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Impact of Production Planning On Operational Effectiveness of Manufacturing Industries in Nigeria

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ABSTRACT
This study examined the impact of production planning on operational effectiveness of manufacturing industries in Nigeria. The study adopted ex-post facto research designs using panel data of seven years (2014-2020) to examine the impacts of autonomous variables (operational costs, profitability and production planning) on the dependent variable (operational effectiveness measured by production cost of sales. The seven years period is chosen in order to have a fairly, reliable and up-to-date available data. Secondary Data was used and data were sourced from the annual reports and audited accounts of sampled manufacturing companies listed on the floor of Nigerian Exchange Group (NGX) fact book. The Ordinary Least Square (OLS) regression estimation technique was used with the aid of EViews 10 and the result revealed that, operational costs, profitability and production planning have a positive impact on the operational effectiveness of manufacturing industries in Nigeria. The study recommends that manufacturing industries in Nigeria should integrate their supply chain management operations efficiently to improve their sales and profitability also to adopt the supply chain strategy/models that were developed in this study to align with their operations and prospective clients.
Key words: Manufacturing, Production, Operational Effectiveness, Industry.

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I. INTRODUCTION

In the past, there have been major changes to the business environment that affect material sourcing, customer satisfaction, inventory management, and overall profitability in the businesses operating within it. The degree of globalization many businesses now operate in fiercely competitive international markets along with the application of extremely sophisticated strategies and technologies have challenged the core tenets of business and marketing management. Companies need to adapt in order to stay competitive and continue growing and setting new standards in the global economy. Because of this, the majority of industries have completely moved away from manual labor and toward sophisticated, computerized and automated technologies and processes (Minoli, 2005). Planning for production involves scheduling the resources needed to complete these phases of transformation in the most economical or efficient manner possible (Ahuja, 2004). This includes scheduling their acquisition, use, and quantity. Put another way, deciding on the best bargain between financial and consumer satisfaction or service goals is a common process used to make decisions in manufacturing. In other words, profitability refers to the operating efficiency of the business. Profitability is the state or condition of generating financial profit or gain. It is the capacity of an enterprise to deliver a reasonable return on the capital and labor invested in its activities. A company's performance is essentially defined by its capacity utilization, as revenue and earnings are entirely dependent on market share and efficiency. Production planning is the lifeblood of any industrial company (PP). It necessitates striking a careful balance between supplier management and customer satisfaction (Bradley, 2017). When a company's production system is based on estimates, it can waste countless hours and money on pointless operations rather than a thorough analysis of market/customer demand (Bradley, 2017). Furthermore, a company's ability to continue operating as a corporate entity may be compromised if production planning is done without adequate forecasting. In this competitive market, a manufacturing company's ability to know what, how, when, where, and how much to produce is essential to its success.

II.MATERIALS AND METHOD

2.1 Research Design

This study adopts ex-post facto research design. The choice of this research design is appropriate because it help to improve a wide investigation of the key question raised in the study. This design helps to investigate the relationship as well as the source and impact of production planning on operational effectiveness of manufacturing industries in Nigeria.

2.2 Population, Sample and Sampling Techniques

The forty-eight (48) listed manufacturing companies that were trading on the Nigeria Exchange Group's (NGX) floor as of December 31, 2020, made up the study's population. It can be divided into four (4) sectors: industrial goods firms (13), consumer goods firms (20), agriculture (5), and healthcare (10). The seven (7) years that this study was conducted, from 2014 to 2020, were covered. Based on the businesses that regularly submitted their annual financial statements to the Nigeria Exchange Group (NGX) throughout the review period, a purposeful sampling approach was used. In view of this, the sample frame for this study comprises of the ten listed manufacturing companies under the consumer's good category on the Nigeria Stock exchange as at 31st December 2020. These goods are for direct consumption by the consumer in their respective target market. The seven (7) years period is chosen in order to have a fairly, reliable and up-to-date available data.

Table 1 Lists of Manufacturing Companies listed on the Nigerian Stock Exchange in Nigeria

N/S	ConsumerGoods
1	Cadbury Nigeria Plc.
2	Dangote Sugar Refinery Plc
3	Dangote Flour Mills Plc
4	Flour Mills Nig. Plc.
5	Honeywell Flour Mill Plc
6	Nascon Allied Industries Plc
7	Nestle Nigeria Plc
8	P Z Cussons Nigeria Plc
9	U T C Nig. Plc.
10	Unilever Nigeria Plc.

Source: Author Compilation 2022

2.3 Methods of Data Collection

This study used secondary data in order to achieve the objectives highlighted in chapter one of this study. The use of secondary data has been adjudged a good source as it makes available all that is needed for the empirical investigation on this nature of research which is quantitative. Data were sourced from annual reports and audited accounts of the selected sampled manufacturing firms in Nigeria from 2013-2020.

2.4 Technique for Data Analysis and Model Specification

Utilizing the ordinary least square (OLS) regression technique, the effect of production planning on the manufacturing industries' operational effectiveness in Nigeria was evaluated.

The efficiency of the regression technique in determining the effects of one variable on another and testing relationships between theoretically related variables influences the choice of regression technique as a data analysis tool. Regression analysis was used to analyze the data, and EViews 10 statistical software was used to help. The study used diagnostic tests such as the Breusch-Pagan-Godfrey to address the effects of multicollinearity and serial correlation in order to ensure the reliability of the results. The tests are necessary to regression estimation in order to satisfy the assumptions of the ordinary least square (OLS) of homoskedasticity and absence of correct correlations between the independent variable in the model.

Model Specification

$PCSit = \beta0 + \beta_1 OPXit + \beta_2 PROFit + \beta_3 COMRit + \beta_4 FSIZEit + \mu it$

Where:

PCS = Production Cost of Sales of firm i at time t

$\beta0$ = Constant term (intercept);

$\beta_1 - \beta_4$ = Coefficients for the independent variables

OPX = Operating Expenses

PROF = Profitability

COMR = Cost of Raw Materials requirement

Control Variables

FSIZE = Firm Size

µit = error term.

Table 1 Variables Measurement

Variables	Acronym	Measurement	Source
Operational Effectiveness	PCS	Operational Effectiveness was measured using production cost of sales of firm i at time t.	Stahl & Wallace (2012)
Operational costs	OPX	Operational costs were measured using total operating expenses to total assets of firm i at time t	Ovunda, Isaac and Ndor (2019)
Profitability	PROF	Profitability (measured by Profit before Tax divided by Total Assets of firm i at time t	Oyedokun. Tomomewo& Owolabi (2019)
Production Planning	COMR	Production Planning was proxied using Cost of Raw Materials requirement for planning of firm i at time t	Ikon, and Nwankwo (2016)
Firm Size	FSIZE	Natural log of total asset of the client firm of firm i at time t.	Oyedokun. Tomomewo& Owolabi (2019)

Source: Author Compilation 2022

2.5 Justification of Methods

This study adopts ex-post facto research design because this type of research design enables investigation to find the impact of production planning on operational effectiveness of manufacturing industries in Nigeria. The choice of regression technique is because the variables are studied at a point in time for each firm and all the firm across a time period. The aim of regression technique is to minimize the error term with the prospect to finding the model or regression equation that explains the data. Oyedokun, Tomomewo and Owolabi (2019) used similar method in their analysis.

III. DISCUSSION

This chapter deals with the presentation, analysis, interpretation of data and discussion of findings. The chapter, in essence, deals with the detailed econometric analysis of the production effectiveness, operational costs, profitability, production planning and firm size in Nigeria. Data on production effectiveness (PCS), operational costs (OPX), profitability (PROF), production planning (COMR) and firm size (FSIZE)were obtained from the annual reports and audited accounts of listed manufacturing companies in Nigeria for the period of 2014 to 2020.

3.1 Data Presentation

Table 3.1.1 Data Presentation

COMPANIES	ID	YEAR	PCS	OPX	PROF	COMR	FSIZE
Cadbury Nigeria Plc.	1	2014	399715	306916	79686	2253564	35205
Cadbury Nigeria Plc.	1	2015	1199144	399578	109823	2927336	45975
Cadbury Nigeria Plc.	1	2016	3181699	521170	129237	3833357	59640
Cadbury Nigeria Plc.	1	2017	415732	677565	145304	4948652	78285
Cadbury Nigeria Plc.	1	2018	5387776	885945	183425	6551419	100636
Cadbury Nigeria Plc.	1	2019	7084189	1146751	200119	8294537	134218
Cadbury Nigeria Plc.	1	2020	9079137	1511085	235794	11359720	167689
Dangote Sugar Refinery Plc	2	2014	12173431	1929167	275794	13523891	234965
Dangote Sugar Refinery Plc	2	2015	15063981	2604089	327565	18205934	268103
Dangote Sugar Refinery Plc	2	2016	21456312	3183411	379816	21076496	436792
Dangote Sugar Refinery Plc	2	2017	23735633	4628855	602878	23132755	367518
Dangote Sugar Refinery Plc	2	2018	30922902	4355615	390828	30532074	942857
Dangote Sugar Refinery Plc	2	2019	43306511	5500059	1537104	31268078	159696
Dangote Sugar Refinery Plc	2	2020	42250029	6295028	254995	31679423	2668874
Dangote Flour Mills Plc	3	2014	53563211	7130930	1370485	35238466	2574855

Dangote Flour Mills Plc	3	2015	40017290	1.1808	1027108	44959132	437538
Dangote Flour Mills Plc	3	2016	50985842	1289148	1304675	49823543	2121410
Dangote Flour Mills Plc	3	2017	64864235	1728942	3015210	52688223	3804140
Dangote Flour Mills Plc	3	2018	1.03408	2939553	4324760	91688824	7443741
Dangote Flour Mills Plc	3	2019	1.47018	2366069	2469512	13331110	4171386
Dangote Flour Mills Plc	3	2020	1.57208	6430771	1337073	22648927	5359078
Flour Mills Nig. Plc.	4	2014	1.62008	5415369	1009575	92681637	2665746
Flour Mills Nig. Plc.	4	2015	0	8.47128	-1.23407	0	2986760
Flour Mills Nig. Plc.	4	2016	2.261408	1.13658	8440528	16271434	2732613
Flour Mills Nig. Plc.	4	2017	2.468608	9060630	1111337	20244576	2514305
Flour Mills Nig. Plc.	4	2018	1667126	897503	254471	21642204	324846
Flour Mills Nig. Plc.	4	2019	2186756	1168655	332087	96699	423148
Flour Mills Nig. Plc.	4	2020	2814623	1523855	431327	126106	551389
Honeywell Flour Mill Plc	5	2014	3745645	1982111	564933	163991	718054
Honeywell Flour Mill Plc	5	2015	4698223	2589454	729049	214328	936116
Honeywell Flour Mill Plc	5	2016	6238707	3356878	965750	277644	1218046
Honeywell Flour Mill Plc	5	2017	7855980	4411485	1221396	365341	1590301
Honeywell Flour Mill Plc	5	2018	10860141	5659149	1675853	467592	2063837
Honeywell Flour Mill Plc	5	2019	12707801	7575305	1988334	628429	2707065
Honeywell Flour Mill Plc	5	2020	19872622	9402143	3039225	774347	3484447
Nascon Allied Industries Plc	6	2014	18250781	1332377	2925778	1110937	4636748
Nascon Allied Industries Plc	6	2015	21494464	1488265	3152671	1212109	5816593
Nascon Allied Industries Plc	6	2016	15007097	2508865	2698885	1313280	8093651
Nascon Allied Industries Plc	6	2017	27981831	3243310	3606456	1515622	9356129
Nascon Allied Industries Plc	6	2018	39623810	4668668	2235977	1920307	1386185
Nascon Allied Industries Plc	6	2019	45399901	4668668	740685	3811142	2737475
Nascon Allied Industries Plc	6	2020	35672696	5126439	721983	5152188	5984151
Nestle Nigeria Plc	7	2014	31303845	2300180	290335	5063299	1094309
Nestle Nigeria Plc	7	2015	30109610	2348980	1704092	5107744	263950
Nestle Nigeria Plc	7	2016	41839919	2721027	5359861	5295523	463695
Nestle Nigeria Plc	7	2017	42695383	2931876	3753248	31842774	2829608
Nestle Nigeria Plc	7	2018	38679844	2726776	920383	33659644	2472543
Nestle Nigeria Plc	7	2019	29859976	5783262	-313819	31372618	9613645
Nestle Nigeria Plc	7	2020	14050996	5192555	-721701	0	2476887
P Z Cussons Nigeria Plc	8	2014	41265972	3296530	-619400	39310274	2092312
P Z Cussons Nigeria Plc	8	2015	843643	10623	16769	0	151401
P Z Cussons Nigeria Plc	8	2016	1097723	138773	21893	42699112	197345
P Z Cussons Nigeria Plc	8	2017	1433206	180797	28414	0	256858
P Z Cussons Nigeria Plc	8	2018	1859964	235523	37265	48204693	335177
P Z Cussons Nigeria Plc	8	2019	2439654	306867	47978	146523	435398
P Z Cussons Nigeria Plc	8	2020	3140238	399701	63817	190881	570131
U T C Nig. Plc.	9	2014	4178724	520900	80115	248688	736066

U T C Nig. Plc.	9	2015	5241991	678202	111337	323956	974326
U T C Nig. Plc.	9	2016	7286896	884499	129009	422137	1233873
U T C Nig. Plc.	9	2017	8439076	1150106	205001	549640	1689106
U T C Nig. Plc.	9	2018	13421614	1503392	182027	716772	2012513
U T C Nig. Plc.	9	2019	11895615	1946926	432977	932147	3054804
U T C Nig. Plc.	9	2020	28369226	2563249	113106	1218167	2982734
Unilever Nigeria Plc.	10	2014	28369226	3277530	168827	1578278	3126873
Unilever Nigeria Plc.	10	2015	7,317,620	4412216	170,492	2076228	2838596
Unilever Nigeria Plc.	10	2016	7,790,058	5420372	167,161	2658606	3415149
Unilever Nigeria Plc.	10	2017	13146833	7816277	722557	3570077	4868156
Unilever Nigeria Plc.	10	2018	15599805	8444840	636343	4405740	4860375
Unilever Nigeria Plc.	10	2019	18773815	1264046	816452	6304490	7449989
Unilever Nigeria Plc.	10	2020	25964192	1286595	209107	6912730	8137475

Source: Author's Compilation 2020

In this chapter, the empirical results based on the formulated regression models in the preceding chapter are presented, while the interpretation and discussion of each result is aligned with the stated objectives. It also provides the platform on which conclusion and recommendations are based. The data that was discussed in the previous chapter was analyzed in two folds, namely: the descriptive analysis, which describes the data and showing the trends of the various independent variables on the dependent variable; empirical analysis, where the correlation analysis result and regression analysis estimates are shown.

3.2 Data Analyses and Results

This section of the analysis provides an overview on the data set while attempt is also made to describe the main attributes of the data. The descriptive statistics displays the nature of each of the variable of the study.

Table 3.3.1 Descriptive Statistics

Variables	Minimum	Maximum	Mean	Std Dev.
PCS	0.000000	2.468608	31703452	48567316
OPX	10623.00	8.471208	28849062	1026308
PROF	12339687	13370731	1089196	3403382
COMR	1.96699.00	2.166708	24366213	45185234
FSIZE	35205.00	59841510	5648021.	10095078

Source: EViews 10 Output 2022

According to descriptive statistics, the mean value of operational effectiveness (PCS) in Nigeria's manufacturing sectors is 31703452, with a standard deviation of 48567316. The minimum and maximum values of PCS are 0.000000 and 2.468608, respectively. This suggests that there are deviations from both sides of the mean in the operational effectiveness of Nigeria's manufacturing sectors. Operational costs (OPX) have a mean value of 28849062, a maximum value of 8.471208, a minimum value of 10623.00, and a standard deviation of 1026308, which indicates that the data are not significantly distributed from the mean, according to the descriptive statistics. The outcome also shows that, with a mean value of 1089196 and a standard deviation of 3403382, the lowest and maximum values of profitability (PROF) are, respectively, 12339687 and 13370731. This suggests that there are deviations from both sides of the mean in the manufacturing industries' profitability. The production planning (COMR) has minimum and maximum values of 1.96699 and 2.166708, respectively, according to descriptive statistics. The mean value of 24366213 and the standard deviation of 45185234 show a little wide dispersion from the mean. Additionally, the descriptive statistics show that the firm size (FSIZE) has a mean value of 5648021 and minimum and maximum values of 35205.00 and 59841510, respectively. and a standard deviation of 10095078 shows a relatively narrow deviation from the mean.

3. 3.2 Correlation Matrix

The correlation matrix is used to determine the degree of relationship between the dependent and independent variables of the study as well as independent variables themselves. These associations among the variables of the study are presented in Table.

Table 3.3,2 Correlation Matrix Table

	PCS	OPX	PROF	COMR	FSIZE
PCS	1.000000				
OPX	0.736493	1.000000			
PROF	0.779332	0.548687	1.000000		
COMR	0.707150	0.480670	0.429652	1.000000	
FSIZE	0.489104	0.587020	0.279338	0.272654	1.000000

Source: EViews 10 Output 2022

The correlation result in table 4.3.2 above, with a correlation coefficient of 0.736493, shows that operational costs (OPX) and operational effectiveness (PCS) of manufacturing industries during the study period have a positive relationship. With a correlation coefficient of 0.779332, the correlation result above shows a positive relationship between profitability (PROF) and operational effectiveness in the manufacturing industries. The correlation coefficient of 0.707150 in Table 4.3.2 further suggests a positive relationship between production planning (COMR) and operational effectiveness in the manufacturing industries. Additionally, Table 4.2 demonstrates a 0.489104 correlation coefficient between firm size (FSIZE) and operational effectiveness in the manufacturing industries.

Diagnostic Tests

The diagnostic tests carry out in this study are Multicollinearity Tests and Serial Correlation Test. The tests are necessary to regression estimation in order to satisfy the assumptions of the ordinary least square (OLS) of homoskedasticity and absence of correct correlations between the independent variable in the model.

Multicollinearity Test

Variance Inflation Factors
Date: 10/06/22 Time: 21:43
Sample: 1 70
Included observations: 66

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	9.328612	1.560345	NA
OPX	0.020168	3.160451	2.188423
PROF	1.107166	1.903905	1.513739
COMR	0.004072	1.775380	1.370668
FSIZE	0.100577	1.979572	1.531881

Source: EViews 10 Output 2022

Table above presents the variance inflation factor (VIF) and tolerance coefficients of each of the explanatory variables. The Variance Inflation Factor (VIF) for OPX, PROF, COMR and FSIZE are 2.188, 1.513, 1.370 and 1.531 respectively. This indicates that, the VIF are less than 10 respectively. This shows that there is no threat of Multicollinearity or independent errors. This also indicates that Multicollinearity does not constitute a problem when the variance inflation factor (VIF) does not exceed 10.

Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.439901	Prob. F(2,59)	0.6462
Obs*R-squared	0.969725	Prob. Chi-Square(2)	0.6158

Source: EViews 10 Output 2022

The result of the test shows that F-statistic value of 0.439 with the corresponding probability value of 0.646 which implies that there is no case of serial correlation.

3.4 Test of Hypotheses

The hypotheses formulated in this study are tested and analyzed in this section. The section begins with the hypotheses one to four.

3.4.3 Regression Results

Table3.4.3 Summary of Ordinary Least Square Regression

Variables	Coefficient	t-Statistic	Probability.
Constant	1197553.	0.392269	0.6962
OPX	0.462423	3.256209	0.0018
PROF	7.882845	7.491634	0.0000
COMR	0.396545	6.214511	0.0000
FSIZE	0.627357	1.978176	0.0524
R-squared	0.849122		
F-statistic	85.82531		
Prob(F-statistic)			0.000000

Source: EViews 10 Output 2022

Table 4.4.3 presents the results of the ordinary least square regression technique. The model's overall fitness is shown by the F-statistic of 85.82531, which is less than the traditional critical p-value of 0.05, as well as the Probability Prob(F-statistic) of 0.000000. This implies that the estimated model is statistically significant at the 5% level and that the linearized functional specification of the model is appropriate. The R-square, a measure of the model's overall explanatory power, indicates that the independent variables operational costs, profitability, production planning, and firm size (FSIZE) account for about 84.9% of the systematic variation of the dependent variable. However, the 15.1% systematic variation in the dependent variable that the model did not account for was contained in the error term.

Hypothesis One

$H0_1$: Operational Cost has no significant effects on operational effectiveness of manufacturing industries in Nigeria

The regression result in table 4.4.3 shows that operational costs have positive and significant effect on operational effectiveness of manufacturing industries in Nigeria, from the coefficient 0.462423 and t-statistics of 3.256209 and probability value of 0.0018 which is less than 0.05 percent (the level of significant). Therefore, the null hypothesis which states that operational cost has no significant effects on operational effectiveness of manufacturing industries in Nigeria is rejected at the 5% level of significance.

Hypothesis Two

$H0_2$: Profitability has no significant effects on operational effectiveness of manufacturing industries in Nigeria

In a similar vein, the regression result shows that profitability has a favorable and significant impact on the manufacturing sectors' operational effectiveness in Nigeria, as evidenced by the coefficient of 7.882845, t-statistics of 7.491634, and probability value of 0.0000, which is less than 0.05 percent (the significant level). Thus, at the 5% level of significance, the null hypothesis which claims that profitability has no appreciable impact on the operational effectiveness of Nigeria's manufacturing industries is rejected.

Hypothesis Three

$H0_3$: Production Planning has no significant effects on operational effectiveness of manufacturing industries in Nigeria

The table presents evidence that production planning has a noteworthy and affirmative impact on the operational effectiveness of Nigeria's manufacturing industries. This is supported by the coefficient of -0.396545, t-statistics of 6.214511, and probability value of 0.0000, all of which fall below the significance level of less than 0.05

percent. Thus, at the 5% level of significance, the null hypothesis which claims that production planning has no appreciable impact on the operational effectiveness of Nigeria's manufacturing industries is rejected.

3.5 Discussion of Findings

The conclusions drawn from the regression estimates are covered in this section. According to the study, operational costs significantly and favorably affect Nigeria's manufacturing sectors' operational efficacy. The conclusion of the study is that Nigeria's manufacturing sectors will become much more operationally effective as operating costs rise. The results are consistent with those of Ovunda, Isaac, and Ndor (2019), who discovered that while operational costs decreased unit by unit, they increased to represent an increase in cost reduction when all production components were fully utilized.

Similarly, The study discovered that the operational effectiveness of Nigeria's manufacturing industries is positively and significantly impacted by profitability. This finding implies that the manufacturing industries in Nigeria that were sampled will become more profitable as income rises. The results are in line with those of Ikon and Nwankwo (2016). The results conflict with those of Oyedokun, Tomomewo, and Owolabi (2019), who discovered a substantial inverse relationship between the profit before taxes of Nigerian manufacturing companies and the cost of raw materials.

The study also found that production planning has positive and significant effect on operational effectiveness of manufacturing industries in Nigeria. This finding implies that production planning significantly impact on the operational effectiveness of manufacturing industries in Nigeria. This study is agreement with the studies of Okah, Nduka and Ugwuegbu (2018) who found that production planning significantly affects the organizational effectiveness of firms.

IV. CONCLUSION

All the independent variables (operational costs, profitability and production planning) have statistical significance on the dependent variable (operational effectiveness of manufacturing industries). A graphical representation of the movement and variations in the values of operational costs, profitability and production planning for the seven (7) years period was captured to depict the movement of values and also to compare the influence of each of the independent variables on the dependent variable.

The study comes to the conclusion that production scheduling, profitability, and operational costs are what determine how well Nigeria's manufacturing sectors operate. The study concludes, in particular, that, during the study period, operational costs had a positive and significant impact on the operational effectiveness of Nigeria's manufacturing industries. The study also comes to the conclusion that, during the study period, there was a positive and significant relationship between the profitability and the operational effectiveness of Nigeria's manufacturing industries. Similarly, during the study period, the study deduces that there is a positive and significant relationship between production planning and the operational effectiveness of Nigeria's manufacturing industries.

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