

Assessment and Analysis of Factors Affecting Quantitative Techniques' Applications in Nigerian Small-Scale Industries

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Abstract

This paper examined factors that affect quantitative techniques (QTS') applications by selected Nigerian Small-Scale Industries (SSIs). Specifically, it assessed factors affecting applications of QTS to Production Planning and Control (PP&C) activities of companies within the selected SSIs in Nigeria. It also analysed data on the assessed factors to determine the most important of them all.

Use was made of responses from the designated staff of 20 companies randomly chosen from each of 8 purposively selected Nigerian SSIs. Kendall's coefficient of concordance (w) test was used to determine the most important of all the assessed factors

In all, 8 factors – unawareness, lack of qualified manpower, lack of adequate financial resources, no research and development (R & D) unit, lack of information technology (IT) facilities, inadequate managerial skills, managers not able to understand clearly the benefits of QTs usage, and lack of exposure of managers to QTs in earlier training, were assessed. Test results showed a significant difference in the ranking of importance of all the assessed factors. Lack of adequate financial resources had the highest mean rank of 8.00, $w = 0.82$; ($\chi^2 = 46.572$ and $P = 0.000 < 0.05$).

The paper concluded that the above named 8 factors were assessed to have affected QTs' applications to PP&C activities within the surveyed companies of the selected industries in Nigeria. Further, the lack of adequate financial resources was the most important of all the assessed factor. It was therefore recommended that meaningful and concerted efforts, by operators in these industries, should be increased and geared toward a considerable increase in their sourcing of financial resources. In turn, this would assist in availing them more opportunities to increase QTs' applications.

Keywords: Assess, Analyse, Factors, Quantitative Techniques, Small-scale industries.

Introduction

Industries can be classified as “big,” “medium” or “small” – scale. However, each of them had been and is still continuously faced daily, with the problem of “how best” to produce in the required quantity and quality, so that it could meet up with customers' demands and satisfaction (Maurice and Thomas, 1999). Moreso, it is for firms within these industries in their production activities to as well produce at the least-cost of inputs' combination.

Consequently, the above problem, as stated, situates in the domain of production planning and control (PPC), and fundamentally, it is a core decision-making concern in the management of all organizations, especially, the manufacturing ones. The Nigerian small-scale industries (SSIs) belong to these ones.

Production managers, and the likes, in these Nigerian industries, had been, and are continuous, saddled with the responsibility of seeking a solution(s) through.

Statement of the problem

The problem of how best to produce in the required quantity and quality, with the least cost combination of inputs, could easily be identified as prevailing in industries (whether big, medium or small-scale) that produce goods or even services. Emanating from this problem also had been the issue of operational techniques that adequately address the situation. Studies revealed that these industries in developed and developing world economies had found solutions to the problems through the use (extensively), of QTs in all aspects of

production and even beyond. Consequently, they have been enjoying, tremendously, accruing benefits such as, increased and adequate production volumes, satisfying customers' demands with unfailing due dates, goodwill and, above all, increased profits, general contributions to their countries' Gross Domestic Products (GDPs) and invariably, sustainable economic growth and development (Gaither, 2008; Anene, 2014).

However, the Nigerian situation (especially with the SSIs) had been different. The reason for this difference could be traced to factors affecting the use of QTs by Nigerian SSIs. The examination of such factors is a way by which this study set out to bridge the resulting gap.

Study Objectives and significance

This paper examined factors that affect QTs' applications by selected Nigerian SSIs, generally. Specifically, it assessed such factors that affect applications of QTs to (PP&C) activities of companies within the selected SSIs in Nigeria, it also analysed the assessed factors and determined, as well, the most important of them all.

The significance of this study lies mostly on increasing the awareness drive for operators in SSIs to imbibe the culture of QTs' applications, especially, to their PP&C activities; such factors that are revealed with their ranking of importance, also, made up the remaining part of the study's significance.

The study hypothesized that there is no significant difference in the ranking of importance of all the assessed factors that affect QTs' applications to the area of study.

Literature Review

Industries, whether small, medium, or big-scale, are veritable tools that stimulate economic activities and general production of goods and services. These, in turn, are to meet up consumers' demands and satisfaction, generally. Consequently, the attendant benefits of profitability, poverty alleviation and sustainable socio-economic growth and development of many nations, Nigeria inclusive, are achievable. Thus, industries, generally. Through their production planning and control activities, strive at producing in the best practices, so as to meet with consumers' demands and satisfaction. This must be in the least-cost combination of inputs – a fundamental and important decision-making issue of manufacturing organizations, a superset of Nigerian SSIs. QTs: Of interest is the fact that QTs are generally very handy to offer and ensure valuable solutions in assistance to production managers among others, on the above-mentioned decision-making issue. Summarily, QT could rightly be seen as 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 industries, businesses, governments, and defense, this is in line with the British Standard (Taha, 2006). Scientific in nature, QTs are very logical, having the objective, also of providing procedure and process that will aid or assist problem solving. Very importantly, QTs are concerned with the efficient allocation of scarce resources, among others generally (Bronson, 1997). They are also designed to ensure objectivity, generalizability, accuracy, and reliability. Their weakness outside cost, especially, in getting QT experts/knowledgeable personnel, is noticeable when it is difficult to quantify certain variables under consideration; these are however outweighed by their more numerous advantages/strength.

Furthermore, QTs were developed from the field of Management Science, (Weinreich, 2003) or adapted from natural sciences, Mathematics, Statistics and Engineering (Gaither, 1975; Forgionne, 1983; Iyiegboniwe, 2001; Wisniewski, 2006; Taha, 2006). In turn, most of the techniques are also easily adaptable and adaptable to most operations of manufacturing organizations – whether they are big, medium, or small-scale ones, especially in their activities of production planning and control;

Factors

These generally refer to things or variables which are involved in, or that contribute, in one way or the other to procedures or processes in carrying out certain tasks or functions to bring about desired results and/or achieving set out objectives. Also, factors are facts, circumstances or influences that assist or cause something to develop or spring up.

Factors could have a positive or negative effect on influence when analyzed; that is, they could be facilitators (assisting or aiding), or, inhibitors/barriers (detering or causing stumbling blocks/obstacles) in the procedures, or processes, or situations, where they manifest.

Small-scale Industries

Generally, SSIs can be viewed along the lines of differences in industrial organization of different levels of, and differences in, economic development among areas of the same country; firm size, measured by the number of employees and asset base, excluding land; policy, statements by outside countries and our country's designated body(is) and investment ceiling capital outlay (Sule, 1986; Keppa, 1988; White and Feldman, 1989; Ekpenyong and Nyang, 1992).

Nigeria National Council on Industries (NCI), 2001 as reported in Akande, 2005, SSIs are characterized by the following: limitation in accessing financial facilities (resources); extraordinarily simple management structure, in which ownership and management are combined in the chief executive officer of the various firms within the industrials (where he/she oversees all activities of production planning and control, among other functions). The number of employees and capital/investment ceiling criteria is adopted for SSIs also (Anene, 2014).

Quantitative Techniques

Quantitative Techniques, summarily and simply, is the application of the scientific approach to solving problems (no matter their simplicity or complexity) such that managers are helped to make better and even, optimal (best) decisions.

QTs being scientific, are mathematically based and can be simple or complex by their nature. They have, also, been developed within management science field, or adapted from other disciplines like the sciences of nature, mathematics, statistics and engineering (Gaither, 1975; Forgionne, 1983; Iyiegbunuwe, 2006; Taha, 2006).

They are logical; being scientific in nature, they also have steps that are well and orderly defined. Further, QTs are concerned with quantities instead of quality which in whatever form or standard is achievable through the applications of QTs, as they deal effectively on efficient (optimal) allocations of scarce or limited resources – an important aspect of decision making in numerous organizations, no matter the type and/or discipline (Bronson, 1997; Lucey, 2007). As well, QTs totally optimize organizations' operations unlike the narrow aspects of units, departments or single sections.

In all, QTs' features include: application(s) of a model-based scientific approach(es); systems approach to organizations; assistance to management planning and control; the recognition of risks and uncertainties; incorporation of measurement of factors such as changes and risks with which to forecast and compare the outcomes of alternative decisions and strategies (Forgionne, 1983; Taha, 2006).

Methodology

Responses from the designated staff of 20 companies randomly chosen from each of 8 purposively selected Nigerian SSIs. Kendall's coefficients of concordance (w) test and the mean rank value were employed in the determination of the most important of all the assessed factors affecting QTs' applications in the chosen Nigeria SSIs. **Results and Discussions**

The result of Kendall's Coefficient of Concordance (w) Test; (From Table 1)

The Kendall's coefficient of concordance (w), was used to test the hypothesis that there is no significant difference in the ranking of importance of the factors that affect quantitative techniques' applications in the study area - that is; production planning and control.

Table 1: Table showing the number of companies that do not apply (“NA”) QTs (within the selected industries) in their production planning and control activities due to the assessed factors.

Selected industries	A	B	C	D	E	F	G	H	Total
A	2	3	3	3	4	2	2	1	
b	1	1	1	1	1	1	1	1	
c	5	6	7	6	5	6	5	5	
d	1	1	1	1	1	1	1	1	
e	2	2	1	2	2	2	1	1	
f	1	1	1	1	1	1	1	1	
g	1	1	1	1	1	1	1	1	
h	1	1	1	2	1	1	2	1	
Total	14	16	16	17	16	15	14	12	120

Source: Field Survey, 2011

KEY:

- a - Unawareness
- bLack of qualified manpower
- c - Lack of adequate financial resources
- d - No research and development (R & D) unit
- e - Lack of improved information technology (IT) facilities
- f - Inadequate managerial skills
- g - Managers not being able to understand clearly the benefits of QTs usage
- h - Lack of exposure of managers to QTs in their earlier training.

Interpretation of result

Comparing the result of the test of hypothesis of the study (using Kendall's coefficient of concordance (w) = 0.832 and Chi-square obtained from table 2, χ_T^2 .we have that: $\chi_T^2 = 14.067$; $\chi_c^2 = 46.572$; hence $\chi_c^2 = 46.572 > 14.067 = \chi_T^2$

From the above, the calculated value is found to be greater than the value obtained from the table. Hence, we reject the null hypothesis that there is no significant difference in the ranking of importance of the factors that affect quantitative techniques applications in production planning and control activities in the selected Nigeria small-scale industries. Thus, this result shows that there is a significant difference in the ranking of importance of the factors that affect the applications of quantitative techniques in production planning and control activities of some selected Nigerian small-scale industries. The Kendall's coefficient of concordance $w = 0.832$ and confirmed with Chi-square value of 46.572, is also significant at 0.000 level. From the result in Table 3, the

implication of the ranking is that the factor, lack of adequate financial resources (with mean rank, 8.00) is rated as the most important of all the other factors that affect the applications of quantitative techniques in the area of study. This is followed not too closely by, a - unawareness (6.44), while e - lack of improved information technology (IT) facilities 5.13, ranked next, indicating that both factors - unawareness and lack of improved (IT) facilities affect significantly quantitative techniques' applications to production planning and control activities. Furthermore, h - lack of exposure of managers to QTs' usage, being the fourth in rank, with a mean rank of 3.94, is of less significance in effect to the applications of quantitative techniques (QTs) to production planning and control in the companies surveyed. Three other factors, b, d, and g - lack of qualified manpower, no research, and development (R & D) unit, and managers not being able to understand clearly the benefits of QTs' usage, are tied with the equal mean rank of 3.13, respectively at the last position. Thus, it shows that these three factors affect the applications of quantitative techniques to production planning and control activities in the studied companies, much less significantly.

Table 2 Kendall's Coefficient of Concordance (w) Test Result

Test Statistics

N	8
Kendall's w ^{as}	.832
Chi - Square	46.572
df	7
Asymp. Sig.	.000

Source: Field Survey, 2011: Test Results

Table 3 Kendall's Coefficient of Concordance (W) Test Result

Factors	Mean Rank	Rank
A Unawareness	6.44	2
b Lack of qualified manpower	3.13	5
c Lack of adequate financial resources	8.00	1
d No Research and Development (R & D) unit	3.13	5
e Lack of improved Information Technology facilities	5.13	3
f Inadequate managerial skills	3.13	5
g Managers not being able to understand clearly the benefits of QTs usage	3.13	5
h Lack of exposure of managers to QTs in their earlier training	3.94	4

Source: Field Survey, 2011: Test Results

Conclusion

In conclusion, eight (8) factors that affected QTs' applications were assessed: unawareness, lack of qualified manpower, lack of adequate financial resources, no research and development units, lack of information

technology facilities, inadequate managerial skills, managers not being able to understand clearly the benefits of QTs' usage, and lack of exposure of managers to QTs in their earlier training(s).

Clearly, lack of adequate financial resources was topmost of all the assessed factors, have shown a significant difference in the ranking of importance. Thus, this factor is the most important of all the 8 assessed factors.

The paper recommended that meaningful and concerted efforts should be increased and geared toward a considerable increase in their sourcing of financial resources as this would assist them to get more opportunities to increase QTs' applications. Well worked-out collaboration programmes among industrialists in the form of associations/groups, cooperatives or societies, among others, would be of help in sourcing needed funds within themselves and even from financial institutions like the Bank of Industry (BOI), mentioning but a few.

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