

Robotic Intervention and Net Profit before Interest and Tax

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Abstract

Robotic Intervention (RI) strategy is critical to organizational profitability. The documented high cost of production resulted in slower attainment of financial success through continuous surges prices of goods and services. This have led manufacturers to continuously seek various strategies in reducing cost of production, and the need to cope with the growing number of complexities and uncertainties from the business environment led to continuous performance as the objective of any company to increase their capacity to adapt. The use of sophisticated machines or artificial intelligent has fostered profitability through the increase in productivity and ever-mounted pressure to minimize costs. The study employed *ex-post facto* research design. The study's population was 31 manufacturing companies in Nigeria listed on the Nigerian Stock Exchange as at January 18, 2021. Purposive sampling technique was employed to select 21 manufacturing companies based on their use of sophisticated machines in the production process. Validated data were extracted from the published financial statement of the selected companies. The reliability of data was premised on auditor and regulatory agencies' approval of the financial statements. Data were analyzed using descriptive and inferential (multivariate regression) statistics. The result showed that RI measurements had an insignificant effect on Net profit before interest and tax ($Adj.R^2 = 0.1031$, $F(4, 248) = 2.48$, $p > 0.05$). RI measurements combined with a control variable of company size (CS) had significant effect on NPBIT ($Adj.R^2 = 0.8502$, $F(5, 247) = 286.02$, $p < 0.05$). This study concluded that robotic intervention significantly influences performance of listed manufacturing companies in Nigeria. This study therefore, recommends that more robots workforce should be employed because if robotic intervention is held constant based on our findings, net profit will decline. Also, the government should enact policies on robot tax to mitigate the use of outdated industrial machines

Keywords: *Net profit before interest and tax, Profit, Artificial intelligence, Financial performance, Robots*

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Background to the Study

The need to cope with the growing number of complexities and uncertainties from the business environment led to continuous performance as the objective of any company to increase their capacity to adapt. Performance of any company is of great concern to various stakeholders like investors -high and long-term returns is highly valuable, while for employees -financial profitability of the company boosts the income of workers and expansion of the manufacturing company, thus generating employment opportunities. The high cost of production such as high-cost of raw materials, high cost of labour, high cost of consumable supplies increases the price of the products resulting in a negative effect on the product's sales and a negative performance (Godwin, Amos and Owolabi, 2019; Pervan, Pervan, and Curak, 2017; Thornton, 2010). Liu, Ding, Gao, and Gong (2017) submitted that spike in price through a high cost of production results in fewer earnings as the company makes and spend more, thereby reducing the amount of money or profit the company will have for financing manufacturing processes.

There is a need to study the financial performance of manufacturing companies because the manufacturing sector is an avenue for growing output (Thornton, 2010), Notwithstanding, the scholar noted the aftermath of the financial crisis -the stoppage of credit financing led to the constant pressure of manufacturing companies to seek to reduce the cost and prices, resulted in slower attainment of the financial success of the manufacturing companies which also led to the drastic shift from the traditional manufacturing towards process technologies through research and development (R&D). Manufacturing companies find brilliant ways of reducing cost and improve their profitability, which led to constant business expenditure for research and development (BERD) on new products and robotic interventions. robotic intervention as a process of programming and outfitting an industrial machine so that the industrial machines can perform the specific production task (Widyasti and Putri, 2021).Historically, (Dennis, 2018; Ishan, 2019 traced the emergence of robots are from the era of the Greeks myths where a giant creature made with bronze was presented to Europa by Zeus to form self-replicating robots. Scholars have expanded that robots are artificial intelligent machines with actuators and sensors which automatically monitor and report their status to the control system to support collection data and process control for continuous troubleshooting purposes, maintenance or linking the automated machines to a wider manufacturing system, thus enhances profitability through reduction of maintenance cost (Millar, Chen, Waller 2017, Khyatin, 2016).In this study, robots are plug-and-play semi-autonomous or fully autonomous industrial machines which performs boring and hazardous production task.

Globally, manufacturing companies from 1993 to 2016 recorded productivity growth of 10% in GDP per capita as a result of the use of innovative technologies (Manyika, Chui, Miremadi, Bughin, George, Willmott and Dewhurst, 2017), the use of a sophisticated machine or artificially intelligent machines fosters profitability through the increase in productivity and ever-mounted pressure to minimize costs. Despite the global shift from traditional manufacturing to enhance profitability, PWC (2020) observed that the attainment of the financial success of manufacturing companies, recently, have been disrupted by the COVID-19 pandemic, and more affected by the lockdown policies to curb the spread of the virus, thus, plunging the global economy into -3%.

In Nigeria, Uma, Obidike, Chukwu, Kanu, Ogbuagu, Osunkwo and Ndubuisi (2019), submitted an unstable manufacturing production index in which 1991 stood at 178.1, and continuously dropped to 136.3 in 1995. Also, Onodje and Farayibi (2020) noted a slow growth in the manufacturing sector from 6% in 1998 to 10% in 2011 which later experienced a fall in 2015 to 9.5% in which 2016 experienced negative growth. Around this period Davies (1998) noted that the science and technology policy failed to embrace the opportunity of technology, voluminous and lack the need synergy with other national policies (Siyanbola, Adeyeye, Olaopa, and Hassan, 2016), resulted in the implementation of both strategic implementation plan (SIP), economic recovery and growth plan (ERGP) in 2017, and also, the various 140 reforms by the Presidential Enabling Business Environment Council (PEBEC) in 2016, in which the country harnessed on technological innovation, provided tax incentives for business expenditure on research and development (BERD), encouraged innovation hubs, private equity and venture capital players to MSME has contributed greatly to manufacturing growth from negative growth of -2.9% in the third quarter to positive growth of 3.4% in the first quarter of 2018.

Despite the ERGP launched in 2017 to 2020 which promised to revive the economy from recession, Business Hilight (2020), opined that from the International Monetary Fund indicators of the country's economic growth from 2.5% to decline to 2% over the last four years, the government blueprints of economic reform has failed, in which the manufacturing sector remained in a coma as profitability declines and also declining number of portfolio investors at the stock market continues to rise and also rise in default of loan payment for CBN's Anchor Programme (ABP). Performance of manufacturing sector in Nigeria is important because small scale enterprises contributed to 50% of industrial jobs, 90% of activities in the manufacturing sector. (PWC, 2020).

The major problem of this study is that even though there are some substantial scholarly works on the impact of robots on profitability like Edquist and Jacobsson (1987) Hung and Hou (2018), Alvarez and Argothy (2018), Alvarez and Argothy (2018), and labour cost, as the study of Ballestar, Diaz-Chao, Sainz and Torrent-Sellens (2021), there is still no know studies on robotic intervention on net profit before interest and tax. Hence it is imperative for this study to investigate the influence of robotic intervention on net profit before interest and tax, and also to investigate the effect of company size on the effect of robotic intervention on net profit before interest and tax of manufacturing companies listed in Nigeria;

Conceptual Review

Net Profit before Interest and Tax

Net profit before interest and tax has been discussed by different authors in literature. Ningzhong (2016) submitted that net profit before interest and tax is the operating income or earnings before interest and tax (EBIT) which shows the stakeholders how much the organization earns from the day-to-day operations excluding tax-deductibility and interest charges i.e., $NPBIT = \text{Revenue} - \text{the cost of goods sold (COGS)} - \text{Operating expenses}$. Notwithstanding, EBIT and operating profit are used interchangeably to know the impact of profit arises to company's activities and the influence of interest on efficiency and profitability of the organization. Joshi (2015) noted the difference between operating profit and EBIT in

which calculating for operating income is only suitable if the various stakeholders want to know about the operating efficiency (operating ratio and operating profit ratio) of the company and also to know about the cash generated from the core activity of the business in which non-operating expenses (interest due or paid), other non-operating expenses (Sale of asset or loss), non-operating income (interest receivables or received) and other non-operating income like profit generated from the selling of assets are all excluded.

Also, Joshi (2015) asserted that EBIT is only suitable to evaluate the organization use of debt security or financial leverage and the degree to which the business is exposed to risk. It is very beneficial when EBIT is calculated with other profitability metrics like return on shareholders fund, and return on net worth. The formula for Operating Profit is as follows:

Operating profit = Net sales - Cost of goods sold – other (indirect) operating expenses

Where Net sales = Gross sales – Sales return

Cost of goods sold = Raw material consumed (Opening Stock of Raw Material + Purchases - Closing stock of raw material) + Direct manufacturing expenses + Opening stock of finished goods - Closing of finished goods.

And Other (Indirect) operating expenses = Administrative expenses + Selling expenses.

While EBIT formula is as follows

$$EBIT = \text{Net profit after tax (EAT)} + \text{Interest (paid)} + \text{Tax paid.}$$

Net profit before interest and tax ratio is a useful financial performance metrics for various stakeholders in calculating or understanding the company's capacity in generating sufficient profit in funding day to day operations and setting debt. This profitability ratio exposes companies that are capital intensive or have a significant number of properties, sophisticated machines in their balance sheet. In this study sophisticated machines are robots. NPBIT was traced by Munger (2018), who noted the original activity that produces profits and expenses which was drawn from the 1974 article of Robert Nozick titled "why intellectuals oppose Capitalism" Robert Nozick in the article discusses how labours (intellectuals) find it frustrating going to the best schools and getting the best grades, only for the wealthy capitalist to be rewarded by producing what people love and charging more than goods and services cost to produce, the intellectuals are even more frustrated that the capitalist who pays their salaries less educated. Historically, in 1978 Isreal Kirzner given a classic explanation between profit, value, correcting errors, and entrepreneurship, Isreal Kirzner also stated that instead of entrepreneurs been busy with price differences or by correcting errors of a single existing product, they think about new products and brilliant ways of improving their production (Munger, 2018).

Robotic Intervention

Robotic intervention is seen by Wotxa (2021), as a process of programming and outfitting an industrial machine so that the industrial machines can perform the specific production task. Robotics integration needs an integrator -someone that will integrate the robots which must have the robotic experience, but nowadays, an integrator does not need the experience to manage the robots in the production process because robots have been reframed to have

super intelligence to operate and maintain easily. Modern robots are designed to be easy to use towards a specific task with no unnecessary features like vision sensors that may not be relevant to the task. Integration of robotics is faster than the misconception that it wastes to integrate into the factory. Robots are now designed simply and collaboratively with other robots or machines in the factory to reduce the cost of integration. Also, the integration of robots does not require manufacturing companies to overhaul completely the initial manufacturing process.

Theoretical Framework

This study is anchored on resource-based theory. The theory of resource-based was proposed by Jay Barney in 1991 from an article concerning corporate resources and continuous competitive edge. The theory deals with using the managerial framework to know the strategic resources a company can maximize to gain a competitive edge and sustainability (Ozbag and Arslan, 2020). The theory places attention on the company's internal resources as a means of planning processes and deriving a competitive edge. The theory asserted assumptions that for resources to be of sustainable competitive benefits, such resources must be uncommon, valuable, not substitutable and not perfectly imitable.

The Resource-based view (RBV) derived from the economic theory of Ricardian and Penrosian in 1959 which asserts that companies can obtain sustainable abnormal profit if and only if these companies have high-quality resources and those resources are preserved by some mechanism of separation. RBV entails companies to develop rare core firm-specific competencies that will enable the organization to do things uniquely and gain a competitive advantage. Firm resources consist of relational, informational, legal and human capital which must be distinct from other competitors. These resources are immobile and heterogeneous which make it imperative for management to appreciate these resources to gain sustainable competitive gain.

RBV gives strategic examining potential features that can be employed to confer a competitive advantage, conversely, not all resources are of the same value and importance to the organization nor do they have the potential feature to become a source of viable competitive edge. The viability of any competitive benefit anchor on the extent to which resources are copied or substituted. Scholars like Collins (2020), have expanded the resource-based view model of strategic management of human resource to explain that CEO's social, human capital and cognition is important when an organization is pursuing human assurance human resource (HAHR) strategy which potential result to efficient corporate-level employee-based resources

The theory is being criticized by Kura, Abubakar and Salleh (2020), to be a tautology, have limited and rigid managerial implications and also the role of the product market is small. Kraaijenbrink, Spender, and Groen (2010) emphasized that the theory's rare, valuable, inimitable and non-substitutable resources (RVIN) are neither sufficient nor necessary making the firm's sustainable competitive advantage unachievable. The scholar also asserted that the definition of resources is impracticable and the value of a resource is too unknown to be used for generalization or a theory.

The theory of resource-based theory is pertinent to this study because the assumptions of this theory is that for resources to be of sustainable competitive benefits, such resources must be uncommon, valuable, not substitutable and not perfectly imitable and that companies can obtain sustainable abnormal profit if and if these companies have high-quality resources and those resources are preserved by some mechanism of separation. Robotic workforce is been employed to produce larder high quality goods and services in large quantity.

Methodology

This study employed *ex-post facto* design, the population of this study was thirty-one (31) manufacturing companies listed on the Nigeria Stock exchange as of December 31, 2019., 21 manufacturing companies based on the use of sophisticated machines in their production process. To accomplish this study. Descriptive and inferential statistics was employed through multiple analysis. The *a priori* expectation for this study is that the measurements for robotic intervention which are cost of sales, maintenance cost, cost of equipment, research and development will have a positive effect on netprofit before interest and tax (NPBIT). The stated objective was operationalized below

- Y = f(X)
- Y= Dependent Variable
- y= Net Profit Before Interest and Tax (NPBIT)**
- X = Independent Variable
- X = Robotic Intervention (RI)**
- x₁=Cost of Sales (COS)
- x₂=Maintenance Cost (MC)
- x₃= Cost of equipment (CE)
- x₄=Research and Development (R&D)

Model 1

$$y_{1it} = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} + \mu_{it}$$

$$NPBT_{it} = \beta_0 + \beta_1 COS_{it} + \beta_2 MC_{it} + \beta_3 CE_{it} + \beta_4 R\&D_{it} + \mu_{it} \text{----- (1)}$$

Model 2

$$y_{1it} = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} + \beta_5 x_{5it} + \mu_{it}$$

$$NPBT_{it} = \beta_0 + \beta_1 COS_{it} + \beta_2 MC_{it} + \beta_3 CE_{it} + \beta_4 R\&D_{it} + \beta_5 CS_{it} + \mu_{it} \text{----- (2)}$$

Hypothesis:

H₀: Robotic intervention has no significant impact on net profit before tax of manufacturing listed companies in Nigeria

Question: How does robotic intervention impact net profit before tax of manufacturing listed companies in Nigeria?

Table 1: Test of the Hypothesis

Variable	Model 1				Model 2			
	Pooled Ols With Cluster Std. Err.				Pooled Ols With Cluster Std. Err.			
	Coeff	Std.Err	t-test	Prob	Coeff	Std.Err	t-test	Prob
Constant	21273.58	3629.318	5.86	0.000	-3307.514	1752.877	-1.89	0.060
COS	-.192	.108	-1.77	0.104	.011	.040	0.29	0.769
MC	.005	.015	0.37	0.718	-.009	.033	-0.27	0.787
CE	.0681	.040	1.69	0.120	.027	.018	1.48	0.140
R&D	.584	.277	-2.11	0.059	-.027	.096	-0.29	0.772
CS					.163	.004	36.49	0.000
Adj. R ²	0.1031				0.8502			
F-Stat	0.1055				F _(5, 246) = 286.02			
Probability of	0.1055				0.0000			
F-statman Test	chi ² ₍₄₎ = 9.98 (0.0407)				chi ² ₍₃₎ = 19.47 (0.0016)			
Testparm Test	2.28 (0.0118)				1.78 (0.0589)			
Heteroskedast	12033.09 (0.0000)				chi ² ₍₁₎ = 324.25 (0.0000)			
icity Test	66.524 (0.0000)				31.425 (0.0000)			
Pesaran's test of cross sectional independence	2.865, Pr = 0.0042							

Notes: Table 1 reports pooled OLS results of the effect of robotic intervention on net profit before interest and tax (NPBIT). The dependent variable is NPBIT. The Independent variables are cost of sales (COS), maintenance cost (MC), cost of equipment (CE), and research and development (R&D). The control variable is company size (CS).

Source: Author's Work (2021)

$$y_{it} = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} + \mu_{it}$$

$$NPBIT_{it} = \beta_0 + \beta_1 COS_{it} + \beta_2 MC_{it} + \beta_3 CE_{it} + \beta_4 R\&D_{it} + \mu_{it} \dots \dots \dots (Model 1)$$

$$NPBIT_{it} = 21273.58 - .192COS_{it} + 0.005MC_{it} + 0.0681CE_{it} + 0.584R\&D_{it} + \mu_{it} \dots \dots \dots (Model 1)$$

Interpretation

Table 1 depicts the outcome of the coefficient of the constant or intercept has a positive value of 21273.58. This indicates that should the independent variables (cost of sales (COS), maintenance cost (MC), cost of equipment (CE), and research and development, (R&D)) be held constant, for instance in a year, the dependent variable which is net profit before interest and tax (NPBIT) would increase by 21273.58. The probability of the individual T-test depicts that the coefficient has significant effect on NPBIT (p-value = 0.0 < 0.05)

The result from Table 1 for model 1 evidenced that individually the coefficients of the independent variables which are COS, MC, CE and R&D. COS has a negative coefficient value of -0.192, this implies that a unit increase in COS would cause a decrease of 0.192 in NPBIT vice-versa. The probability of the individual T-test depicts that COS has a negative

insignificant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.104 as indicated ($p = 0.104 > 0.05$). MC has a positive coefficient value of 0.005, which implies that a unit increase in MC would lead to a unit increase of 0.005 in NPBIT. The probability of the individual T-test depicts that MC has a positive insignificant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.718 as indicated ($p = 0.718 > 0.05$). CE has a positive coefficient value of 0.0681 which means that a unit increase in CE would lead to 0.0681 increase in NPBIT. The probability of the individual T-test depicts that CE has a positive insignificant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.120 as indicated ($p = 0.120 > 0.05$). R&D has a positive coefficient value of 0.584 which implies that an increase in R&D would lead to a unit increase of 0.584 in R&D. The probability of the individual T-test depicts that R&D has a positive insignificant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.059 as indicated ($p = 0.059 > 0.05$). The sign of the coefficients is indicated $\beta_1 = 0.192 < 0$, $\beta_2 = 0.005 > 0$, $\beta_3 = 0.0681 > 0$, $\beta_4 = 0.584 > 0$. The output shows that cost of sales (COS), maintenance cost (MC), cost of equipment (CE) and research and development (R&D) is consistent with the *a priori* expectation

Decision

At a level of significance 0.05, the degree of freedom or the coefficient of multiple determination is 10.5% which implies that only 10.5% variations in net profit before tax (NPBIT), is traceable or influenced by the independent variables. This shows that the model has a fairly poor fit. The probability of F-test is 0.1051 which is greater than 0.05 adopted level of significance. Thus, the null hypothesis would not be rejected which means that robotic intervention does not have significant impact on NPBIT without the control variable of company size.

Diagnostic Test

Table 1 depicts the outcome of the diagnostic test, which is used to examine the selection and the appropriateness of the estimation technique used whether fixed effect, random effect or pooled ordinary least square estimation technique is appropriate for the models. The test was conducted at significance level of 5%. From Model 1, the result of the test (p-value = 0.0407), less than 5% level of significance, the result reveals that Fixed Effect is the most appropriate estimator. Thus, this study can reject the null hypothesis. A confirmatory test on the result of Hausman test was conducted using Testparm Test. This was done to confirm whether the fixed effect is really the most appropriate estimation technique for the model. The decision rule of the Pearson's Test for the cross-sectional independence is that if the p-value of the Pearson's statistics is greater than 0.05, which means do not reject the null hypotheses of cross-sectional independence. From the result obtained, since the p-value of the Pearson is statistic is 0.0042 and is less than the p-value of 0.005, the null hypothesis is rejected. This leads to confirm that there is cross-sectional dependence amongst the residuals of the model. However, despite the presence of cross-sectional dependence, coefficient of the model 1 are still valid as the problem of cross-sectional dependence is common with panel data studies due to the different characteristics of the different cross-sections used.

Breusch-Pagan/Cook—Weisberg Test for heteroskedasticity was also conducted for model 1. The test result (p -value = 0.000) indicated that there is presence of heteroskedasticity problem in the model which implies that variations in the residuals of the model over the period “t” in both models are trending. The existence of associations among the coefficients of the model and its residuals were further tested using the Wooldridge test for serial autocorrelation. The significance of the test result (p -value = 0.000) indicates that the null hypothesis of this test, which states that there is no first order autocorrelation is rejected. This implies that there is autocorrelation problem among the series of this model. This means that the observations are in aspects other than time or the data are closely related or closer together in time. Despite the presence of autocorrelation, coefficient of the model 1 are still valid as the problem of autocorrelation is common with panel data studies due to the different characteristics of the different cross-sections used.

Based on the results of the diagnostic tests carried out; the model was estimated using fixed effect with Cluster Standard Errors to rectify all the econometric issues inherent in the model.

$$y_{it} = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} + \beta_5 x_{5it} + \mu_{it}$$

$$NPBT_{it} = \beta_0 + \beta_1 COS_{it} + \beta_2 MC_{it} + \beta_3 CE_{it} + \beta_4 R\&D_{it} + \beta_5 CS_{it} + \mu_{it} \text{----- Model 2}$$

$$NPBT_{it} = -3307.5 + 0.011 COS_{it} + -0.009 MC_{it} + 0.027 CE_{it} - 0.027 R\&D_{it} + 0.163 CS_{it} + \mu_{it} \text{-----}$$

----- Model 2

Interpretation

Table 1 (Model 2) depicts the outcome of the coefficient of the constant or intercept has a negative value of -3307.514. This indicates that should the independent variables (cost of sales (COS), maintenance cost (MC), cost of equipment (CE), and research and development, (R&D)) be held constant, for instance in a year, the dependent variable which is net profit before interest and tax (NPBIT) would decrease by 3307.514. The negative sign of the coefficient of the intercept or constant shows that there are no other variables that positively affect the dependent variable NPBIT other than the independent variables in the model.

The result from Table 1 for model 2 evidenced that individually the coefficients of the independent variables which are COS, MC, CE and R&D. COS has a positive coefficient value of 0.011, this implies that a unit increase in COS would cause a unit increase of 0.011 in NPBIT vice-versa. The probability of the individual T-test depicts that COS has a positive insignificant effect on NPBIT at 0.05 adopted level of significance given the p -value of 0.769 as indicated ($p = 0.769 > 0.05$). MC has a negative coefficient value of -0.009, which implies that a unit increase in MC would lead to a unit decrease of 0.009 in NPBIT. The probability of the individual T-test depicts that MC has a negative insignificant effect on NPBIT at 0.05 adopted level of significance given the p -value of 0.787 as indicated ($p = 0.787 > 0.05$). CE has a positive coefficient value of 0.027 which means that a unit increase in CE would lead to 0.027 increase in NPBIT. The probability of the individual T-test depicts that CE has a positive insignificant effect on NPBIT at 0.05 adopted level of significance given the p -value of 0.140 as indicated ($p = 0.140 > 0.05$). R&D has a negative coefficient value of -.027 which implies that an increase in R&D would lead to a unit decrease of 0.027 in R&D. The probability of the individual T-test depicts that R&D has a negative insignificant effect on

NPBIT at 0.05 adopted level of significance given the p-value of 0.772 as indicated ($p = 0.772 > 0.05$). CS has a positive coefficient value of 0.163 which means that a unit increase in CS would lead to 0.163 increase in NPBIT. The probability of the individual T-test depicts that CS has a positive significant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.000 as indicated ($p = 0.000 < 0.05$). The sign of the coefficient is depicted $\beta_1 = 0.011 > 0$, $\beta_2 = 0.009 < 0$, and $\beta_3 = 0.027 > 0$, $\beta_4 = 0.027 < 0$, $\beta_5 = 0.163 > 0$.

Decision

At a level of significance 0.05, the degree of freedom or the coefficient of multiple determination is 85% which implies that only 85% variations in net profit before tax (NPBIT), is traceable or influenced by the independent variables. This shows that the model has a strong fit. The probability of F-test is 0.000 which is less than 0.05 adopted level of significance. Thus, the null hypothesis was rejected which means that robotic intervention does have significant impact on NPBIT with the control variable of company size.

Diagnostic Test

Table 1 depicts the outcome of the diagnostic test, which is used to examine the selection and the appropriateness of the estimation technique used whether fixed effect, random effect or pooled ordinary least square estimation technique is appropriate for the models. The test was conducted at significance level of 5%. From Model 1, the result of the test (p-value = 0.0407), less than 5% level of significance, the result reveals that Fixed Effect is the most appropriate estimator. Thus, this study can reject the null hypothesis. A confirmatory test on the result of Hausman test was conducted using Testparm Test. This was done to confirm whether the fixed effect is really the most appropriate estimation technique for the model. The decision rule of the Pearson's Test for the cross-sectional independence is that if the p-value of the Pearson's statistics is greater than 0.05, which means do not reject the null hypotheses of cross-sectional independence. From the result obtained, since the p-value of the Pearson is statistic is 0.0042 and is less than the p-value of 0.005, the null hypothesis is rejected. This leads to confirm that there is cross-sectional dependence amongst the residuals of the model. However, despite the presence of cross-sectional dependence, coefficient of the model 1 are still valid as the problem of cross-sectional dependence is common with panel data studies due to the different characteristics of the different cross-sections used.

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Based on the results of the diagnostic tests carried out; the model was estimated using fixed effect with Cluster Standard Errors to rectify all the econometric issues inherent in the model.

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Interpretation

Table 1 (Model 2) depicts the outcome of the coefficient of the constant or intercept has a negative value of -3307.514. This indicates that should the independent variables (cost of sales (COS), maintenance cost (MC), cost of equipment (CE), and research and development, (R&D)) be held constant, for instance in a year, the dependent variable which is net profit before interest and tax (NPBIT) would decrease by 3307.514. The negative sign of the coefficient of the intercept or constant shows that there are no other variables that positively affect the dependent variable NPBIT other than the independent variables in the model.

The result from Table 1 for model 2 evidenced that individually the coefficients of the independent variables which are COS, MC, CE and R&D. COS has a positive coefficient value of 0.11, this implies that a unit increase in COS would cause a unit increase of 0.11 in NPBIT vice-versa. The probability of the individual T-test depicts that COS has a positive insignificant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.769 as indicated ($p = 0.769 > 0.05$). MC has a negative coefficient value of -0.009, which implies that a unit increase in MC would lead to a unit decrease of 0.009 in NPBIT. The probability of the individual T-test depicts that MC has a negative insignificant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.787 as indicated ($p = 0.787 > 0.05$). CE has a positive coefficient value of 0.027 which means that a unit increase in CE would lead to 0.027 increase in NPBIT. The probability of the individual T-test depicts that CE has a positive insignificant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.140 as indicated ($p = 0.140 > 0.05$). R&D has a negative coefficient value of -0.027 which implies that an increase in R&D would lead to a unit decrease of 0.027 in R&D. The probability of the individual T-test depicts that R&D has a negative insignificant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.772 as indicated ($p = 0.772 > 0.05$). CS has a positive coefficient value of 0.163 which means that a unit increase in CS would lead to 0.163 increase in NPBIT. The probability of the individual T-test depicts that CS has a positive significant effect on NPBIT at 0.05 adopted level of significance given the p-value of 0.000 as indicated ($p = 0.000 < 0.05$). The sign of the coefficient is depicted $\beta_1 = 0.011 > 0$, $\beta_2 = 0.009 < 0$, and $\beta_3 = 0.027 > 0$, $\beta_4 = 0.027 < 0$, $\beta_5 = 0.163 > 0$.

Decision

At a level of significance 0.05, the degree of freedom or the coefficient of multiple determination is 85% which implies that only 85% variations in net profit before tax (NPBIT), is traceable or influenced by the independent variables. This shows that the model has a strong fit. The probability of F-test is 0.000 which is less than 0.05 adopted level of significance. Thus, the null hypothesis was rejected which means that robotic intervention does have significant impact on NPBIT with the control variable of company size.

Diagnostic Test (With Control Variable)

Model 2, the result of the test (p -value = 0.00016), less than 5% level of significance, the result reveals that Fixed Effect is the most appropriate estimator. Thus, this study can reject the null hypothesis. A confirmatory test on the result of Hausman test was conducted using Testparm Test. This was done to confirm whether the fixed effect is really the most appropriate estimation technique for the model. The test result (p -value = 0.0589) is higher than 5% level of significance which connotes that the null hypothesis of the test could not be rejected which shows that fixed effect is the most appropriate estimation technique for the model

Breusch-Pagan/Cook—Weisberg Test for heteroskedasticity was also conducted for this model. The test result (p -value = 0.000) indicated that there is presence of heteroskedasticity problem in the model which implies that variations in the residuals of the model over the period “t” in both models are trending. The existence of associations among the coefficients of the model and its residuals were further tested using the Wooldridge test for serial autocorrelation. The significance of the test result (p -value = 0.000) indicates that the null hypothesis of this test, which states that there is no first order autocorrelation is rejected. This implies that there is autocorrelation problem among the series of this model. Based on the results of the diagnostic test carried out, the model was estimated using fixed effect with robust standard error to rectify the econometric issue of heteroskedasticity inherent in the model.

Discussion of Findings

The results of model 1 and model 2. The model 1 tested the effect of robotic intervention that were expected to affect net profit before interest and tax. The regression result shows that the overall model is insignificant. However, Model 2 tested the combined effect of robotic intervention as well as controlling company size that were expected to affect net profit before interest and tax is captivating because though the overall model is significant as all the individual measurements of robotic intervention had an insignificant effect on NPBIT. In (Model 1 and Model 2), R&D had an insignificant effect on NPBIT, this result opposed the report of Alvarez *et al* (2018), who discovered that a positive impact of investing in R&D and the total sales growth in state-owned enterprises in Ecuador.

The result in model 2 agrees with the study of PWC (2016), who discovered that robotic technologies (automation) positively influenced companies' growth and expansion in 26 countries surveyed. Edquist *et al* (1987), who discovered that employing robotic workforce in the manufacturing sector lowers profitability at the short run but increases profitability at the long run. Magwentshu, *et al* (2019) highlighted the study of Mckinsey Global Institute on harnessing digitalization for growth and employment, investigating the influence of robotic intervention on the performance of 71 emerging economies over the last 50 years, through trend analysis. The scholars discovered. Akinwale, Adepoju and Olomu (2017) investigated the effect of robotization after distributing questionnaire to 521 respondents discovered that R&D expenditures by manufacturing companies as well as innovativeness of product and process has significant effect on the performance of manufacturing companies. Huang *et al* (2018) who discovered that investment in research and investment improves productivity. This study is not in line with the study of Alvarez *et al* (2018), discovered that there is a positive impact of investing in R&D and the total sales growth in state-owned enterprises in Ecuador.

Conclusion and Recommendations

The findings of this study have implications to the manufacturers, management and the society. Recently Nigeria has experienced the increase in the price of petroleum spirit has always have a multiplier effect on the cost of production and prices of goods and services. All these have a negative impact on the welfare of the people in the society. Robotic intervention through the use of Velox generation which uses water instead of fuel can be used to power manufacturing companies in Nigeria experiencing erratic power supply to reduce the cost of production. Thus; reduction in the cost of production through robotic intervention fosters the welfare of the society. Therefore, this study concluded that robotic intervention significantly influences performance of listed manufacturing companies in Nigeria. This study therefore, recommends that more robots workforce should be employed because if robotic intervention is held constant based on our findings, net profit will decline. Also, the government should enact policies on robot tax to mitigate the use of outdated industrial machines.

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