

Development of Standard Operations and Procedures for Inventory Control for Selected Brewery Industries

Francis Anietie AKPAN^{1*}, Aniekan OFFIONG^{1*}, Idorenyin E. MARKSON¹, Alexander Aniekan Offiong¹, A.P. Ihom¹

^{1*}Department of Mechanical and Aerospace Engineering, Faculty of Engineering, University of Uyo, Uyo, Nigeria
Corresponding Author: ihomaondona@uniuyo.edu.ng

Abstract—The study was carried out to improve the effectiveness and performance of the brewery industries through the development of standard operations and procedures for inventory control. Descriptive survey design was used to pick two breweries (A and B) in Nigeria based on purposive sampling. A questionnaire was used to gather information on inventory control practices in the breweries. Items on the questionnaire were validated and reliability conducted. Copies of questionnaire were administered and collected back for analysis. Based on the data provided, standard operations and procedures for inventory control were developed and validated. Both qualitative and quantitative data analyses were done using Microsoft Excel. The results showed that the annual sales for Breweries A and B were N7, 096,599,000.00 and N16, 186,160,530.00, respectively. So, their turnovers were computed as 12. All the lead times (in days) were less than or equal to agreed elapsed days. Therefore, both Breweries A and B recorded an excellent ordering and delivery service. Annual stockout frequencies, for Breweries A and B were 1.84% and 2.99%, respectively. These values were very small indicating that both Breweries A and B inventory management/control systems are worthy of emulation.

Keywords— Standard operations, Procedures, Inventory control, Brewery Industries.

I. INTRODUCTION

Inventory is one of the most classy and vital assets of many companies, representing as much as 50% of total invested capital. Managers have long identified (Lizzie, 2023). Inventory is any stored resource that is used to satisfy a current or future need. On the hand, a firm can attempt to reduce costs by reducing on-hand inventory levels. Inventories could be grouped in manufacturing companies as: (i) Raw Materials: These are unprocessed natural products used in manufacturing process; (ii) Work in Progress: These are partially finished goods and materials subassemblies between manufacturing steps; (iii) Finished Goods: These are goods that are completed and ready for sales. Stock of raw materials and work-in-progress enables production while stock of finished goods is essential for the smooth marketing operations (Prempeh, 2015; Simplinotes, 2023). Besides, Inventory policies are decisions that guide in the development and establishment of programs that controls business organizations so that an appropriate rate of return would be earned. In most situations, the policies will cover (Ugwu, 2012): (i) How much to order that is the optimal quantity of an item that could be ordered whenever an order is placed? (ii) When should an order be placed? (iii) How much safety, stock should be kept? Furthermore, control in management is the

action of determining whether resources have been provided and production done in accordance with strategy plan and where this is not the case, corrective action is taken. Inventory control is an inventory policy established to obtain accurate quantity and exact quality of raw materials at the right place (Ugwu, 2012). Nevertheless, purposes of inventory control in any organization are to (i) minimize cost; (ii) maximize profit; (iii) maximize the return out of stock; (iv) avoid running out of stock; (v) prevent surplus stock that are uncalled for; (vi) keep resources with an available storage capacity; (vii) control capital investment in order to avoid mismanagement and misappropriation of funds; and (viii) maximize sales (Ugwu, 2012). Many researchers have conducted several studies relating some standard techniques and procedures in many industries (Takim, 2016). Ogbo *et al.* (2014) examined the impact of effective inventory control management on 7up Bottling Company 9th Mile Enugu, Nigeria as a case study, and the result showed that flexibility in inventory control management is an important approach to achieving organizational performance. Anichebe and Agu (2013) examined the impact of inventory management on organizational effectiveness in selected organizations in Enugu Nigeria and recommended that organizations should diversify their inventory system to suit specific needs of production. Nsikan *et al.* (2015) studied inventory practices and operational performance of flour mill firms in Nigeria and recommended the need for flour manufacturing firms to implement scientific inventory management models to adequately handle material shortages, product stock outs, and product piled up with consequent penalties. However, there was no information relating inventory management and control in brewery industries. Hence, in order to improve the effectiveness and performance of the brewery industries, there was need to develop standard operations and procedures for inventory control for brewery industries in Nigeria. The outcome of the study could help brewery industries in Nigeria to: (i) maximize the return out of stock; (ii) avoid running out of stock; (iii) prevent surplus stock that are uncalled for; and (viii) maximize sales.

II. MATERIALS AND METHODS

2.1 Design, Target Population, Sample and Sampling Technique

In this study, descriptive survey design was employed. The target population was brewery industries, sited in Nigeria.

Samples were two brewery industries (names withheld for privacy reason) and were selected using purposive sampling method.

2.2 Instrument for the Study

The instrument was a researcher-developed questionnaire that contained open-ended questions.

2.3 Validation, Reliability, Administration and Collection of the Instrument

The instrument was examined for both face and content validities using content validity index (CVI) given in Equation 1.

$$CVI = \frac{\text{Total number of valid items (TNVI)}}{\text{Total number of items on the instrument (TNI)}} \quad (1)$$

The recommended CVI is from 0.7 – 1.0. If $CVI < 0.7$, then modifications are to be made on the items so as to have the highest degree of content validity. Photocopies of the questionnaire were administered to the breweries A and B at two different periods to ascertain instrument reliability. The results were correlated using Pearson’s Product Moment Correlation Coefficient (r) and consistency calculated. Still, if the correlation coefficient is greater than 0.7, the instrument is reliable (Beebwa, 2007), else, it is not. Subsequently, the photocopies of questionnaire were administered to the participants and collected for analysis.

2.4 Development of Standard Operations and Procedures for Inventory Control in Brewery industry

In order to develop standard operations and procedures for inventory control in breweries, data concerning inventory control practice such as availability and accessibility of warehouse, inventory level prediction, response to inventory control cost, cycle count schedule, raw materials / product labelling, etc. were specified in the questionnaire (Appendix I). The responses from the items on the questionnaire were used to discuss sumptuously all facets of promising standard operations and procedures for inventory control in brewery industry.

2.5 Validation of Standard Operations and Procedures for Inventory Control in Brewery industry

2021 production data relating customer’s order, quantity supplied, date ordered, agreed elapsed days, date supplied and monthly sales as provided by the both Breweries A and B were used to evaluate the standard operations and procedures for inventory control employed. The key indices used were: turnover, lead time and stockout frequency. These parameters were calculated as expressed in Equations 2 to 6 (Upkeep, 2021; Interlake Mecalux, 2022).

$$\text{Turnover} = \frac{\text{Annual sales}}{\text{Average sales for the same period}} \quad (2)$$

$$\text{Annual sales (Naira)} = \text{Annual quantity ordered} \times \text{cost per carton} \quad (3)$$

$$\text{Lead time (days)} = \text{date supplied} - \text{date ordered} \quad (4)$$

$$\text{Stockout frequency (\%)} = \frac{\text{Quantity of customer's order unable to be met}}{\text{Total quantity order for the period (monthly or annually)}} \times 100 \quad (5)$$

$$\text{Annual stockout frequency (\%)} = \frac{\text{Sum of stock out frequencies from Jan.2021 to Dec.2021}}{12 \text{ months}} \quad (6)$$

2.6 Data Analysis

Data were collated and evaluated using Microsoft Excel 2019.

III. RESULTS AND DISCUSSION

3.1 Instrument Validity, Reliability, and Response and Return Rate

The results of content validity and reliability of the instrument, response and the return rate of copies of questionnaire are presented in Tables 1a and 1b.

TABLE 1a: Content validity and reliability.

Parameter	Value
Content validity	0.989
Reliability	1.000

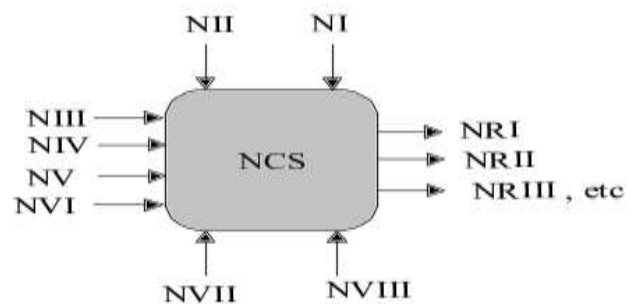
TABLE 1b: Response and return rate (%).

% Response and Return Rate	
Brewery A	100
Brewery B	100

Instrument content validity (0.989) was extremely commendable because it was greater than 0.7. Also, the coefficient of correlation (r) was 1.00. This demonstrates that the instrument was reliable (Beebwa, 2007). Both Breweries (A and B) answered to the entirety items on the questionnaire. This gave 100% response and return rate; hence, it was sufficient to carry out the research since the bench mark is 50% (Kumar, 2010). This suggests a healthy response and return rate, and that the respondents were eager to response but under anonymity.

3.3 Development of Standard Operations and Procedures for Inventory Control in Brewery industry

The responses from the items on questionnaire relating inventory control procedures designated in both Breweries (A and B) are depicted in Figure 1.



Note: NI is the availability of storage facilities for inventories; NII is the accessibility to storage facilities; NIII is the availability of mechanism for forecasting and tracking inventory level; NIV is the paying attention to inventory control cost; NV is the paying attention to unnecessary stocks or products about to expire; NVI is the provision of cycle count schedule; NVII is the raw materials / product labelling; NVIII is the reduction of shrinkage; NIX is the inventory control responsibility assigned to specific personnel (NIX), etc.; NRI is the profit maximization; NR II is the avoidance of running out of stock, and shrinkage, etc.

Figure 1: Inventory control structure.

From Figure 1, some of the important standard operations and procedures for inventory control or contributions that cannot be disregarded, if the inventory control / management is expected to be efficient and rewarding operations, are as follows:

- (i) *Availability and Accessibility to Storage Facilities:* First and foremost, storage facilities in both breweries for inventories such as raw materials, consumables and finished products are provided. Provision is always made in the warehouse so that the products could be easily access. The floor layout and its structure are well designed to take care of accessibility.
- (ii) *Mechanism for Forecasting and Tracking Inventory Level:* It is necessary to trail inventory level. Today, inventory management software applications are employed for this purpose where sales are monitored.
- (iii) *Inventory Control Cost:* It is always advisable to pay attention to the cost of inventory control. It should be reduced to barest minimum.
- (iv) *Removal of Unnecessary Stocks or Soon-Expired Products:* Efforts are made to get rid of any product before it expires. Discount offers or promotion could help in this aspect.
- (v) *Provision of Cycle Count Schedule:* Cycle count schedule helps to control product flow rather than looking for an opportunity to count inventory. It also shows when it is not feasible to pay for inventory cost.
- (vi) *Raw Materials / Product Labelling:* All products (raw and finished) are expected to be well labelled, even in batches, for ease of recognition.
- (vii) *Reduction Shrinkage:* Plan to reduce shrinkage must be put in place. Shrinkage refers to lost inventory through returns, defective products, shoplifting, and internal theft. It can also mean raw materials that are wasted while processing.
- (viii) *Creation of Back-ups for Inventory Data/ Information:* Critical information concerning inventory must have backups to ensure availability and accessibility at any time.
- (ix) *Assignment of Inventory Management Responsibility:* Separate inventory management responsibilities are assigned to an individual. There is room for personnel to have a better performance.
- (x) *Instant Inspection of Raw Materials and Consumables after Delivery:* As soon as the raw materials and consumables order arrives, the product's quality is ascertained so as to reject the spoiled or raw materials with questionable specification. This prevents cases where the real stock is insufficient or excess inventory information.

3.4 Validation of Standard Operations and Procedures for Inventory Control in Brewery industry

The results of validation of standard operations and procedures for inventory control in Breweries A and B are presented in Tables 2 and 3.

As seen from Tables 2 and 3, several orders were made by the customers in both Breweries A and B between Jan., and

Dec., 2021. The sums of the orders were 3,942,555 and 8,279,366 cartons of beer (product), respectively for Breweries A and B. Recall that their polices were to produce 500,000 and 1,000,000 cartons of products, respectively when need arose and kept in the store (warehouse). Brewery A made production in Dec., 2020 in order to have on-hand inventory, Feb., 2021, April, May, August, Sept., Oct., and Dec., 2021 (on-hand inventory to begin 2022). Similarly, Brewery B made its production in Dec., 2020 in order to have on-hand inventory, Feb., 2021, April, June, August, Sept., Oct., Nov., and Dec., 2021 (on-hand inventory to start with 2022). Breweries A and B recorded total annual production capacities of 4,000,000 and 8,400,000 cartons, respectively. With these stocks, certain quantities were allotted as quantities supplied to fulfill the customers' order. Since the costs per unit cartons were N1, 800.00 and N1, 955.00 for Breweries A and B, respectively, their monthly sales, for instance, Jan., and Feb., 2021 were N540, 000,000.00 and N 666,000,000.00; N1,231,650,000.00 and 1,519,035,000.00, respectively.

The rest of the months are as stipulated in Tables 2 and 3. However, their annual sales were N7, 096,599,000.00 and N16, 186,160,530.00, respectively. Hence, their turnovers were computed as 12. Turnover is the rate at which inventory (stock) is sold, used or replenished. The observed value is higher. This implies their sales strengths were higher. Besides, it could be deduced that their stocks were kept in stores for a very limited period. Turnover is an index that shows how efficient Breweries (A and B) are in terms of inventory management / control. A study by Wight (2016) to evaluate the role of planned inventory control on performance of manufacturing firms revealed that problems such as inadequate inventory control, poor policies in order fulfillment, reduction of consumer active demand due to unfortunate forecasting and lack of suitable ICT application systems would lead to poor performance. This in turn reduces sales turnover. Again, as observed, in Jan., 2021 for Brewery A, customer's order was made on the 6th Jan., 2021 and the agreed elapsed time was 13 days. Based on the management strategy, the order was supplied on the 18th Jan., 2021. It took exactly 12 days lead time. Lead time means a time elapsed from the moment a customer places an order and when the order is met or supplied. Nevertheless, for an efficient product ordering and delivery service, the agreed elapse time must be greater than or equals to lead time. In this case, both breweries A and B recorded an excellent ordering and delivery service. All the other month's orders recorded had commendable lead times. In Brewery A, majority of the month's orders were met with surplus (Feb., March and May to Dec., 2021). However, Jan., 2021 did not have any surplus. Unfortunately, only April, 2021 order was not met instantly. Production was made to fulfill the order. Similar case was also observed in Brewery B, except only in Aug. and Oct., 2021 that the orders were not met. Hence, stockout frequency for Brewery A in month of April, 2021 was computed as 22.05%, while that of Brewery B were 21.33% and 14.53% for Aug. and Oct., 2021, respectively. But their annual stockout frequencies were 1.84% and 2.99%, respectively. These values were very small

indicating that both breweries A and B inventory management /control systems are superb.

TABLE 2: Validation of standard operations and procedures for inventory control in Brewery A for 2021.

2021	Customer' Order (Cartons)	Quantity Supplied (Cartons)	Date Ordered	Agreed Elapsed Days	Date Supplied	Lead Time (Days)	Monthly Sales (Naira)	Status of Customer' Order Met/ Not Met	Stockout Frequency (%)
Jan	300,000	300,000	6-Jan-21	13	18-Jan-21	12	540,000,000	Met	0
Feb	370,000	370,100	3-Feb-21	13	16-Feb-21	13	666,000,000	Met with surplus	0
Mar	260,000	281,000	4-Mar-21	10	14-Mar-21	10	468,000,000	Met with surplus	0
Apr	445,000	346,880	1-Apr-21	13	13-Apr-21	12	801,000,000	Not Met	22.05
May	180,000	223,000	2-May-21	13	15-May-21	13	324,000,000	Met with surplus	0
Jun	150,000	161,010	2-Jun-21	11	12-Jun-21	10	270,000,000	Met with surplus	0
Jul	273,000	293,010	2-Jul-21	13	15-Jul-21	13	491,400,000	Met with surplus	0
Aug	290,555	313,000	3-Aug-21	16	18-Aug-21	15	522,999,000	Met with surplus	0
Sep	394,000	395,000	3-Sep-21	10	13-Sep-21	10	709,200,000	Met with surplus	0
Oct	390,000	395,000	2-Oct-21	11	13-Oct-21	11	702,000,000	Met with surplus	0
Nov	440,000	462,000	3-Nov-21	10	12-Nov-21	9	792,000,000	Met with surplus	0
Dec	450,000	460,000	2-Dec-21	10	11-Dec-21	9	810,000,000	Met with surplus	0
Sum	3,942,555	4,000,000					591,383,250		1.84
Cost/carton (N)	1800								
Annual Sales (N)	7,096,599,000.00								
Turnover	12								

TABLE 3: Validation of standard operations and procedures for inventory control in Brewery B for 2021

2021	Customer' Order (Cartons)	Quantity Supplied (Cartons)	Date Ordered	Agreed Elapsed Days	Date Supplied	Lead Time (Days)	Monthly Sales (Naira)	Status of Customer's Order Met/ Not Met	Stockout Frequency (%)
Jan	630,000	636,000	10-Jan-21	15	23-Jan-21	13	1,231,650,000	Met with surplus	0
Feb	777,000	777,200	8-Feb-21	14	20-Feb-21	12	1,519,035,000	Met with surplus	0
Mar	546,000	600,000	8-Mar-21	12	20-Mar-21	12	1,067,430,000	Met with surplus	0
Apr	934,500	940,000	7-Apr-21	14	20-Apr-21	13	1,826,947,500	Met with surplus	0
May	378,000	468,300	9-May-21	10	18-May-21	9	738,990,000	Met with surplus	0
Jun	315,000	338,000	5-Jun-21	15	17-Jun-21	12	615,825,000	Met with surplus	0
Jul	573,300	665,000	7-Jul-21	12	19-Jul-21	12	1,120,801,500	Met with surplus	0
Aug	610,166	480,000	7-Aug-21	15	21-Aug-21	14	1,192,874,530	Not Met	21.33
Sep	827,400	829,500	6-Sep-21	12	17-Sep-21	11	1,617,567,000	Met with surplus	0
Oct	819,000	700,000	6-Oct-21	10	16-Oct-21	10	1,601,145,000	Not Met	14.53
Nov	924,000	1,000,000	6-Nov-21	11	17-Nov-21	11	1,806,420,000	Met with surplus	0
Dec	945,000	966,000	7-Dec-21	12	18-Dec-21	11	1,847,475,000	Met with surplus	0
Sum	8,279,366	8,400,000					1,348,846,711		2.99
Cost/carton (N)	1955								
Annual Sales (N)	16,186,160,530.00								
Turnover	12								

IV. CONCLUSION

In conclusion, in an effort to enhance the efficiency and performance of the brewery production, standard operations and procedures for inventory control were developed using two Breweries (A and B) in shores of Nigeria. The results showed that the annual sales for Breweries A and B were N7, 096,599,000.00 and N16, 186,160,530.00, respectively. So, their turnovers were computed as 12. All the lead times (in days) were less than or equal to agreed elapsed days. Therefore, both Breweries A and B recorded an excellent ordering and delivery service. Annual stockout frequencies, for Brewery A and B were 1.84% and 2.99%, respectively. These values were very small indicating that both Breweries A and B inventory management /control systems are worthy of emulation.

REFERENCES

[1] Anichebe, N. A and Agu, O. A. (2013). Effect of inventory management on organizational effectiveness. *Information and Knowledge Management*, 3(8): 2-10.

[2] Beebwa, E. (2007). *Selection of Secondary School Teachers and Students' Academic Performance in Mukono Town Council*. Master Dissertation. Makerere University, Uganda, 233p.

[3] Interlake Mecalux (2022). *Seven Formulas for Inventory Management Efficiency* <https://www.intermecalux.seven-formulas-for-inventory-management> (Retrieved on 4th February 2022).

[4] Kumar, R. (2010). *Research Methodology: A Step-by Step Guide for Beginners*. SAGE Publications, Thousand Oaks, 211p.

[5] Lizzie, D. (2023). What is Inventory and Why is It Important? A 2023 Guide. <https://www.shopify.com/ng/blog/what-is-inventory> (Retrieved on 5th May 2023).

[6] Nsikan, E. J., John, J. E. and Tommy, U. I. (2015). Inventory management practices and operational performance of flour milling firms in Lagos, Nigeria. *International Journal of Supply and Operations Management*, 1(1): 392-406.

[7] Ogbo, A. I., Onekanma, I.V. and Wilfred, I.U. (2014). The impact of effective inventory control management on organizational performance. *Mediterranean Journal of Social Science*, 5(10): 109-114.

[8] Prempeh, K. B. (2015). The impact of efficient inventory management on profitability: Evidence

from selected manufacturing firms in Ghana. Munich Personal RePEc Archive MPRA Paper No, 67889: 1-6. <https://mpra.ub.uni-muenchen.de/67889/> (Retrieved on 5th May 2023).

[9] Simplinotes (2023). Types of Inventories. <http://www.simplinotes.com/types-of-inventories> (Retrieved on 5th May 2023).

[10] Takim, S. A. (2016). *Optimization of effective inventory control and management in manufacturing industries: A case study of Flour Mills Company Calabar, Nigeria. Journal of Emerging Trends in Engineering and Applied Sciences*, 5: 265-276.

[11] Ugwu, U. E. (2012). *Effectiveness of Inventory Management in a Manufacturing Company: A Case Study of Ama Greenfield Breweries Plc, Enugu, Nigeria*. Masters Dissertation, Caritas University, Amorji-Nike, Enugu, Nigeria, 201p.

[12] UpKeep (2021). How to Measure Inventory Performance with Inventory Management Metric www.upkeep.com/learning/measure-inventory-management. (Retrieved on 4th February 2022)

[13] Wight, O.W. (2016). *Production and Inventory Management in the Computer Age*. Van Nostrand Reinhold Company, Inc., New York, 256p.

APPENDIX

Appendix I: Standard operations and procedures for inventory control in brewery industry.

1.	Do you have storage facilities for keeping inventories?	*Yes [] *No []
2.	Is it accessible?	*Yes [] *No []
3.	Do you have mechanisms for inventory level forecast and tracking?	*Yes [] *No []
4.	Do you prioritize inventory control cost?	*Yes [] *No []
5.	Do you pay attention to unnecessary stocks and products that have few months to expire? <i>If Yes, explain briefly.</i>	*Yes [] *No [] * *
6.	How do you monitor products flow? <i>Explain briefly.</i>	*
7.	Do you label all your raw materials and stocks in batches?	*Yes [] *No []
8.	Is there any specific personnel assigned the responsibility of inventory control management?	*Yes [] *No []
9.	What other operations and procedures do you employ in controlling inventory in your brewery?	* * *
10.	Provide data relating turnover, stockout frequency and lead time as tools for evaluation of your inventory control procedure, from Jan., to Dec., 2021.	* * * *