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STUDY ON EOQ TECHNIQUE OF INVENTORY MANAGEMENT TO IMPROVE QUALITY AND PRODUCTIVITY OF MATERIAL

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Abstract

Businesses desire growth and energy to lower overall costs in today's global marketplaces, and management companies are likely to enhance quality, efficiency, and energy efficiency without spending more money. Many businesses' success is fortunate to have the opportunity to deliver the promised service at the proper time and place. Various innovative management solutions have been adopted by the company to manage and control the stock and residual protection list. The manufacturing business case is investigated in this research. The paper presents and displays a research of Economic Order Quantity (EoQ) technology for asset management in a sample of 12 high-speed machinery firms. The company's stock control, from the other hand, is out of date, that's why there is a residue. The two procedures adopted by these companies, along with others proposed by the model, are compared in this research, and expenses are estimated to compare them. Techniques and computations have been shown to be beneficial in assessing present inventory management techniques and determining development efforts.

Keywords: Inventory Management Technique, Economic Order Quantity, EOQ, Ordering Cost, Reorder Point, Quality and Productivity, Material Management, Inventory Control.

INTRODUCTION

In today's environment, all firms are attempting to find the right balance between what is required and why it is required, while also reducing costs. This is referred to as inventory management or inventory control. Inventories are indeed the products and commodities which compose a company's stock. Inventory planning is associated with the quantities of inventories, the position of accessibility when it is required, inventory management, and raw resources. Projecting, inventory management, inventory carrying costs, prediction, asset pricing, asset verification, and forecasting future demand are all aspects of inventory management. This enables a high-quality ship to comprehend and engage with both product and quality management. Inventory and supply chain management are critical components of any corporate operation. Inventory management has experienced revolutionary and astonishing changes as a result of technological advancements in the period and enhanced software application processes. The functions of every organization's business process are linked and tied to one another, and they frequently overlap. The logistics, inventory, and supply chain management functions constitute the backbone of the business delivery function. As a result, marketing managers and finance controllers must perform all of these tasks.

The research work was undertaken by Haolan Liao et al, 2021 [1] who found that the classic economic order quantity (EOQ) model calculates the right ordering strategy based on the assumption that market demand is constant, resulting in evident departures beneath unpredictable circumstances. Under the arrangement of consumption across the economy, the author develops an effective ordering strategy to maximize environmental benefits. Also Models and solutions for the building of a shopping network that integrates site-travel and innovation concerns are presented by Agus Darmawan et al, 2021 [2] they also consider the network's use of structured asset management. They designed work methods to overcome the challenges generated by the two tactics due to the complexity of the efficiency concerns. When the cost of holding is high and high, the results are most pronounced. According to Puppala Sridhar et al, 2021 [3] inventory management and control, as well as appropriate regulations, are critical to improving organizational performance. The current study examines a solution to an issue involving the gathering of assets purchased by the corporation in a retail store. The proposed method will lower innovation by 40% and sales by 87% when compared to the existing standard asset management system. The study G. Karakatsoulis et al, 2021 [4] shows that the inventories policy (r, Q) is utilized to govern the system and theoretical studies ensure that the control, and as a result, the quantities, have a

smaller impact on the typical overall cost of such an inventory management system than other models.

A multi-position inventory of a huge amount of cover offered by the ecological capital in order to get another significant amount of the surrounding area. Abdullah A.H.A et al, 2021 [5] shows that the design is intended being a global finite - dimensional task involving four criteria: raise the profit-to-total-order-amount ratio, bring down the cost of both the storage system, reduce the total waste produced mostly by inventory tracking cycle, and impose sanctions. The study of Christoph H. Glock et al, 2021 [6] determine the study to get a thorough and detailed overview of batch model calibration, or EPQ also the research of Josef Svoboda et al, 2021 [7] presents the layout of the type and reviews the literature on inventory models using multi-source tools.

The Heibatolah Sadeghi et al, 2021 [8] proposes an ideal integrated production and warehouse system with multiple, isolated deliveries and no control over the phased delivery of goods the evidence contains a number of organizational concerns that enables the client to be the simplest way to acquire the concept using various quantities of charge and the research of R. Janani et al, 2021 [9] shows the process of developing, organizing, and maintaining your website, on-line, and the companies that manufacture cases is known as materials management. The major goal of dust control is to ensure that the fabric‘s structure is always available for them to employ if they need to accomplish the assignment on time. This can lead to excellent and long-term environmental preservation.

Gaffar Hossain et al, 2020 [10] conducted the research work which concerned with the piezoresistive textile sensor production paradigm and their use in retail shelves for inventory management data. A single column and multi-column shelf sensor that can detect an object based on its weight and transfer data wirelessly (through a smartphone) to the control room to record associated data is created using a pressure-sensitive semiconductor fabric with textile electrodes. By plasma, semi-conductive coating of polyester textile, and electrode materials, together with the sewing process, the piezoresistive sensor‘s sensitivity is increased. Last but not least, a fabric sensor included into the sales shelf keeps track of inventory-related data including the presence and absence of items in addition to stock level, product value, positioning, and delivery time, etc.

Hesham Al-Momani et al, 2020 [11] conducted the research work which seeks to provide a local, affordable, superior, trustworthy, and adaptable asset management system that controls and enhances the collection of commodities in the military aviation sector (Air Force). The purpose of this new system is to increase the usability, dependability, and readiness of vessels in order to enhance operating circumstances and degree of readiness at the lowest feasible cost. Cheap software that enables the availability of broken components during the installation of wind turbine equipment The suggested system offers top-notch reports that enhance purchase management procedures and procedures that aid in the fusion of storage, procurement, and inventory data to reduce stocks. As a result, structural design will be enhanced, efficiency, availability, and dependability will increase, prices will go down, and there will be fewer aircraft on the ground (A.O.G).

Jan de Vries 2020 [12] conducted the research work which He has performed study to look at the many sorts of conflicts, their origins, and the creation of character conflict throughout the formulation, usage, and implementation of innovation since it appears that asset-related disputes have some important lessons to learn. As a result, a framework for investigating the many types of conflict is considered as the initial step. It may be inferred from case studies that some of the old issues that have been submitted to our framework originate from the businesses examined. The study case studies strongly imply that asset management disagreements may evolve over time throughout the restoration process and the execution of development. The results presented in this article can help project managers to direct projects to the asset management area more effectively.

Zeyu Zhang et al. 2020 [13] The study proposes a model that will discuss the potential for data in a particular piece of information to be misinterpreted. The model‘s parameters are measured using the maximum probability approach. Grid search is utilised while setting the starting measurement to prevent accurate localization. To find any misalignments in the presented sample data, estimates are applied. Simulated data sets are used to validate the suggested technique. The findings demonstrate that the suggested technique is more effective in terms of categorization, can learn the guidelines for identifying specialists from the training set, and can be used to the planning of novel projects.

Masoud Mehdizadeh, 2020 [14] the researcher intends to as the most crucial method by which merchants will submit new orders to the distributor, examine the number of automobiles sold and their mileage associated to each of the recreational regions. The ABC analysis is subject to additional circumstances, such as the demand for a certain component in relation to the growth in the total number of miles driven by compatible cars during a given time period. Using the complicated set-up approach, we may develop patterns and rules using previously unverified data that was gathered by ABC analysis. We occasionally make an order based on the review procedure and utilise the regulations published to estimate future seller demands. The implementation of the proposed model in one of the Iranian distributors, shows significant improvements in key operational measures such as increased service level and reduction in the average price and age of goods.

Thabet Abdeljawad et al. 2020 [15] In the research work We investigate certain particular classes of Caputo operator operators with multiple Mittag-Leffler (ABC) characteristics. In this work, a certain class of Caputo is used to modify quadratic and cubic logistic models. It is demonstrated that existence and variety exist, and it is addressed how stability analysis might obstruct equality points. There are several study model demonstration examples given.

Jianqiang Gong et al. 2020 [16] This study, highlights,

however, utilizing the failure of the failure and value analysis mode (FMECA) as the foundation for developing an ABC planning system that is capable of reliably identifying sensitive equipment and facilitating effective maintenance. The suggested technique allows for the systematic failure analysis method to be used to derive priority numbers (RPNs) and values as an indication of safety and dependability. To generate comprehensive scores, the segmentation class can be employed once these indicators have been added to the economic index of maintenance costs. The outcomes demonstrate that the priorities are lowered by the ABC categorization scheme. This strategy may lower the cost of corporate management, increase the efficiency of the repair operation, and focus on the most important portions. Inventory management is an essential phase that governs the supply chain‘s functionality and also the financial and balance sheet implications. Any organization‘s core strategy is to always strive to maintain accurate at the optimal level to meet demand while avoiding over- and under-inventory, which can have a negative influence on the financial structure. Inventory should always be changing. Inventory management necessitates the integration of overt and covert components, and also some supervision via planning and implementation, and even some ongoing observation and caution. Inventories planners are a group of people who work in almost every organization as a particular division or specific role. These departments or teams‘ responsibilities include constant inventory monitoring, control, and evaluation, as well as interface with procurement, production, and finance departments.

MATERIALS

The fair market value of an order that such a corporation can acquire to minimize the expense such as holding costs, deficit costs, plus ordering costs is termed as an economic order price (EoQ). EoQ is sometimes a good ordering firm since it lowers the total expenses of ordering, receiving, and retaining products. When the expenses of searching, ordering, and hosting remain consistent throughout time, the EoQ model works best. Amongst the most significant drawbacks of an economic order’s worth is just that it believes that demand for a company’s products will be constant.

The formula assumes that the costs of searching, ordering, and hosting all remain constant.

The following are the assumptions of economic order quantity.

1. The EOQ model assumes that the comprehension is understandable and remains constant over time.
2. No shortages allowed.
3. The lag time for receiving an order is indefinite.
4. The order amount is all received directly.
5. The item‘s purchase price doesn’t change.

- Formula and Calculations of Economic Order Quantity:

The formula for EOQ is,

$$Q = \sqrt{\frac{2DS}{HC}} \qquad (1)$$

Where,

Q = EoQ units

D = Demand in units (typically on an annual basis)

S = Order cost (per purchase order)

H = Holding cost (per unit, per year)

C = Unit cost

The goal of the EOQ formula is to figure out how many product units to order. If this goal is achieved, the organization should be able to decrease the price of purchasing, delivering, and servicing units. Companies with global supply chains and significant operating expenses use an algorithm on their computer software to build an EOQ, which is frequently adjusted to establish different levels of production or order periods. The EOQ is an important leadership tool. The formula can help the company control the amount of money involved within the establishment balance. In a number of companies, inventory is its largest asset apart from human resources, and these businesses must carry an adequate list to satisfy the needs of consumers. If the EOQ can help reduce the size of the inventory, savings are often used for other business purposes or investments.

The EOQ formula identifies whether a corporation should restructure. When inventory levels drop below a given threshold, the EOQ formula, when implemented in business operations, necessitates the placement of repeated demand orders. The business avoids inventory depletion and can still fulfil client orders by establishing the re-order point. A quantity demand whenever a corporation runs off from stock, which implies money is wasted because the company does not have the funds to complete the order. Lack of inventory may also indicate that the company has lost a customer or that the customer will order less in the future.

Problem Definition: The major goal of this research is to learn about the comprehensive perspective to material management and how to apply it to better inventory management. It is really important to manage inventory in the day-to-day operations including its business and ensuring timely delivery of items. The study’s purpose outlines strategies for aiding the company by reducing stocks and pricing through the gradual deployment of EOQ and ROP expectations. As a result, the company’s product investigation is completed utilizing the previous year’s details. Finally, the expenses are determined in establishing the value, and the priorities are reformed in comparison to the present and suggested models.

METHODOLOGY

Annual Demand: The following case was conducted in the inventory stores of the manufacturing organization of a capsule production. Primary data was gathered from the stock registers maintained in the stores by making use of the format. The given data are of previous year operation.

Annual demand for material is calculated based on average monthly turnover in this firm.

The Material demand is 5000 kg per month.

D = 5000 kg per month * 12

= 60000 kg per year

Cost of one unit is Rs. 520 per kg.

Therefore, C = 520 per kg ordering cost (OC)

According to company current forecasting model, the firm place an order in a month and the total charge for that is (5000 * 520) = Rs. 26,00,000 and the cost of ordering is 10%.

So, 10% of Rs. 26,00,000 is ordering cost per order i.e., Rs. 2,60,000

Therefore, Ordering cost per order = Rs. 2,60,000

Therefore, cost of material = 26,00,000 – 2,60,000 = Rs. 23,40,000

Now, no. of kgs of material,

$$\text{Material Purchased} = \frac{\text{Cost of material}}{\text{Unit cost of materail}}$$

$$\text{Material Purchased} = \frac{23,40,000}{520}$$

$$\text{Material Purchased} = 4500 \text{ kg}$$

Company makes 1 order per month, therefor total no. of orders in a year = 12 nos.

$$\text{Ordering cost per kg} = \frac{\text{Ordering cost per order} * \text{total no of orders yearly}}{\text{Material purchased}}$$

$$= \frac{2,60,000 * 12}{4500}$$

$$\text{Ordering cost per kg} = 700 \text{ /kg}$$

After calculating cost now, we can estimate EOQ:

$$EOQ = \sqrt{\frac{2DS}{HC}}$$

$$EOQ = \sqrt{\frac{2 * 60,000 * 700}{0.01 * 520}}$$

$$EOQ = 4020 \text{ kg}$$

Therefor, the EOQ for material is approximately 4020 kg. Since the company currently orders 5000 kg, it should decrease the amount of order to 4020 kg in order to minimize the cost.

Total cost calculation:

For EOQ = 4020 kg

$$\text{No. of orders per year} = \frac{D}{EOQ} = \frac{60,000}{4020}$$

$$= 15 \text{ nos.}$$

$$\text{Order size} = \frac{D}{\text{No. of orders}} = \frac{60,000}{15}$$

$$= 4000$$

$$\text{Average inventory} = \frac{\text{Order Size}}{2}$$

$$= \frac{4000}{2} = 2000$$

Carrying (Holding) cost
= Order size * Average inventory
= 4000 * 2000
carrying (Holding) cost = Rs. 80,00,000

Ordering cost = Cost per order * No. of orders
= 700 * 15
= Rs. 10,500

Total annual cost
= Carrying (Holding) cost + Ordering cost
= 80,00,000 + 10,500
= Rs. 80,10,500

From company's data = 5000 kg

$$\text{No. of orders per year} = \frac{D}{EOQ} = \frac{60,000}{5000}$$

$$= 12 \text{ nos.}$$

$$\text{Order size} = \frac{D}{\text{No. of orders}} = \frac{60,000}{12}$$

$$= 5000$$

$$\text{Average inventory} = \frac{\text{Order Size}}{2}$$

$$= \frac{5000}{2} = 2500$$

Carrying (Holding) cost
= Order size * Average inventory
= 5000 * 2500
carrying (Holding) cost
= Rs. 1,25,00,000

Ordering cost = Cost per order * No. of orders
= 700 * 12
= Rs. 8,400

Total annual cost
= Carrying (Holding) cost + Ordering cost
= 1,25,00,000 + 8,400
= Rs. 1,25,08,400

The result is summarized as,

Table 1. Results Technique Comparison

Term	EOQ Technique	Company's Current Technique
Annual Demand (kg)	= 4020 * 12 = 48240 kg	= 5000 * 12 = 60,000 kg
Order Quantity (kg)	4,020 kg	5,000 kg
No. of orders	15	12
Carrying (Holding) cost	Rs. 80,00,000	Rs. 1,25,00,000
Ordering cost	Rs. 10,500	Rs. 8,400
Total cost	Rs. 80,10,500	Rs. 1,25,08,400

So, optimal order quantity Q = 4020 kg is appropriate, which minimizes the total cost for holding inventory.

• *Reorder Point*

A reorder level, also known as a reorder point, is a predetermined stock or inventory level at which a firm or business places a fresh order with its suppliers to receive raw material or completed goods inventory.

Table 2. Reorder Point Data Table

Parameters	Unit
Material	48240 kg
EOQ	4020 kg
Safety stock	30 Days
Lead time	10-20 Days
Working days / year	360 Days

$$\text{Reorder level} = (\text{Lead time} * \text{Average usage}) + (\text{Safety stock})$$

$$\text{Reorder level} = \left(\text{Lead time} * \frac{\text{Material usage}}{\text{Working}\frac{\text{days}}{\text{year}}}\right) + (\text{Avg daily use} * \text{Safety stock days})$$

$$= \left(10 * \frac{48240}{360}\right) + (134 * 30)$$
$$= 1340 + 4020$$
$$= 5360 \text{ kg}$$

$$\text{Minimum stock level} = \text{Reorder level} + (\text{Avg usage} * \text{Average lead time})$$
$$= 5360 + \left(134 * \frac{10 + 20}{2}\right)$$
$$= 5360 + 149$$
$$= 5211 \text{ kg}$$

$$\text{Maximum stock level} = \text{Reorder level} + Q - (\text{Avg usage} * \text{lead time})$$
$$= 5360 + 4020 - (134 * 10)$$
$$= 9380 - 1340$$
$$= 8040 \text{ kg}$$

$$\text{Danger level} = \text{Average usage} * \text{Max. lead time}$$
$$= 134 * 20$$
$$= 2680 \text{ kg}$$

$$\text{Average stock level} = \frac{\text{Max. stock level} + \text{Min. stock level}}{2}$$
$$= \left(\frac{8040 + 5211}{2}\right)$$
$$= 6625 \text{ kg}$$

Since most significant interval is 10 days, the firm should make an order when stock level is 5360 kg or 1340 kg.

RESULTS AND CONCLUSIONS

An EOQ asset management strategy reduces holding and order costs while increasing order volume. This has a significant impact on business costs in these areas. The total cost of the items has been decreased by around 10% as a result of this checklist. According to the findings of the following study, the industry does not always adhere to a high degree of asset management framework. Things are ordered at a discretionary rate or when material quantities are steadily depleted. They keep a one-month supply of supplies on hand and wait for the next package‘s order. As a result, the company occasionally faces the challenge of overdoing it or overreacting. Along these lines, the organisation requires a solid framework to keep running costs to a minimum. When the eoq method is applied for suitable issuance, the order‘s consequences of engaging and price are typically decreased to a large extent. Companies can believe a predictable amount of products to order and when to apply for additional items for each item by employing this approach. Again from sense of reordering, that is fine and will be handled when the next order is placed.

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