi-square value of 36.969 with 3 degrees of freedom is statistically significant, with a p-value of 0.000 for the Step, Block, and Model. This highly significant p-value indicates that the predictors, Process Improvement (PIP), Lifecycle Cost Analysis (LCA), and Quality Assurance (QUA) collectively contribute to explaining variations in the Performance of MIKAP Nigeria Limited (PEF). The model is thus significantly better than a model with no predictors, confirming that the independent variables have a meaningful impact on the dependent variable.

The implications of these findings are crucial for the study. The significance of the model shows that improvements in PIP, LCA, and QUA are likely to lead to significant enhancements in the performance of MIKAP Nigeria Limited. This confirms the relevance of focusing on these areas to achieve better performance outcomes. The model's ability to explain variation in performance suggests that management should prioritize these factors when seeking ways to drive organizational growth and efficiency.

Table 16: Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	PIP	-1.235	.484	6.505	1	.011	.291	.113	.751
	LCA	-1.733	.564	9.444	1	.002	.177	.059	.534
	QUA	1.652	.461	12.846	1	.000	5.216	2.114	12.871
	Constant	1.575	.677	5.404	1	.020	4.828		
a. Variable(s) entered on step 1: PIP, LCA, QUA.									

Source: SPSS Result, Version 27.0

Legend: PEF = Performance of MIKAP Nigeria Limited. PIP = Process improvement, LCA = Lifecycle cost analysis, QUA = Quality assurance

HYPOTHESES TESTING

This section discusses the testing of hypotheses of the study on the effect of the independent variables on the dependent variable of the study. Based on the p-values in the table, the following decisions can be made at the 5% level of significance:

H_{01}: *Process improvement has no significant effect on performance of MIKAP Nigeria Limited. Benue state Nigeria*.

For H_{01} Process improvement has no significant effect on the performance of MIKAP Nigeria Limited.), the p-value is 0.011, which is less than 0.05. Therefore, we reject the null hypothesis (H_{01}) and conclude that process improvement has a significant effect on the performance of MIKAP Nigeria Limited.

H02: *Lifecycle cost analysis has no significant effect on performance of MIKAP Nigeria Limited. Benue state Nigeria*

For H_{02} (Lifecycle cost analysis has no significant effect on the performance of MIKAP Nigeria Limited.), the p-value is 0.002, which is also less than 0.05. Thus, we reject the null hypothesis (H_{02}) and conclude that lifecycle cost analysis significantly affects the performance of MIKAP Nigeria Limited.

H03: *Quality assurance has no significant effect on performance of MIKAP Nigeria Limited., Benue state Nigeria*.

For H_{03} (Quality assurance has no significant effect on the performance of MIKAP Nigeria Limited.), the p-value is 0.000, which is much less than 0.05. Hence, we reject the null hypothesis (H_{03}) and conclude that quality assurance has a significant effect on the performance of MIKAP Nigeria Limited.

EFFECT OF PROCESS IMPROVEMENT ON PERFORMANCE OF MIKAP NIGERIA LIMITED., BENUE STATE NIGERIA.

The result of this study shows that process improvement has a negative but significant effect on the performance of MIKAP Nigeria Limited. This finding is somewhat at odds with the results of several empirical studies that highlight the positive impact of process improvement or value engineering on project performance and cost savings. For instance, studies by Sudarso (2023) and Hossam et al. (2023) found that the application of value engineering led to significant cost reductions and improved project outcomes in construction projects in Java and Egypt, respectively. These studies emphasize the importance of systematic approaches to optimizing resources, yet they focus primarily on cost reduction without necessarily addressing potential downsides to performance, which contrasts with the negative relationship found in this study.

Similarly, Medhat *et al.* (2023) and Oladigbolu et al. (2022) explored value engineering in the construction of educational buildings and projects in Lagos, revealing that implementing such techniques led to cost savings of up to 30% while maintaining or improving project quality. These studies align with the general understanding that process improvements and value engineering can optimize costs and performance. However, the negative relationship between process improvement and performance in the present study could suggest that the specific context of MIKAP Nigeria Limited. involves challenges or inefficiencies in implementing process improvements, which may be negatively impacting performance. The differences may stem from industry-specific factors or the particular methods used to achieve process improvements.

In contrast, Mthembu (2022) and Suleiman (2021) found that process improvement through value engineering positively impacted both project cost reduction and overall performance in South Africa and Nigeria. These studies highlight the significance of balancing cost with performance improvements, suggesting that when process improvement is well-managed, it should enhance, rather than diminish, organizational performance. The contradiction in results could indicate that MIKAP Nigeria Limited. may need to review how process improvements are implemented, as poor execution might lead to reduced effectiveness, which could explain the negative relationship observed in this study.

EFFECT OF LIFECYCLE COST ANALYSIS ON PERFORMANCE OF MIKAP NIGERIA LIMITED, BENUE STATE NIGERIA

The results of this study, which found a significant negative relationship between Lifecycle Cost Analysis (LCA) and the performance of MIKAP Nigeria Limited., align with several empirical studies on value engineering (VE) and cost management practices, though some contradictions exist. For example, Sharma (2020) and Chirag et al. (2020) both emphasize the effectiveness of VE techniques in reducing project costs and improving performance, similar to how poor LCA was found to negatively affect MIKAP's performance. Sharma's study, which highlighted an 18% cost reduction through optimized designs and efficient processes, echoes the importance of thorough cost analysis in driving performance. Similarly, Chirag et al. demonstrated the importance of cost reduction through identifying high-cost functions, which aligns with the current study's implication that inadequate cost analysis leads to performance setbacks. Conversely, the study by Ozcan-Deniz and Ramirez (2021) suggests that the effectiveness of value engineering may vary based on available resources and training, highlighting a potential limitation of cost analysis that is not deeply explored in the current study. Their findings on the variability of VE success imply that merely conducting LCA may not always guarantee improved performance unless other factors, such as staff competency and resource allocation, are also considered. Additionally, Mwangi (2021) supports the finding that value engineering can improve performance through cost reductions, but cautions that the focus on a single case study in Kenya may not fully represent broader industry practices. This mirrors the findings in the MIKAP study, where inadequate lifecycle cost management hampers performance, though the broader application in different contexts remains a topic for further exploration.

However, Ahmed (2021) and Olawuyi (2019) introduce slight contradictions by focusing on the contextual factors that might limit the effectiveness of cost management strategies. Ahmed's study in governmental housing found significant

cost reductions through value engineering, similar to the negative relationship found in this study. However, Ahmed also noted that reliance on a single governmental model limits generalizability, much like the current study's limitation to MIKAP Limited. Similarly, Olawuyi's study in Nigeria found that VE practices are not widely recognized, leading to less impactful cost savings, in contrast to the significant negative impact found in the current study. This difference in findings may point to contextual factors in Nigeria's industry that could affect the generalizability of MIKAP's results across different sectors or firms.

EFFECT OF QUALITY ASSURANCE ON PERFORMANCE OF MIKAP NIGERIA LIMITED. BENUE STATE NIGERIA

The results of this study demonstrate a significant positive relationship between Quality Assurance (QUA) and performance at MIKAP Nigeria Limited, indicating that quality assurance greatly enhances organizational performance. This aligns with findings from empirical studies like Rane and Attarde (2016), who highlighted that the application of value engineering techniques in construction projects enhances performance by improving process time and durability. Similarly, Senay and Niyazi (2013) also observed that value engineering principles applied during construction projects significantly improved performance and reduced costs, reinforcing the notion that quality-related interventions drive organizational success. However, while these studies emphasize the importance of quality and value engineering, their contexts differ as they focus more on the construction sector, unlike MIKAP, which is in the manufacturing sector.

On the other hand, studies such as Nnolum (2019) and Olukoya (2018) provide partial alignment with this study's findings. Nnolum's research on the application of value engineering in construction projects found that quality assurance frameworks could improve project outcomes. However, it also pointed out that such methodologies are underutilized in construction in Abia State, suggesting potential gaps in implementation that MIKAP Nigeria Limited may have successfully bridged. Olukoya (2018), while confirming the cost-saving benefits of value engineering and performance enhancement, specifically noted that the results were more prominent in larger, formal organizations like Dutum Construction Company, potentially limiting the generalizability of his findings across smaller-scale industries. This partial alignment indicates that while the role of quality assurance is universally recognized, its impact may vary across sectors and organizational sizes.

In contrast, the findings of Ahmed et al. (2017) and Bínová (2014) partly contradict this study's conclusions. Ahmed et al. found that while value engineering holds potential for improving performance in Public-Private Partnership (PPP) infrastructure projects, its full applicability remains constrained in certain contexts due to challenges like limited adaptability and industry-specific barriers. Similarly, Bínová (2014) emphasized that cost management through value engineering could enhance project value, but did not definitively link quality assurance with significant performance improvements, focusing instead on balancing quality, safety, and costs. These discrepancies suggest that while quality assurance is critical in MIKAP Nigeria Limited's case, its impact may not be as pronounced or straightforward in all industries or project types.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The study reveals that performance in MIKAP Nigeria Limited. is significantly influenced by several key factors, highlighting the importance of continuous improvement in operational processes, cost management, and quality assurance. Process improvement, despite being crucial for organizational success, demonstrates a negative relationship with performance in this context, suggesting that inadequate or inconsistent improvements can hinder progress. This underscores the necessity for companies to invest in and sustain efforts aimed at refining their processes to achieve long-term success. Lifecycle cost analysis emerges as a critical determinant of performance, with poor cost management practices being detrimental to the company's growth. The results highlight that neglecting a thorough cost analysis throughout the lifecycle of products or services can severely undermine performance. This finding emphasizes the need for businesses to adopt a more holistic and strategic approach to managing costs to avoid inefficiencies that could limit overall success. Finally, the study shows that strong quality assurance practices significantly boost performance, reflecting the essential role of quality management in driving organizational excellence. Ensuring high standards of quality control not only enhances operational efficiency but also contributes to better outcomes and competitive advantage. Therefore, MIKAP Nigeria Limited. and similar organizations should prioritize quality assurance as a core component of their business strategies to achieve sustainable performance improvements.

RECOMMENDATIONS

The following are the summary of the study based on the specific objectives of the study:

i. MIKAP Nigeria Limited. should prioritize consistent and structured efforts towards improving operational processes. Given the negative relationship between insufficient process optimization and performance, the company should invest in training, technology, and performance metrics to ensure continuous enhancement of processes, thereby minimizing inefficiencies and improving overall performance.

ii. To mitigate the adverse effects of poor cost management, MIKAP should implement a more thorough and systematic approach to lifecycle cost analysis. This involves evaluating the long-term costs of products and services to identify potential savings and improve resource allocation, ultimately driving better performance outcomes.
iii. MIKAP should emphasize quality assurance as a central part of its operational strategy. Ensuring rigorous standards and frequent evaluations will not only enhance performance but also provide a competitive edge in the market. The positive relationship between quality assurance and performance highlights the importance of maintaining high-quality outputs to sustain organizational success.

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