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## **Adoption of quantitative techniques and performance of selected quoted manufacturing companies in Nigeria**

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### **Abstract**

The study was conducted to examine the influence of quantitative measures on performance of manufacturing companies in Nigeria. The survey research design was adopted in this study because data were collected using primary technique. Champion Brewery Plc., Uyo was considered as a manufacturing company studied. The population of this study was made up of thirty-four (34) employees who were in the strategic position in Champion Brewery Plc, Uyo. The entire population of thirty-four (34) employees were sampled for this study. Data were collected using structured questionnaire. The dependent variable was Performance (PM) while the independent variables were quantitative measures represented by Linear Programming (LP), Linear Regression (LR) and Break-even Analysis (BEA). From the outcomes of the analyses, it was discovered that LP, LR and BEA had positive and significant influence on PM of Champion Brewery Plc, Uyo. It was concluded that quantitative measures (linear programming, linear regression and break-even analysis) had positive and significant influence on performance of manufacturing companies in Nigeria. However, it was recommended that linear programming should be adopted effectively in the operations of manufacturing companies in Nigeria to solve the problem of allocation and ascertaining optimal products that could raise profitability and drive performance of the firms.

**Keywords:** Quantitative measures, performance, break-even analysis

### **1. Introduction**

Manufacturing companies are entities that drive the economic growth and development of Nigeria. The role of these entities in economic growth and development is achieved through the level of growth in performance achieved over the years (Anene and Oyelere, 2014) <sup>[1]</sup>. In other words, the level of performance of manufacturing companies in Nigeria defines the level of economic growth and development of the country as well. The progress in performance of manufacturing companies is tied to many factors which are quantitative and qualitative in nature. The qualitative factors are those factors that are without the attributes of measurement and the quantitative factors are those factors that could be measured using values or figures (Bagshaw, 2019) <sup>[2, 3, 4]</sup>. Quantitative measures are some of these quantitative factors that could influence performance of manufacturing companies in Nigeria when adopted and used properly.

Before now, the decisions taken by managers were mostly without the application of mathematical models but interpreted manually. During this period, the economy of different countries was considered to be in primitive stage for the fact that there was no technological innovations and advancement. During the primitive era, ideas were rarely transformed into device that could bring about greater advantage to the organization (Devi Devaki, 2019) <sup>[6]</sup>. Since the economy of countries had been developed through inventions of techniques to solve tedious problems, organization have been encouraged to take advantage of these inventions to raise their performance. Quantitative measures are some of these inventions brought by statisticians to solve challenging issues that are quantitative in nature in organizations like manufacturing companies in Nigeria.

The quantitative measures invented by statisticians include linear programming, linear regression, break-even analysis, inventory model, among others. All these techniques are expected to be effectively used by manufacturing companies in Nigeria to drive their performance (Fuller, 2015) <sup>[8]</sup>.

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Despite the adoption of these quantitative measures, manufacturing companies in Nigeria are still applying the usual ways of analysing decision problems.

Performance is defined as the level of growth in certain attributes regarded as performance indicators. These attributes include revenue, profitability, employee's productivity and investment. Thus, when talking about performance of manufacturing companies in Nigeria, it is possible to say that performance has no common definition or meaning but it could be explained based on certain parameters which have been mentioned (Verma and Sharma, 2017) <sup>[12]</sup>. For there to be improvement in performance, both qualitative and quantitative factors, must be put together. Studies in this area of survey by the researcher of this study have not really dwelt on the influence of the individual quantitative measure of performance, especially manufacturing companies in Nigeria. This study is set to achieve what have not been covered by previous researchers in this area.

Some of the multinational companies whose branches are overseas have adopted different quantitative measures to analyse their decision problems and the outcome of the application have impacted positively on their performance (Ukata, 2017) <sup>[11]</sup>. In Nigeria, some companies have decided to adopt the ideas of the counterparts in adopting quantitative measures to solve the challenging issues of decisions taken by managers. However, some of these entities that have adopted quantitative measures in Nigeria have been reporting growth in their performance while others are still reporting poor performance despite the application of quantitative measures including manufacturing companies in Nigeria (Ezema and Amakon, 2012) <sup>[7]</sup>. Some of the manufacturing companies in Nigeria have not even adopted quantitative measures in solving decision problems. It appears that the importance of using quantitative measures have not been unveiled to the managers of these entities.

Some of the manufacturing companies in Nigeria that have adopted quantitative measures in their operations are still not doing well in terms of performance because of the skills to make proper use of these measures. It is on this note that the researcher is in doubt whether quantitative measures applied by manufacturing companies in Nigeria has any influence on their performance by taking Champion Brewery Plc, Uyo as a company to study.

The main objective of this study was to examine the influence of quantitative measures adopted on performance of manufacturing companies in Nigeria - a study of Champion Brewery Plc, Uyo, Akwa Thom State.

## 2. Review of related literature

### 2.1. Conceptual Review

Manufacturing companies in Nigeria are drivers of economic growth and development in Nigeria; from the role played in manufacturing of essential goods to put in local market in the country and international market (Anene and Oyeler, 2014) <sup>[1]</sup>. Manufacturing entities earn income from local market and international market in which the products manufactured are sold. Foreign earnings are made from goods locally manufactured by these companies to the international market. Manufacturing companies in Nigeria are involve in transformation of local economy by ensuring

that needed products are produced based on the size of market (Monday, Akinola, Ologbenla & Aladeraji, 2015) <sup>[9]</sup>. The basic kinds of products manufactured by these firms are broadly classified into consumer goods and industrial goods. In Nigeria, manufacturing companies are broadly classified into the following subcategories of consumer goods companies, industrial goods companies, oil and gas companies and health care companies (Ukata, 2017) <sup>[11]</sup>. Consumer goods companies are those entities that are concerned with the production of varieties of products needed and desire by individuals or the general public who are regarded as consumers or buyers. Industrial goods companies are those companies whose major activities is the production of industrial products such as cable for electrical connections, plant for production of essential goods (plants for conversion of raw materials to finished goods) (Bagshaw and Nissi, 2019) <sup>[4]</sup>. The core activities of these companies are to manufacture products needed by other companies or industries.

Oil and gas companies are those companies that are engaged in the activities of upstream and downstream in oil and gas sector (Ezema and Amakon, 2012) <sup>[7]</sup>. They are concerned with the activities of extraction of crude oil, processing the crude oil extracted to needed products and distributing them to the consumers. The upstream activities of oil and gas sector is the activities of development, extraction and production of new oil and gas reserves while the downstream activities of oil and gas sector is associated with the activities of marketing and distribution of finished products of crude oil to the consumers or buyers.

Health care companies are those entities that carry out the activities of producing clinical and pharmaceutical products to the general public regarded as consumers (Bagshaw, 2017). Clinical products manufactured by health care companies in Nigeria include hospital beds and other apparatus used by medical doctors. On the other hand, pharmaceutical products are drugs, cotton wool, methylated spirit and so on.

The survival of all these entities is associated with the level of performance attained by the companies. Thus, performance of manufacturing companies is very fundamental to the continuous existence of these firms. Performance is defined as the level of improvement in financial and non-financial indicators (Verma and Sharma, 2017) <sup>[12]</sup>. Performance is also defined as the level of growth in both quantitative and qualitative factors. In this case, it is observed that performance has to do with the extent to which companies have achieved their goals and objectives. Performance is anchored on the level of improvement of some factors as stated earlier which could be financial and non-financial in nature. The financial factors of performance are those attributes that are often presented on financial statements published by managers of manufacturing companies in Nigeria while the non-financial factors are those attributes that are not presented on published financial statements of manufacturing entities in Nigeria (Wazis, Imam and Kashim, 2016).

The financial factors of performance are also regarded as quantitative factors of performance because of the characteristics of being measurable with values or figures. On the contrary, some of the non-financial factors of performance are quantitative and others are qualitative in

nature. The quantitative factors of non-financial performance are those attributes although not reported on financial statements published by managers of manufacturing companies in Nigeria but can be translated into quantifiable attributes (Bagshaw, 2017). For instance, the number of hours spent by employees in production of certain product could be regarded as quantitative non-financial indicator because the number of hours spent, and the quantity of goods produced could be translated into quantifiable data.

Qualitative non-financial performance are those attributes that lacks the characteristics of being measurable with quantifiable data. Qualitative non-financial performance are those factors that could not be measured by assigning numbers to but are existing in an organization (Wazis *et al.*, 2016) Example of qualitative non-financial performance are decisions often taken by managers, the skills of individual directors in an organization and the experience acquired by employees in an organization. Qualitative nonfinancial performance, when properly managed, usually raise the overall growth of an entity.

Performance in this study is considered from the standpoint of measurability of actions. Thus, performance of manufacturing companies in Nigeria especially that of champion brewery Plc, Uyo is connected to growth in revenue, growth in profitability, growth in investment of non-current assets, improvement in employees' efficiency and improvement in value. Growth in revenue has to do with increase in sale or turnover of an entity between two accounting periods (Ukata, 2017). <sup>[11]</sup> In this case, when revenue falls between two accounting periods, growth in revenue could be described as being negative and thus, performance between the two accounting periods is not impressive. Increase in profitability is described as a fundamental achievement in performance of firms.

It is also important to note that growth in profitability might not really indicate that companies have attained progress in performance especially when managers adopt the approach of earnings management where expenses are reduced or when a greater proportion of sale revenue is done on credits (Fuller, 2015) <sup>[8]</sup>. In this case, it could be stated clearly that manufacturing companies in Nigeria could declare paper profits which might not really portray the image of performance of the firms. For profit to affect performance of companies positively, quality of profit is expected whereby a greater proportion of the profits is on cash and the negative effect of earnings management is minimized.

Investment in non-current assets usually describe the extent to which a company is expanding. The higher the investment in acquisition of non-current assets, the larger the entity and vice versa (Verma and Sharma, 2017) <sup>[12]</sup>. The level of investment in which a manufacturing firm commits funds into defines the propensity of the company growing larger in the future. Employee's efficiency is very important in ensuring the growth in performance of an entity. Employee's efficiency has to do with the possibility of employees utilizing less hours to [produce larger volumes of product. In the case, employee's efficiency is capable of driving the performance of manufacturing companies in Nigeria (Onukwuli *et al.*, 2014). Growth in value usually defines the performance of an entity, value of a manufacturing company in Nigeria could be described in

terms of growth in stock price, growth in assets, growth in book value of equity and growth in market of equity.

Performance of manufacturing companies in Nigeria in this study is measured in terms of growth in revenue, growth in profitability, improvement in investment and growth in value. This is because all these factors mentioned are reported on financial statements of manufacturing companies in Nigeria as well as disclosing them in annual reports (Bagshaw, 2019). The reason behind the choice of quantitative indicators reported on annual reports and financial statements of manufacturing companies in Nigeria is owing to the fact that the independent variables is concerned with quantitative measures.

Quantitative measures that has been introduced to be utilized in the operations of manufacturing companies in Nigeria include linear programming, linear regression and break-even analysis. Linear programming is defined as a quantitative measure usually adopted to solve a decision problem the has more than one limiting factor (Anene and Oyelere, 2014) <sup>[1]</sup>. Linear programming is usually adopted to solve the problem of allocation to enable the user to appropriately ascertain the best combination of allocations that could yield meaningful results. The benefits of adopting linear programming quantitative measure is to assess the optimal combination of activities or products that could yield the highest outcome to the user. Linear programming is often used to assess the best combination of more than one product that could either maximize profit or minimize cost. Also, linear programming is also used to assess the combination of labour hours that could produce maximum quantity of products as well as combination of products that could be produced using minimum hours (Fuller, 2015) <sup>[8]</sup>.

For the fact that linear programming is often adopted in assessing the best combination of products known as optimal products, it is clear to say that linear programming, as one of the quantitative measure, is adopted in manufacturing companies because of its suitability in deQision making which has to do with profit maximization, cost minimization, output maximization and labour hours minimization (Bagshaw, 2019). Thus, the application of linear programming in operations of manufacturing companies in Nigeria is targeted towards raising performance of the entities. Linear programming is applicable in various areas of management science such as accounting and finance, marketing and distribution, human resource management and production.

Linear programming is adopted in accounting and finance department of an organization particularly in assessing the optimality of investments (Fuller, 2015) <sup>[8]</sup>. The application of linear programming in the area like capital budgeting assist managers of manufacturing companies in Nigeria to decide the investments that are ideal, and which can add more value to the wealth of the shareholders. Also, in the area of accounting and finance, linear programming is used to solve the problem of capital rationing in an organization which is drawn from investment perspective (Devi and Devaki, 2019). Usually, a manufacturing company might be faced with different investment opportunities with positive Net Present Value (NPV) with different amount of initial capital outlay and the company might be constrained in terms of available capital to invest in all these investments with positive Net Present Value (NPV). In this case, linear

programming could be used to allocate appropriately or to decide the investments to be combined to yield meaningful result to the organization.

Linear programming is adopted in marketing and distribution activities of a manufacturing company. It is basically used to allocate the quantity of products to produce to different market based on size of the market and the available resources in the organization with the aim of reducing waste. Linear programming is also adopted in marketing and Distribution activities of a manufacturing entity to help managers to assess the markets with higher patronage. It is also adopted in distribution activities to ascertain the route to advertise company products or to deliver the products with minimal costs (Onukwuli *et al.*, 2014). Linear programming as a quantitative measure is also used in research and development activities of an organization to enable the user or manager to determine quantitatively the level of satisfaction derived from the company's products as well as locating new markets for the company's products.

Linear programming is applicable in human resource department of an organization. Particularly, it is used to evaluate the efficiency of employees in terms of labour hour usage. It is usually adopted to determine the combination of employees that could produce the maximum quantity of products needed in an organization with limited hours and limited costs (Ukata, 2017) <sup>[11]</sup>. The application of linear programming in human resource management is achievable when the user understands how the models work. The use of linear programming in human resource management also help managers of manufacturing companies to select the best employees that could handle the activities of the organization efficiently and effectively to raise the performance. This is achievable in recruitment process often conducted by a manufacturing company in Nigeria.

Linear programming is employed in production department of a manufacturing company. The essence of its adopting is to ascertain the combination of hours that could yield maximum output given the limited resources or input. The application of linear programming is basically suitable in manufacturing process where raw materials are transformed into finished goods or products (Verma and Sharma, 2017) <sup>[12]</sup>. Linear programming is also applied to decide the quantity of input to combine to produce the maximum quantity of products at a given period of time. This is mostly applicable in a manufacturing company where there are varieties of products often produced by the organization. Linear programming is also adopted in production department to ascertain the combination of products that could yield higher turnover or revenue.

However, linear programming is a quantitative measure that has some limitations based on its applicability. These limitations include: first, linear programming cannot be applied to solve a problem that has one limiting factor or scarce resource. Second, linear programming cannot be applied in a scenario that is full of uncertainties (Wazis *et al.*, 2016). The application of linear programming does not warrant the exact outcome calculated using objective function because of the historical data used. Finally, linear programming model is not suitable in production of one product. To adopt linear programming, there are basic steps that must be followed.

### These steps include

- i. Define the variables in accordance with the products
- ii. State the objective function either to minimize costs or to maximize profits for instance.
- iii. Formulate the constrain in line with their limited resources.
- iv. State the non-negativity function.

It is important to note that in maximization of profits, the less than or equal to ( $\leq$ ) symbol should be used and to minimize costs, the greater than or equal to ( $\geq$ ) symbol should be used. To obtain the optimal value from the linear programming model to substitute in the objective function, the constrain must be converted into equation and solved appropriately using a specified method. Basically, there are two methods used in solving linear programming problems and they are graphical method or algebraic method. The graphical method is only used to solve a linear programming problem that has just two variable- X and Y for instance. The algebraic method could be used to solve different kind of linear programming problems. It includes matrix method, determinant (Cramer's rule) and simplest tableau method. The matrix, determinant and simplest methods could be used to solve linear programming problems involving just two variables and above.

Linear regression is another quantitative measure used to solve decision problems in manufacturing companies in Nigeria. Linear regression is used mostly to solve the problems that has to do with dependent and independent variables. In other words, in the application of linear regression, the essence is to establish the rate of influence of independent variables on dependent variables (Ezema and Amakon, 2012) <sup>[7]</sup>. Linear regression is a statistical tool that is mostly used in prediction of one quantity or variables given the other.

Linear regression has some assumptions which are often satisfied before the adoption. These assumptions include: first, the data for both dependent and independent variable must exhibit the attribute of normality. Second, the independent variables must influence the dependent variable individually to avoid the problem of multi-collinearity (Bagshaw and Nissi, 2019) <sup>[4]</sup>. Finally, the dependent variable must be predicted by the independent variables to avoid the problem of first-order autocorrelation.

Before the adoption of linear regression, the user should be familiar with the requirements which has to do with the variables, the assumptions and the expected result (Bagshaw, 2017) <sup>[2]</sup>. This simply means that before linear regression is adopted to solve a problem in a manufacturing company, the dependent and independent variable must be accurately stated, and the assumption of normality and others must be strictly adhered. When all these requirements are satisfied, the result provided by linear regression could be said to be authentic and not with high level of spuriousness.

Like linear programming, linear regression is applicable in the following areas or departments in a manufacturing company such as finance and accounting, marketing department, human resource and production department. Linear regression is basically adopted in accounting and finance department especially in the prediction of costs which cut across various areas and practices of the



department (Verma and Sharma, 2017) <sup>[12]</sup>. Linear regression is also adopted in marketing department for the purpose of predicting the quantity of products manufactured by firms that could be patronized in a given market given other conditions to be favourable like taste of the buyers, price of the product, then nature of the product and political stability.

Linear regression is applicable in human resource department of a manufacturing company in Nigeria. The essence of the adopting of linear regression in human resource department rest on prediction (Devi and Devaki, 2019) <sup>[6]</sup>. Linear regression could help managers of human resource department to predict the number of outputs that could be produced with the available labour hours. Linear regression is also employed in production department for the purpose of predicting the cost of raw materials that could be used to acquire the suitable raw materials that could produce certain number of products at a given period. The essence of adopting linear regression in prediction is to solve decision problems which could influence performance of manufacturing companies in Nigeria positively.

Break-even analysis is another quantitative measure used in taking decision in an organization. In break-even analysis, the major concern of a manager is to ascertain a point where profit is zero and cost is zero. In this case, break-even point is a point of equilibrium between total revenue and total cost of an entity. The total revenue is derived by multiplying the price charge with the quantity of products (Fuller, 2015) <sup>[8]</sup>. Total cost is broadly classified into total fixed cost and total variable cost. In the computation of break-even point, certain factors must be taken into consideration and these include selling price per unit, variable cost per unit and total fixed cost. Break-even point in quantity usually indicate the quantity of products that could be manufactured by a firm to more no profit and no loss.

Break-even analysis is usually used by managers to determine the point of equilibrium between revenue and total cost so as to decide the quantity of product to produce further at a given price and variable cost per unit to maximise profit (Bagshaw, 2019) <sup>[3, 4]</sup>. This is how important break-even analysis is in manufacturing companies in Nigeria. In deciding the quantity of product to produce beyond break-even point to maximize profit, performance of manufacturing companies in Nigeria could be influenced positively.

## 2.2 Theoretical Review

A theory was reviewed and adopted in the study because of its suitability in the study conducted.

### 2.2.1 Resource-Based Theory

The resource-based theory was formulated and developed by Barney (1995). The resource-based theory emanates from the principle that the source of firm's competitive advantage lies in their internal resources, as opposed to their positioning in the external environment. That is, rather than simply evaluating environmental opportunities and threats in conducting business, competitive advantage depends on the unique resources and capabilities that a firm possesses (Barney, 1995). The resource-based approach of the firm predicts that certain types of resources owned and controlled by firms have the potential to generate competitive

advantage as well as superior firm performance (Devi and Devaki, 2019). Quantitative measures adopted in manufacturing companies could be regarded as resources controlled by the organization for the purpose of improvement in performance.

The resource-based approach stipulates that in strategic management the fundamental sources and drivers to firms' competitive advantage and superior performance are mainly associated with the attributes of their resources and capabilities which are valuable and costly-to-copy. Firm resources include all assets, capabilities, organizational processes, firm attributes and information, knowledge controlled by a firm that enable the firm to conceive and implement strategies that improve its efficiency and effectiveness (Barney, 1995). Quantitative measures adopted by manufacturing companies are included in organizational processes used in conducting business activities. This is how relevant resource-based theory is in this study. Thus, it is adopted in this study.

## 2.3 Empirical Review

Previous studies in relation to this study were reviewed to ascertain the gap in the present study.

Fuller (2015) <sup>[8]</sup> conducted a study on the strategist's scorekeeper: A quantitative approach to the assessment of business strategies. The study was carried out to evaluate the importance of using quantitative models in solving decision problems. Five metrics for comparatively assessing business strategies, both longitudinally and cross-sectionally, were provided. Academics will benefit from being able to assess the viability of strategies among a range of theoretical perspectives, enhancing opportunities for cross theoretical strategic analysis. Practitioners can better document their firm's strategies, identifying strategic gaps with their rivals and assessing the potential impact on firm performance among various strategies prior to implementation.

Munday *et al.* (2015) assessed strategic management and firm performance: A study of selected manufacturing companies in Nigeria. The intention of the researchers was to provide further evidence on the effects of strategic management (SM) on the performance of manufacturing industries in Nigeria. Five large-scale quoted manufacturing firms located in Lagos metropolis were selected. The study relied on primary data which were obtained using structured questionnaire administered to 50 purposively selected respondents of the selected firms. The data collected were analysed using Analysis of Variance (ANOVA) and correlation analysis as well as descriptive analysis in pursuance of the stated specific objectives of the study. The result showed that strategic management had significant effects on the profitability and operational performance of the selected manufacturing firms. Also, strategic management had positive relationship with the level of competition of the firms. The study concluded that the practice of strategic management is *sine qua non* in boosting firm performance in the manufacturing industries in Nigeria. Ukata (2017) <sup>[11]</sup> in a study to investigate the use of quantitative business models as an aid for financial management by entrepreneurs to surmount Nigeria's economic challenges. The investigation used causal comparative research design. The research design sought to

find out that which is associated with certain occurrence, conditions, and outcomes types of behaviour by analysis of the past events, or already existing records. It was discovered that quantitative business models like price earnings ratio, dividend-discount-model, discount-cash-flow-model, Pie in 3-D, price-to-cash-flow-ratio, cost-benefit-analysis, breaking-even-analysis, statistics analysis of feasibility study, gross-domestic-product (GDP), and contribution margin (marginal income) were used as an aid for financial management in the areas of investments decision-making to clients, financial projection of potential future performance of firms, determining stock valuation of companies in the same industries, to know sales rate/investment areas and expected returns of private and public firms.

Verma and Sharma (2017) <sup>[12]</sup> conducted a study to determine the role of quantitative techniques in business and management. The purpose of the study was to discuss the various quantitative techniques and methods used in managerial decisions. Quantitative techniques are very powerful medium through which we solve uncertainty in decision making and enhance projectability and efficiency in the business. A systematic approach to decision making is complex because today's business and environment in which it is functioning are for more complex than in the past. For large business, a single wrong decision very painful but may also have ramifications in national economy.

Bagshaw (2019) <sup>[3, 4]</sup> conducted a review of quantitative analysis in production planning decisions using the linear programming model. The purpose of the study was to examine the role of quantitative analysis in production planning decisions. This draws from the observed imperatives of quantitative analysis in business decisions and its capacity for predictability and enhanced decision making given the increasingly complex nature of the business environment. The study therefore addressed the historical evolution of quantitative technique as an efficient and effective decision-making tool. The content of the study addressed commonly applied quantitative technique in manufacturing firms today which is, linear programming and its subsequent impact on production planning decisions. The results based on a congruence of views revealed that the "best-fit" application of quantitative analysis models and tools can untangle the complexities of production and planning decision making process in order to achieve the organizational goal.

Devi and Devaki (2019) evaluated the applications of quantitative techniques in decision making of business organisation. In the business world, and in fact, in practically every aspect of daily living, quantitative techniques are used to assist in decision making. Quantitative techniques are used to assist in decision making. Managers must be able to use quantitative techniques in a confident and reliable manner. Accountants make decisions based on the information relating to the financial state of organization. Economists make decision based on the information relating to the economic

framework in which the organization operates. Marketing staff make decisions based on customer response to product and design. Personnel managers make decisions based on the information relating to the levels of employment in the organization, and so on. Such information is increasingly quantitative, and it is apparent that managers need a working knowledge of the procedures and techniques appropriate for analysing and evaluating such information.

### 2.3.1 Gap in the Literature

From the empirical literature reviewed, it was discovered that studies on quantitative measures and performance of manufacturing companies were limited considering the variables of this study and the company chosen for the study. For this reason, the present study on quantitative measure and performance of manufacturing companies in Nigeria using the variables of linear programming, linear regression and break-even analysis as quantitative measures would contribute to knowledge and existing literature in this area of interest, hence, the need for the study.

## 3. Methodology

The conduct of this study necessitated the application of survey research design simply because of the fact that the data collection method of the present study required the researcher to design an instrument regarded as questionnaire for obtaining the relevant data (Verma and Sharma, 2017) <sup>[12]</sup>. The adoption of such design allowed the researcher to evaluate the influence of quantitative measures adoption and performance of manufacturing companies in Nigeria.

The population of this study consisted of the employees in Champion Brewery Plc, Uyo who are acquainted with the subject matter. The total number of employees in the organization were thirty-four (34). Thus, the population of this study was thirty-four (34). For the fact that the researcher was able to reach out to the entire population of thirty-four (34), the entire number of employee that constituted the population of this study was sampled for the study. In this regard, the sample size of this study was thirty-four (34) employees obtained from the Champion Brewery Plc, Uyo. The researcher believed that the entire population of thirty-four (34) employees studied together would offer directions on the influence of quantitative measures adoption and performance of manufacturing companies in Nigeria.

The census sampling techniques was employed by the researcher in this study. This supported the fact that the entire population of thirty-four (34) employees drawn from Champion Brewery Plc, Uyo Were sampled for the study. The method of data collection was primary with the use of a research instrument. The research instrument employed in the study in the collection process of data was structured questionnaire. The key variables of these study were quantitative measures and performance. The dependent was Performance (PM) while the independent variables were quantitative measures represented by Linear Programming (LP), Linear Regression (LR) and Break-even Analysis (BEA). All the variables were described on Table 1:

**Table 1:** Variable Description

S/N	Variable	Abbr.	Measurement	Apriori Expectation
1	Performance	PM	Five-Point Likert Scale	
2	Linear Programming	LP	Five-Point Likert Scale	Positive
3	Linear Regression	LR	Five-Point Likert Scale	Positive
	Break-even Analysis	BEA	Five-Point Likert Scale	Positive

Source: Researcher's Compilation (2022)

The empirical models were stated appropriately in line with the variables in each of the objectives of the study:

$$PM = \beta_0 + \beta_1 LP + e_t \quad \text{Equation (3.1)}$$

$$PM = \beta_0 + \beta_1 LR + e_t \quad \text{Equation (3.2)}$$

$$PM = \beta_0 + \beta_1 BEA + e_t \quad \text{Equation (3.3)}$$

Where  $\beta_1$ ,  $\beta_2$  and  $\beta_3$  = Coefficients of the independent variables,  $\beta_0$  = Intercept of PM and  $e_t$  Random Error Term.

The data collected were analysed using descriptive statistics and inferential statistics. The descriptive statistics was used to evaluate the nature of the data collected for the study while the inferential statistics was used to establish the influence of quantitative measures adoption and performance of manufacturing companies in Nigeria. The inferential statistics included various regression statistical tool such as R,  $R^2$ , Adjusted  $R^2$ , t-statistic, p-value, and F-statistics. R was used to establish the relationship between the dependent and independent variables in the study.

## 4. Data analysis and Findings

### 4.1 Data Analysis

Data collected for the study were analysed appropriately based on the stated statistical tools.

#### 4.1.1 Descriptive Statistics

The descriptive statistics for each of the variables were computed and presented on

The Table 2:

**Table 2:** Descriptive Statistics

Variable	N	MIN	MAX	MEAN	STD
PM	34	1.50	5.00	4.5972	0.1015
LP	34	1.00	5.00	4.7434	0.5928
LR	34	1.75	5.00	4.4207	0.2047
BEA	34	1.00	5.00	4.2990	0.6051

Source: Researcher's Computation (2022)

From Table 2, Performance (PM) had minimum value of 1.50, maximum value of 5.00, a mean value of 4.5972 and standard deviation of 0.1015. This indicated that Champion Brewery Plc, Uyo in average was 4.597 for the period of the study. The minimum and maximum of PM made were 1.50 and 5.00 respectively. The standard deviation of 1.015 indicated that variation from mean was much for the period of the study. It also showed that fluctuation in PM for the period was high.

From Table 2, Linear Programming (LP) had minimum

value of 1.00, maximum value of 5.00, a mean value of 4.743 and standard deviation of 0.5928. This indicated that Champion Brewery Plc, Uyo in average was 4.743 for the period of the study. The minimum and maximum of LP made were 1.00 and 5.00 respectively. The standard deviation of 5.93 indicated that variation from mean was high for the period of the study. It also showed that fluctuation in LP for the period was high.

From Table 2, Linea Regression (LR) had minimum value of 1.75, maximum value of 5.00, a mean value of 4.42 and standard deviation of 0.2047. This indicated that Champion Brewery Plc, Uyo in average was 4.42 for the period of the study. The minimum and maximum of LR made were 1.75 and 5.00 respectively. The standard deviation of 0.2047 indicated that variation from mean was much for the period of the study. It also showed that fluctuation in LR for the period was high.

From Table 2, Break-even Analysis (BEA) had minimum value of 1.00, maximum value of 5.00, a mean value of 4.299 and standard deviation of 0.605. This indicated that Champion Brewery Plc, Uyo in average was 4.299 for the period of the study. The minimum and maximum of BEA made were 1.00 and 5.00 respectively. The standard deviation of 0.6051 indicated that variation from mean was much for the period of the study. It also showed that fluctuation in BEA for the period was high.

#### 4.1.2 Check of Relationship

The simple correlation of each of the variables were computed and presented as shown on the Table 3:

**Table 3:** Simple Correlation

Variable	PM	LP	LR	BEA
PM	1.000			
LP	0.844	1.000		
LR	0.813	0.233	1.000	
BEA	0.911	0.386	0.186	1.000

Source: Researcher's Computation (2022)

From Table 3, the relationship between pairs of independent variables was below 0.60 (60.0%). The relationship between LP and PM was .844%; the relationship between LR and PM was 81.3% and the relationship between BEA and PM was 91.1%.

#### 4.1.3 Test of Hypotheses

The coefficients of each of the independent variables and other statistics were computed and presented on individual Tables based on the hypotheses of the study.

#### Hypothesis One (1)

The linear regression outputs were presented on Table 4 to enable the researcher to test the hypothesis:

**Table 4:** Linear Regression Outputs

Variable	Beta $\beta$	t-Stat.	P-Value	$R^2$	F-ratio
Constant	0.038	1.439	0.152	0.7123	18.649, p<0.05
LP	0.742	5.791	0.000		

\* Dependent Variable=PM

Source: Researcher's Computation (2022)

From the Table 4, it was observed that Linear Programming (LP) had positive and significant influence on Performance (PM) of Champion Brewery Plc, Uyo. This was because both t-statistics and p-value indicated that LP was significant. The beta-value of LP, which is the coefficient, was positive as well. This showed that an increase in LP could also raise PM of Champion Brewery Plc, Uyo by 74.2%. In accordance with the regression technique stated by the researcher, LP complied with the *a priori* expectation. The constant value of 3.8% showed the rate of PM as LP was held constant and was insignificant (p-value>0.05).  $R^2$  showed that 71.23% variation in PM was caused by the influence of LP in the model. The F-ratio of 18.649 (p<0.05) computed indicated that  $R^2$  was significant in explaining the model.

The null hypothesis, which states that linear programming does not significantly influence performance of manufacturing companies in Nigeria, was rejected and the alternative hypothesis, which states that linear programming significantly influence performance of manufacturing companies in Nigeria, was accepted on the basis of both t-statistics and p-value for LP.

### Hypothesis Two (2)

The linear regression outputs were presented on Table 5 to enable the researcher to test the hypothesis:

**Table 5:** Linear Regression Outputs

Variable	Beta $\beta$	t-Stat.	P-Value	$R^2$	F-ratio
Constant	0.024	1.129	0.142	0.6610	17.449, p<0.05
LR	0.582	4.791	0.000		

\*Dependent Variable=PM

Source: Researcher's Computation (2022)

From the Table 5, it was observed that Linear Regression (LR) had positive and significant influence on Performance (PM) of Champion Brewery Plc, Uyo. This was because both t-statistics and p-value indicated that LR was significant. The beta-value of LR, which is the coefficient, was positive as well. This showed that an increase in LR could also raise PM of Champion Brewery Plc, Uyo by 58.2%. In accordance with the regression technique stated by the researcher, LR complied with the *a priori* expectation. The constant value of 2.4% showed the rate of PM as LR was held constant and was insignificant (p-value>0.05).  $R^2$  showed that 66.10% variation in PM was caused by the influence of LR in the model. The F-ratio of 17.449 (p<0.05) computed indicated that  $R^2$  was significant in explaining the model. The null hypothesis, which states that linear regression does not significantly influence performance of manufacturing companies in Nigeria, was rejected and the alternative hypothesis, which states that linear regression significantly influence performance of manufacturing companies in Nigeria, was accepted on the basis of both t-statistics and p-value for LR.

### Hypothesis Three (3)

The break-even analysis outputs were presented on Table 6 to enable the researcher to test the hypothesis:

**Table 6:** Linear Regression Outputs

Variable	Beta $\beta$	t-Stat.	P-Value	$R^2$	F-ratio
Constant	0.042	1.439	0.562	0.8299	20.342, p<0.05
BEA	0.672	6.121	0.000		

\* Dependent Variable PM

Source: Researcher's Computation (2022)

From the Table 6, it was observed that Break-even Analysis (BEA) had positive and significant influence on Performance (PM) of Champion Brewery Plc, Uyo. This was because both t-statistics and p-value indicated that BEA was significant. The beta-value of BEA, which is the coefficient, was positive as well. This showed that an increase in BEA could also raise PM of Champion Brewery Plc, Uyo by 67.2%. In accordance with the regression technique stated by the researcher, BEA complied with the *a priori* expectation. The constant value of 4.2% showed the rate of PM as BEA was held constant and was insignificant (p-value>0.05).  $R^2$  showed that 82.99% variation in PM was caused by the influence of BEA in the model. The F-ratio of 20.342 (p<0.05) computed indicated that  $R^2$  was significant in explaining the model.

The null hypothesis, which states that break-even analysis does not significantly influence performance of manufacturing companies in Nigeria, was rejected and the alternative hypothesis, which states that break-even analysis significantly influence performance of manufacturing companies in Nigeria, was accepted on the basis of both t-statistics and p-value for BEA.

### 4.2 Discussion of the Findings

From the analyses, Linear Programming (LP), Linear Regression (LR) and Break- even Analysis (BEA) had positive and significant influence on performance of Champion Brewery Plc, Uyo. This indicated that quantitative measures adopted by manufacturing companies in Nigeria had a positive and significant influence on performance. The result of the analyses on regards to LP, LR and BEA was in compliance with the *a priori* expectation stated by the researcher of this study. when quantitative measures are appropriately adopted and used by a company, the outcome is usually reflected on the performance of these entities. On the other hand, when quantitative measures are not properly used to solve decision problems in an organization, performance of such company might not be influence positively because solution to decision problems is always the rudiment to improvement in performance.

The positive and significant influence of quantitative measures (LP, LR and BEA) on performance of manufacturing companies in Nigeria in this study could be accorded to the fact the quantitative measures adopted in these entities have been properly utilized to solve managerial problems. The present study was in line with the study of Bagshaw (2019) [3, 4] who conducted a review of quantitative analysis in production planning decisions using the linear programming model. It was in consistent with the study of Devi and Devaki (2019) who evaluated the applications of quantitative techniques in decision making of business organisation.



## 5. Summary, Conclusion and Recommendations

### 5.1 Summary of the Findings

The study was conducted to examine the influence of quantitative measures on performance of manufacturing companies in Nigeria. Champion Brewery Plc was chosen as a manufacturing company studied. The dependent variable was performance and the independent variables were quantitative measures represented by Linear Programming (LP), Linear Regression (LR) and Break-even Analysis (BEA). Data were collected for the study using questionnaire structured. The sourced data were analysed using descriptive statistics and simple linear regression.

From the analyses, it was discovered that:

- i. Linear Programming (LP) had a positive and significant influence on performance of Champion Brewery Plc, Uyo.
- ii. Linear Regression (LR) had a positive and significant influence on performance of Champion Brewery Plc, Uyo.
- iii. Break-even Analysis (BEA) had a positive and significant influence on performance of Champion Brewery Plc, Uyo.

### 5.2 Conclusion

The study was conducted to examine the influence of quantitative measures on performance of manufacturing companies in Nigeria. Champion Brewery Plc was chosen as a manufacturing company studied. Data were collected and analysed using simple linear regression analytical tool. From the outcomes of the analyses, it was concluded that quantitative measures (linear programming, linear regression and break-even analysis) had positive and significant influence on performance of manufacturing companies in Nigeria.

### 5.3 Recommendations

From the empirical findings, the following recommendations were suggested:

- i. Linear programming should be adopted effectively in the operations of manufacturing companies in Nigeria to solve the problem of allocation and ascertaining optimal products that could raise profitability and drive performance of the firms.
- ii. Linear regression should be applied in solving forecasting problems in manufacturing companies in Nigeria continuously for the purpose of influencing upon the performance of the entities positively.
- iii. Break-even analysis model should be applied to decide the level of quantity of the products to be manufactured to maximize profit and raise performance of the companies.

### 5.4 Suggestions for Further Studies

The following suggestions were made in regard to the areas not covered in this study:

- i. Quantitative measures and performance of manufacturing companies in Nigeria should be studied by selecting other manufacturing companies to study.
- ii. Quantitative measures and performance of manufacturing companies in Nigeria should be investigated by other researchers by including other variables regarded as quantitative measures not

captured in this study.

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