

## **Assessing the Manufacturing Characteristics (Technological and Financial) as Determinants of Productivity of the Manufacturing Industry in Nigeria: Cross Sectional Survey Approach.**

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**Abstract.** The paper assesses the Manufacturing Characteristics (Technological and Financial) as Determinants of Productivity of the Manufacturing Industry in Nigeria. The study adopted a cross sectional data obtained from four (4) manufacturing industries which were in operation by the year 2016 production season. Data was analyzed using STATA Version 13 (Nonparametric and Parametric Statistics). The result indicated that technology, equipment accessibility, finance as well as capital base were good determinants of Productivity in manufacturing industry in Nigeria. It is recommended that new technology should be put in place, avenue for capital investment should be provided and efficient management should take charge.

### **1. Introduction**

Globally, it is reported that middle income countries such as: Hong Kong, South Korea, Singapore, the Philippines, India, Mexico as well as Brazil which took similar steps and embraced boosting of productivity among manufacturing industries as an integrals part of their national planning scheme have made a very significant roads into the world manufacturer's market (Graig, C. & Harris, R., 1973). Also, Japan from the end of the World War II and the United States of America from the 1970's have

made high productivity the center point of their economic development plans and results have been resounding (Anyanwu, 2004).

Explaining the productivity variation among smallholder maize farmers in Tanzania East Africa using SFPF, discovered that the major determinants of productivity are low level of education of farmers, lack of extension services, limited capital and fragmentation and unavailability of inputs among others (Martin A.J., 2004).

In Nigeria, Nto and Mbansor,(2011) observed that enhanced productivity will equally contribute to the competitiveness of manufacturing industry in both domestic and foreign market which is what is required to put Nigeria back on the path of economic recovery and growth. This is imperative following the prolonged economic recession occasioned by the collapse of the world oil market from the early 1980's as well as global financial crisis that rocked all the manufacturing industries since 2007, (Oyeranti, 2012). However, many economic measures have been introduced by the Nigerian government to address problems associated with productivity decline but evidence about that they have not yielded the desired results. For example, contribution of manufacturing industries to the Nigeria's Gross

Domestic Product (GDP) have been on the declining trend, ranging from 9.2% in 1981 – 1985 to 6.3% in 1996-1998 (Anyawu, 2004).

A report by manufacturers Association of Nigeria, confirmed that the general trend in productivity among manufacturing industries was negative in 1989. (MAN, 2010). According to National Bureau of Statistics (NBS), the situation has not improved, though growth rate of manufacturing industry may have increased imaginary from 7.31% in 2010 to 7.32% in 2011 but an ugly scenario could be drawn when compared with 2008 and 2009, when growth rate was 8.39 and 8.13 percent respectively. With this statistical review of contribution of manufacturing industry to GDP, it is obvious that productivity among the manufacturing industries has not improved, hence the need for an urgent and critical step that will help to identify major drivers of productivity among manufacturing industries in Nigeria (NBS, 2012).

Therefore Nigeria scholar as well as social and economic researchers must borrow a leaf by bringing productivity to lamp light, if and only if the country is to join the league of economically vibrant states (NBS, 2012).

## 2. Methodology

The study was conducted in Northern Nigeria which consists of North West North East and North Central parts of Nigeria. The cross sectional data used for the study were collected from four (4) manufacturing industries which included the following; automobile, food and beverage, textile and mining. The procedures adopted in the study were as follows;

In order not to select a subject more than once, the researcher used proportionate stratified sampling method. In doing so, the following strategies were followed; each element came from the population and each element was selected independently (Anderson, *et al*, 2006). An individual employed by the industry at the time of the study survey satisfied the first requirement. The second requirement was satisfied selected procedure was devised to select the item independently and thereby

avoided a selected bias that gives higher probability to certain industries. To obtain the respondents, the researcher identified a contact person in each industry who then identified the respondents to answer the questionnaire. This procedure was deemed to have eliminated the researcher’s bias but could introduce the biases of the contact person. Nevertheless, for most of the cases, the contact person was the Human Resource Manager of the individual industry who was usually directed to grant permission to researchers to solicit information from the respective respondents.

Sloven’s Formulae was used for the computation of a sample size as presented in the table below:

Name of Industries	Targeted Population	Computed Sample Size
Food and Beverages	100	50
Mining	42	32
Automobile	58	40
Textile	100	49
<b>Total</b>	<b>300</b>	<b>171</b>

Source: Researcher’s computation

To achieve the objectives of the study, specific characteristics of the sample industries were realised with simple descriptive statistics which determinants of the level of productivity in Nigeria with manufacturing industry characteristics (Technological and financial) were analysed with ordered logistic regression model and cross tabulation.

Productivity by technology and financial characteristics was assessed using cross tabular analysis and associations investigated using the Pearson’s chi-square test.

$$\chi^2 = \sum_{i=1}^2 \sum_{j=1}^2 \frac{(O_{ij}-E_{ij})^2}{E_{ij}}$$

Where  $O_{ij}$  is the number of individuals observed in the  $i$ th row and  $j$ th column cell,  $E_{ij}$  is the number of individuals expected in the  $i$ th row and the column cell.

Since the dependent variable, productivity was an ordinal outcome, to assess the net impact of technological and financial characteristics on productivity; the plausible model was an ordered logistic regression model.

$$\log \left( \frac{\Pr(y_i=j)}{\Pr(y_i=1)} \right) = \alpha_j + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_k x_{ki} + \mu_j$$

Where  $\alpha_1 < \alpha_2 < \dots < \alpha_{k-1}$

Where  $\beta_0$  is the intercept,  $\beta_1 \dots \beta_k$  are slope coefficients for independent variables,  $x_1 \dots x_k$  are the independent variables,  $k$  is the number of possible outcomes,  $\alpha_1, \alpha_2, \dots, \alpha_{k-1}$  are cut points,  $\mu_j$  the error term is assumed to be logistically distributed,  $y_i$  is the dependent variable. **PARAMETRIC STATISTICS** (Correlation and Regression).

**3. Result and Discussion**

**3.1 Association between level of Productivity and Technology characteristics**

Technology quality, equipment accessibility, and equipment relevance were significant across at least one of the industries. Technology quality

was significant in industries; automobile ( $\chi^2 = 18.8742$ ,  $p = 0.026$ ), food & beverage ( $\chi^2 = 44.5499$ ,  $p = 0.000$ ) and mining ( $\chi^2 = 17.9694$ ,  $p = 0.001$ ) with respondents rating the technology as satisfying in the automobile industry (21.43%) and those rating technology as high in both the food & beverage (62.5%) and mining (84.62%) being the majority rating productivity as high. Equipment accessibility was significant in both the food & beverage ( $\chi^2 = 36.8494$ ,  $p = 0.000$ ) and mining ( $\chi^2 = 14.1319$ ,  $p = 0.007$ ) industries with the majority of respondents regarding material and equipment highly accessible rating productivity levels as high both in the food & beverage (62.5%) and mining (90%) industries. Regarding equipment relevance, it was only significant in the food & beverage industry ( $\chi^2 = 44.6565$ ,  $p = 0.000$ ) with respondents who regarded equipment highly relevant having the majority rating productivity as high (66.67%).

**Table1: Association between level of Productivity and Technology characteristics**

<b>Food &amp; beverage</b>				
<b>Variable</b>	<b>Very low</b>	<b>Low</b>	<b>Satisfying</b>	<b>High</b>
<b>Technology quality</b>				
Very low	0	40	60	0
Low	0	85.71	14.29	0
Satisfying	0	7.32	85.37	7.32
High	0	12.5	25	62.5
Chi2(6) = 44.5499 Pr = 0.000				
<b>Equipment accessibility</b>				
Very low	0	75	25	0
Low	0	38.1	57.14	4.76
Satisfying	0	3.57	89.29	7.14
High	0	0	37.5	62.5
Chi2(6) = 36.8494 Pr = 0.000				
<b>Equipment relevance</b>				
Very low	0	50	25	25
Low	0	77.78	22.22	0
Satisfying	0	7.14	85.71	7.14
High	0	0	33.33	66.67
Chi2(6) = 44.6565 Pr = 0.000				
<b>Mining</b>				
<b>Variable</b>	<b>Very low</b>	<b>Low</b>	<b>Satisfying</b>	<b>High</b>
<b>Technology quality</b>				
Very low	0	0	0	0
Low	0	50	50	0
Satisfying	0	33.33	50	16.67
High	0	7.69	7.69	84.62
Chi2(4) = 17.9694 Pr = 0.001				
<b>Equipment Accessibility</b>				
Very low	0	0	0	0
Low	0	28.57	28.57	42.86

Satisfying	0	33.33	44.44	22.22
High	0	5	5	90
Chi2(4) =14.1319 Pr =0.007				
<b>Automobile</b>				
Variable	Very low	Low	Satisfying	High
<b>Technology quality</b>				
Very low	100	0	0	0
Low	0	0	100	0
Satisfying	7.14	35.71	35.71	21.43
High	3.13	34.38	46.88	15.63
Chi2(9) =18.8742 Pr = 0.026				

Source: Result of Data Analysis (2016)

### 3.2 Association between level of Productivity and Financial characteristics

Capital base, profitability and financial management were significantly associated with productivity levels at least across one of the industries. The organization capital base was significant for industries of; automobile ( $\chi^2 = 22.8630$ ,  $p=0.007$ ), food & beverage ( $\chi^2 = 35.0537$ ,  $p=0.000$ ) and textile ( $\chi^2 = 15.7071$ ,  $p= 0.015$ ) with the majority of respondents who rated the capital base as satisfying in the automobile industry (30%) as well as those who rated the capital base as high in both food & beverage (22.73%) and textile (41.67%) rating productivity as high. Regarding profitability, it was significant in all the industries that is, automobile ( $\chi^2 = 17.1624$ ,  $p=0.046$ ), food & beverage ( $\chi^2 = 36.8198$ ,  $p= 0.000$ ), textile ( $\chi^2 = 24.9242$ ,  $p= 0.000$ ) and mining ( $\chi^2 = 26.2595$ ,  $p= 0.000$ ). Majority of respondents who rated organisational profitability as high rated productivity as high in the industries automobile (33.3%), textile (40%) and mining (94.12%) though for food & beverage (26.67%) it was mostly respondents who rated profitability as satisfying. Financial management was significant across all industries with; automobile ( $\chi^2 = 19.4314$ ,  $p= 0.022$ ), food & beverage ( $\chi^2 = 25.1315$ ,  $p= 0.000$ ), textile ( $\chi^2 = 13.6063$ ,  $p= 0.034$ ) and mining ( $\chi^2 = 39.1005$ ,  $p= 0.000$ ). Majority of respondents who reported high financial management rated productivity as high across industries food & beverage (23.53%), textile (50%) and mining (94.74%) except automobile (50%) where these rated financial management low.

**Table 2: Association between level of Productivity and Financial characteristics**

Food & beverage				
Variable	Very low	Low	Satisfying	High
<b>Capital base</b>				
Very low	0	50	50	0
Low	0	80	20	0
Satisfying	0	0	88	12
High	0	9.09	68.18	22.73
Chi2(6) =35.0537 Pr =0.000				
<b>Profitability</b>				
Very low	0	100	0	0
Low	0	61.54	38.46	0
Satisfying	0	0	73.33	26.67
High	0	12.5	87.5	0
Chi2(6) =36.8198 Pr = 0.000				
<b>Financial Management</b>				
Very low	0	100	0	0
Low	0	42.86	57.14	0
Satisfying	0	4.76	76.19	19.05
High	0	0	76.47	23.53
Chi2(6) =25.1315 Pr =0.000				
<b>Mining</b>				
Variable	Very low	Low	Satisfying	High
<b>Profitability</b>				
Very low	0	33.33	33.33	33.33
Low	0	62.5	37.5	0
Satisfying	0	0	25	75

High	0	0	5.88	94.12
Chi2(6) =26.2595 Pr = 0.000				
Financial Management				
Very low	0	83.33	0	16.67
Low	0	0	100	0
Satisfying	0	11.11	44.44	44.44
High	0	0	5.26	94.74
Chi2(6) =39.1005 Pr =0.000				
Automobile				
Variable	Very low	Low	Satisfying	High
Capital base				
Very low	25	37.5	25	12.5
Low	7.14	64.29	28.57	0
Satisfying	0	20	50	30
High	0	0	85.71	14.29
Chi2(9) =22.8630 Pr =0.007				
Profitability				
Very low	16.67	22.22	50	11.11
Low	0	61.11	27.78	11.11
Satisfying	0	10	60	30
High	0	0	66.67	33.33
Chi2(9) =17.1624 Pr =0.046				
Financial Management				
Very low	0	0	50	50
Low	14.29	71.43	0	14.29
Satisfying	9.09	9.09	68.18	13.64
High	0	50	33.33	16.67
Chi2(9) =19.4314 Pr =0.022				
Textile				
Variable				
Capital base				
Very low	0	100	0	0
Low	0	25	75	0
Satisfying	0	21.43	71.43	7.14
High	0	0	58.33	41.67
Chi2(6) =15.7071 Pr = 0.015				
Profitability				
Very low	0	100	0	0
Low	0	33.33	66.67	0
Satisfying	0	8.33	79.17	12.5
High	0	0	60	40
Chi2(6) =24.9242 Pr = 0.000				
Financial Management				
Very low	0	33.33	66.67	0
Low	0	50	50	0
Satisfying	0	17.65	73.53	8.82
High	0	0	50	50
Chi2(6) =13.6063 Pr =0.034				
Mining				
Variables				
Profitability				
Very low	0	33.33	33.33	33.33
Low	0	62.5	37.5	0
Satisfying	0	0	25	75
High	0	0	5.88	94.12
Chi2(6) =26.2595 Pr = 0.000				
Financial Management				
Very low	0	83.33	0	16.67
Low	0	0	100	0
Satisfying	0	11.11	44.44	44.44
High	0	0	5.26	94.74
Chi2(6) =39.1005 Pr =0.000				

Source: Result of Data Analysis (2016)

## 4. Discussion

### 4.1 Manufacturing industry characteristics (technology and financial)

The study required assessing the manufacturing industry characteristics as determinants of level of productivity in Nigeria, this focused on the effect of both technological and financial characteristics on productivity. Regarding technological characteristics, only equipment relevance ( $p < 0.05$ ) significantly affected level of productivity in the manufacturing industry whereas for financial characteristics, only profitability ( $p < 0.05$ ) had a significant effect on the level of productivity. The insignificance of equipment accessibility is inconsistent with studies by Brill (1992) who estimated that improvements in the physical design of the workplace may result in a 5-10 percent increase in employee productivity as (Stallworth and Kleiner, 1996) argued that increasingly an organization's physical layout is designed around employee needs in order to maximize productivity and satisfaction

## 5. Conclusion

The study focused on the manufacturing industry characteristics (Technological and Financial) as determinants of the level of productivity in Nigeria. It employed ordered logistic regression model (cross tabulation) and parametric statistics in the analysis of data. The study revealed manufacturing industries characteristics (Technological and Financial) as determinants of level of productivity in Nigeria, the study concludes that, for technology characteristics, only equipment relevance ( $p < 0.05$ ) had significant effect on the level of productivity, whereas for financial characteristics, only profitability ( $p < 0.05$ ) had a significant effect on level of productivity. The study rejects the null hypothesis ( $H_0$ ) which states that; manufacturing industry characteristics in Nigeria do not assess the level of productivity and concludes that manufacturing industry characteristics in Nigeria assesses the level of productivity. The study further recommended that in manufacturing industries, new technology should be put in

place, avenue for capital investment should be provided and efficient management should take charge.

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