American Journal of Engineering Research (AJER)
E-ISSN: 2320-0847 p-ISSN: 2320-0936
Volume-8, Issue-1, pp-63-81
www.ajer.org
Research Paper Open Access

Assessment of the Impact of Production Planning and Operational Cost Control in the Beverage Industries

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ABSTRACT: *Production planning and operational cost in manufacturing industries are major concern in most developing countries especially in Nigeria. In order to meet the rising demand of goods and services of the people in any locality, production planning and operational cost control becomes imperative both to the Government and Private organization. This research was carried out to ascertain the degree of application and implementation of production planning and control by the beverage industries in Nigeria, and how relevant it is to operational cost minimization and expenses of the companies. Although, only three beverage production companies were studied; this research will be relevant to the rest of the beverage production companies and other similar industries. A total number of samples collected from the three organizations were 97. The descriptive and inferential statistics were applied in the analysis. The analysis carried out showed that the companies used production planning and control in taken decisions. This was evident by strong response to questions on the utilization of plans for material requirement, manufacturing resource and just in time. Thus, an overall mean of 4.077 and standard deviation of 0.0417 showed that application and implementation of production planning and control by the companies were high. Also, the results obtained on the relevance of production planning and control to operational cost and expenses revealed the usefulness of production planning and control to cost minimization. However, the mean responses obtained indicated that inventory control, budgeting and planning, timely delivery of material order, management decision, product quality and the right utilization of raw material and equipment, minimizes operational cost of material and equipment cost, which as a result, reduced the operational cost of the beverage manufacturing companies. Thus, overall mean of 3.964 and standard deviation of 0.040, affirmed that production planning and control minimizes operational cost and expenses. Furthermore, to actually account how much of the cost reduced, a cost model was proposed, which establishes a relationship between cost reduction and production planning components. The result analysis revealed that operational cost was reduced by 0.078unit, but when all the production components were fully utilized, operational cost increased to 0.1198 representing 4.18% increase in cost reduction. This implied that, there was not just a relationship between production planning and operational cost, the effective implementation of production planning and control will improve the overall growth of the beverage production companies through increased profit.*

KEYWORDS: *Growth Planning, Just-In-Time, Material Requirement Planning, Nigeria Bottling Company, Production Planning and Control, Resources Planning.*

Date of Submission: 27-12-2018 Date of acceptance: 11-01-2019

I. INTRODUCTION

Production planning and control is a tool available to the management to achieve the stated objectives. Production planning and control is the direction and coordination of firm's resources towards attaining the prefixed goals. It helps to achieved uninterrupted flow of materials at the right time and required quality. Production planning involves the sequence of activities performed before the real production process. These include schedule of production, economic batch quantities, dispatch of priorities and operation sequence. In

order hand, production control ensures the implementation of all plans for production such as initiation of production, dispatching of items, monitoring of production activities among others.

Production planning and control deals with implementation of set out plans, involving the detailed scheduling of jobs, assigning of workloads to machines and people as well as the actual flow of work. However, production itself is the organized activity that leads to the transformation of raw materials into useful products. For a successful production, series of activity are involved. These include effective utilization of natural resources such as workers, finance, equipment, materials and time [1], [2].

While production planning and control is very necessary in the manufacturing sectors, it also has some challenges that limit its optimum performance. Such militating factors include lack of modern automation equipment for accurate computation, seasonal variations, market, after sales service, losses due to unpredictable factors, wastage and production of order [3]. All these can be effectively addressed with continuous review of already set out production planning and control [4], [5], [6]. Also, flexibility will equally help in dealing with some of these unexpected factors, by allowing management to take action [7].

When planning and control are not effectively adopted and implemented, operational cost will increase, which could lead to possibly collapse of an organization. This means, inappropriate handling of production planning and control will affect the profit margin of business organisations. Reference [8]. noted that production planning and control alone cannot be completed without consideration to cost management. Cost management is an important concern for effective performance and financial management of companies [9], [10]. The essence of production planning and control is to minimize cost and improve growth. Though, business growth, which is associated with lot of changes, affects cost and planning, especially in developing country like Nigeria. For instance, Nigeria is faced with economic issues ranging from poor road network to epileptic power supply. These challenges demand stringent production planning and control to ensure survival of a business.

It is for this reason that the research has decided to take a critical look at production planning and control as practiced in beverage manufacturing industries in Nigeria. This is informed by the variety of major product and beverage produced in the industry as exemplified by the Nigerian Bottling Company (NBC), Seven-up Bottling Company and **Lacasera CompanyPlc,**Port Harcourt. Production can be regarded as the centre focus of any manufacturing organisation concerned. It is a stage where the real action takes place: the transformation of raw materials (inputs) into finished products (outputs). The planning and control operations are necessary because in every manufacturing unit there are people, machines and materials. There is need to plan all expensive resources required for production in order to make effective use of them and maximize profit making for the organisation.

Coca-Cola is the world leading manufacturer of soft drink, which is sold in over 145 countries, with a total of 250 million bottles consumed every day across the globe. Coca-Cola first came to Nigeria in 1953 when Nigeria Bottling Company set up the first plant in Lagos. A.J. Leventist brought Coca-Cola to Nigeria and he is the owner of Nigerian Bottling Company (NBC). The first plant was built in Apapa, Lagos, and in Port Harcourt, it was established in the year 1976. It was the beginning of exciting story of growth and development particularly during the last decade of the 20th century [11]. The Coca-Cola brand include coke, fanta, sprite, lemon lime fanta ginger, fanta tonic, fanta soda, club soda and crest bitter lemon.

In the same vein, Pepsi came to Nigeria in1990 when it took over Seven-Up Bottling Company, whereupon the Pepsi brand was introduced [12]. However, Seven-up Bottling Company was formerly established in Nigeria in 1960, and today, it is the second largest manufacturer of soft drinks in Nigeria, only behind Coca-Cola Plc The company brands include 7-UP, Mirinda, Pepsi, and Mountain Dew.

Similarly, **Lacasera Company Plc** was incorporated in Nigeria in the year 2000 and launched its Apple carbonated soft drink in Nov. 2001 with 4% composition of real apple juice. **Lacasera Company Plc**is the first beverage company in Nigeria to package its drinks in plastic bottle. It is rated third, behind Nigerian Bottling Company Ltd (Coca-Cola Plc) and Seven-Up Bottling Company Plc [13]. La Casera Apple carbonated soft drink was launched in November, 2001. The word "La Casera" is a Spanish word translate as 'A drink from the home'. The company's brands presently, include nirvana tonic water, nirvana soda water, smoov chapman and bold bitter lemon. The beverage companies also, produced table water: Eva water for Coca-Cola and Nirvana Premium Table Water for La Casera.

Interestingly, over 6 million bottles of soft drinks are consumed daily in Nigeria, and this figure will continue to grow due to the nation's population increase. This also, has led to the expansion of new plant across the Federation by these beverage manufacturing companies [10], [12].

II. RELATED WORK

The production planning and control, and its implication on the cost of production are reviewed to comprehend its efficacy in any manufacturing industry. Of course, in industries, lack of plan often leads to panic, chaos, overtime cost shooting up, unite cost rising, and even dissatisfied customers. Problems arise from lack of or ill-defined objectives, activities, and priorities [14]. while the control of the production plans involves the coordination of production activities such as sales, finance, quality, engineering, production, production engineering, schedules, stock control, buying, stores, and progress. Therefore, the purpose of production planning and control (PPC) in manufacturing industries is to strategise plans that will not only satisfy customers, but also make profits, achieve high return on investment and provide employment through supply of commodities needed by the society [4], [15].

III. METHODOLOGY

The approach and tools used in the study to achieving the stated objectives are presented in this chapter. These include area of the study, design of the study, method of data collection, population and sample size, and method of data analysis.

This study was carried out in two Local Government Areas of Rivers State: Obio/Akpor and Eleme Local Government Areas. Obio/Akpor is in the heart of Port Harcourt, Rivers State while Eleme Local Government Areas is located outskirt of Port Harcourt. Eleme is regarded as not only the industrial hub of the State, but also of the Country; and play host to lots of multi-national companies, from the oil and gas to allied industries[16]. These major economic industries attracted other industries, including beverage manufacturing industries to the area. However, Rivers State is located in the South-South Geopolitical Zone, and bounded with Abia, Akwa-Ibom, Bayelsa, Delta and Imo States (see Appendix D). The State has 23 Local Governments with eight ethnic groups.

3.1 Design of the Study

This study adopted a descriptive survey research design. In reference [17], Nworgu described descriptive survey as collection of data for the purpose of describing systematically the characteristics, features and facts about a given population. While [18] stated that descriptive survey utilizes data collection upon which, its analysis yielded information relating to measures of central tendency, variation and correlation of collected data. This descriptive survey research design used in this research helped in establishing an empirical relationship between production planning and control and operational cost in the manufacturing organizations.

3.2 Method of Data Collection

In obtaining information for this study, the primary and secondary source of data collection were used. Structured questionnaires as presented in Appendix B were sent to staff of the researched organizations. The questions were developed after a thorough review of relevant literatures. The questions are close ended, given the respondent to respond precisely. The question was divided into sections: section A bothered on the demographic information of the respondents, section B deals on questions accessing the level to which production planning and control was implemented, while section C deals with the level to which production planning and control affect operational cost. Also, an empirical relationship between production planning and operational cost was established through the daily recording of the achieved proportion of production components and the proportion of cost reduced. A 5 scale point format was adopted for the questionnaire (That is, 1 to 5). 1 represents the very weakest response, while 5 represents the strongest response. The secondary data were obtained through literatures.

3.3 Population and Sample Size

A population sample is seen as organizations, institutions, group of individuals, objects or items from which samples are taken for measurement [19], [20].The target population for this study is beverage manufacturing companies. While this study is limited to information collected from three beverage manufacturing industries, the results will be useful to other beverage and allied manufacturing industries in determining key factors in production planning and control towards cost reduction. The population of sample was drawn from production, finance and management departments. The categories of staffs were chosen due to their strong involvement in daily planning of production and financial requirement for production activities such as recording and management of daily inventory orders, economic lot size quantities, production, sales and costs associated with these production activities. Table 1 shows the information about the sampled population.

Table 1 Total Number of Staff in the Accessible Population

S/N	Beverage Company	No of Staff
1	Coca-Cola Nigeria Plc. Port Harcourt	45
2	Lacasera Apple Drink 87 Ada-George road Rumueme Port Harcourt	40
3	7 up /Pepsi Nigeria Plc. 4 east west road off Eleme Junction Port-Harcourt	43
Total		128

Source: (Coca-Cola Nigeria Plc, Pepsicola Plc and Lacasera Ltd).

3.3.1 Determination of Sample Size

To determine the sample size, Taro Yamane's formula described by [18]. was used, and stated in equation (1).

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Where N = Total Population = 128
e = Level of error of tolerance = 5%
1 = Constant
n = Total Sample Size
Substituting the various surveyed population in the above formula:

$$n = \frac{128}{1 + 128\,(0.05)^2}$$

$$= 128 / 1.32$$

$n = 97$ respondents

To allocate the proportion of population sample to the beverage companies, Bowley's proportion formula described by reference [21]. was used as stated in equation (2).

$$nh_i = \frac{NH \times n}{N} \quad (2)$$

Where nh = number of units/categories allocated to each organization
N = Overall population of Study
NH = No of population in each organization of Study
n = Total sample size obtained
Substituting in the above expression
$Nh_1 = 45/128 * 97/1 = 34$
$Nh_2 = 40/128 * 97/1 = 30$
$Nh_3 = 43/128 * 97/1 = 33$

Table 2: Summary of Population Size Composition across the Companies

Company	Sample size	Finance/Management Staff	Production Staff
Coca-Cola	34	11	23
Lacasera	30	11	19
7Up/Pepsi	33	12	21

3.4 Method of Data Analysis

Descriptive statistics was used for analysis of data collated from the responses. The mean and standard deviation of the respondents were used to judge the responses from the structured research questions. Also, for the cost model, regression analysis was used. The Excel software was used for the analysis.

3.5 Cost Model

It is important to study the effect of production planning and control components on operational cost. So, in establishing a relationship, the staff of the researched organizations assisted in recording the cost and production components performance for a period of seven (7) days. In this study, the cost model followed the equation developed by reference [22]. and it was described as a multiple linear equation.

$$C_p = \alpha_o + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 \quad (3)$$

Where: C_p = Minimized unit operational cost

X_1 = Proportion of material planning utilized for the production with coefficient α_1

X_2 = Proportion of resource planning utilized for the production with coefficient α_2

X_3 = Proportion of growth planning utilized for the production with coefficient α_3

X_4 = Proportion of JIT planning utilized for the production with coefficient α_4

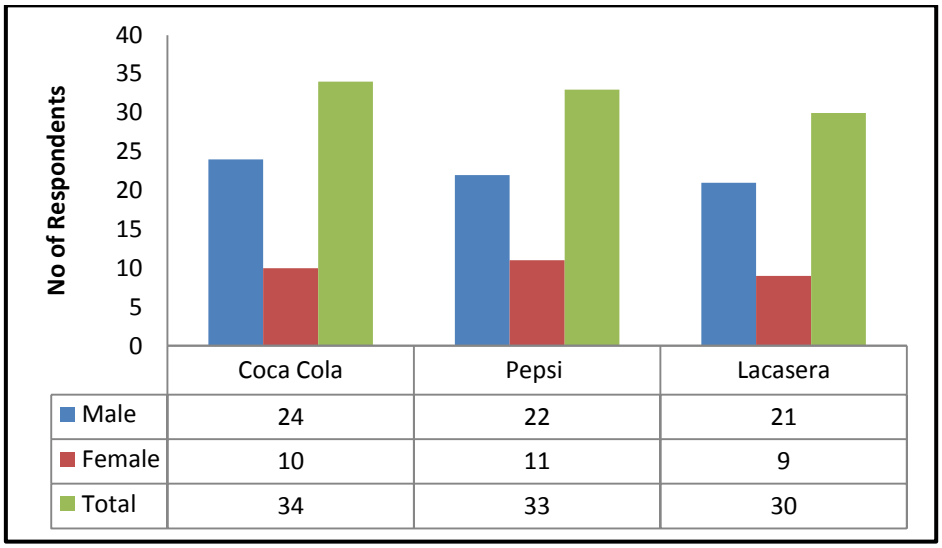
α_o = Cost coefficient

IV. RESULTS AND DISCUSSION

The validity of the data collected from the field were analysed in this Chapter. The analyses were performed according to the objectives set out in this research. Although, data analysis may not provide the requisite answers to question raised by the research hypothesis, the necessary collection of qualitative data can aid in providing the necessary framework that could lead to answering the questions. The information obtained through the questionnaire and other relevant data were geared towards a successful analysis and finding a systematic approach of providing answers to the structured research questions. Thus, to obtain a reliable analysis, 97 of the population, representing 75.78% out of the total 128 targeted population were randomly sampled and were tested for validity. Firstly, statistical analyses of the respondents were performed to obtain information about them.

4.1 Analysis of Respondents

The respondents' analysis, based on sex was carried to ascertain the population of female and male participated in the study. Figure 4.1 is a pictorial representation of information obtained from field survey. Here the blue bar represents the male respondents, the red bar represents the female respondents while the green bar stands for the sum of both sex in each of the companies. To further elucidate the understanding of the figure, the population of the both sexes as well as the total, have been presented below the bar chart.



	Coca Cola	Pepsi	Lacasera
Male	24	22	21
Female	10	11	9
Total	34	33	30

Figure 1 Analysis of Sex of the Respondents

Figure 1 shows the population of male and female respondents from the three selected organizations. A total of 30 females and 67 males representing 30.93% and 69.07% respectively, from the three companies participated in the exercise. However, Coca-Cola Plc has 24 males and 10 females; Pepsi has 22 males and 11 females, while 21 males and 9 females respondents come from Lacasera Plc.

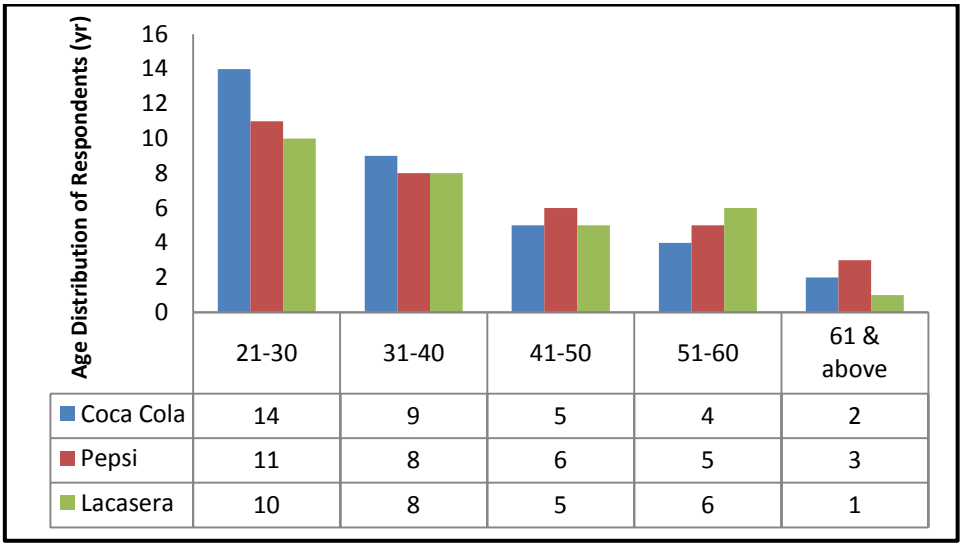


Figure 2: Analysis of Ages of Respondents

The age distribution of the respondents is shown in Figure 2. Out of the 97 respondents 35 of them, representing about 36.08% were of the age bracket of 21-30 years. 25 respondents (25.77%) of age bracket of 31-40 years; 16 (16.49%) of the respondents are of the age bracket of 41-50 years; 15 (15.46%) respondents are between the age of 51 and 60 years, while 6 (6.19%) respondents are of age 61 years and above.

Again, from Figure 2, the blue bar in each category represents the age distribution in Coca-Cola, while the red and the green bars represent the age distributions in Pepsi and Lacasera companies respectively. The three bars in the age distribution 21-30; show that 14 respondents are staff of Coca-cola, 11 respondents are staff of Pepsi while 10 respondents are staff of Lacasera plc. Within the age bracket 31-40, Coca-cola has 9 respondents, while 8 respondents each are from Pepsi and Lacasera respectively. Also, within the age group 41-50, 5 respondents each are staff of Coca-cola and Lacasera, while 6 of the respondents are staff of Pepsi. Similarly, 4 respondents within the age bracket 51-60 are from Coca-cola, 5 from Pepsi and 6 from Lacasera. Finally, 2 respondents within the age brackets 60 years and above are from Coca-cola, while 3 staff is from Pepsi and 1 from Lacasera. This research shows that the companies engaged the services of more of youthful and energetic staff.

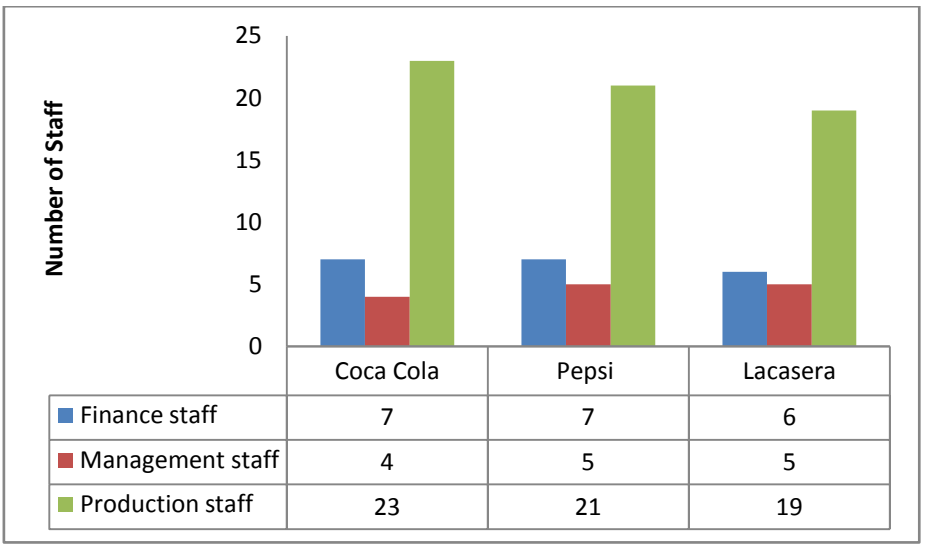


Figure 3: Organizational Job Categorization

The analysis of categories of staff who responded to questionnaire from the selected organizations is shown in Figure 3. From the survey, a total of 20 staff was from the finance department, with 7 each from Coca

Cola and Pepsi, while 6 was from Lacasera. Also, a total of 14 staff worked in the management cadre, with 4 staff coming from Coca Cola, while 5 each from Pepsi and Lacasera. A large number of the respondents were from the production department, with a total of 63 staff. 23 staff was from Coca Cola, 21 from Pepsi and 19 from Lacasera, representing a total of 64.95% of the entire respondents.

4.2 Extent of Application and Implementation of Production Planning and Control in Nigerian Beverage Manufacturing Industries

The assessment and evaluation of the responses from the manufacturing industries was made possible through statistical analysis. The mean and standard deviation of the respondents from the five point scale was used to draw conclusion on the acceptability of the extent of application and implementation of the production planning and control in Nigerian beverage industries. Thus, a mean of 4.1 to 5 implies that Nigerian beverage industries strongly used production planning and control; a mean of 3.1 to 4 implies the use of production planning and control is good; a mean of 2.1 to 3 implies the use of production planning and control is on the average; a mean of 1.1 to 2 implies the use of production planning and control cannot be determined; and a mean of 0 to 1 implies that production planning and control is not used by the Nigerian beverage industries in their production activities. However, a standard deviation of less than unity (S.D<1) shows there was no significant different from answers given by the respondents.

4.2.1 The Level of Material Requirement Planning Application and Implementation by Nigerian Beverage Manufacturers

In arriving at substantial judgment on the degree of utilization of production planning and control by Nigerian beverage industries, knowledge of material requirement and level of its implementation must be known. This is because, material a key parameter in production process, as without it, there will be no production. [23]. had underscored the usefulness and various aspects of materials for production. Also, in making plans for production, independent demand items such as fabricated components and subassemblies has to be considered too [24].

Table 3: Material Requirement Planning Application and Implementation

Material Requirement Planning Application and Implementation	x=5	x=4	x=3	x=2	x=1	N	Σfx	Mean	S.D
Production Materials are Timely Provided	53	26	11	6	1	97	415	4.278	0.044
Human-Equipment Interaction Improves Production	35	48	8	5	1	97	402	4.144	0.042
Budgeting and Planning for Production Materials, Equipment and Man Power is Efficient	37	45	6	4	5	97	396	4.082	0.041
Raw Material Requirement Matches with Production Capacity	29	43	11	9	5	97	373	3.845	0.038
Product Quality Reduces Customers' Complaints Due to Raw Material Choice	31	38	16	8	4	97	375	3.866	0.039
Mean						**97**		**4.043**	**0.041**

Table 3 shows the level of application and implementation of material requirement by the investigated organizations based on the questionnaire. The mean response of 4.278 showed that production materials are timely provided before production process. Also, planning on human-equipment interaction improves production, as the mean response of 4.144 suggested. Similarly, the mean response of 4.082 indicates that budgeting and planning for production materials, equipment and man power was efficient. In the same vein, the mean response of 3.845 showed that the raw material required for production of any particular product matched with the production capacity, and finally, due to planning, the quality of product produced reduces complaints from customers which arise due to raw material choice, as this was indicated by a mean response of 3.866. Thus, the overall mean response of the entire questions on the applicability and implementation material requirement by the beverage companies is 4.043, while the standard deviation was 0.041. This implies that there was strong production planning and control of material requirement by the beverage companies.

4.2.2 The Level of Manufacturing Resource Planning Implementation by Nigerian Beverage Manufacturers

Again, to determine whether manufacturing resource planning was implemented by Nigerian beverage manufacturing industries, questions relating to planning and control on manufacturing resource were asked as shown in Table 4.

Table 4: Implementation of Manufacturing Resource Planning and Control

Implementation of Manufacturing Resource Planning and Control	x=5	x=4	x=3	x=2	x=1	N	Σfx	Mean	S.D
Organization's Production Schedule is Efficient	41	47	5	4	0	97	416	4.289	0.045
Public Demand Enhances Production Performance	22	33	19	12	11	97	334	3.443	0.035
Allocation of Materials/Equipment/Personnel to Production Units is Efficient	32	46	7	7	5	97	384	3.959	0.040
Materials Required for Production are Determined by Production Schedule	43	37	8	7	2	97	403	4.155	0.043
Healthy Working Conditions of Your Workers is Efficient	38	42	13	3	1	97	404	4.165	0.043
Mean						**97**		**4.002**	**0.041**

Table 4. shows the degree at which manufacturing resources planning was applied and implemented by the beverage manufacturing industries. Thus, for production scheduling, the mean response of 4.289 showed that it was strongly implemented, while a mean response of 3.443 indicated that public demand enhances production performance in the organizations. Similarly, the mean response of 3.959 signified that allocation of materials/equipment/personnel to production units was efficient. Also, the mean response of 4.155 showed that materials required for production are determined by production schedule, and finally, the mean response of 4.165 showed that healthy working conditions of the organizations' workers were very strong. The overall mean response of 4.002 of the entire questions on the applicability and implementation manufacturing resources planning by the beverage companies with a standard deviation of 0.041 indicates strongly that production planning and control was applied and implemented by the beverage companies on manufacturing resources. The strong agreement on responses from manufacturing resource planning collaborated with literature findings on this same discussion[25], [26], [27].

4.2.3 The Level of Organization's Growth Planning Implementation by Nigerian Beverage Manufacturers

The importance of production planning and control on organizational growth has been highlighted by many researchers [28], [29] Therefore, in determining whether the organizational growth was implemented by Nigerian beverage manufacturing industries, questions on growth as a function of planning and control were asked and analysed as shown in Table 5.

Table 5: Implementation of Organizational Growth Planning

Implementation of Organizational Growth	x=5	x=4	x=3	x=2	x=1	N	Σfx	Mean	S.D
Management Decisions Influences Production Performance	36	49	8	4	0	97	408	4.206	0.043
Inventory Management is Efficient	35	47	10	3	2	97	401	4.134	0.042
Your Customers' Relationship is Efficient	31	37	22	7	0	97	383	3.948	0.040
Management Periodically Review Production Plans and Control	22	33	21	15	6	97	341	3.515	0.035
Management of Raw Material Quality is Efficient	32	48	12	4	1	97	397	4.093	0.042
Effective Schedule Plans Reflected on Performance	44	35	14	4	0	97	410	4.227	0.044
Planning Improves Communication amongst Production Unit Workers	38	46	9	2	2	97	407	4.196	0.043
Mean								**4.046**	**0.041**

Table 5 shows the degree at which implementation of organizational growth planning was applied and implemented by the beverage manufacturing industries. Therefore, as shown in the table, a mean response of 4.206 showed management decisions strongly influenced production performance. Similarly, a mean response of 4.134 showed that inventory management was very efficient, while mean response of 3.948 implies that there was good relationship between the customers and the organization improves growth in the companies. Also, the mean response of 3.515 showed that periodical review production plans and control by management was good and helped in the growth of the companies, while a mean response of 4.093 showed that management of raw material quality by the organizations was very strong. Again, a mean response of 4.227 indicted that effective schedule plans strongly reflected on growth performance, and finally, a mean response of 4.196 showed that planning also improved communication amongst production unit workers strongly. The overall mean response of 4.046 of the entire questions on the applicability and implementation of organizational growth planning by the beverage companies with a standard deviation of 0.041 indicated that there was strong production planning and control by the beverage companies to encourage growth. This observed statistical result analysis is synonymous to previously conducted studies on the growth of manufacturing companies in Nigeria [30].

4.2.4 Just-In-Time Planning Implementation by Nigerian Beverage Manufacturers

The extent at which Just-In-Time (JIT) Planning was implemented by Nigerian beverage manufacturing industries was investigated. The structured questions on JIT are shown in Table 6. Of course, the components, advantages and detail review of JIT on production planning have been studied [31], [32], [33], [34], and [35].

Table 6: Implementation of Just-In-Time Planning

Implementation of Just-In-Time Planning	x=5	x=4	x=3	x=2	x=1	N	Σfx	Mean	S.D
Your Work Procedures Reduces Unnecessary Product Production	45	42	7	3	0	97	420	4.330	0.045
Production of Defective Product is Minimal	33	38	15	6	5	97	379	3.907	0.039
Idleness and Waiting by Workers during Production is Minimized	38	47	6	5	1	97	407	4.196	0.043
Right Production Process is Utilized for the Desired Product	48	40	6	3	0	97	424	4.371	0.046
Right Materials were Used for the Desired Product	41	47	5	3	1	97	415	4.278	0.044
Mean								**4.216**	**0.044**

Table 6 shows the responses for implementation of JIT planning by the beverage manufacturing companies. From Table 4, a mean response of 4.330 showed that the Work procedures adopted by the companies strongly reduces unnecessary product production, while a mean of 3.907 implies that production of defective products was minimal. Also, a mean response of 4.196 showed that idleness and waiting by workers during production was effectively minimized, while mean response of 4.371 signified that the right production process was strongly utilized for the desired product by the companies. Finally, a mean response of 4.278 showed that the right materials were strongly utilized for the desired product. Again, the overall mean response of 4.216 of the entire questions with a standard deviation of 0.044 revealed that there was very strong implementation of just-in-time planning by the beverage companies.

4.2.5 Summary of Production Planning and Control Application and Implementation

The summary of production planning and control application and implementation by the beverage manufacturing companies as obtained from the statistical analysis is presented in Table 7.

Table 7: Summary of Production Planning and Control Application and Implementation

Component	N	Mean	S.D
Material Requirement Planning	97	4.043	0.0411
Manufacturing Resource Planning	97	4.002	0.0408
Organizational Growth Planning	97	4.046	0.0412
Just In Time Production Planning	97	4.216	0.0436
Mean	**97**	**4.077**	**0.0417**

From Table 7, it was shown that production planning and control was strongly applied and implemented by the beverage manufacturing companies. Thus, material requirement planning,manufacturing resource planning,organizational growth planning and just in time production planning were highly utilized by the beverage manufacturing companies. Therefore, a mean of 4.077 showed that production planning and control was strongly implemented by the beverage companies, while a standard deviation of 0.0417 (S.D<1) implied that responses on this subject matter should be accepted.

4.3 The Relevance of Production Planning and Control to Operational Cost and Expenses in Nigerian Beverage Manufacturing Industries

The relevance of production planning and control to operational cost and expenses is a major aspect in the manufacturing industries as had been investigated [36], [37]. The essence of production planning and control is to reduce operational cost, time and wastages. Therefore, Table 8 shows the responses on the relevance of production planning and control to cost reduction by the beverage companies.

Table 8:Relevance of Production Planning and Control to Cost Minimization

Relevance of Production Planning and Control to Cost Minimization	x=5	x=4	x=3	x=2	x=1	N	Σfx	Mean	S.D
Inventory Control Minimizes Operational Cost	34	46	13	2	2	97	399	4.113	0.042
Budgeting and Planning Reduce Material/Equipment Cost	32	36	21	5	3	97	380	3.918	0.039
Timely Delivery of Material Order Reduces Cost	29	37	23	3	5	97	373	3.845	0.038
Management Decision Reduces Cost	25	41	16	11	4	97	363	3.742	0.037
Product Quality Improves Profit Margin	41	32	12	9	3	97	390	4.021	0.041
Utilization of the Right Raw Material/Equipment Reduces Cost	34	46	14	3	0	97	402	4.144	0.042
Mean								**3.964**	**0.040**

From Table 8, a mean response of 4.113 showed that inventory control minimizes operational cost, and also, a mean of 3.918 revealed that budgeting and planning reduce material and equipment cost. In the same vein, a mean response of 3.845 showed that timely delivery of material order reduced operational cost, while mean response of 3.742 signified that management decision also reduced operational cost. Further, a mean of 4.021 indicated that product quality improved the profit margin of the companies and finally, a mean response of 4.144 showed that the utilization of the right raw material and equipment reduced operational cost. The overall mean response of 3.964 of the entire questions with a standard deviation of 0.040 showed that production planning and control minimizes operational cost in the manufacturing companies.This statistical result collaborated with the statement of [1]. while they underscored the important of pre-production planning. In addition, [9]. showed that cost minimization is key to manufacturing industries in the changing economy.

4.4 Relationship between Operating Cost and Production Planning

In other to establish operational cost relationship with production planning and control, staff from the selected departments assisted in giving information on the daily production and cost performance. The initial production planning was recorded daily, and after the end of the day's production, the extent of production activities achieved was again recorded. Also, the effect of the daily production activities on the daily operational cost of the three companies was recorded. This was done by recording the fraction of the actual cost expended in the execution of the daily production events as against the initial planned cost estimate. The average data for seven (7) days obtained is shown in table 9. Where C_p is the fraction of actual daily production cost as against the initial budgeted cost, MP is the fraction of actual daily material planning as against the initial estimate, RP is the fraction of actual daily resource planning as against the initial estimate, GP is the fraction of actual daily event relating to growth planning as against the initial estimate and JITP is the fraction of actual daily timely implementation of Just-In-Time planning as against the initial estimated time.

Table 9:Performance of Production Planning and Operational Cost

Days	C_P	MP	RP	GP	JITP	Mean
1	0.081	0.88	0.74	0.82	0.86	0.83
2	0.101	0.85	0.85	0.88	0.98	0.89
3	0.064	0.89	0.82	0.93	0.76	0.85
4	0.082	0.91	0.72	0.78	0.92	0.83
5	0.053	0.84	0.76	0.69	0.73	0.76
6	0.068	0.87	0.84	0.73	0.81	0.81
7	0.094	0.93	0.97	0.86	0.87	0.91
Mean	**0.078**	**0.88**	**0.81**	**0.81**	**0.85**	**0.84**

Table 9 shows the impact of production planning and control on operational cost minimization. Thus, the daily record of production performance index and the operational cost initially projected, and after production for seven effective production days showed that there was variability in the extent of production components achievement, with respect to the initial estimated plans over the period investigated. However, the cost performance was highest in day 2 (0.101 unit reduction), where Just-In-Time planning recorded the highest implementation of its initial planning. This implies that the total implementation of JIT components will significantly minimize operational cost. On the other hand, the least minimized cost was recorded in day 5 (0.053 unit reduction) where growth planning indices were lowest (0.69 level of achievement as against the initial 100% estimate). This indicated that only about 69% of factors that leads to organizational growth were implemented by the beverage manufacturing organizations. In Table 9, it is seen that the performance of production components in day 7 was highest with overall average proportion of 0.91, where operational cost was reduced by 0.094 units, compared to day 2 which has 0.101 unit of cost reduction. This scenario could be attributed to the high proportion of production components utilized for the production, which then attracted more cost for its effective implementation.

In summary, the overall minimized cost recorded within the seven days was 0.078 units at mean material planning proportion of 0.88; mean resource and growth planning proportion of 0.81 respectively; and JIT planning proportion of 0.85, with overall mean of 0.84.

Table 10: Production Planning and Operational Cost Relationship

Statistics	Value
Multiple R	0.9846
R Square	0.9694
Adjusted R Square	0.9083
Standard Error	0.0051
Observations	7

Table 11: Statistical Analysis of Production Planning Coefficients

Production Index	Coefficients	Standard Error	P-value	Lower 95%	Upper 95%
Intercept	-0.1466	0.05891	0.13059	-0.4001	0.10687
MP	0.02912	0.07398	0.7319	-0.2892	0.34743
RP	0.05337	0.02775	0.19432	-0.066	0.17276
GP	0.02034	0.02919	0.55804	-0.1053	0.14595
JITP	0.1635	0.02546	0.0234	0.05396	0.27304

The relationship between operational cost and the components of production planning and control was established through statistical analysis. The excel wizard was utilized to obtain the regression parameters for the relationship. Table 10 shows an R Square of 0.9694, which is an indication that the operational cost relates very well with material, resource, growth and JIT planning. The remaining 0.0306 implies that other factors not mentioned could affect operational cost and were not explained by the cost model. Several researchers on the cost and production planning have identified cost reduction as a panacea for organizational performance and profit maximization [38], [39] and [40].However, in Table 11, the coefficients of the cost model stated in equation (3.3) were presented. Thus, cost coefficient, α_o = -0.147; material planning coefficient, α_1 = 0.0291; resource planning coefficient, α_2 = 0.0534; growth planning coefficient, α_3 = 0.0203; and JITplanning coefficient, α_4 = 0.164. Other statistical parameters are equally shown in Tables 10 and 11. Therefore, the cost model can be expressed as:

$$C_p = -0.147 + 0.0291 X_1 + 0.0534 X_2 + 0.0203 X_3 + 0.164 X_4 .$$

From the given cost model, when all the components of production planning are fully achieved as initially planned (that is, when all the X variables is unity), the operational cost would be minimized by about 0.1198 (11.98%) as against the mean cost reduction of 7.8% seen in day 2 (Table 9), representing 4.18% increase. [26].equally had suggested several equations for monitoring and optimization of production planning and control performance indices, aim at minimizing operational cost.

Furthermore, the actual scenario of production component performance as well as the impact they have on operational cost (in proportion) are shown in Figure 4, while the mean proportion is shown in Figure 5. Thus, the variability of the material, resource, growth and JIT planning within the days investigated has been clearly seen in Figure 4, which indicated that there was overlap amongst the components under review. Also, there mean value as shown in Figure 5, followed same mechanism depicted in Figure 4. The minimized cost over the period was shown in Figure 6.

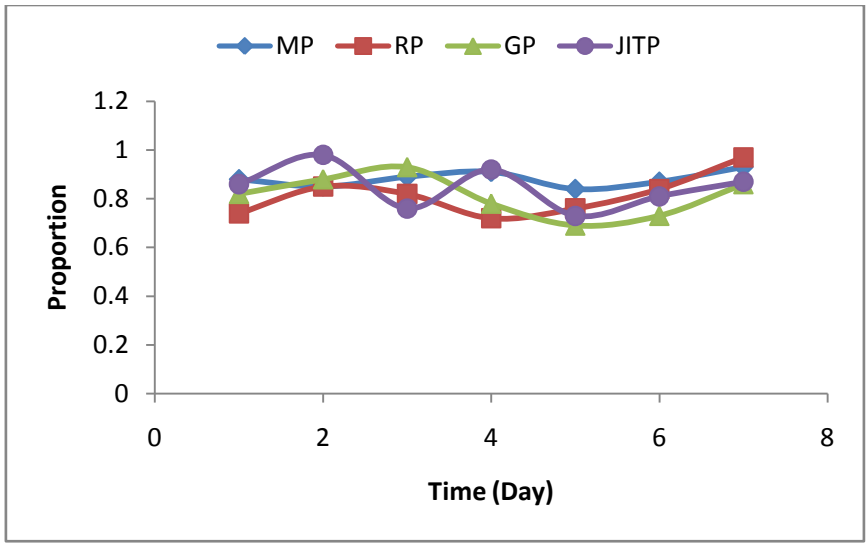


Figure 4: Production Indices vs. Time

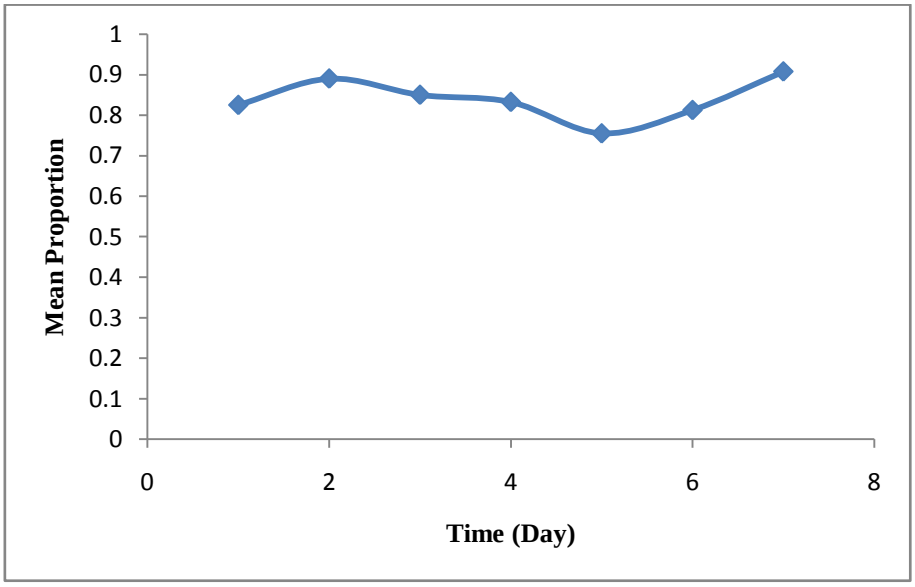


Figure 5: Mean Proportion vs. Time

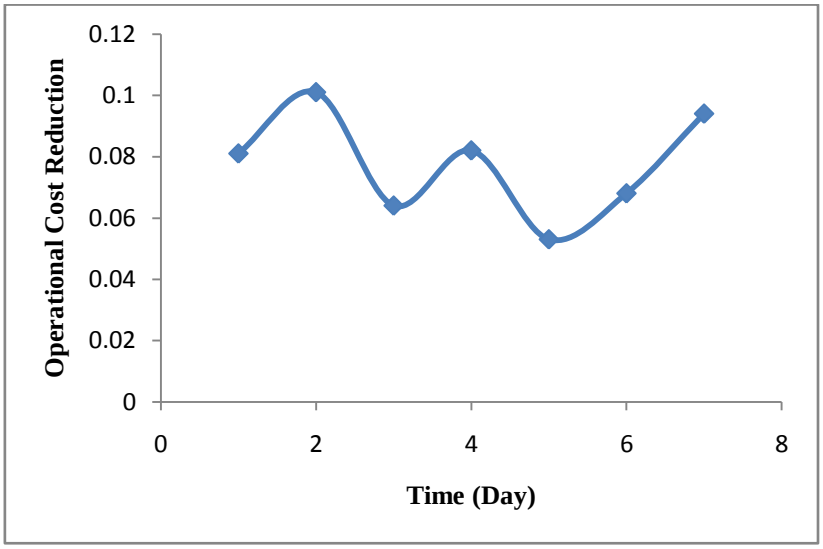


Figure 6: Cost variation with Time

Figure 6 above shows that reduction in operational cost varies over time, and indeed, depends not just on application and implementation, but on the adequate planning and control of production components. However, it may be difficult to fully implement all set out initial production plans for material, resources, growth and JIT of a particular product manufacturing due to factors that could affect production. Irrespective of unforeseen production factors, it is primary to maximize production planning and control such that reduction in cost would be realized.

4.5 Discussion of Findings

To achieving the research objectives, questions were structured for response to be provided by the staff of three researched beverage manufacturing companies. The statistical analyses of the obtained responses with respect to the guided research questions have been performed. Therefore, we summarised the observed perceptionof production planning and control as well as its implication on cost minimization in Nigerian beverage manufacturing industries.

4.5.1 Application and Implementation of Production Planning and Control

The statistical analysis carried out on responses collated from the staff of three beverage manufacturing companies showed that the components, which indicated how efficient production planning and control were utilized for proper functioning of any manufacturing organization, were strongly applied and implemented by the beverage manufacturing companies. Thus, for material requirement planning, the overall mean response of 4.043 implied that material requirement planning was strongly implemented by the companies. This is in line with the findings by several researchers that material requirement is key for effective production planning [38], [26] and [28]. Similarly, the mean values obtained for manufacturing resource planning (4.002),organizational growth plans (4.046) and just in time production planning (4.216) were equally strongly utilized by the beverage manufacturing companies. The mean of all the components was 4.077 which affirmed that production planning and control was strongly implemented by the beverage companies, and a standard deviation of 0.0417 (S.D<1) implied that responses on this research question should be accepted. Therefore, production planning and control is necessary for any manufacturing organization, as have been also asserted [27], [28], [37] and [29].

4.5.2 The Relevance of Production Planning and Control to Operational Cost and Expenses in Nigerian Beverage Manufacturing Industries

The results obtained on the relevance of production planning and control to operational cost and expenses in Nigerian manufacturing industries revealed the efficacy of planning in cost reduction. Thus, the mean responses obtained from the structured questions on the relevance of production planning and control to operational cost minimization indicated that inventory control, budgeting and planning, timely delivery of material order, management decision, product quality and the right utilization of raw material and equipment, minimizes operational cost of material and equipment cost thereby, improving the profit margin of the beverage

manufacturing companies. The overall mean response was 3.964 with standard deviation of 0.040, which showed that production planning and control minimizes operational cost and expenses.This result is synonymous with findings by other studies [30],[36], [1], [15, [9], [2], [35] and [37]

4.5.3 Relationship between Operating Cost and Production Planning

Beyond finding the extent of production planning application and implementation and its impact on cost minimization in beverage manufacturing industries, it is imperative, as an engineering tool, to establish a relationship between cost reduction and production planning components. Thus, daily record of the production planning components proportion after production output and the proportion of cost saved for seven days was estimated. From the analysis, the overall operational cost reduced by 0.078unit for in for the period studied with the following mean proportions: material planning, 0.88; resource planning, 0.81; growth planning, 0.81; and JIT Delivery, 0.85, amounting to an overall mean of 0.84. The means, there is relationship between production planning and operational cost, and the efficient implementation of production planning and control will guarantee optimum utilization of production capacity, excellent inventory management, optimum time management of production activities and sustenance of final product quality.

Again, the R Square value of 0.9694 obtained indicated that the operational cost relates very well with material, resource, growth and JIT Delivery as functional parameters of production planning and control. As observed from the given cost model, the fully utilization of all the production planning components as initially planned, the operational cost was minimized by 0.1198 (11.98%) with 4.18% increase.

V. CONCLUSION

The analysis carried out on the beverage manufacturing companies showed that production planning and control depends on several components such as material requirement, manufacturing resource, organizational growth plans and just in time. Thus, their effective implementation is an indication that production planning and control is strongly utilized. Therefore, the analysis obtained showed that production planning and control was strongly applied and implemented by the beverage companies with an overall mean of 4.077 and standard deviation of 0.0417.

Also, the relevance of production planning and control to operational cost and expenses was x-rayed. The results obtained revealed the usefulness of production planning and control to cost minimization. Accordingly, the mean responses obtained indicated that inventory control, budgeting and planning, timely delivery of material order, management decision, product quality and the right utilization of raw material and equipment, minimizes operational cost of material and equipment cost, which as a result, reduced the operational cost of the beverage manufacturing companies. Hence, the overall mean of 3.964 and standard deviation of 0.040, affirmed that production planning and control minimizes operational cost and expenses.

Furthermore, to buttress the relevance of production planning to cost minimization, a cost model was used, which establishes a relationship between cost reduction and production planning components. The result analysis revealed that operational cost was reduced by 0.078unit and when all the components of production planning are fully utilized, the operational cost reduced to 0.1198 with 4.18% increase. This implies that, there is not just a relationship between production planning and operational cost, the effective implementation of production planning and control will improve the overall growth of the beverage manufacturing companies through increased profit.

VI. RECOMMENDATION

The following recommendations are drawn from this study:

- Proper production planning and control should be performed by considering all components required for effective production in manufacturing industries.
- Periodical review of production planning and control should be serious considered in order to detect any possible loophole that will increase operational cost as well as low product quality.
- Projected production plans should be fully implemented to drive profit and hence, organizational growth.
- Operational cost relationship with production planning components should be studied with model such as the one stated in this study, to optimize production at a cheaper cost.
- Future studies should consider developing cost model with respect to actual production event taking place in the beverage manufacturing industries, so that figures reported will be from direct production variables rather than just human judgment.

Finally, manufacturing industries in Nigeria should allow research students at this level to gain access to their facilities and provide only accurate inform, as this may help solve challenging problem and also, may lead to new innovation.

APPENDIX A
Questionnaire
Section A
Demographic Information
This section seeks information about you and your company. Please, you are requested to tick in the box appropriate to your answer.
1. Sex distribution of respondents
(a) Male ☐ (b) Female ☐

2. Age of Respondent
(a) 21 - 30 ☐
(b) 31 – 40 ☐
(c) 41 – 50 ☐
(d) 51 – 60 ☐
(e) 61 and above ☐

3. Which of the following department do you belong?
(a) Management ☐
(b) Production ☐
(c) Finance ☐

4. Please tick your role
(a) Inventory Management ☐ (b) Production Scheduling ☐
(c) Sales Management ☐ (d) Financial Management ☐

SECTION B
Application And Implementation Of Production Planning And Control
Instruction: Read carefully and tick (√) the appropriate option that indicates your opinion on the application and implementation of production planning and control in your company.

Strongly Agree (SA) = 5, Agree (A) = 4, Average (Av) = 3, Neutral (N) = 2 and Disagree (D) = 1.

Table 3: Material Requirement Planning Application and Implementation

Comment	SA	A	Av	N	D
Production Materials are Timely Provided					
Human-Equipment Interaction Improves Production					
Budgeting and Planning for Production Materials, Equipment and Man Power is Efficient					
Raw Material Requirement Matches with Production Capacity					
Product Quality Reduces Customers' Complaints Due to Raw Material Choice					

Table 4: Implementation of Manufacturing Resource Planning and Control

Comment	SA	A	Av	N	D
Organization's Production Schedule is Efficient					
Public Demand Enhances Production Performance					
Allocation of Materials/Equipment/Personnel to Production Units is Efficient					
Materials Required for Production are Determined by Production Schedule					
Healthy Working Conditions of Your Workers is Efficient					

Table 5: Implementation of Organizational Growth Plans

Comment	SA	A	Av	N	D
Management Decisions Influences Production Performance					
Inventory Management is Efficient					
Your Customers' Relationship is Efficient					
Management Periodically Review Production Plans and Control					
Management of Raw Material Quality is Efficient					
Effective Schedule Plans Reflected on Performance					
Planning Improves Communication amongst Production Unit Workers					

Table 6: Implementation of Just-In-Time Planning

Comment	SA	A	Av	N	D
Your Work Procedures Reduces Unnecessary Product Production					
Production of Defective Product is Minimal					
Idleness and Waiting by Workers during Production is Minimized					
Right Production Process is Utilized for the Desired Product					
Right Materials were Used for the Desired Product					

SECTION C

Relevance Of Production Planning And Control To Cost Minimization

Instruction: Read carefully and tick (√) the appropriate option that indicates your opinion on the application and implementation of production planning and control in your company.

Strongly Agree (SA) = 5, Agree (A) = 4, Average (Av) = 3, Neutral (N) = 2 and Disagree (D) = 1.

Table 8:Relevance of Production Planning and Control to Cost Minimization

Comment	SA	A	Av	N	D
Inventory Control Minimizes Operational Cost					
Budgeting and Planning Reduce Material/Equipment Cost					
Timely Delivery of Material Order Reduces Cost					
Management Decision Reduces Cost					
Product Quality Improves Profit Margin					
Utilization of the Right Raw Material/Equipment Reduces Cost					

SECTION D

Performance Of Production Planning And Operational Cost

Please, enter as appropriate your daily recording of the proportion of cost reduced and the proportion of production components utilized at end of production in the table below.

Nomenclature:

Cp is the proportion of operational cost reduced, MP is the proportion of utilized material, RP is the proportion of utilized resource, GP is the proportion of utilized events relating to growth and JITP is the proportion of utilized Just-In-Time planning as against the initial estimated time.

Table 9:Performance of Production Planning and Operational Cost

Days	Cp		MP	RP	GP	JIT
	Initial Estimate	Final Expenses				
1						
2						
3						
4						
5						
6						
7						

APPENDIX B
Responses From Field Survey

Table 1: Total Number Sex Distribution of Respondent from the Beverage Companies

Sex	Coca Cola	Pepsi	Lacasera
Male	24	22	21
Female	10	11	9
Total	34	33	30

Table 2: Department of Respondent from the Beverage Companies

Department	Coca Cola	Pepsi	Lacasera
Finance	7	7	6
Management	4	5	5
Production	23	21	19

APPENDIX C
Map Of Rivers State And Niger Delta Region

Map of River State Showing the Study Areas

Map of the Niger Delta Region Showing States that Made Up the Region

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Ovunda, Mercy Nyekpunwo" Assessment of the Impact of Production Planning and Operational Cost Control in the Beverage Industries" American Journal of Engineering Research (AJER), vol.8, no.01, 2019, pp.63-81