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The Effect of Production Planning and Budgeting on Organizational Productivity

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Abstract

Improved productivity and proper organizational structure are desired by most manufacturing outfits within the highly turbulent business environment of Nigeria. With various contributing factors, scientific basis for decision making that will lead to enhanced policies for organizational operations is stronlgy established. Five statistical hypotheses which are influence of education, government policies, planning and organizational output, and production planning/budgeting and technological advancement, propounded in this work were investigated to establish a valid decision basis on a confidence level assumed to be 0.05. The work finally examined the impact of the hypotheses on productivity.

Keywords

Production Engineering; Control Limits and Quality Control.

Introduction

Production management is simply the analysis involved in transforming raw material or components into finished products, integrated synergistically to reduce waste in time and finance with maximum obtainable profit. With reference to services (intangible), production is the discharge of a function with some degree of utility, which for goods (tangible) production is viewed as the fabrication, interchange and re-use of physical objects through machines, human resources and any other pertinent applicable tools. The use of tools in a concise approach is referred to as operation which is however broader and all encompassing due to its non-limitation.

In Operations, there is a continuous dearth of well-defined, interchange and effective production management due to consistent failure in production variables such as production operations, budgeting, profitability and technological advancement coupled with competitions in working environment. The sole objective of a production policy is to ensure that products are supplied in the required volume of the required quality at the time required and at affordable minimum cost. This simplistic desire, demands effective and flexible production planning, in meeting all the requirements in terms of resources usage.

Delivery schedules/promises have been broken in many situations with various legal implications due to wrong capacity assessment, production schedule, internal bureaucracies, idle time and other excess production requirements. For an economical production, there must be a minimum interruption to flow due to lack of work information with balanced work load between departments.

The objectives of production planning can be summarized as follows: provide the capacity and production to meet agreed or projected demand, ensure timely and positional availability of materials and components, provision of a steady flow of work through all departments, provide a balanced work between various departments involved in production operation, make available adequate manufacturing instructions to enable proper management, and supervision and records and Provide adequate information to arrest failure and delay.

Planning is a continuous process which involves decisions or choices, about alternative ways of using available resources with the aim of achieving a particular product at some time in the future [1]. Budgeting, popularly known in organizations as annual estimates can be defined in its broadest form as a conscious and systematic allocation of resources

prepared in advance, relating to a future period based on a forecast of key variables adopted to achieve certain policy objectives [2]. The output of budgeting according to Werner [3], is obtained via organized and pre-planned efforts which depends on the departmental size, separation of functions and independent processes [4]. It relates anticipated expenditure to revenue and forms the basis against which expenditure and revenue can be measured and controlled [5]. The relatedness of planning to effective budgeting on production operation in any organization has been indicated and recognized as enhancement to organizational output and profitability.

The objectives of this study is to present a statistical correlation between some identified variables that may have direct impact on planning, budgeting and production in an industry and how these variables can be adjusted for profit optimization. The study summarizes field survey results designed and administered to staffs in a production industry.

Performance, Productivity and Profitability

Performance, productivity and profitability (three P's) are usually found in all aspects of the management process. Used together as a slogan, the three P's are a dramatic force applied to strengthen the urge for improvement on current activities, bringing home the messages of inescapable obligation by managers. The three P's can be succinctly summarized as business - to - business rather than business - to – customer relations according to Calosso et al., [6] which are performance; allows goods output from economic application of resources, maintaining efficient operation in all activities, from all equipment and systems and meeting the targets requirement, plans and budgets as laid down in a manufacturing or marketing program: productivity; this is specifically to seek improvement in ways and means in methods, equipments, use of materials systems procedure, manpower and application of diagnostic and better techniques: profitability; this is sharing with all managers in the firm a genuine concern for cost effectiveness, vitality of outlook, progressive advancement and marketing orientation thereby, contributing to improved firm income through better overall service to customers.

Various researches have shown that these three essential elements do not appear in their simple elemental forms, but are clothed partly in procedures or techniques and partly in

the thinking and action of the managers [7-9]. The primary management responsibility arising from the planning element is the determination of policy, the laying down of objectives and the general principles all serving as the basis on which operation is executed. This is required not only in a general sense, but also in relation to each of the major divisions. Planning lays down the program to be followed and standards or budgets to be attained, establishes control measures to enhance adherence to plans and why certain plans are not achieved [10].

Production relates to the usual management activities of productive performance or progress outputs. These include clearly stated objectives such as, process control (production control), utilization of manpower, machine hours, fuel etc., materials or stores control (control or prevent shortages of materials and waste), components balance, work in progress etc., and quality control by appropriate means.

Most of the planning control use inbuilt features to coordinate, but there are few specific techniques in which coordination is sought and achieved by the skill of the manager or supervisor with personal attitude and constructive cooperation coupled with the sense of mutual responsibility from subordinates [11]. In production planning, effective management concerned with determining the pattern of delegation of responsibilities regarded as organization can be achieved by dividing the total management responsibility and accountability between executive and specialist positions, defining the delegated responsibilities attached to each and establishing formal relationships between positions to ensure coordination of efforts and understanding [12, 13].

The overall pattern which emerges as a result of the delegation and sharing of responsibilities between different executives and specialists is the popularly known organization structure. Every industrial and commercial undertaking has an organization structure, but the extent to which this represents a pattern of delegated responsibilities which has been consciously planned and conscientiously promulgated by management as a matter of policy varies. Among factors likely to have influence on organizational development are: ▪ nature of products or service being rendered; ▪ numbers and characteristics of the staffs and operatives employed; ▪ ratios of professional, technical, skilled and unskilled workers; ▪ historical growth pattern of the undertaking itself; ▪ financial structure of the enterprise whether privately owned; ▪ limited liability with restricted shareholdings or public company, whether wholly owned or partially owned subsidiary of another undertaking; ▪ past and present condition of marketing; ▪ fluctuations in demand for labor required, materials

consumed or products services offered; ▪ extent to which general attitudes and behaviors have in the past been influenced by the personal traits of individual top managers and finally, records of the chief executive and his senior department managers in constantly reviewing, planning, adapting and suitable staffing to meet the business needs [14-16].

Quality Control

Quality refers to all features and characteristics of a product or services, which are relevant to its ability to satisfy a particular need [17]. Such features and characteristics may include physical dimensions, weight, hardness, color resistance etc., [5]. Quality may however depend on individual perception with a quality product to a customer being what satisfies expectations. A good quality product should possess certain attributes which should determine the satisfaction level of the product. These attributes can basically be classified as functional qualities performing intended functions and should be highly reliable i.e. continuous performance within some set of limit over a given period of time. Non-functional qualities have intangible characteristics that are known to play an important part in the individual judgment of quality. They are difficult to measure but are related to the appearance of the product, style and variety of use.

An enhanced productivity can be established with good and definite quality practice within a defined budget and planning, scheduled by an organization cutting across every unit of the structures on ground. Quality problems therefore must be solved promptly with maximum attention in order to maintain the defined goals and objectives. Major quality problems include human error - all assignable cause of quality problems which result in variation of products can be classified as human error [5]. This error may result due to inherent problems with workers for instance, dissatisfaction with remunerations, emotional problems, physical and health related problems etc. Fatigue and boredom may set in during inspection causing variation in quality of products. Quality of raw material: poor inspection, receiving, purchasing, storage and handling of materials may lead to inconsistent observation of products and this will directly affect the products. Environmental factors: poor lightening, high humidity, temperature, dust and other environmental factors that cannot be controlled have been reported to have pronounced negative impacts on quality of products. Machines

and tools: cheap maintenance, poor handling and servicing of tools, improper replacement of parts are major factors that can contribute to the defectiveness of a machine affecting the performance of the operators and the quality of products [18].

These problems are reduced by appropriate quality control practice through, quality inspection which may be in the form of maintaining certain specified standards in products, meeting customers' specifications in order to minimize complaints and products return rate, eliminating products rework which do not meet standards, detecting problems within production lines and processes thereby reducing scrap generation and providing information concerning the effectiveness of individual worker and a department.

Most of the quality control data can be transformed into more useful and representative data by the application of statistics. The statistical quality control helps in determining the level of variations in a process and thus predicts the steady or unsteady nature of the process. Effective statistical control is specified by attributes classifying objects in a binary way such as yes or no, accept or reject, defective or non-defective and by variable or technical qualities of the products such as length, diameter, density etc., [5].

Control of variables is achieved by the use of π-chart and R-chart (Range charts) [5]. The π-chart is to monitor the variations around the process mean value while the R-chart is designed to control range variation or dispersion in product values. In the construction of π-chart and R-chart, a process control limit must be created as shown in Figure 1.

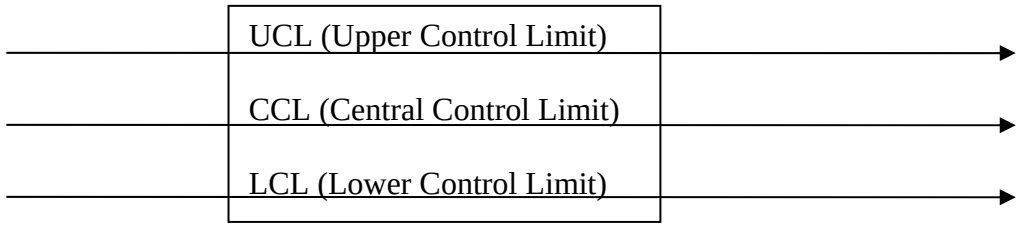

Figure 1. *Quality Control Limits*

The π-chart determines whether the mean of the products manufactured falls within a pre-determined value or range. The steps involved include the computation of the mean of the samples i.e. the central control limit (CCL), computation of the values of upper control limit (UCL) and lower control limit (LCL), and the plot of the mean of the various samples, followed by the checking of the positions of the control limits.

The control limits of π-chart are given by equation 1 as shown

$$UCL = \pi + 30\,\pi \quad (1)$$
$$CCL = \pi$$
$$LCL = \pi - 30\,\pi$$

Attention has been drawn to the normal sampling theory, thus the variability of a sampling plan can be expressed in terms of the standard error of the mean. Various studies have elucidated further that the R-chart is useful in monitoring product quality ranges so as to ensure that the variability is kept within acceptable limits. The construction of such R-chart requires the following data:

$$R = {}^{N}\sum R_i \quad (2)$$
$$UCL = D_4R$$
$$LCL = D_3R$$

where the values D_3 and D4 depend on the sample size N.

Another useful chart, the P-chart is constructed following equation 3.

$$UCL = P - 3[(\sqrt{P(1-P)})/N] \quad (3)$$
$$LCL = P - 3[(\sqrt{P(1-P)})/N]$$

where P = total number of detected samples / total number of observations

If the sample sizes are not equal then the formula is without 3.

Methodology

A food and beverage limited liability company was used as the case study. Collections of organizational and production planning and budgeting information were made through designed and administered questionnaires to ascertain the contribution pattern and to test the hypothesis of contributions. Five research questions drawn are: 1). Will there be any statistically significant relationship between production planning operation and organizational output? 2). What is/are (if any) influences of government policy on organization productivity? 3). Is there any correlation between educational ability of the planners and organization productivity? 4). Will there be any significant relationship between production planning operations/budgeting and the ever improving technological advancement? 5. Do organizations require training and development as a pre-requisite for production planning and organizational output?

While the study is limited to information gathered from only one manufacturing outfit, the results will be of immense value to the public and private enterprises in terms of identifying management priority towards profit making. The company selected is a subsidiary of a group of companies with staff strength of about 900 and is well positioned to remain a leading indigenous manufacturing company in Nigeria. The company products include: cooking cubes, tea, vegetables oil, margarine and semolina. The company's products have been given various standard certifications by the Nigeria Institute of Standard, Standard Organization of Nigeria and International Standard Organization.

Research Design and Instrument

The experimental research design used involved some new and untried elements with a view to evaluating the effect of these elements under controlled conditions. The elements being evaluated are referred to as the independent variable, while the criterion by which evaluation is made is termed dependent variable. Research instrument used for the study was a well-structured questionnaire and audio recording gadgets. The questions were categorized into three sections which are: Biological data, Information from respondents based on general questions drawn from the research topic and the hypothesis and Additional information and responses for evaluation.

The five LIKERT approach of agreed, strongly agreed, uncertain, disagreed and strongly disagreed was employed. Top managers of this company were subjected to interviews and data were collected via audio recording machine.

Sample and Sampling Technique

The sample in the case study consists of 150 respondents. The figure was chosen through stratified random sampling technique using table of random numbers. The result has been streamlined into a stratification given by Table1.

Table 1. Stratification of staff in data collected

Position of Workers	No. of Respondent
Top Managers	15
Superintendents	15
Officers	25
Supervisors	50
Junior Staff	45
Total	150

Data Analysis Technique

The simple analytical tool of percentages and inferential statistical method of Chi-square was adopted for this study.

$$X^2 = \frac{(f_o - f_e)^2}{f_e} \tag{4}$$

where, f_o is the observed frequency and f_e is the expected frequency; df = (r-1)(c-1), significance level of 5%.

Data collected from respondents was subjected to Chi-square analysis. This formed the basis in which the null hypothesis was either rejected or accepted.

Data Analysis, Presentation and Discussion of Findings

Biographical data showed that about 57% of the respondents were male while, 43% were female workers. Table 2 below showed the result of the coding used based on the five LIKERT approach of Agreed, Strongly agreed codified as YES, Uncertain as OFF, Disagreed and strongly disagreed as NO. Thirty two questions were formulated in the questionnaire.

Based on these questions and the coding result, hypothesis testing of different forms were applied to ascertain and propound the main theme of the research study.

Hypothesis One

Questions 1, 4, 15, 16 and 17 were designed to test hypothesis one that states that there will be no statistical significant relationship between production planning operations and organizational output. The Chi-square was applied as shown in Table 3 using Table 2 grouping and Table 4 is the chi-square analysis for hypothesis one.

Table 2. Coding sheet result

Question No	Strongly agreed	Agreed	Uncertain	Disagreed	Strongly Disagreed
1	-	50	40	-	50
2	20	20	10	60	40
3	30	40	5	-	75
4	30	35	5	10	70
5	30	30	10	20	60
6	70	30	10	20	20
7	40	25	5	70	10
8	23	20	7	80	20
9	20	42	8	70	10
10	75	10	3	40	23
11	25	20	15	50	40
12	80	25	5	20	20
13	15	25	-	80	30
14	12	8	15	20	95
15	70	35	7	15	23
16	60	30	10	30	20
17	30	3	12	75	30
18	60	26	9	30	25
19	70	35	4	20	21
20	75	25	10	20	20
21	65	30	3	22	30
22	80	35	2	20	13
23	60	45	25	13	17
24	55	25	-	20	50
25	76	40	13	12	9
26	-	80	20	20	20
27	40	70	25	8	7
28	60	30	20	20	20
29	45	70	10	10	15
30	30	50	5	5	60
31	25	60	3	7	55
32	40	75	-	20	15

Table 3. Grouping to analyze hypothesis one

Question No	1	4	15	16	17	TOTAL
YES	50	65	105	90	33	310
NO	60	80	38	50	105	333
TOTAL	110	145	143	140	138	676

Remarks: Calculated chi-value is far greater than the table value at alpha (confidence) level of 0.05 and degree of freedom 4. The null hypothesis that there is no statistical significant relationship between production planning operations and organizational output is therefore rejected.

Table 4. Chi-square analysis

f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
50	50	0	0	
65	66	-1	1	0.02
105	66	39	1521	14.5
90	64	26	676	7.5
33	63	-30	900	27.3
60	54	6	36	0.6
80	71	9	81	2.0
38	70	-32	1024	27.0
50	68	-18	324	6.5
105	68	37	1369	13.0
				97.42

Hypothesis Two

Questions 1,5,7,9 and 11 on the questionnaire were designed to test this hypothesis which states that government policies do not have any significant effect on organizational productivity. Table 5 is a summary of the grouping of the questions and Table 6 is the Chi-square analysis.

Table 5. Grouping for hypothesis two test

Question No	1	5	7	9	11	TOTAL
YES	50	60	65	62	45	282
NO	60	80	80	80	90	390
TOTAL	110	140	145	142	135	672

Table 6. Chi-square analysis for hypothesis two

f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
50	64	-14	196	3.9
60	58	1	1	0.02
65	61	4	16	0.25
62	60	2	4	0.07
45	57	12	144	3.2
60	64	4	16	0.27
80	81	-1	1	0.01
80	84	-4	16	0.02
80	82	-2	4	0.05
90	78	12	144	1.6

Chi-value was 9.57 and the table value is 9.49.

Remarks: Since the calculated value is approximately the same as the table value at alpha level 0.05 and degree of freedom 4, the null hypothesis that Government policies do not have

any significant effects on the organizational productivity is accepted.

Hypothesis Three

Questions 17, 18,19,21,22 and 23 on the questionnaire were designed to test hypothesis three which states that there will be no correlation between educational ability of the planners and productivity. Table 7 is the grouping used to evaluate the Chi-square of Table 8 for the test.

Table 7. Grouping for hypothesis three test

Question No	17	18	19	21	22	23	Total
YES	33	86	105	100	95	105	524
NO	105	55	41	40	52	30	323
TOTAL	138	141	146	140	147	135	847

Table 8. Chi-square analysis for hypothesis three

f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
33	85	52	2704	81.01
86	87	1	1	0.01
105	90	15	225	2.1
100	87	13	169	1.69
95	91	4	16	0.17
105	84	21	441	4.2
105	23	82	6724	64.0
55	54	1	1	0.02
41	56	-15	225	5.5
40	53	-13	169	4.23
52	56	-4	16	0.30
30	51	-21	441	14.7
				177.92

The calculated chi-value is 177.92 and the table value is 11.07.

Remarks: The null hypothesis that there will be no correlation between educational ability of the planners and productivity is rejected because the calculated chi-value was far greater than the table value at the alpha level of 0.05 and with degree of freedom 5.

Hypothesis Four

Questions 8, 19, 20, 25, 26, 27 and 28 on the questionnaire were designed to test hypothesis four which states that there will be no significant relationship between improved

technology and production planning operations/budgeting Table 9 is the grouping used and the Chi-square analysis is summarized in Table 10.

Table 9. Grouping to test hypothesis four

Question No	8	19	20	25	26	27	28	TOTAL
YES	43	105	100	116	80	110	90	644
NO	100	41	40	21	50	15	40	307
Total	*143*	*146*	*140*	*137*	*130*	*125*	*130*	*951*

Table 10. Chi-square analysis of hypothesis four

f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
43	97	-54	2916	67.0
105	98	7	49	0.4
100	95	5	25	0.3
116	93	23	529	4.6
80	88	-8	64	0.8
110	78	32	1024	9.3
90	88	2	4	0.04
100	46	54	2916	29.0
41	47	-7	49	1.2
40	45	-5	25	0.6
21	44	-23	529	25.0
50	42	8	64	1.3
15	37	-22	484	32.0
40	42	-2	4	0.1
				171.64

Chi-value calculated is 171.64 and the table value is 12.59.

Remarks: The calculated Chi-value is far larger than the table value at alpha level of 0.05 and degree of freedom 6. T null hypothesis that there will be no significant relationship between improved technology and production planning operations/budgeting is therefore invalid.

Hypothesis Five

Questions 29, 30, 31 and 32 on the questionnaire were designed to test hypothesis five, which states that organizations do not require training and development as a pre-requisite for production planning and organizational output. Table 11 is the grouping used while Table 12 is the Chi-square analysis for this hypothesis.

Table 11. Grouping for hypothesis five test

Question No	29	30	31	32	TOTAL
YES	105	80	85	115	385
NO	25	65	62	35	187
Total	*130*	*145*	*147*	*150*	*572*

Table 12. Chi-square analysis for hypothesis five

f_o	f_e	f_o-f_e	$(f_o-f_e)^2$	$(f_o-f_e)^2/f_e$
105	87	18	324	3.1
80	97	-17	289	3.6
85	95	-10	100	1.2
115	100	-15	225	2.0
25	42	-17	289	11.6
65	47	18	324	5.0
62	48	14	196	3.2
35	49	-14	196	5.6
				35.3

Calculated chi-value is 35.3 and the table value is 7.82.

Remarks: At alpha level of 0.05 and degree of freedom 3, the calculated chi-value is far larger than the table value thus indicating that the null hypothesis that organizations do not require training and development as a pre-requisite for production planning and organizational output is not tenable.

Discussion of Findings on Hypothesis

Five hypotheses postulated for this study were subjected to statistical analysis using inferential analysis. The conclusions drawn varied according to initial assumptions and conditions to which the hypotheses were subjected. The following findings were observed along with the conclusion drawn on hypothesis one:

1. There exists an absolute dearth of planning strategy which has adversely affected the company output.
2. The organization equally lacked individuals with technical knowledge particularly with respect to product processes, techniques and material and energy management.

Due to improper planning, high waste generation was noticed and also confirmed by the company records. The results showed that the most expected good human relation and

general welfare are conspicuously absent resulting in a low performance and low quality of product and services and an overall poor organizational output. Increase in inputs (materials, labor, machine data, funds etc) were noticed which implies that there was no proper planning to synchronize input and output. The research found out that the organization does not consider certain significant variable in production planning. These include among others, volume of output (i.e. maximum output), cost of materials, labor, delivery, scrap and wastes, extent of capacity utilization (equipment and labor), quality and product reliability, on-time delivery and flexible volume and product change.

From hypothesis two, certain problems were identified as being inherent with the production planning of the organization. These include political instability, frequent change in government policies and poor interpretation and duplication of duties by various governmental agencies. Significant variables of concern are social unrest, ethnic uprising, civil strife all leading sometimes to down-sizing of organization strength, high tax on imported raw materials, and outright embargo on some important and locally unavailable raw materials and corruption at various levels.

Significant correlation between educational ability and qualification of the planner with respect to productivity was observed through hypothesis three. However, a large percentage of planners encountered during the study are not trained planners but people operating on trial-and-error basis. Application of computers and mechanized forms of machineries are very low contributing to low production planning and productivity. This scenario might be a national trend.

Analysis of hypothesis four showed that effective production planning cannot be achieved without commensurable budgeting and adoption of improved technology. Production engineering is concerned with the design of resources and the use of such resources in operations. This area of engineering deals with technological aspect of the design, manufacture, use and development of the process involved and other machinery involved in the production/services. Production management, production engineering and, planning and budgeting all overlap in the choice of appropriate and effective technology. Thus, there must be a concise and integrated structure to enhance inter-relationship of all departments involved.

Result of hypothesis five cannot be ignored as it shows that there must be a continuous training at all levels to enhance productivity. Training and development of man power within

an organization is inevitable regardless of the existing constraints which usually include finance and number of people in need of the training. The advantage of embarking on periodic training of personnel within an organization cannot be easily quantified by any study. The summary of the chi-values and table values is depicted by Figure 2.

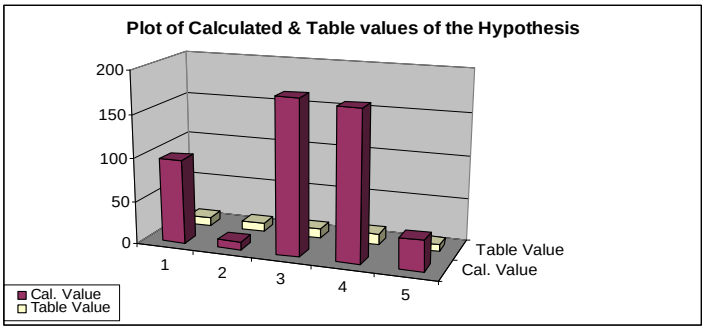

Figure 2. *Summary of Calculated Chi and Table Values*

Conclusions

This paper has examined effective production planning and budgeting for enhanced organizational output. The major constraints in the successful attainment of remarkable organizational output have been the inability to properly plan before embarking on production. Planning also should be integrated with budgeting and capital should be made available from the onset. If the suggested approaches are imbibed, enhanced productivity with its attendant positive development of the organizational operations will be achieved by most companies in Nigeria.

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