EFFECT OF VALUE ENGINEERING ON PROFITABILITY OF QUOTED MANUFACTURING FIRMS IN NIGERIA

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Abstract: This study ascertained the effect of Value Engineering on Profitability of quoted manufacturing firms in Nigeria for a period of thirteen (13) years spanning from 2008 to 2020. Specifically, this studied examined the effect of Target Costing, Kaizen Costing, and Life Cycle Costing on Return on Assets. Purposive sampling technique was employed to select a sample of twenty two (22) manufacturing companies from a population of forty-eight (48) quoted manufacturing companies in Nigeria. Correlational survey design and ex-post facto research design were adopted. Purposive and simple random sampling techniques were used to select a sample of twenty two (22) manufacturing companies and 149 staff of the sampled firms. Panel data were used in this study, which were obtained from the annual reports and accounts of sample firms for the periods 2008-2020. Descriptive statistics of the dataset from the sample firms were described using the mean, standard deviation, minimum and maximum values of the data for the study variables. Inferential statistics using Pearson correlation coefficient, Panel least square regression analysis and Hausman test were applied to test the hypotheses of the study. The results showed that Target Costing, Kaizen Costing, and Life Cycle Costing have a significant and positive effect on Return on Assets of quoted manufacturing firms in Nigeria at 5% significant level respectively. This study recommended amongst others that Value engineering should be inculcated in the organization culture of companies so as enable them effectively put value engineering job plan into use for improved profitability without sacrificing the value to be derived by the customers.

Keywords: Target Costing, Kaizen Costing, Life Cycle Costing, Return on Assets

Background of the Study

In the present era of globalization and trade liberalization, organizations are facing rapid advances in technology and scarcity of resources, thus they are expected to be innovative in order to be effective, grow and survive. Value creation can be developed through new products and services and this can be achieved by meeting customers' specific requirements, as they consider value as something worth paying for. Value creation is the creative invention of new products and services to delight consumers by discovering new market spaces and thus increasing the utility that they draw from them. Innovation and product development are the core activities in the value creation process (Iliemena, Goodluck & Amahalu, 2019). To create value, organizations need to be competitive and hence, it is essential that organizations continuously manage their costs and maintain better quality products that meet customers' changing needs and desires. If these are not achieved, organizations will not be able to survive nor sustain their position in the competitive market. Therefore, industries must increasingly display competitive characteristics which should stimulate the use of cost reduction and prevention techniques such as value engineering (VE). Value Engineering relates to a systematic and multi-disciplinary team approach adopted by organizations to solve problems in terms of value of product or service from the consumer's point of view. As such, value engineering is considered to be an innovative tool that enables firms to sustain their business performance. This is because, value engineering aims to achieve the essential business functions at the lowest overall cost while maintaining customers' optimum value assurance. Despite being viewed as a management accounting tool by accounting researchers, value engineering is commonly applied for cost optimization in the manufacturing, engineering and technical field. As organizations seek to maximize profitability, they utilize various business strategies and techniques to ensure that the objective is achieved. With the current competitive and fast pace dynamic environment, every organization strive to maintain it customers based, and also gain competitive advantage over its competitors by providing goods that are of value to the customers (Amahalu, Egolum & Obi, 2019).

The divergence of theoretical views on the link between value engineering and profitability is manifested in extant empirical literatures. One stream of empirical literature reported negative relationship between target costing and profitability (Ologbenla, 2021; Al-Dhubaibia 2021; Amahalu, Agbionu and Obi, 2017). The second stream reported positive influence of kaizen costing on profitability (Xiaojuan Li, Chen Wang & Ali Alashwal 2021). while the third stream of literature has found evidence of a non-linear effects (Kosala & Karunasena, 2015). These conflicting empirical results may be explained by differences in target populations with respect to country, sector, company and financial periods, application of varied methodological approaches as well as differences in the response (dependent) variables that measure value engineering, thereby creating a gap that this study attempted to address.

Objectives of the Study

The main objective of this work is to determine the effect of Value Engineering on Profitability of quoted manufacturing firms in Nigeria. The specific objectives are to:

i. Ascertain the effect of Target Costing on Return on Assets of quoted manufacturing firms in Nigeria.
ii. Determine the effect of Kaizen Costing on Return on Assets of quoted manufacturing firms in Nigeria.
iii. Evaluate the effect of Life Cycle Costing on Return on Assets of quoted manufacturing firms in Nigeria

Research Hypotheses

The following null hypotheses were formulated in this study:

Ho_1: Target Costing has no significant effect on Return on Assets of quoted manufacturing firms in Nigeria.
Ho_2: Kaizen Costing has no significant effect on Return on Assets of quoted manufacturing firms in Nigeria.
Ho_3: Life Cycle Costing has no significant effect on Return on Assets of quoted manufacturing firms in Nigeria.

Conceptual Review

Value Engineering

Value engineering is a systematic and organized approach to providing the necessary functions in a project at the lowest cost. Value engineering promotes the substitution of materials and methods with less expensive alternatives, without sacrificing functionality. It is focused solely on the functions of various components and materials, rather than their physical attributes. Value engineering is also called value analysis. Value engineering is an approach to productivity improvement that attempts to increase the value obtained by a customer of a product by offering the same level of functionality at a lower cost.

Target Costing

Target costing is a management technique wherein prices are determined by market conditions, taking into account several factors, such as homogeneous products, level of competition, no/low switching costs for the end customer, etc. When these factors come into the picture, management wants to control the costs, as they have little or no control over the selling price (Okoye, Okoye, Amahalu & Obi, 2014). Target costing is an approach to determine a product's life-cycle cost which should be sufficient to develop specified functionality and quality, while ensuring its desired profit. It involves setting a target cost by subtracting a desired profit margin from a competitive market price (Goddard, Molyneux, & Wilson, 2019). Target costing is a system under which a company plans in advance for the price points, product costs, and margins that it wants to achieve for a new product. If it cannot manufacture a product at these planned levels, then it cancels the design project entirely. With target costing, a management team has a powerful tool for continually monitoring products from the moment they enter the design phase and onward throughout their product life cycles. It is considered one of the most important tools for achieving consistent profitability in a manufacturing environment (Mbonu & Amahalu, 2021b).

Kaizen Costing

Kaizen costing is a cost reduction system. Kaizen costing is the maintenance of present cost levels for products currently being manufactured via systematic efforts to achieve the desired cost level. The word kaizen is a Japanese word meaning continuous improvement. Kaizen costing is the process of continual cost reduction that occurs after a product design has been completed and is now in production. Cost reduction techniques can include working with suppliers to reduce the costs in their processes, or implementing less costly re-designs of the product, or reducing waste costs. These reductions are needed to give the seller the option to reduce prices in the face of increased competition later in the life of a product (Amahalu & Obi, 2020a).

Life Cycle Costing

Life cycle costing is the process of compiling all costs that the owner or producer of an asset will incur over its lifespan. In the engineering and production areas, life cycle costing is used to develop and manufacture goods that will have the least **cost** to the customer to install, operate, maintain, and dispose of (Agarwal, 2020). Life-cycle cost analysis (LCCA) is a tool to determine the most cost-effective option among different competing alternatives to purchase, own, operate, maintain and, finally, dispose of an object or process, when each is equally appropriate to be implemented on technical grounds. For example, for a highway pavement, in addition to the initial construction cost, LCCA takes into account all the user costs, (e.g., reduced capacity at work zones), and agency costs related to future activities, including future periodic maintenance and rehabilitation. All the costs are usually discounted and total to a present-day value known as net present value (NPV).

Profitability

Profitability is ability of a company to use its resources to generate revenues in excess of its expenses. In other words, this is a company's capability of generating profits from its operations. Profitability is the metric used to determine the scope of a company's profit in relation to the size of the business. Profitability is a measurement of efficiency and ultimately its success or failure. Profitability is a business's ability to produce a return on an investment based on its resources in comparison with an alternative investment (Ogbodo, Amahalu & Abiahu, 2017). Profitability is the primary goal of all business ventures. Without profitability the business will not survive in the long run. So measuring current and past profitability and projecting future profitability is very important. Profitability is ability of a company to use its resources to generate revenues in excess of its expenses.

Return on Assets

Return on assets (ROA) is a financial ratio that shows the percentage of profit a company earns in relation to its overall resources. Return on assets (ROA) is an indicator of how profitable a company is relative to its total assets. ROA gives a manager, investor, or analyst an idea as to how efficient a company's management is at using its assets to generate earnings. Return on assets is displayed as a percentage (Amahalu & Obi, 2020). Return on assets is a profitability ratio that provides how much profit a company is able to generate from its assets. Return on assets (ROA) measures how efficient a company's management is in generating earnings from their economic resources or assets on their statement of financial position. ROA is shown as a percentage, and the higher the number, the more efficient a company's management is at managing its statement of financial position to generate profits (Oshiole, Elamah & Amahalu, 2020).
ROA = Net income/ Total Assets

Value Engineering and Profitability

It has become compulsory for today's companies to reach product-related cost, time, quality and functionality targets at the same time and at the maxi-mum level possible; in order for them to develop sustainable competitive advantage through producing quality and functional products as demanded by the customers over a price determined by the mar-ket, and to maintain their existence in the ever-changing environment. This compulsion, on one hand, requires planning and control of the cost prices of the products and services to continuously decrease them, and on the other hand, aggravates profit and cost planning. This situation has revealed the concept of market-oriented product development and strategic cost management, and in order to achieve this, various

methods and techniques have been developed and put into practice (Tom-West, Okoye & Amahalu, 2021). During the target costing process, the enterprises must do product and profit planning in consequence of the market research after the determination of the customer needs, suitable product features and the estimated sales volume and price, and before passing to the design stage. These plans will be the basis for the determination of the target costs of the products. For this reason, the results regarding whether the participating enterprises do long-term product and profit planning which is one of the fundamental requirements of target costing process, and the degree of application are important. The results regarding the determination of target costs and the use of cross-functional teams for cost reduction operations and the usage degree by the enterprises included in extant literature has a lacuna between target costing and profitability. Nzekwe, Okoye & Amahalu, 2021; Gagne & Discenza (2018) found a positive relationship between target costing and profitability. Contrarily, Dekker, and Smidt (2016) found a significant negative relationship between target costing and profitability.

Theoretical Framework

Resource-Based View (RBV) Theory

The resource-based view (RBV) is a managerial framework used to determine the strategic resources a firm can exploit to achieve sustainable competitive advantage. Barney (1991) introduced the concept of the resource-based view (RBV) to address the limitations of environmental models of competitive advantage and attempts to provide a link between heterogeneous resources controlled by an organization, mobility of the resources within the particular industry and the strategic or competitive advantage enjoyed by an organization. A firm's resources are used to enable it to establish strategies to improve the overall efficiency and performance of the organization and these can be quite wide ranging. The resource-based view (RBV) is a way of viewing the firm and in turn of approaching strategy. Fundamentally, this theory formulates the firm to be a bundle of resources. It is these resources and the way that they are combined, which make firms different from one another. It is considered as taking an inside-out approach while analysing the firm. This means that the starting point of the analysis is the internal environment of the organization. Resources of the firm can include all assets, capabilities, organizational processes, firm attributes, information and knowledge (Mbonu & Amahalu, 2021a)..

Empirical Review

Peter and Mbah (2020) examined the effect of time management on organizational productivity in the manufacturing industry, using three manufacturing firms from the senatorial zones of Anambra state as a case study. Survey research design was adopted and questionnaire was used for data collection. 560 employees which was the population of study were the survey respondents. The study established the fact that effective time management is an essential factor and a great tool that enables a firm manage its financial future and improve productivity.

Danku and Antwi (2020) examined the effect of value engineering on Road Projects in Ghana. This study employed a two-stage research procedure: desk study and field research. A quantitative survey research design based on a purposive sampling technique of selecting respondents was adopted. Employing closed-ended questions, 40 sets of questionnaire were issued to professionals on Road Infrastructure and Support Agencies (RISA) under the Ministry of Roads and Highways (MRH) in the Eastern Region of Ghana. At a response rate of 85%, descriptive statistical analysis (Means, Standard Deviations and Variances) and inferential statistical analysis of variance (ANOVA) test were used to process the data. The results revealed that value engineering positively affect the performance of road construction.

Ologbenla (2021) investigated the effect of standard costing on financial performance of quoted manufacturing firms in Nigeria. A total of 158 questionnaires were distributed, but 152 respondents completed and returned the questionnaire. The results showed that standard costing has a negative effect of return on equity of sampled firms manufacturing firms in Nigeria.

Li, Wang and Alashwal (2021) determined how value engineering relates with business performance in China in 2020. The data were collected through document analysis, interviews, and a questionnaire survey targeted on the esearch participants. The findings showed that the integration of value engineering facilitated design modification and information extraction such as cost data. The findings showed value engineering has a non-significant effect

on business performance

Methodology

Research design

This study adopted the correlational survey research design which involves the use of questionnaire structured on a five point likert scale ranging from strongly agree to strongly disagree. While *ex-post facto* research design was also employed to determine the cause-effect relationship among the variables of the study (Kothari & Garg, 2014).

Population of the Study

The population of this study comprised all the forty-eight (48) quoted manufacturing companies trading on the floor of the Nigeria stock exchange as at 31st December 2020. This is categorized into four (4) sectors, consisting of Consumer goods firms (20); Industrial Goods firms (13); Agriculture (5); Healthare (10) (see appendix I). This study covered a thirteen (13) year period ranging from 2008-2020. The population element is two hundred and thirty two (232) staff which consists of 48 production managers, 118 Chartered Accountants and 66 Certified Accountants from the respective head offices.

Sample Size and Sampling Technique

The sample size for this study comprised twenty two (22) companies (see appendix I). Purposive sampling method was employed based on the companies that consistently filed their annual financial statements with the Nigerian Stock Exchange (NSE) for the period of interest (2008-2020). Considering the fact that primary data were equally utilised, simple random sampling was also employed because each and every item in the population has the same probability of being selected. From the retrieved questionnaire, 29 copies were from production managers; 76 from Chartered Accountants and 44 copies were from Certified Accountants, thereby making the sample size to be 149. Copies of the questionnaire were rated on a 5-point Likert skill scale ranging from 5 (strongly agree) to 1 (strongly disagree)

Source of Data

Both primary data and secondary data were employed in this study. The secondary data were generated from Nigeria Stock Exchange fact books and annual reports and statement of accounts of sample manufacturing firms in Nigeria from 2008-2020. The primary data were obtained from the respondents through the administration of questionnaire. The questionnaire was divided into two parts. Part A focused on the respondents. The part B was designed into 5 (five) point Likert scale related to the objectives of the study.

Model Specification

The model for this study would be adapted from the work of Amahalu, Nweze and Obi (2017):

$ROA = \beta_o + \beta_1 BFA + LEV + FSZ + \mu$

Where:

ROA = return on assets (dependent variable)
BFA = back flush accounting (explanatory/independent Variable)
LEV = leverage
FSZ = firm size
β_0 = constant term (intercept)
β_1 = coefficients of back flush accounting
μ = Error term (stochastic term)

The constructs for the model of this study would be:

Profitability = *f* (value engineering) + μ

Representing the equations with the variables of the construct, hence the equations below were formulated:

$ROA_{it} = \beta_0 + \beta_1 TGTC_{it} + \beta_2 ASTANG_{it} + \beta_3 LEV_{it} + \mu_{it}$ - **Ho_1**

$ROA_{it} = \beta_0 + \beta_1 KZNC_{it} + \beta_2 ASTANG_{it} + \beta_3 LEV_{it} + \mu_{it}$ - - **Ho_2**

$ROA_{it} = \beta_0 + \beta_1 LCC_{it} + \beta_2 ASTANG_{it} + \beta_3 LEV_{it} + \mu_{it}$ - - **Ho_3**

Where:

β_0 = Constant term (intercept)
β_{it} = Coefficients to be estimated of firm i in period t
μ_{it} = Error term/Stochastic term of firm i in period t
ROA_{it} = Return on Assets of firm i in period t
$TGTC_{it}$ = Target Costing of firm i in period t
$KZNC_{it}$ = Kaizen Costing of firm i in period t
LCC_{it} = Life Cycle Costing of firm i in period t
$ASTANG_{it}$ = Asset Tangibility of firm i in period t
LEV_{it} = Leverage of firm i in period t

Operational Definition of Key Model of Variables

Dependent Variable

Profitability which serves as the dependent variable of this study was measured by:
ROA = Net income/ Total Assets

Independent Variable

The independent variable of this study is Value Engineering. Three proxies of Value Engineering were adopted in this study:

i. Target Costing: The information was extracted from 5 (five) point Likert scale questionnaire
ii. Kaizen Costing: The information was extracted from 5 (five) point Likert scale questionnaire
iii. Life Cycle Costing: The information was extracted from 5 (five) point Likert scale questionnaire

Control Variables

Asset Tangibility = Total assets – Intangible Assets – Total liabilities

- **Total assets** include tangible and intangible assets and can be found on a company's balance sheet.
- **Intangible assets** are those that lack a physical form – such as goodwill, trademarks, copyrights.
- **Total liabilities** include current and non-current liabilities and can be found on a company's balance sheet.

Leverage = $\frac{\text{Total Debt}}{\text{Total Equity}}$

Data Presentation and Analysis

Table 1: Pearson Correlation Matrix

	ROA	TGTC	KZNC	LCC	ASTANG	LEV
ROA	1.0000					
TGTC	0.0289	1.0000				

KZNC	-0.1439	0.2214	1.0000			
LCC	0.4498	-0.1166	-0.2850	1.0000		
ASTANG	0.2704	0.2237	0.2470	0.2518	1.0000	
LEV	-0.0235	0.1234	-0.2032	0.0736	-0.5059	1.0000

Source: E-Views correlation output, 2021

Interpretation of Pearson Correlation Matrix

From the findings on the correlation analysis in table 1, the study found that there was positive correlation coefficient between ITGTC, LCC, ASTANG and ROA by correlation factors of 0.0289, 0.4498 and 0.2704. On the other hand a negative relationship exists between KZNC (-0.1439), LEV (-0.0235) and ROA respectively.

Test of Hypotheses

Test of Hypothesis I

Ho_1: Target Costing has no significant effect on Return on Assets of quoted manufacturing firms in Nigeria.
H_1: Target Costing has significant effect on Return on Assets of quoted manufacturing firms in Nigeria.

Table 2 Panel Least Square Regression Analysis between Target Costing and ROA

Dependent Variable: ROA
Method: Panel Least Squares
Date: 10/08/21 Time: 05:48
Sample: 2008 2020
Periods included: 13
Cross-sections included: 22
Total panel (balanced) observations: 286

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.984849	0.089692	10.98038	0.0000
TGTC	0.321710	0.145541	2.210446	0.0279
ASTANG	0.039477	0.090848	0.434536	0.6642
LEV	-0.043893	0.023950	-1.832660	0.0679

R-squared	0.013251	Mean dependent var	0.933683
Adjusted R-squared	0.002754	S.D. dependent var	0.697322
S.E. of regression	0.696361	Akaike info criterion	2.127991
Sum squared resid	136.7472	Schwarz criterion	2.179124
Log likelihood	-300.3028	Hannan-Quinn criter.	2.148487
F-statistic	6.890942	Durbin-Watson stat	1.589779
Prob(F-statistic)	0.001197		

Source: E-Views 10, Regression Output 2021

Interpretation of Regression Result

In table 2, a panel least square regression analysis was conducted to test the relationship between target costing and return on assets. Adjusted R squared is coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable. From the findings in the table 2, the value of adjusted R squared is 0.202754, an indication that there was variation of 20.28% on ROA due to changes in TGTC, ASTANG and LEV. This implies that only 20.28% changes in ROA of manufacturing firms could be accounted for by TGTC, ASTANG and LEV., while 79.72% was explained by unknown variables that were not included in the model. The probability of the slope coefficients indicate that; P(x_1= 0.0279<0.05; x_2= 0.6642>0.05; x_3=0.0679>0.05). The co-efficient value of; β_1 = 0.321710; indicates a positive and significant relationship between target costing and ROA; $\beta_{2=}$ 0.039477 indicate shows evidence of a non-significant but positive relationship between TGTC and ROA; while, β_3 = -0.043893 implies that there is a non-significant and negative relationship between LEV and ROA of quoted manufacturing firms in Nigeria.

The linear regression model becomes;

ROA = 0.984849 + 0.321710 TGTC + 0.039477 ASTANG -0.043893 LEV+ μ

Holding other factors constant, the coefficient of TGTC implies that if target costing increase by 1%, then return on asset would increase by 32.171%; again one unit increase in ASTANG would lead to 3.95% increase in ROA and a unit increase in LEV will make ROA to reduce by 4.39%.

The Durbin-Watson Statistic of 1.589779 suggests that the model does not contain serial correlation. The F-statistic of the ROA regression is equal to 6.890942 and the associated F-statistic probability is equal to 0.001197, so the null hypothesis was rejected and the alternative hypothesis was accepted.

Decision

Since the Prob(F-statistic) of 0.001197 is less than the critical value of 5% (0.05), then, it was upheld that Target Costing has a significant and positive effect on Return on Assets of quoted manufacturing firms in Nigeria at 5% level of significance, thus, H_1 is preferred over Ho.

Table 3: Hausman Test Output

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	14.269854	3	0.0038

Source: E-Views 10 Hausman Output, 2021

From the Hausman test result in table 3, the p-value is 0.0038, this is statistically significant at the conventional level of 0.05. Thus, the Fixed Effect Model (FEM) is more appropriate than the Random Effect Model (REM) in analysing the relationship between target costing and and return on assets of quoted manufacturing firms in Nigeria at 5% significant level.

Test of Hypothesis II

Ho_2: Kaizen Costing has no significant effect on Return on Assets of quoted manufacturing firms in Nigeria.
H_2: Kaizen Costing has significant effect on Return on Assets of quoted manufacturing firms in Nigeria.

Table 4 Panel Least Square Regression Analysis between Kaizen Costing and ROA

Dependent Variable: ROA
Method: Panel Least Squares
Date: 10/08/21 Time: 05:55
Sample: 2008 2020
Periods included: 13
Cross-sections included: 22
Total panel (unbalanced) observations: 285

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.090107	0.089063	12.23968	0.0000
KZNC	1.257272	0.368941	3.407781	0.0008
ASTANG	0.080805	0.091456	0.883535	0.3777
LEV	-0.036731	0.024257	-1.514249	0.1311

R-squared	0.223668	Mean dependent var	0.936138
Adjusted R-squared	0.213244	S.D. dependent var	0.697309
S.E. of regression	0.692676	Akaike info criterion	2.117426
Sum squared resid	134.8238	Schwarz criterion	2.168689
Log likelihood	-297.7333	Hannan-Quinn criter.	2.137977
F-statistic	5.850085	Durbin-Watson stat	1.510193
Prob(F-statistic)	0.003241		

Source: E-Views 10, Regression Output 2021

Interpretation of Regressed Result

The value of Adjusted R-squared in table 4 showed that 21.32% of the total variation in dependent variable (ROA) is explained by independent variables (KZNC, ASTANG and LEV) to the determination of ROA while the remaining 78.68% is caused by other explanatory factors outside this model and this is captured by the error term. The coefficient result showed that KZNC (β_1=1.257272) and ASTANG (β_2=0.080805) are positively related with ROA, while LEV (β_3=-0.036731) is negatively related with ROA. The probability value of the slope coefficients indicate that P(x_1=0.0008<0.05; x_2=0.3777>0.05; x_3=0.1311>0.05). This implies that ROA has a significant positive relationship with KZNC; a non-significant positive relationship with ASTANG and a non-significant negative relationship with LEV. The Durbin-Watson figure of 1.510193 indicates the absence of autocorrelation in the regression model. The overall performance of the model is satisfactory as shown by Prob(F-statistics) = 5.850085. From the above factual information it is clearly obvious that there is a significant and positive relationship between KZNC and ROA.

The regression equation is:

ROA = 1.090107 + 1.257272 KZNC + 0.080805 ASTANG - 0.036731 LEV+ μ

The implication is that, for there to be a unit/one naira increase in ROA there will be 1.257272 units increase in KZNC, 0.080805 units increase in ASTANG and 0.036731 units reduction in LEV respectively

Decision

Since the result of the Prob(F-statistic) of 0.003241 is less than the critical value of 5% significance level, leading to the conclusion that Kaizen Costing has significant and positive effect on Return on Assets of quoted manufacturing firms in Nigeria at 5% significant level, hence, H_1 is accepted.

Table 5: Hausman Test Output

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	15.129714	3	0.0025

Source: E-Views 10, Regression Output 2021

Interpretation of Post Regression Analysis

From the Hausman test result in table 5, the p-value is 0.0025, this is statistically significant at the conventional level of 0.05. Thus, the Fixed Effect Model (FEM) is more appropriate than the Random Effect Model (REM) in analysing the relationship between kaizen costing and return on assets of quoted manufacturing firms in Nigeria at 5% significant level.

Test of Hypothesis III

H_{O3}: Life Cycle Costing has no significant effect on Return on Assets of quoted manufacturing firms in Nigeria.

H_3: Life Cycle Costing has significant effect on Return on Assets of quoted manufacturing firms in Nigeria.

Table 6 Panel Least Square Regression Analysis between Life Cycle Costing and ROA

Dependent Variable: ROA

Method: Panel Least Squares

Date: 10/08/21 Time: 06:05

Sample: 2008 2020

Periods included: 13

Cross-sections included: 22

Total panel (balanced) observations: 286

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	0.855561	0.090204	9.484737	0.0000
LCC	0.915924	0.302441	3.028439	0.0027
ASTANG	0.034239	0.088230	0.388059	0.6983
LEV	-0.046370	0.023584	-1.966185	0.0503

R-squared	0.243698	Mean dependent var	0.933683
Adjusted R-squared	0.233524	S.D. dependent var	0.697322
S.E. of regression	0.685534	Akaike info criterion	2.096650
Sum squared resid	132.5278	Schwarz criterion	2.147783
Log likelihood	-295.8210	Hannan-Quinn criter.	2.117146
F-statistic	4.295276	Durbin-Watson stat	1.549985
Prob(F-statistic)	0.005529		

Source: E-Views 10 Regression output, 2021

Interpretation of Regression Result

ROA = 0.855561 + 0.915924 LCC + 0.034239 ASTANG - 0.046370LEV + μ

The above model tested the relationship between Life Cycle Costing and return on assets. The result showed that life cycle costing has a significant and positive relationship with ROA.. This can be seen from the coefficients and probability of t-stat in table 4.11; β_1= 0.915924**,** Prob = 0.0027. The probability of t-statistics for life cycle costing at 0.0027 is lower than the acceptable 5%. Furthermore, the Adjusted R- squared which is the coefficient of determination shows the magnitude of variations caused on ROA by the explanatory variables (LCC, ASTANG and LEV) to be 0.2335. This indicates that about 23.35% variation in ROA is attributed to the influence of the explanatory variables (LCC, ASTANG and LEV) while the remaining 76.65% is caused by other explanatory factors outside this model and this is captured by the error term.

Decision:

From Table 6, at the adopted level of significance at 0.05, the overall significance of the model with the Prob(F-statistic) = 0.005529, which is less than 0.05. Therefore, we reject the null hypothesis and accept the alternative, which upholds that Life Cycle Costing has significant and positive effect on Return on Assets of quoted manufacturing firms in Nigeria at 5% level of significance.

Table 7: Hausman Test Output

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.

Cross-section random	18.231056	3	0.0009

Source: E-Views 10, Regression Output 2021

Interpretation of Post Regression Analysis

From the Hausman test result in table 7, the p-value is 0.0009, this is statistically significant at the conventional level of 0.05. Thus, the Fixed Effect Model (FEM) is more appropriate than the Random Effect Model (REM) in analysing the relationship between life cycle costing and return on assets of quoted manufacturing firms in Nigeria at 5% significant level.

Findings, Conclusion and Recommendations

Findings

Based on the analysis of data, the following findings emerged:

i. Target Costing has a significant and positive effect on Return on Assets of quoted manufacturing firms in Nigeria at 5% level of significance ($\beta_1 = 0.321710$; p-value = 0.0279<0.05)

ii. Kaizen Costing has significant and positive effect on Return on Assets of quoted manufacturing firms in Nigeria at 5% significant level ($\beta_1 = 1.257272$; p-value = 0.0008<0.05)

iii. .Life Cycle Costing has significant and positive effect on Return on Assets of quoted manufacturing firms in Nigeria at 5% level of significance ($\beta_1 = 0.915924$; p-value = 0.0027<0.05)

Conclusion

This study examined the effect of Value Engineering on Profitability of quoted manufacturing firms in Nigeria for a period of thirteen (13) years spanning from 2008 to 2020. Panel data were sourced from the annual reports and accounts of the sampled firms. Inferential statistics using correlation analysis, panel least square regression and hausman test were employed via E-Views 10 statistical software. Data analysis revealed that Value Engineering significantly affects profitability. As disaggregated components, Target Costing, Kaizen Costing, and Life Cycle Costing have a significant and positive effect on Return on Assets of quoted manufacturing firms in Nigeria at 5% significant level.

Recommendations

Based on the findings and conclusion, the following recommendations were made:

i. Considering the positive relationship between target costing and profitability, there should be significant amount of staff training on business strategies and techniques to ensure the maximization of profit.

ii. Manufacturing companies should endeavour to identify improved product designs that reduce the product's cost without sacrificing functionality so as to remain profitable.

iii. Value engineering should be inculcated in the organization culture of companies so as enable them effectively put value engineering job plan into use for improved profitability without sacrificing the value to be derived by the customers.

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Appendix I

Nigeria Stock Exchange

Population of the Study

a. Consumer Goods Companies

i. Cadbury Nigeria Plc
ii. Champion Breweries Plc
iii. Dangote Sugar Refinery Plc
iv. DN Tyre & Rubber Plc
v. Flour Mills Nigeria Plc
vi. Golden Guinea Breweries Plc
vii. Guinness Nigeria Plc
viii. Honeywell Flour Mills Plc
ix. International Breweries Plc
x. McNichols Plc
xi. Multi-Trex Integrated Foods Plc
xii. Nigeria Flour Mills Plc
xiii. Nascon Allied Industries Plc
xiv. Nestle Nigeria Plc
xv. Nigeria Breweries Plc
xvi. Nigeria Enamelware Plc
xvii. Cussons Nigeria Plc
xviii. Unilever Nigeria Plc
xix. Union Dicon Salt Plc
xx. Vitafoam Nigeria Plc

b. Industrial Goods Companies

i. Austin Laz & Company Plc
ii. Berger Paints Plc
iii. Beta Glass Plc
iv. BUA Cement Plc
v. CAP Plc
vi. Cutix Plc
vii. Dangote Cement Plc
viii. Greif Nigeria Plc
ix. Lafarge Africa Plc
x. Meyer Plc
xi. Notore Chemical Industries Plc
xii. Portland Paints & Products Nigeria Plc
xiii. Premier Paints Plc

c. Agriculture Companies

i. Ellah Lakes Plc
ii. FTN Cocoa Processors Plc
iii. Livestock Feeds Plc
iv. Okomu Oil Palm Plc
v. Presco Plc

d. Health Care Companies

i. Ekocorp Plc
ii. Evans Medical Plc
iii. Fidson Healthcare Plc
iv. Glaxo Smithkline Consumer Nigeria Plc
v. May & Baker Nigeria Plc
vi. Morrison Industries Plc
vii. Neimeth International Plc
viii. Nigeria-German Chemicals
ix. Pharma-Deko Plc
x. Union Diagnostic & Clinical Services

Sample Size of the Study

a. Consumer Goods Companies

i. DN Tyre & Rubber Plc
ii. Flour Mills Nigeria Plc
iii. Guinness Nigeria Plc
iv. Nigeria Breweries Plc
v. Unilever Nigeria Plc
vi. Union Dicon Salt Plc
vii. Vitafoam Nigeria Plc

b. Industrial Goods Companies

i. Berger Paints Plc
ii. CAP Plc
iii. Cutix Plc
iv. Dangote Cement Plc
v. Greif Nigeria Plc
vi. Lafarge Africa Plc
vii. Meyer Plc

c. Agriculture Companies

i. Livestock Feeds Plc
ii. Presco Plc

d. Health Care Companies

i. Evans Medical Plc
ii. Fidson Healthcare Plc
iii. Glaxo Smithkline Consumer Nigeria Plc
iv. May & Baker Nigeria Plc
v. Nigeria-German Chemicals
vi. Neimeth International Plc

Appendix II

Questionnaire

Section A

Instruction:

Please tick or mark (√) in the boxes provided or fill where appropriate.

Personal Data

1. Sex: Male [ ] Female [ ]
2. Age: 20 -25 [ ] 25 - 30 [ ] 30 – 35 [ ] 35 – above [ ]
3. Educational Qualification: WASCE [ ], OND / NCE [ ], B.Sc / B.A [ ] M.Sc / PhD [ ]
others [ ].
4. For how long have you been working in your present job? 0-5yrs [ ], 5-10 yrs. [ ], 10yrs and above [ ]
5. Which of the professional qualifications have you obtained? ANAN [ ], ICAN [ ],
CIA/NIM [ ], CIBN [ ] None [ ]

Section B

Please tick as appropriate

The questions in this section would also to be answered on a 5-point Likert-type scale, ranging from 5 (*strongly agree*), 4 (Agree), 3 (Neutral), 2 (disagree) to 1 (*strongly disagree*).

1	Kaizen costing aims at establishing value analysis as an ongoing system that will be formally applied to all problems of the organization that concern cost and function	5	4	3	2	1
2	Target costing is an effective management's proactive action to monitor product cost	5	4	3	2	1
3	Life cycle costing identifies the activities necessary for a process to develop a product or service, and finds the most economic way to accomplish it	5	4	3	2	1
4	Target costing is a technique that requires a manufacturing business to plan in advance for its product costs, prices and the margin it intends to achieve	5	4	3	2	1
5	Life cycle costing permits the effective identification of that part of process cost which does not contribute to ensure process quality.	5	4	3	2	1
6	Kaizen drives firm profitability so that stakeholders may recognize and implement appropriate business policy with good investment decisions.	5	4	3	2	1
7	Kaizen costing is an effective management technique for achieving quick results in cost reduction and to solve business problems related to profitability	5	4	3	2	1
8	Life cycle costing is a system of profit planning and cost management that is price led, customer focused and design centered	5	4	3	2	1
9	With target costing, a manufacturing business has a powerful tool to continually monitor product costs right from the design phase (stage) through the product lifecycle	5	4	3	2	1
10	Target cost enables firms to cope with the growing dynamics of the competitive environments in which they operate	5	4	3	2	1

11	Life cycle costing can make an existing process profitable or optimize the effectiveness and the profitability of a process at the time of its design.	5	4	3	2	1
12	Adoption of Kaizen costing technique would increase the value of the firm which improves profit of the company by reducing cost of manufacture rather increasing the price of the product	5	4	3	2	1