

## Quantitative Techniques' usage and Performance: The Case of Nigerian small scale industries (2007 – 2011)

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### **Abstract**

*The paper examined quantitative techniques' (QTS) usage and performance (measured in terms of annual profits) in a select small-scale industry (SSIs) in Nigeria within a five-year period (2007 – 2011). Specifically, it analyzed the effect of QTs' usage on annual profits of the companies within the selected industries. The significance of such effect was, also, examined. This paper hypothesized that QTs' usage has no significant effect on annual profit. Data were extracted from questionnaire responses by relevant companies in the author's Ph.D. work. Descriptively, data were partly analyzed, using percentages and mean values. Chi-square ( $\chi^2$ ) statistic was applied to testing the stated hypothesis. Analytical results showed that usage of QTs had an effect on profitability, which effect, however, was not significant. Conclusively, this paper asserted that QTs' usage in the study area, within the given period had an effect on Nigeria small-scale industries performance as proxied by annual profits of their companies. It recommended increased awareness and usage of QTS and increased financial provisions for QTs in order to increase profits, hence, performance (with its other aspects like increased output volumes, meeting up with customers' demands and general satisfaction) in these industries.*

**Keywords:** *Quantitative technique, usage, performance, small-scale industries.*

### **Introduction**

Small scale industries have been identified, all over the world, as the bed-rock and sustaining factor of the economies of many countries; developed, developing and even the under-developed. Germany, Britain, France, Russia, U.S.A, before Japan and India, Malaysia, Korea, Taiwan, and China have also joined in the success story of high manufacturing technology through the immense contributions of SSIs in their countries (Chibundu, 2006; Anene, 1993). Consequently, these industries and the countries in which they operate had been reaping the benefits from QTs' usage.

Manufacturers within, look forward to grapple with and generally surmount production problems. The greatest of these being the problem of producing with a least-cost combination of input/material resources. This least-cost, when achieved, would always imply maximization of profit (in line with the economic theory of production). (Ogbo *et al.*, 2012; Anene, 2014). Increased profit, in particular, is an important measure of performance, on which other aspects like increased output volumes, customers' general satisfaction and growth of the firms within the various industries rely. Profits also influence contributions to the overall economic, social development and growth of countries. Consequently, Nigerian industries, however, are not yet in tune with the above trend. Thus, the need for this study.

### **Statement of problem**

QTs' usage in developing economies like Korea, Malaysia, and Hong Kong among others had recorded successes, thus, enjoying the benefits of such usage accordingly. This is truly shown in recent years with firms within their SSIs, by way of increased: profits, adequate financial resources (for continual production), output volumes and, by implication, increased performance generally (Lam, 1993). This could not be said to be true with firms in the Nigerian SSIs. This paper set out to address such a gap.

### **Study Objectives and Significance of the study**

Generally, the paper examined QTs usage and performance (using annual profits as a proxy) in selected Nigerian SSIs. It specifically analyzed the effect of QTs' usage on annual profits of the surveyed companies from the selected industries; examined, as well, the significance of such an effect. This paper's significance is embedded in the actual effect of QTs' usage, by companies within the selected Nigerian SSIs, on annual profits

used here, as a measure of performance, such effect could influence other aspects of performance are left out in this paper purposively, for other studies.

### **Literature Review**

Organizations, generally, whether, firms, factories, farm, or even domestic kitchens with resources of man, materials, and money have to be coordinated in the course of time and space constraints. This is in order to achieve laid down objectives in a most efficient manner.

Consequently, organizations involved in economic activities as well as those with social objectives or their mixture, need management which recently has become a field of study that is being taught as a separate subject. The theory essentially, and the eventual practice, of production center on the conversion of material inputs into goods and services. In manufacturing industries, therefore, almost all activities revolve around production. This is the main reason for describing it as a hub of the wheel of manufacturing industries (whether big, medium or small). Thus, production determines what is available for sale, in what quantity and quality and, to a considerable extent, at what price (Buffa, 1972; Wild, 1998; Imaga, 2003; Ahuja, 2004).

In the production of goods and services, manufacturing firms, (including those from small-scale industries) are faced with the decision problems of how to determine the least –cost combination of inputs needed for actual production and , how best to produce in the right quantity and quality for customers’ satisfaction. These, in turn, necessitate allocation problems concerning the utilization of limited resources. Regardless of the size of a manufacturing organization all the raised issues above could be best handled by only one aspect of all the production management functions – production planning and control; this could be the main reason for regarding production planning and control as the most important of all the production management functions (Anene, 1993).

Also, the Economic Theory of production states that the reasons for becoming entrepreneurs or owners of factors of production are purely economic. For instance, being economic entails profitability, increased output volume among others. Here in this study, the profitability aspect is considered. The Economic Theory accepts the resource-based theory and emphasizes the principles of supply and demand. The supply of managerial services is a function of the need of the society (Ogbo *et al.*, 2012). The issue of QTs applications by firms in their respective industries. Thus, this study considered and adopted the Economic theory of production as more appropriate. The need for improved general performance (and especially profit) could rightly be seen as a function of the awareness created for, and the actual, applications of relevant QTs to production planning and control. The specific function out of all others in the entire production management system that is solely saddled with the responsibility of turning out goods or services, in the required least-cost combination of inputs so as to “satisfy” customers; this, consequently, brings about increased profitability.

### **Quantitative techniques**

Quantitative techniques are connected and concerned with amounts instead of the nature or quality of something. Quantitative techniques are about the analysis of quantities (measured in physical, so-called objective data). Operations are an exercise in logic as much as statistics. These techniques are scientific in nature. Their objective is to provide procedure and process that will aid or assist problem solving.

Quantitative technique (QT) is the attack of modern science on complex problems arising from, or in the direction and management of large systems of men, machines, materials, and money, in industry, business, government, and defense, going by the British Standard (Taha, 2006). Lucey (2007) went on to remark that its distinctive approach is to develop a scientific model of the system incorporating measurements of factors like change and risk, with which to predict and compare the outcome of alternative decisions, strategies or controls.

Also, quantitative technique is the application of a scientific approach to solving management problems in order to help managers make better decisions, impliedly, it encompasses a number of mathematically oriented techniques that can be simple or complex in nature, which also has either been developed within the field of management science or adapted from other disciplines such as the natural sciences, mathematics. statistics and engineering (Gaither, 1975; Forgionne, 1983; Iyiegbuniwe, 2001; Wisniewski, 2006; Taha, 2006).

Quite convincingly, the quantitative technique is concerned with the efficient allocation of scarce resources, is both an art and a science. It is important to note that optimal allocation of resources (which quantitative techniques help to achieve) is of utmost importance to decision making in many traditional disciplines including all production concerns (Bronson, 1997; Lucey, 2007).

### **Usage**

This can be referred to, generally, as the direct application of anything such as tools, equipment, and other materials to tasks, activities and the likes in the course of production of goods and services within any organization or by individuals. The above is for the realization of set goals and objectives.

### **Performance**

Performance generally and specifically in the industries can be seen rightly as development, effective and efficient utilization of both human and material resources available in the firms within the industry to achieve their specified goals and objectives. It can be measured in terms of accruing profits, output volumes, growth represented by opening new factories, expansion of the existing production facilities and the likes, more channels of distribution/warehouses), among others.

### **Small-Scale Industries**

All over the world, economies are sustained by various contributions made by sectors and sub-sectors. Industries making up one of these sectors are responsible for the production of various goods and services for local consumption and export generally. The industries include: big, medium and small. This paper focused on small scale industries.

These refer to business activities, branches of trades or manufacture, where goods or services are produced; they constitute those business outfits employing between 5 and 30 people and a maximum of 1 million naira asset base excluding building and some sophisticated machineries (equipment) in just a few cases; (₦162: \$1.00). Also, they are such that adopt the batch-type of production; that is, producing in batches to a suite and meet the market demands in advance, or for stock, with the products varying only in size or are in fixed range and in anticipation of the market or customers' orders.

### **Methodology**

Data on range of profits estimates, their frequencies, means and total mean values for companies within the 8 purposively selected SSIs Garment (A), Block-making (B), Footwear (C), Bag-making (D), Domestic soap-making (E), Edible oil-extraction (F), Furniture (G) and, Metalworks (H), and within the period of study, were extracted from the relevant questionnaire responses (only profit figures for the years 2007-2010 were used for the analysis); the extraction was from an earlier work by the author (Anene, 2012). Data analysis was partly done descriptively using total mean values for the various ranges of profit estimates in tabular forms and the 8 industries. Testing of hypothesis and further analysis were carried out with the aid of chi-square ( $\chi^2$ ) statistic.

### **Results and Discussions**

#### **Analysis of the effect of QTs' applications on profitability**

Results shown in (tables 4.3a-e ) reveal that companies of the selected small scale industries surveyed made profits irrespective of whether they apply QTs to their production planning and control or not. Further analytical results show that no industry (AH), within each of the years (2007 - 2010) under reference, recorded a zero (0) frequency; this confirms the assertion that the surveyed industries made profits whether they applied QTs or not. Also, results from table 4.3e show that within the above reference period, annual profit estimates of less than or equal to ₦1,500,000 ( $\leq$ ₦1,500,000) is the mode with an overall total of means value, 53.50. This implies that the highest number of companies from the selected industries made a profit figure of ₦1,500,000 or less. The range of above ₦1,500,000 but less than or equal to ₦3,000,000 (Above ₦1,500,000  $\leq$  ₦3,000,000), annual profit estimates is next with an overall total of means' value 51.25. Above ₦4,500,000 range, followed third, with 20.75 overall total of means' value. In the last position, is the above ₦3,000,000 but less than or equal to ₦4,500,000 (Above ₦3,000,000  $\leq$  ₦4,500,000) range with a value of 14.5, as overall total of means. This also means that the least number of companies from the selected small-scale industries made profits in the reference period which are in the range of annual profit estimates of above ₦3,000,000  $\leq$  ₦4,500,000. Still

from the analysis of annual profit estimates for the reference period. Results of the study further revealed that all the companies from the 8 selected small-scale industries surveyed, actually recorded profits within the various annual profit estimates' ranges of: less than or equal to ( $\leq$  ₦1,500,000); above ₦1,500,000 but less than or equal to ₦3,000,000(Above ₦1,500,000  $\leq$  ₦3,000,000); above ₦3,000,000 but less than or equal to ₦4,500,000 (Above ₦3,000,000  $\leq$  ₦4,500,000 and lastly, Above ₦4,500,000. Metalworks industry (H), once more came out topmost with the highest mean value (7.5) for the number of companies within the industry that recorded annual profit estimates above N4,500,000.00 - the maximum profit range. Furniture industry (G) followed closely second with a mean value of (6.75), while with (6.5) mean value, Garment industry (A) occupied the third position. The remaining industries - Block making (B), Footwear (C), Bag making (D), Domestic soap making (E) and, Edible oil - extraction (F), placed joint last, having recorded zero (0) mean value each in the range of annual profit estimates above N4,500,000 the maximum profit range.

**Table 4.3a: Annual profit estimates with their frequencies for selected industries A and B (2007 – 2010)**

Annual Profit Estimates	Frequencies										
	Selected Small-scale Industries A					Selected Small-scale Industries B					
	2007	2008	2009	2010	Mean	2007	2008	2009	2010	Mean	Total of Means
$\leq$ N 1,500,000	2	1	1	0	1.0	13	14	10	8	11.25	12.25
Above N1,500,000 $\leq$ N3,000,000	5	6	7	6	6.0	6	5	9	11	7.75	13.75
Above N3,000,000 $\leq$ N4,500,000	7	6	6	7	6.5	1	1	1	1	1.0	7.5
Above N4,500,000	6	7	6	7	6.5	0	0	0	0	0.0	6.5
<b>Total</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>		

**4.3b : Annual profit estimates with their frequencies for selected industries C and D (2007 – 2010)**

Annual Profit Estimates	Frequencies										
	Selected Small –scale Industries C					Selected Small –scale Industries D					
	2007	2008	2009	2010	Mean	2007	2008	2009	2010	Mean	Total of Means
$\leq$ N 1,500,000	14	13	9	7	10.75	16	17	15	14	15.5	26.25
Above N1,500,000 $\leq$ N3,000,000	6	6	10	12	8.5	4	3	5	5	4.25	12.75
Above N3,000,000 $\leq$ N4,500,000	0	1	1	1	0.75	0	0	0	1	0.25	1.0
Above N4,500,000	0	0	0	0	0.0	0	0	0	0	0.0	0.0
<b>Total</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>		

Source: Field Survey, 2011

**4.3c: Annual profit estimates with their frequencies for selected industries E and F (2007 – 2010)**

Annual Profit Estimates	Frequencies										
	Selected Small –scale Industries E					Selected Small –scale Industries F					
	2007	2008	2009	2010	Mean	2007	2008	2009	2010	Mean	Total of Means
$\leq$ N 1,500,000	14	13	11	10	12.0	3	2	1	1	1.75	13.75
Above N1,500,000 $\leq$ N3,000,000	5	6	8	9	7.0	14	16	18	17	16.25	23.25
Above N3,000,000 $\leq$ N4,500,000	1	1	1	1	1.0	3	2	1	2	2.0	3.0
Above N4,500,000	0	0	0	0	0.0	0	0	0	0	0.0	0.0
<b>Total</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>		

Source: Field Survey, 2011

**4.3d: Annual profit estimates with their frequencies for selected industries (2007 – 2010)**

**G and H**

Annual Profit Estimates	Frequencies										
	Selected Small –scale Industries										
	G				Mean	H				Mean	Total of Means
	2007	2008	2009	2010		2007	2008	2009	2010		
≤ N 1,500,000	2	1	0	0	0.75	1	1	0	0	0.5	1.25
Above N1,500,000 ≤ N3,000,000	6	7	6	7	6.5	5	4	5	6	5.0	11.5
Above N3,000,000 ≤ N4,500,000		5	7	6	6.0	7	7	8	6	7.0	13.0
Above N4,500,000	6	7	7	7	6.75	7	8	7	8	7.5	14.25
<b>Total</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>		

Source: Field Survey, 2011

**Table 4.3e: Overall Total of means for Ranges of Annual Profit Estimates**

≤ ₦1,500,000	-	12.25 + 26.25 + 13.75 + 1.25	=	53.50
Above ₦1,500,000 ≤ ₦3,000,000	-	13.75 + 12.75 + 23.25 + 11.5	=	51.25
Above ₦3,000,000 ≤ ₦4,500,000	-	7.5 + 1.0 + 3.0 + 13.0	=	14.5
Above ₦4,500,000	-	6.5 + 0.0 + 0.0 + 14.25	=	20.75

Source: Field Survey, 2011

**Test of hypothesis**

Ho: Applications of QTs have no significant effect on profitability

Data from table 4.8 were subjected to Chi – Square,  $\chi^2$  statistic. With degrees of freedom,  $\nu = 28$  at significance level of 0.05 ,  $\chi^2_T = 41.337$ . Chi – Square test result shows calculated value,  $\chi^2_c$  to be 3.665.

**Interpretation of results**

Since  $\chi^2_c = 3.665$  less than  $41.337 = \chi^2_T$ , the null hypothesis is accepted; that is: applications of QTs have no significant effect on profitability.

However, result from the descriptive analysis of annual profit estimates revealed that applications of QTs have an effect on profitability, considering the industrial mean values singly and combined ( See table 4.3a – e).

**Summary of findings**

It was revealed, also, that companies from the selected small – scale industries surveyed, made profits irrespective of whether they applied QTs or not. This is confirmed from analytical results which showed that no industry (AH) within each of the years under reference (2007 – 2010) recorded a zero (0) frequency. Results from table 4.3e show annual profit estimates (≤ ₦1,500,000) as the mode with an overall total of means' value, 53.50; this indicates that highest number of companies from the selected industries made profit figure of ₦1,500,000 or less. Above ₦1,500,000 ≤ ₦3,000,000), annual profit estimates followed with an overall total of means' value, 51.25. With 20.75 overall total of means' value, above ₦4,500,000 came third .

In the last position, is the Above ₦3,000,000 ≤ ₦4,500,000) range with a value of 14.5, as overall total of means. Results of the study further revealed that all the companies from the 8 selected small-scale industries surveyed, actually recorded profits within the various annual profit estimates' ranges. Once more, Metal works industry (H) recorded the highest mean value (7.5) for the number of companies within the industry having

annual profit estimates above N4,500,000.00 - the maximum profit range. Furniture industry (G) followed closely second with a mean value of (6.75), while with (6.5) mean value, Garment industry (A) occupied the third position. The remaining industries - Block making (B), Footwear (C), Bag making (D), Domestic soap making (E) and, Edible oil - extraction (F), placed joint last, having recorded zero (0) mean value each in the range of annual profit estimates above N4,500,000 the maximum profit range.

### Conclusion

This paper concluded that QTs' usage in the study area, within the given period had an effect on Nigeria small-scale industries performance as proxied by annual profits of their companies. The effect, however, was not significant. It recommended increased awareness and usage of QTS and increased financial provisions for QTs in order to increase profits, hence, performance (with its other aspects like increased output volumes, meeting up with customers' demands and general satisfaction) in these industries.

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