



OPTIMIZING PRODUCTION AND INVENTORY ANALYTICS FOR THE GARMENT INDUSTRY : A CASE STUDY

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Abstract

A garment industry's largest and most valuable resource is its global market inventory. India is rapidly growing market, on track to reach a half-billion middle-income people by 2030. In the long term, these characteristics benefit the garment industry. As the global financial crisis is expected to deepen day by day and the countries in South Asia continue to emerge and develop their garment industry in this challenging time. The garment industry will continue to flourish with their continuous efforts. The purpose of this research is to determine how successful and practical the EOQ technique is in the garment sector. This scientific research is a quantitative examination of the MADAN GOPAL VARSHNEY HRK GARMENT firm. The data utilized in this study are for 2020 and 2021 in terms of the amount of purchases and usage of recyclables, information on purchasing cost and data on maintaining costs, raw commodity costs, and cycle times. The findings of this research shows that the frequency with which purchases are made exceeds 100 times, resulting in significant ordering expenses. According to EOQ, the amount of optimal inventories for a single order is 646.56 kg in 2020 and 808.67 kg in 2021. The inventory expenditures using the EOQ approach is expected to be INR 5,94,868.29 in 2020 and INR 6,12,955.76 in 2021. In 2020, INR 10,811,246.82 or 94.59 percent of spending may be saved by using EOQ. Spending that may be saved in 2021 by using EOQ total INR 11,066,169.21, or 94.86%.

Keywords: Inventory, Economic Order Quantity, Garment Industry

1. INTRIDUCTION

The garment business is often regarded as highly competitive across the globe. Planning for garment manufacturing is a difficult job, when demand is diverse. Seasonal variation of demand in the garment business necessitates the development of short plans that address the need for immediate production choices [1]. Simultaneously, management choices must be made quickly to keep up with the other competitors. Manufacturers are attempting to keep up with new fashion trends. There are certain critical choices that must be made with caution since they have a direct effect on expenses and income. These choices include that

timing of production and the quantity of output required to fulfill deadlines [2]. India's textile industry generated 7% of the country's overall industrial output and 2% contribution in overall GDP in 2019-20 where as 11% contribution to exports in 2020-21. In Financial year 2022, overall exports are expected to increase up to 13% [3]. India's garment sector is entirely self-sufficient everything is manufactured in the nation, from fiber to completed clothes. Factors such as 'buyers in town' and a 'busy booking season' have an effect on India's garment exporting companies. Buyers in town indicate consumer interest for the garment sector, and a busy booking season indicates the peak season for shopping for clothes. With the economy showing early indications of recovery from recessionary pressures, foreign fashion brands are lining up to invest in India. When it comes to clothes, Indian producers and exporters are excellent at predicting "what in" and "what's out". New raw materials, designs, and concepts are included into the production of readymade clothes, which contributes to increased sales and a feeling of uniqueness [4].

Material stock ("raw materials, semi-finished materials, and finished items") is a critical component of a company's process and manufacturing operations [5-6]. A critical component of meeting production and working targets, when demand is increasing [7]. Stock controlling and inventory ledgers have become critical for every continuing business [8-9], regardless of whether the ongoing business has optimized inventory management in order to meet production goals or has a warehouse that is inefficient at procuring goods. The term "inventory" refers to any kind of resource that has economic worth and is kept in order to meet an organization's current and future requirements. As described by Fred Hansman, inventory is "an idle resource of any sort that has economic worth". A resource inventory is maintained in order to offer desired service to consumers and to meet sales volume targets [10].

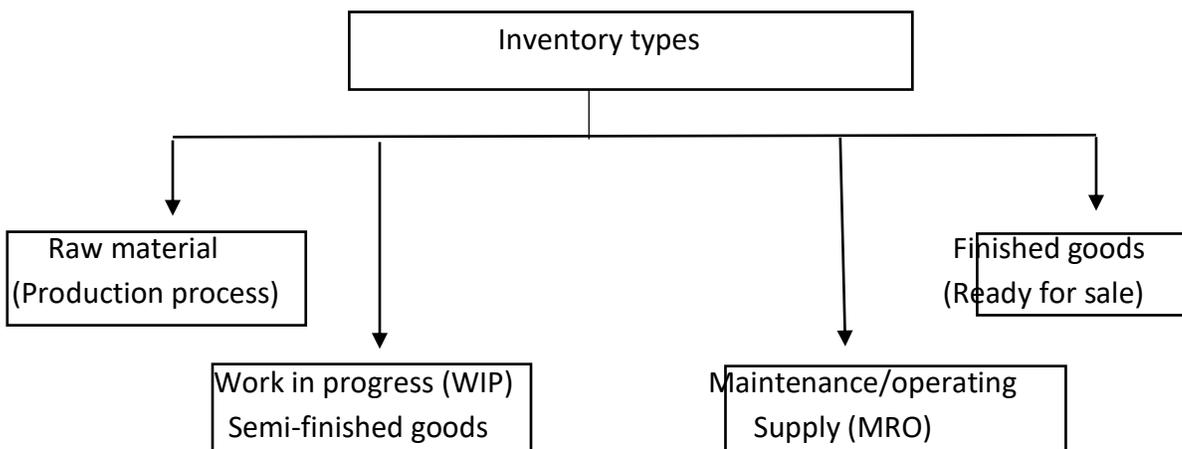


Figure 1. Essential features of Inventory

Raw material inventory refers to materials that have been bought but have not yet been processed. The work-in-progress content has been altered but is not yet complete. Work in progress occurs as a result of the time required to manufacture a product, referred to as the "CYCLE TIME". Maintenance, repair, and operational materials comprise the MRO inventory. They exist because the need and timing of some equipment's maintenance and repair are uncertain. Finished goods inventory refers to products that have been completed and are awaiting shipping. Finished products may be inventoried if demand for a certain time period is unclear.

1(A) FUNCTIONS OF INVENTORY

Inventory provides a number of purposes that help a business be more adaptable in its day-to day operations.

- ❖ Controls of stock in inventory to ensure there is enough to satisfy consumer demand.
- ❖ Quantity Discounts: Many vendors provide QDs on big inventory purchases. In order to get bulk discounts from a manufacturer.
- ❖ Inflation and price fluctuations may be hedged against using inventory.
- ❖ Inventory will serve as “safety stock” by keeping additional products on hand in case of a stock-out.
- ❖ The usage of “work in progress” inventory aids in keeping operations running efficiently.

MADAN GOPAL VARSHNEY HRK GARMENTS is a micro- business in the fashion industry that was founded in 2019 in the populous town of Hathras, India. It manufactures clothes and trousers in a variety of styles and colours, as well as other types of models. The manufacturing process is carried out, the product is provided directly to customers, and client orders are taken into consideration (task order). Cotton is utilized as a main manufacturing material, since the goods requested are tops. All of the appropriate time goods purchased and kept have been in 30s cotton fabric, since this is the primary manufacturing material for T-shirts, Each month, MADAN GOPAL VARSHNEY HRK GARMENT utilizes thirty raw days. Cotton materials weigh between 700 and 1000 kilos, and manufacturing varies accordingly to the really diverse variety of directions (job order). The cost of shipping and ordering is INR 20,000 each order. MADAN GOPAL VARSHNEY HRK GARMENT orders an average of 860 kilos each order every four weeks, which may be delivered by vehicle. The wait time for shipping natural materials is one day for the MADAN GOPAL VARSHNEY HRK GARMENT business. MADAN GOPAL VARSHNEY HRK GARMENTS sales will be determined only by the anticipated remaining stock and the goal amount to be created. MADAN GOPAL VARSHNEY HRK GARMENTS makes reservations on an average of 9-12 times each month. It resulted in a large purchase, ranging from INR. 1,60,000 to 2,20,000 each, and thirty days later, the cost spent ranged from INR, 21,40,000 to 28,60,000 per for purchasing 30s of natural cotton textile materials. The inventory management assessment will be conducted using the EOQ technique in order to determine the following:

- a. Is the business using the inventory technique successfully and efficiently?
- b. Are there any advantages to adopting the EOQ technique for inventory management, such as ease of execution and cost savings?
- c. In terms of EOQ, how often inventory would be required to fulfill one demand efficiently?
- d. How much will inventory expense if the EOQ technique is used?
- e. How much money can you save with EOQ?

2. LITERATURE REVIEW

S.Hastari et al. [11] The aim of this research is to assist “small medium enterprises (SMEs)” who are participants of the WASUKA collaborative in conducting more effective and efficient raw material inventory management via the use of the EOQ technique. This is a qualitative analytic research design in which the gathered data are used to explain or give an overview of the study object. This research makes use of two data

sources: primary data on the acquisition and usage of raw materials, as well as secondary data on the number of order and storage expense.

A.M. Elmehanny et al. [12] Traditional technologies in the literature place minimal emphasis on capacity allocation between “Mixed Make To Order (MTO)/Make To Stock (MTS)” environment that is responsible for the fluctuations in goods prices. The discussed framework was implemented in Egypt, and the findings are evaluated for sensitivity. Changing fabric prices had a significant impact on the model’s results. While changes in inventory holding cost had little effect on total net profitability.

Yopan Maulana et al. [13] Inventories are a firm’s assets, either in the form of raw materials, processed products, or completed items. Excess or insufficient inventory will have a detrimental effect on the financial performance of the business, such as the flow of bad money or capital, the presence of jobless workers, the risk of damaged goods, and disruption of the manufacturing process.

H. H. Septiawan et al. [14] the purpose of this research is to compare the EOQ technique to the company’s real method for buying Raw Materials and Home Industry Socks. Additionally, to determine the efficacy of the EOQ technique when used to the business. The data for this research were gathered from the owner’s notes, reports, and business paperwork for the years 2018, 2019, and 2020. They were gathered via inspection, discussion, paperwork, and a review of the literature. Meanwhile, business records are used to gather use statistics, raw material pricing, and raw material purchasing data. The “EOQ formula, standard deviation, safety stock, total holding cost, total ordering cost, and total inventory cost” were all utilized in this study’s analysis. The findings of this study indicate that the EOQ technique is beneficial for assisting business in the socks home sector in controlling inventory more effectively by lowering inventory expenses.

3. ECONOMIC ORDER QUANTITY (EOQ)

EOQ is inventory managerial methods used to estimate the optimum quantity of products/raw materials to buy at the lowest possible cost [15]. The EOQ technique seeks to attain the lowest inventory levels feasible at the lowest possible cost [16]. The EOQ model may be readily customized to meet specific business requirements and serve as a decision-making foundation. EOQ is a method of business management used by a firm, particularly the production and inventory departments, to ensure that operations remain stable under a variety of circumstances [5].

Some common assumptions related to EOQ [17]

- ❖ Needs are known to remain stable over the course of a year.
- ❖ There is no variation in the lead time.
- ❖ The supplies are delivered promptly.
- ❖ There are no discounts for purchasing in bulk.
- ❖ Ordering and keeping inventory cost are also fixed.
- ❖ If order is place, hence prevent it running out of stock.

Table 1

| | |
|----------------|--|
| EOQ or Q = | EOQ or Q* Optimal Order Amount (in units) D = Number of Demand Per Year (in units) |
| $N = D/Q^*$ | S = Ordering Cost H = Holding Cost Per Units N = Frequency of Order for Per Tear |
| $TCC = Q/2$ | TCC = Total Holding Cost TOC = Total Ordering Cost |
| $TC = TCC+TOC$ | TC = Total Cost |

Some common formulas for evaluation of EOQ

4. METHODOLOGY

In this research quantitative analysis is obtained from interviews and information which can be secondary company reports including:

1. Data regarding the true wide range of acquisitions and uses of garbage in 2020 and 2021
2. Ordering price information in 2020 and 2021
3. Data on stock costs in 2020 and 2021
4. Price of recyclables in 2020 and 2021
5. Lead time in 2020 and 2021

Into the educational examination of computation made using the EOQ technique. Cotton from the 30s is utilized as the basic material. Through the outcomes of EOQ-based calculations, a comparison is performed between EOQ-based stock costs and stock costs accomplished for 2020 and 2021. A part from assessing the frequency of sales and the quantity of orders for one-time purchases, this section compares EOQ calculations using those presently being conducted in 2020 and 2021.

5. RESULT AND ANALYSIS

Computation of buying stock and expense costs

A. Ordering expense

Investment from the continuing business into your provider, averaging INR 20,000 each buy in buying expenditures (“transportation expenses”).

B. Stock cost

Inventory expense consists of two kinds:

- 1) The payment for warehouse employees who perform stock checks and paperwork preparation is INR 82,00,000 per year.

- 2) Labor cost

Labor cost = Total worker x Total amount each day

- (i) For 2020

Labor cost/day = $6 \times 160 = 960$ INR

Labor cost/year = INR. 960x365 = INR. 3,50,400/year

(ii) For 2021

Worker cost/day = 6x220 = INR. 1320

Worker cost/year = INR. 1320x365 = INR. 4,81,800/year so it can be determined for keeping costs, as follows:

a) 2020: = INR. 82,00,000 + INR. 3,50,400 = INR. 85,50,400

b) 2021: = INR. 82,00,000 + INR. 4,81,800 = INR.86,81,800

c) Calculation of raw product usage

Counts per ball are used in every shirt sale, with each ball holding 25 kg of clothes. 3 shirts may be made using 3.5 meters of material, which is equivalent to one kilogramme of fabric. As a result, 75 tops need just one ball. Every day, on average, MADAN GOPAL VARSHNEY HRK GARMENTS.

The amount of pant is:

I. 2020: 30 kg = 105m = 90 pant each day

II. 2021: 40 kg = 140m = 120 pant each day

d) Purchase and Demand data for cotton materials

Table 2 Purchases data in 2020

| Month | Number of Buying(kg) | Amount of Deal (frequency) | Ordering cost(IDR) | Amount of Demand(kg) |
|----------|----------------------|----------------------------|--------------------|----------------------|
| January | 722 | 10 | 180,000 | 812 |
| February | 722 | 9 | 180,000 | 712 |
| March | 722 | 10 | 200,000 | 812 |
| April | 802 | 9 | 180,000 | 812 |
| May | 882 | 11 | 220,000 | 812 |
| June | 962 | 13 | 240,000 | 812 |
| July | 722 | 12 | 260,000 | 812 |

| | | | | |
|-----------|------|-----|-----------|------|
| August | 722 | 9 | 200,000 | 812 |
| September | 882 | 11 | 220,000 | 812 |
| October | 722 | 9 | 200,000 | 812 |
| November | 962 | 12 | 240,000 | 812 |
| December | 962 | 12 | 240,000 | 812 |
| TOTAL | 9784 | 127 | 27,60,000 | 9664 |

Total computation in 2020 amounted to 9784 kg, where as total demand was 9664 kg .

Table 3 Purchases data in 2021

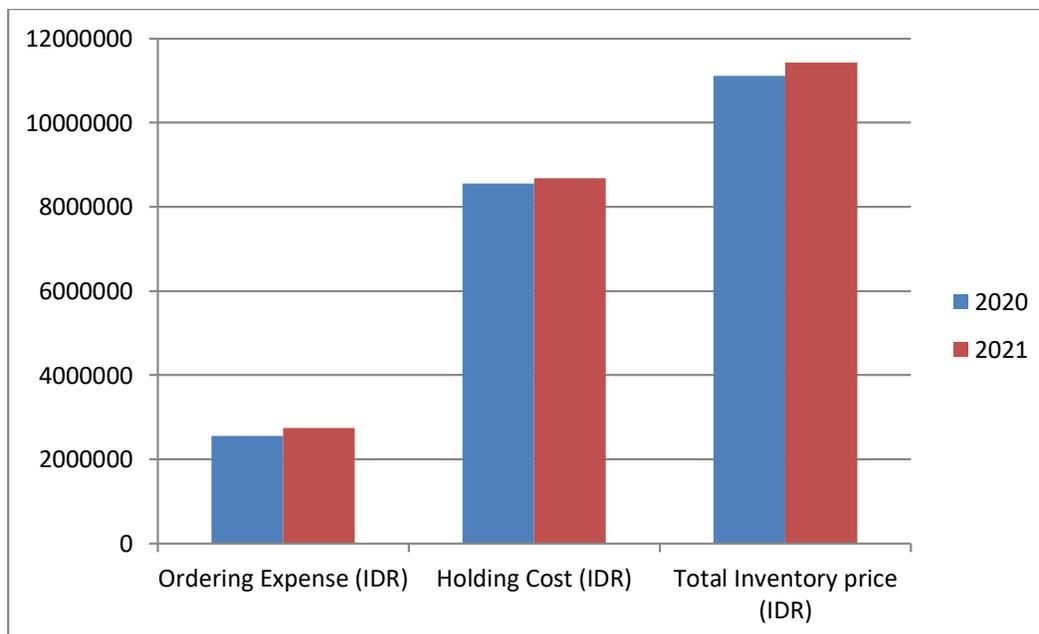
| Month | Number of Buying(kg) | Amount of Deal (frequency) | Ordering cost(IDR) | Amount of Demand(kg) |
|-----------|----------------------|----------------------------|--------------------|----------------------|
| January | 950 | 10 | 200,000 | 1,040 |
| February | 855 | 9 | 180,000 | 960 |
| March | 950 | 10 | 200,000 | 1,040 |
| April | 855 | 9 | 180,000 | 1,040 |
| May | 1,045 | 11 | 220,000 | 1,040 |
| June | 1,235 | 13 | 260,000 | 1,040 |
| July | 1,140 | 12 | 240,000 | 1,040 |
| August | 855 | 9 | 180,000 | 1,040 |
| September | 1,045 | 11 | 220,000 | 1,040 |
| October | 855 | 9 | 180,000 | 1,040 |
| November | 1,140 | 12 | 240,000 | 1,040 |

| | | | | |
|----------|--------|-----|-----------|--------|
| December | 1,042 | 12 | 260,000 | 1,040 |
| TOTAL | 12,089 | 127 | 27,40,000 | 12,424 |

Total computation in 2021 to 12,089 kg, where as total demand was 12,424 kg.

Table 4 Total Inventory cost for 2020 & 2021

| | 2020 | 2021 |
|-----------------------------|----------|----------|
| Ordering Expense (IDR) | 2560000 | 2740000 |
| Holding Cost (IDR) | 8550400 | 8681800 |
| Total Inventory price (IDR) | 11110400 | 11421800 |



Total inventory expenses in 2020 amounted to INR. 1,11,10,400. Total inventory expenses in 2021 amounted to INR. 1,14,21,800.

Table 5 EOQ computational results for 2020 and 2021

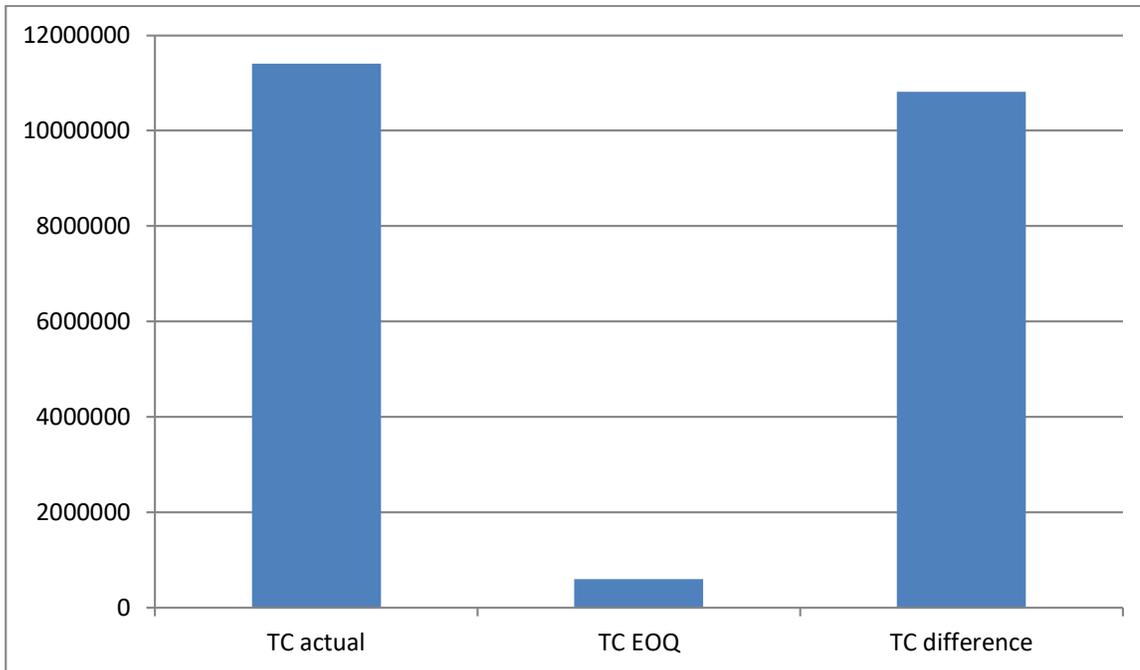
| The material that is natural 30s cotton textile | 2020 | 2021 |
|---|------------|------------|
| Need (kg) | 9784 | 12089 |
| Ordering cost (IDR) | 20.000 | 20000 |
| Holding cost (IDR) | 918.66 | 737.03 |
| EOQ (kg) | 647.54 | 809.19 |
| Frequency | 14.87-15 | 15.32-15 |
| Total Ordering cost (TOC)/per-year (IDR) | 297,433.85 | 306,478.13 |
| Total Holding cost (TCC)/per-year (IDR) | 297,433.85 | 306,478.13 |
| Total inventory cost (TC) | 594,867.69 | 612,956.26 |

| | | |
|---------------------------------------|-------|-------|
| (IDR) | | |
| Standard deviation | 216 | 279 |
| Provider level (95%) | 1,644 | 1,644 |
| Protection stock (kg) | 357 | 460 |
| Lead time (day) | 1 | 1 |
| Demand EOQ/month that is average (kg) | 54 | 67,43 |
| Re-order time (kg) | 411 | 52 |

The expenditures necessary to maintain 2020 INR 918.66 are calculated by multiplying the 2020 electricity cost of INR. 5,66,115 by the 2020 worker pay costs of INR. 8200,000, and then dividing by the 9,784 kg were house capacity. Holding costs of INR. 737.03 in 2021 are derived from power expenses of INR. 7,39,125 in 2021+ worker income costs of INR. 82,00,000 in 2021, and then divided by the 12,424 kg were house capacity. The total stock for 2020 is INR. 594,867.69, calculated using the EOQ method as the overall order costs of INR. 297,433.85 and costs of holding. The recorder point for 2020 is 411 kg. For starts, using the EOQ method, the charge of INR 612,956.26 is calculated by subtracting the amount of the buying expenses of INR 306,478.13 from the amount of the holding fee of 306,478.13. The 2021 recorder point achieved a 528 kg table 6 differences in prices between before and after the 2020 EOQ computation.

Table 6 TC difference before and after the 2020 computation using EOQ

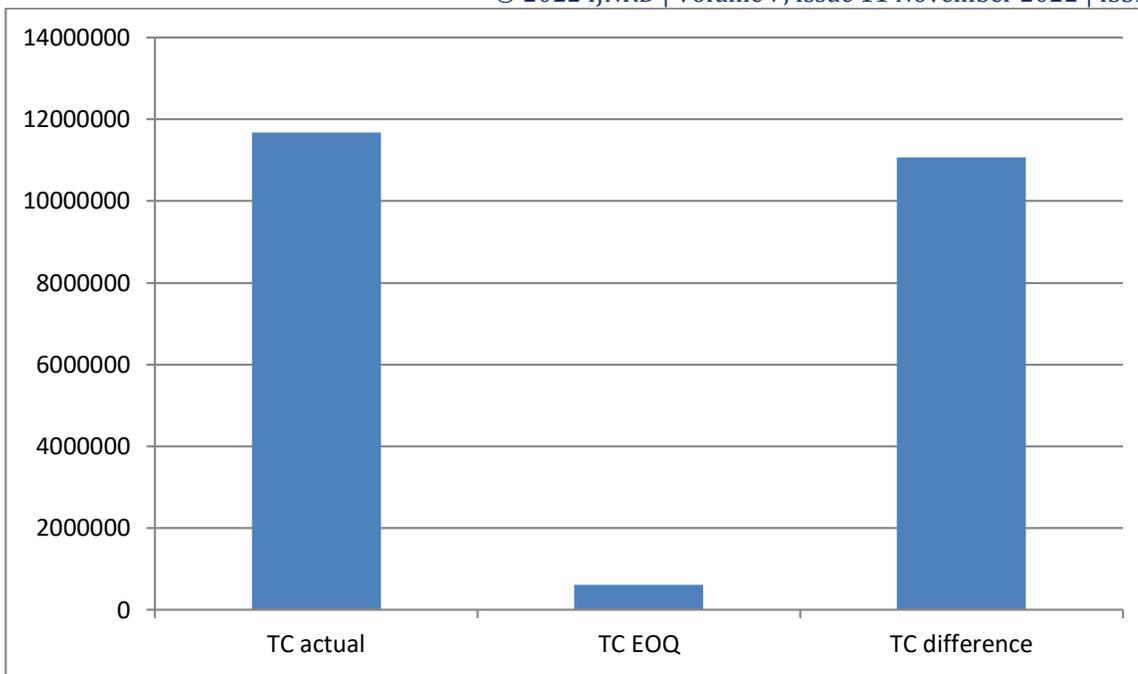
| TC actual | TC EOQ | TC difference | % |
|-------------|-------------|----------------|--------|
| 1,14,06,115 | 5,94,868.29 | 1,08,11,246.82 | 94.59% |



The “Total cost (TC)” before EOQ computation is INR 11,406,115 and the charge after the EOQ calculation is INR 5,94,868.29 indicating that the business can save INR 1,08,11,246.82 or 94.59 percent, by using the EOQ technique.

Table 7 TC difference before and after the 2021 computation using EOQ

| TC | TC EOQ | TC difference | % |
|----------|-----------|---------------|--------|
| 11679125 | 612956.25 | 11066169.21 | 94.86% |



The TC computation using before EOQ is INR 1,16,79,125 and after the INR 6,12,956.25. Therefore EOQ method is highly efficient in saving expenses by INR 1,10,66,169.21 having a percentage lowering of costs of 94.86%.

6. CONCLUSIONS

Indian garment industry future development potential is very bright. There are many variables that favor the Indian garment sector, including cost-effective raw material acquisition, affordable skilled labour, and rapid production. However, India's clothing sector confronts strong competition from Bangladesh, China, and Vietnam. The Indian clothing sector alone employs thousands of workers, including a disproportionate number of young women. As a result, the Indian garment industry's contribution to employment and foreign currency creation cannot be discounted. The garment industry's expansion will bolster the Indian economy's development. On the basis of the findings of study performed on the raw material of MADAN GOPAL VARSHNEY HRK GARMENTS convection organizations, and ordering 30s cotton textiles. The proposed study shows the EOQ is highly efficient method in saving cost.

7. RECOMMENDATION

As the EOQ approach has been shown to improve purchasing efficiency, the MADAN GOPAL VARSHNEY HRK GARMENTS convection is recommended EOQ method for the next session

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