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**INVENTORY CONTROL AND CORPORATE PRODUCTIVITY OF FOOD MANUFACTURING
FIRMS IN PORT HARCOURT**

NWIBIABU MENE AUGUSTINE
Department of Management,
Faculty of Management Sciences,
University of Port Harcourt,
Port Harcourt, Nigeria

And

NDU, EUGENE CHIGOZIE PhD.
Department of Tourism and Hospitality Management,
Faculty of Management Sciences,
University of Port Harcourt,
Port Harcourt, Nigeria

Abstract

This research work investigated the influences of inventory control on corporate productivity of food manufacturing firms in Port Harcourt, Nigeria. It sought to establish if inventory control correlated with the measures of corporate productivity (cost reduction and improved quality product). This gave rise to two hypotheses stated in the null form. The design of the study was cross-sectional survey; while an instrument designed by the researcher was used to elicit responses for the respondents. The sample comprised 165 general managers, heads and assistants of functional departments of the 16 food manufacturing firms in Port Harcourt. The Pearson Moment Product correlation coefficient with the aid of statistical package for social science was used to test the proposed hypotheses. It was found that inventory control significantly and directly related to cost reduction and improved quality product. The study concluded that inventory control can be used to explain 75% of the variance in cost reduction and 85% of that in improved quality product. Consequently, it was recommended that management of food manufacturing firms should facilitate faster execution of prudent inventory control techniques such as JIT, EOQ and ABC analysis; explore and utilize inventory control systems and effective application of ICT in inventory management; employ the services of experts in such areas as inventory management, operations control and systems analysis.

Keywords: ABC Analysis, Cost Reduction, Economic Order Quantity, Just in Time, Vendor Managed Inventory.

Introduction

The term corporate productivity is seen as the ability of an organization to transform available resources into profitable services or goods. Corporate productivity allows one or organization to use skills, technology as well as innovative ideas to achieve maximum output. According to Greasley (2009), it is a ratio to calculate how best an organization converts input resources into goods as well as services. Corporate productivity assist in the

increment of standard of living of the people, since more and more food products can be purchased easily. This way, consumers will benefit from a higher productivity. Corporate productivity increases profits for food manufacturing firms as well as other businesses. It measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output. Corporate productivity is viewed as a prime means of economic growth as well as competitiveness; as such, it is the basic for statistical information as well as performance assessments. It likewise allows business organizations, manufacturing firms to determine capacity utilization, which in turn allows them to scale the place of economies in the business cycle as well as predicting economic growth. Corporate productivity is more significant than profit and revenues. It is because profit dictates only the end effect, whereas productivity dictate the efficacy of the business and usefulness of its methods and strategies. Corporate productivity assists food manufacturing firms in measuring their strengths as well as weaknesses alongside the threats and opportunities that the market brings. This allows for favourable competition and cost effectiveness.

Food manufacturing industries are more material intensive; materials are the essence and heart of any manufacturing system. No manufacturing firm function without them. Inventories are like visible materials that an organization transmits either for the desire to sale or to be offered as inputs to manufacturing system. Inventory control entails coordinating, controlling of all inventory levels of raw materials, work-in-progress as well as finished goods (Kotler, 2002). Lysons (1996) stipulated that inventory control enhances costs reduction and it is linked with material handling and storage. Inventory control is a crucial mechanism for maintainers' of corporate productivity since without effective inventory control, productivity will be hampered, which will result to less finished goods and high dissatisfaction in terms of customers demand (Allison, 2000). Jones (2003) asserted that execution of appropriate inventory control practice entails offering high-quality merchandises at moderately less cost.

The primary aim of this study is to scrutinize the bearing of inventory control on corporate productivity in Port Harcourt manufacturing firms. Specifically, the study sought to:

- i. Determine the correlation between inventory control and cost reduction
- ii. Discover the bond between inventory control and improved quality product

Based on the foregoing research objectives, the study is set to answer the following questions:

- i. What is the link between inventory control and cost reduction of food manufacturing firms in Port Harcourt?
- ii. What is the association between inventory control and improved quality product of food manufacturing firms in Port Harcourt?

Theoretical Framework / Literature Review

Inventory Control

As mentioned earlier, inventories are materials that a business organization transmits either for the purpose of selling or to be rendered as inputs to manufacturing institutions. All business organizations or institutions require inventories. Frequently, they are a significant part of total assets. Inventory control is responsible for planning as well as managing inventory from the raw material phase to the customer. Inventory must be

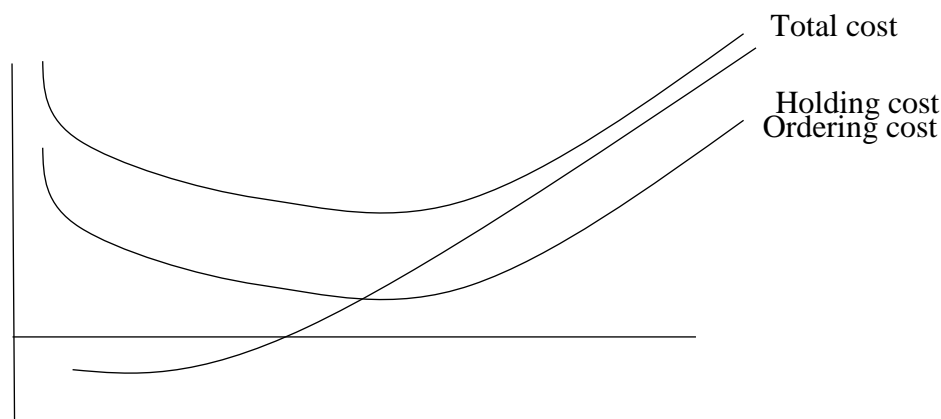
considered at each of the planning levels and is thus part of production planning, master production scheduling, as well as material requirements planning.

According to Miller (2010) inventory control and management involves all activities put in place to make sure that implied customers are satisfied with either services or products desired. It organizes the acquiring, production as well as dissemination functions to catch up with marketing desires and manufacturers wishes of making the products available to the clients. Inventory control is largely involved with stipulating the size in addition to assignment of stocked products. Inventory control is obligatory at diverse locations within a facility or within manifold positions of a supply system to defend the regular as well as planned course of manufacturing against the random commotion of going out of materials. The scope of inventory control likewise involves managing the refill lead time, refill of goods, returns, substandard goods and demand forecasting, inventory carrying costs, forthcoming inventory price prediction, quality management, demand forecasting, inventory visibility, inventory valuation, asset management and available physical space.

Inventory Control Theories and Techniques

Economic Order Quantity Theory:

This theory cum technique avers that given the basic assumptions, the right quantity of inventory can be ordered per time so as to eliminate the challenges associated with over-stocking or under-stocking. Bowersox (2002) cited in (Atnafu & Baldcited, 2018) stipulated that, inventory control ought to be planned in a logical manner to enable organizations to be aware of when to order as well as how much to order. This can be achievable through the use of Economic Order Quantity (EOQ).



Holding cost is cost of keeping a stock until when it is needed

Ordering cost is constant overtime while holding cost changes with quantity

Practical problem: The annual demand for a PHONE is 12,075 units, and it is ordered in quantities of 600 units. Calculate the average inventory as well as the number of orders placed per year.

Answer

$$\text{Average cycle inventory} = \frac{\text{order quantity}}{2} = \frac{600}{2} = 300 \text{ units}$$

$$\text{Number of orders per year} = \frac{\text{annual demand}}{\text{Order quantity}} = \frac{12,075}{600} = 20.125$$

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When order quantity increases, the average inventory as well as the annual cost of carrying inventory increase, but the number of orders per year and the ordering cost decrease.

Another practice example:

UNIPOINT investment deals with UNIPOINT water, from their record so far, there annual demand is 700 bags, the price per Catton is 2500, the ordering cost is 10% of the total cost whereas the holding cost is 3% per unit cost. Supposing UNIPOINT water decided to offer a 10% discount for goods worth 1000 carton. Determine the EOQ difference, total inventory cost, and inventory cycle.

Solution:

No of discount scenario

$$D = 700$$

$$P = 2500$$

$$TC = 700 * 2500 = 1750000$$

$$C = 10\% \text{ of } \$1750000 = 75000$$

$$H = 3\% \text{ of } 2500 = 75 * 700 = 5250$$

$$EOQ = \sqrt{\frac{2 * 175000 + 700}{52500}} = 68.3$$

Inventory cycle = $\frac{\text{Annual, wks, months}}{\text{Number of order}}$

$$\text{Number of order} = \frac{d}{EOQ} = \frac{700}{68} = 10.3$$

$$\text{Inventory cycle} = \frac{52}{10.3} = 5.05$$

$$TC = PQ + \frac{CD}{Q} + \frac{Qh}{2}$$

$$\text{Purchase} = 1750000$$

$$\text{Order cost} = \frac{cd}{Q} = \frac{175000 * 700}{68} = 1801470.6$$

$$\text{Holding cost} = \frac{qh}{2} = \frac{68 * 52500}{2} = 178500$$

$$\text{Total} = 21549706$$

Discount scenario (10%)

$$D = 1000$$

$$P = 10\% \text{ of } 2500 = 2500$$

$$= 2500 - 250 = 2250$$

$$TC = 1000 * 2250 = 2250000$$

$$C = 10\% \text{ of } 2250000 = 225000$$

$$H = 3\% \text{ of } 2250 = 67.5$$

$$= 67.5 * 1000 = 67500$$

$$EOQ = \sqrt{\frac{2 * 225000 * 1000}{67500}}$$

$$\sqrt{\frac{450000000}{67500}}$$

$$EOQ = 81.6$$

$$\text{Number of order} = \frac{d}{EOQ} = \frac{1000}{81.6} = 12.3$$

$$\text{Inventory cycle} = \frac{52}{12.3} = 4.2$$

$$\text{Purchase} = 2500000$$

$$\text{Order cost} = \frac{225000 * 1000}{81.6} = 2757353$$

$$\text{Holding cost} = \frac{81.6 * 67500}{2} = 2754000$$

$$\text{Total} = 8011352.6$$

The Just-in-Time Theory/Technique:

The JIT is a Japanese idea that is rationality based. It is related with assembling which encompasses getting the right things in the right quality as well as amount in the actual place at appropriate time. Application of JIT system brings to limelight the increase in quality, cost-effectiveness, as well as profit, boosted correspondence, and abatements in expenses and wastes. Hutchins (1999) describes JIT as a procedure that is prepared for moment response to the wish without the necessity for any overstocking, either in the wish of the application being forthcoming or as a concern of wasteful features (Atnafu1 & Baldcited, 2018).

Vendor Managed Inventory Theory and Technique:

Vendor Managed Inventory is a modernized form to deal with inventory control and management and request fulfillment whereby the merchant is wholly in charge of refreshing of stock in light of opportune point of all data to the purchasers. This notion forms the client approachability by lessening the free market activity hole thus giving the accomplishment to end client by profiting the coveted item when required. Store system accomplices must share their dream of interest, necessity, as well as requirement to set the steady destinations. Kazim (2008) recognizes that upstream information swapped to suppliers such as the current stock level as well as precise deals conjecture is the most vital element for the effective usage of Vendor Management Inventory (Atnafu1 & Baldcited, 2018).

ABC Analysis (Pareto Model):

The ABC stock control technique depends on decision that a little package of the things might usually address the weight of money estimation of the total stock. It is applied as a part of the era technique, while an incredible number of things might occur from a little part of the money estimation of stores. Consequently, to manage stock control high regard things are more solidly regulated than low regard things. ABC checkup is an indispensable action process that work in line with Pareto Principle regarding an organization's classification of stock. Most organization attempts and oversights are depleted on managing "A" things. "C" things get the base thought, then "B" things are in the centers. The ABC approach does its ranking with the above criteria: "A" things signify 70–80 percent of the yearly consuming estimate of the firms and just 10–20 percent of summative stocked items. "B" things signify 15–25 percent of yearly use esteem as well as 30% of total stock, while

“C” things portray 5 percent of the yearly use of esteem and half of total stocked items (Atnafu1 & Baldcited, 2018).

Corporate Productivity

Productivity has been applied as a measurement tool for assessing diverse decisions as well as averting resources' wastes (Gunasekaran et al., 1994). Also it can assist managers to decide the succeeding investments on a fresh technology and to divide resources distribution (Chiou et al., 1999). Greasley (2009) cited in (Azad & Reza, 2013) asserted that “productivity is used at both organizational as well as national level as a comparative measure of performance”. Productivity is a notion in which both effectiveness as well as efficiency issues is well-thought-out (Kurosawa, 1991). In over-all, productivity is seen as a ratio of outputs into inputs in a manufacturing sector. Inputs are the production factors which are used in manufacturing process, and outputs are the finished goods or services (Azad & Reza, 2013).

Measure of Productivity

According to Kendrick and Creamer (1965) a company's productivity can be measured and analyzed using 3 types of productivity indices,

a) Total productivity index

$$\frac{\text{Total Output}}{\text{All input factors}}$$

b) Total factor productivity index

$$\frac{\text{Net output}}{\text{Total factor input}}$$

Where

Net output = output - intermediate goods and services

Total factor input = Manpower input + capital input

c) Partial productivity index

$$\frac{\text{Output}}{\text{One factor of input}}$$

Input factors are considered as labor, capital and materials as well as the partial productivity index, so gotten are referred to as partial productivity of labor, partial productivity of capital as well as partial productivity of materials.

According to Faraday (1971) TPM (Total Productivity Measure) is as follow;

$$\frac{V}{M + Q + C}$$

Where,

V = value of the total output

M = input of manpower

Q = input of materials

C = input of capital

Ramsay proposed an extension over Faraday's model and suggested measurement of productivity as overall productivity measures (Ramsay, 1973).

(OPM) 1 (OPM) 2 and (OPM) 3 so that

$$(\text{OPM}) 1 = C + P + M$$

C - M

Where

C = Total cost

P = Profit

M = Materials cost

Leon Greenberg (1973) the author suggested Total Productivity measure as follow;

$$P_t = \frac{Q_t}{L + C + R + Q}$$

Where:P_t = Total Productivity

L = Labor input factor

C = Capital input factor

R = Raw materials and purchased parts input factor

Q = other miscellaneous goods and services input factor

Q_t = Total output

Mundel (1976) stressed the need for productivity measurement for productivity enhancement and recommended productivity index to be arrived at as follows:

$$PI = \frac{OMP / IMP}{OBP / IBP} \times 100$$

Where:

OBP = Aggregated outputs, base period.

OMP = Aggregated outputs, measured period

IBP = Inputs base period

IMP = Inputs measured period

The numerator in the model above denotes current performance index and the denominator to the base performance index. Productivity evaluation center (PEC) Virginia polytechnic institute and state university has likewise contributed a model to measure company productivity (Ghare, 1982).

As per this model, TPF productivity index can be measured as,

$$P_t = \frac{\text{Output}}{\text{Input}}$$

Output = Sales + Potential Sales and again

Sales = Net sales

$$\text{Potential Sales} = \frac{\text{Change in Inventory}}{\text{Costs}} \times \text{Sales}$$

$$\text{Change in inventories} = \frac{\text{Inventory of current period input} - \text{Inventory of last period}}{\text{Costs}}$$

$$\begin{aligned} \text{Costs} &= \text{Cost of goods sold and Input} \\ &= \text{Costs} + \text{Implied costs of capital} \\ &= \text{Costs} + \text{depreciation} + \text{opportunity cost on invested capital} \\ &= \text{Costs} + \text{Depreciation} + (\text{inflation rate} + 3\% (\text{Net equity} + \text{debt})) \end{aligned}$$

Invested capital has been defined as encompassing of net shareholders' equity as well as long term debts. The model assumes that opportunity cost interest rate is 3% more than the predominant inflation rate.

Cost Reduction

Cost is said to be reduced if the prices of all the elements of production fall as output expands. An industry is said to be reducing cost if its long run supply is negative signifying that output will rise as prices drop. The increased demand for factors inspires their suppliers to improve their skills, so that factor costs become lower per unit of output. The decline in factor prices shifts the cost of individual firms downwards. The manufacturing supply shift so that fee in the long run falls beneath the early level (Koutsoyiannis, 1979).

The cost emphasis focuses on the efficiency of the firm's processes. General cost reduction efforts (downsizing) do not necessarily improve efficiency, but quality efforts that reduce costs always do. So every successful programs tend to accelerate the productivity of quality efforts by reducing the input required to produce a unit of output. These enhancements can be incremental or discontinuous; in either form, the core motive is internal and reduction of costs. Customer satisfaction improvements are sought only indirectly, through such results as increased reliability or lower prices. Cost reduction programs thus transfer their savings to the bottom line directly.

Improved Quality Product

Quality product signify that a product satisfy or exceed customer's expectations (Waters & Waters, 2008). The most known and general operational definition postulates quality as the customer's perception of product and service excellence. In today's competitive world, quality is prime to an organization's success as well as survival. Intense worldwide rivalry over price determination, market share, growth rate and product quality has accelerated the increasing significance of quality. Superior quality no longer distinguishes participants; instead, it authenticates the earnestness of a business organization to compete (Giffi et al., 1990). Business organizations worldwide whether involved in the manufacturing of physical goods or the provision of services or both recognize quality as a foremost competitive instrument for improvement or maintenance of their market share as well as sales growth. Thus, business organizations continuously nurture innovative ways using quality management principles with a vision to design continuous techniques as well as procedures in order for effective control and sustainability of quality in the pursuit of excellence.

Quality is critical to corporate success as it demonstrates a significant role in improving organizational productivity. This is evidenced by the work of Aremu, Ekpo, and Mustapha (2013) who asserted that a quality product leads to a good consequence. Kotler and Armstrong (2012) stipulated that product quality is the distinctness of a product or service in fulfilling customer needs. According to Palmer (2005) quality can only be expressed by customers and occurs where an organization supplies goods or services in the specifications that satisfy their implied customer's needs.

Link between Inventory Control and Corporate Productivity

One of the inescapable and enduring objectives of production is to improve productivity, which entails reducing the cost per unit of output, or increase output with a stable amount of input like material through stock control as well as other inputs. This leads to cost reduction and increase in returns (Pandey, 1999). According to Hyder (2011) inventory control contribute to high productivity that lead to cost and time reduction in production processes thus assisting the organization to attain its objectives. Anichebe and Agu (2013) in their study of the effects of inventory control on organizational effectiveness,

employed descriptive research design, with a sample size of two hundred and forty-eight (248). Data were obtained using questionnaire, interviews, and observations. The findings signify that there is a significant association between inventory control and organizational effectiveness. That is, inventory control has a noteworthy effect on corporate productivity (Agu, Oziom & Nnate, 2016). Kamau and Assumpta (2008) in their study on the effect of inventory control on organizational competitiveness, sought to ascertain the effects of inventory turnover, inventory shrinkage and inventory investment. Descriptive design was employed. The study established that inventory investment; inventory turnover as well as inventory shrinkage affects the competitiveness of firms. The study then resolved that inventory control are significant to the competitiveness of firms (Agu, Oziom & Nnate, 2016). In the study of Ogbo, Onekanma and Wilfred (2014) on the impacts of inventory control on organization performance. It was established that organizations profits from inventory control by means of stress-free storage as well as material retrieving, effective sales improvement, as well as cost reduction. The study likewise established that there is a significant relationship between operational feasibility, the utility of inventory control in the customer related issues of the organization and cost effectiveness. This discussion places acceptable limitations on the link between the variables; hence the following hypothesized statements are made.

H₀₁: *There is no significant link between inventory control and cost reduction of food manufacturing firms in Port Harcourt.*

H₀₂: *There is no significant association between inventory control and improved quality product of food manufacturing firms in Port Harcourt*

Methodology

The study embraced a cross sectional survey design to acquire responses from the general managers, heads and assistants of functional departments in 16 functional food manufacturing firms in Port Harcourt. The study embraced census sample based on the modest size of the elements that constituted the population; and since the study units were known, there was no need of sampling. Questionnaire was the foremost instrument for data collection. The singular firm sample size was scientifically determined as well as disseminated for each of the selected food manufacturing firms separately using Bowley (1964). The nature of the data was quantitative. So, 165 copies of questionnaire were distributed to the sixteen (16) food manufacturing firms under study. Out of these, the responded and retrieved copies amounted to 161; while only 157 of these were usable for analysis. The reliability of the study instrument was verified using the Cronbach alpha. The Pearson Moment Product Correlation Coefficient with the aid of Statistical Package for Social Science was used to test the proposed hypotheses at a significant level of 0.01.

Table 1: Result of Reliability Tests

Variables	No of Items	Alpha Value
Inventory Control	4	0.874
Cost Reduction	4	0.850
Improved Quality Product	4	0.925

Test of Hypothesis 1

H₀₁: *There is no significant link between inventory control and cost reduction of food manufacturing firms in Port Harcourt.*

Table 2: Correlation of Inventory Control and Cost Reduction

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		Inventory Control	Cost Reduction
Inventory Control	Pearson Correlation	1	.866**
	Sig. (2-tailed)		.000
	N	157	157
Cost Reduction	Pearson Correlation	.866**	1
	Sig. (2-tailed)	.000	
	N	157	157

**correlation significant at 0.01 level

Source: Survey Data, 2021

Table 2 clearly indicated the correlation results between inventory control and cost reduction. It shows a positive as well as significant relationship between the variables. From the correlation statistics ($r = 0.866$, $p = 0.000$, $r^2 = .7499$), the coefficient of correlation (r) signifies a strong positive relationship between the two variables; while the probability value (p) which is less than the .01 level of significance indicates the existence of a significant relationship. The coefficient of determination (r^2) implies that inventory control can explain about 75% of the differences in cost reduction. Since the result affirmed the existence of a significant relationship between the two variables, it then means that the null hypothesis was not supported; hence, the alternative hypothesis became applicable. The study therefore states that there is a significant link between inventory control and cost reduction of food manufacturing firms in Port Harcourt.

Test of Hypothesis 2

H₀₂: There is no significant association between inventory control and improved quality product of food manufacturing firms in Port Harcourt.

Table 3: Correlation of Inventory Control and Improved Quality Product

		Inventory Control	Improved Quality Product
Inventory Control	Pearson Correlation	1	.921**
	Sig. (2-tailed)		.012
	N	157	157
Improved Quality Product	Pearson Correlation	.921**	1
	Sig. (2-tailed)	.012	
	N	157	157

Source: Survey data, 2021

Table 3 has vividly shown the correlation analysis result between inventory control and improved quality product. It could be seen from the correlation statistics ($r = 0.921$, $p = 0.012$, $r^2 = .8482$) that the coefficient of correlation (r) showed a very strong correlation between the two variables; while the probability value (p) which is less than the 0.01 level of significance indicates the existence of a significant relationship between the two variables. The coefficient of determination (r^2) signifies that inventory control can be used to explain about 85% of the variance in improved quality product. Since this result confirmed the existence of a significant and direct relationship between the two variables,

the null hypothesis was not supported; hence, the alternative hypothesis became applicable. The study therefore states that there is a significant association between inventory control and improved quality product of food manufacturing firms in Port Harcourt.

Discussion of Findings

The findings of the test of hypothesis 1 and 2 showed that there is a strong direct correlation between inventory control and cost reduction as well as between inventory control and improved quality product of food manufacturing firms in Port Harcourt. These findings were anticipated in that it is normal to expect a reduction in cost and improvement in quality of product when inventory is properly controlled and managed as proper inventory control usually reduce loss and wastages. These findings tally with those of Jones (2003) who in his study asserted that execution of appropriate inventory control practice entails offering high-quality products at moderately less price. It was further pointed out that it is essential to establish a daily ordering and frequent calculation of inventory turns. Support was also found in Anichebe and Agu (2013), who studied the effect of inventory control on organizational effectiveness and found that vital significant relationship exists between inventory control and organizational effectiveness. Hence, the conclusion that inventory control has a noteworthy effect on corporate productivity. Another supportive finding came from Ogbo, Onekanma and Wilfred (2014) who conducted a study to determine the effect of inventory control on organization performance. They established that firms benefit from inventory control by means of stress-free storage as well as material retrieving, improved product quality and cost reduction. Other supportive studies include Agu, Oziom and Nnate (2016); Kamau and Assumpta (2008) as well as Ogbo, Onekanma and Wilfred (2014).

Conclusions and Implications

The result and findings of this study indicated a strong and positive correlation between inventory control and the two measures of corporate productivity (cost reduction and improved quality product) adopted for this study. Based on the findings, it was concluded that inventory control meaningfully results to cost reduction and improved quality product of food manufacturing firms in Port Harcourt. Specifically, inventory control accounted for 75% of the variation in cost reduction as well as 85% of the variance in improved quality product of food manufacturing firms in Port Harcourt. This has implications for theory and practice. In terms of the theoretical implication, the study supports and affirms inventory management theories such as Just-in-Time (JIT), Economic Order Quantity (EOQ), ABC analysis and Vendor Managed Inventory. These theories as reviewed in the literature emphasized the need for efficient and effective management of inventory so as to achieve optimization in the use of resources (in this case, inventory) to effecting desired output levels. For the managerial implications, the study averred that managers can use inventory control to reduce cost to the tune of 75%; leaving the remaining 25% to other variables not accommodated in the study. In other words, they must hold these variables constant or control for them if they must maintain this 75% level or improve on it. Similarly, the study professed that managers intending to improve the quality of their product via inventory control can achieve that to the extent of 85%; leaving the remaining 15% to other factors not captured in the model. Hence, to achieve or exceed this level of variance explanation, such managers must monitor these exogenous factors and control for them.

Recommendations

Based on the conclusions above, it was recommended that to assist firms in cost reduction and improved product quality, management of food manufacturing firms should:

1. Facilitate faster execution of prudent inventory control techniques such as JIT, EOQ and ABC analysis. This can be achieved by training personnel on the use and application of these techniques for efficient and effective inventory control.
2. Explore and utilize inventory control systems; as well as effective utilization of ICT in inventory management. To achieve this, they need to invest heavily on acquisition of the relevant technology.
3. Employ the services of experts in such areas as operations management and control, systems management and control, inventory management experts and system analysts to fast-track the achievement of their desired levels of inventory control.

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