"AN ANALYTICAL STUDY OF STOCK LEVEL MANAGEMENT SYSTEM WITH ECONOMIC ORDER QUANTITY"

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Abstract: -
Inventory management is day to day challenge for management. Inventory management is a field of production and balance stock of raw material for achieve the target production goal. The paper will focus on the calculation of optimum stock of inventory. This paper will also discuss various cost of storage inventory, economic order quantities, stock levels and shortage cost etc. In this Paper We have discussed the Inventory data of a industry and have comparative analysis on year wise. We will show the comparative study in the cost of inventory according to the level of the stock.

Key Words: - Economic Order Quantity, Stock level, Optimization, Reorder cost, Shortage cost.

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Introduction: -

An inventory management is required for substantial share of funds investment in them. Each industry must ensure about the desire stock of raw material. Inventory control management is a process for developing and managing the healthy stocks of raw materials and finish goods. (P. Gokhale & B Kaloji, 2018) [4] Introduced different parts of the inventory management concepts and different inventory control techniques. The study described that how the inventory management plays a significant role not only in the financial statement. According to this study company should adopt the Economic Order Quantity for optimum procurement and it can maintain different stock level for its mechanisms/components in order to avoid inventory-out conditions and helps in different flows of production. (S. White & Censlive, 2016) [9] Presented a model to show that the impact of not increasing capacity promptly results in catastrophic failure of sales as a structural. (Monov & Tashev, 2011) [13] Presented several inventory control algorithms developed on the basis of widespread mathematical models of inventory systems. The algorithms presented have the solutions to some basic inventory control problems and also used to facilitate the stock management in small and medium enterprises. (Andrade, Sikorski, & Alstott, 2016) [8] Presented a model for inverse loss due to uncertain demand for lot sizing policy and inventory decisions. These studies also present a direct numerical method for determining the inverse standardized loss by polynomial regression. (Ramírez & Labadie, 2017) [11] Determined the blood samples and the number of units of blood products to be ordered by hospitals to minimize the total cost and the shortage and wastage levels in blood supply chain. They showed SP Model for lower expected rates of shortage and wastage compared to the deterministic model. (Eme, Ugboaja C. A, Uwazuruike, & Ukpai, 2018) [6] Studied carried out to reduce the problems of inconsistency and inaccuracy of sales and drug data inherent in the existing manual system of the pharmacy. They developed Software alert of every expired drug and minimum quantity of each drug available in stock. (Šustrová, 2016) [7] Examined methods of ANN and their application in business operations and supply chain management. They concluded model of artificial neural network can be successfully used for predicting order size and therefore for improving the order cycle of an enterprise. (Yadav, Swami, Kher, & Garg, 2017) [10] Proposed a new dimension on warehouse with Economic Load Dispatch using genetic algorithm processes in Seven Stages - 10 Member Supply Chain in Electronic component inventory optimization based on supply reliability and more realistic. (Grygor, Fedorov, Nechyporenko, & Grygorian, 2022) [3] Discussed a method to improve the prediction efficiency by increasing the prediction accuracy and decreasing the computational complexity. (Singh & Kumar, 2011) [14] Proposed an efficient approach which uses Genetic Algorithm for optimal inventory control. This method based on genetic algorithm to find out optimize inventory in supply chain management. They discussed a method based on genetic algorithm to optimize inventory in supply chain management. (H. Teunter & Kuipers, 2022) [1] Studied optimal inventory control of two products with demand substitution customer's choices regarding the option availability. They presented a Economic Order Quantity type model with two substitute products having the same constant demand rate and cost structure. (Susanto, 2018) [5] Concluded EOQ method can be used to minimize the total inventory cost of ordering with a minimum surcharge and total incremental cost for each raw material. (Kontuš, 2014) [12] Provided a model for calculate savings from changes in inventory level with optimization model. (Huang, Guo, & Wang, 2022) [2] Showed the optimal group size that maximizes the welfare throughput is weakly smaller than the one that maximizes the identification rate.

Preliminary: Inventory is any kind of resource that is stocked to satisfy the present and the future needs of any organization. Such a resource has its economic value. Resources can be categorized into three categories-

(1) Physical resources such as – raw materials, semifinished goods, finished goods, spare parts etc.
(2) Human resource such as unused Labor (manpower).
(3) Financial resources such as working capital etc.

Economic order quantity is that size of order which minimizes total annual(or other time period as determined by the individual firms) costs(carrying cost and ordering cost).

$$EOQ = \sqrt{\frac{2 \times Annual\ requirement(or\ Demand) \times Ordering\ cost}{Carrying\ cost}}$$

Stock levels

Stock levels are very useful for the control of inventory. Following are such stock levels-

(1) Reorder level
(2) Minimum stock level
(3) Maximum stock level

Discussion and Results:

Calculation of EOQ

[In the year 2014-2015]

Annual requirement/ Demand (in million ton) = 401.89

Ordering cost per order (in Rs) = 75

Annual Holding cost (%) = 5

Purchase price per ton (in Rs) = 30950

Carrying cost per ton (in Rs) = 1548

$$EOQ = \sqrt{\frac{2 \times Demand \times ordering\ cost}{carrying\ cost}}$$

$$= \sqrt{\frac{2 \times 401.89 \times 75}{1548}}$$

$$= \sqrt{\frac{60283.5}{1548}} = \sqrt{38.9428}$$

$$= 6.24041\ tons$$

[In the year 2015-2016]

Annual requirement/ Demand (in million ton) = 453.59

Ordering cost per order (in Rs) = 75

Annual Holding cost (%) = 5

Purchase price per ton (in Rs) = 28323

Carrying cost per ton (in Rs) = 1416

$$EOQ = \sqrt{\frac{2 \times 453.59 \times 75}{1416}}$$

$$= \sqrt{\frac{68038.5}{1416}} = \sqrt{48.0497} = 6.931789\ tons$$

[In the year 2016-2017]

Annual requirement/ Demand (in million ton) = 642.95

Ordering cost per order (in Rs) = 75

Annual Holding cost (%) = 5

Purchase price per ton (in Rs) = 23940

Carrying cost per ton (in Rs) = 1197

$$EOQ = \sqrt{\frac{2 \times 642.95 \times 75}{1197}}$$

$$= \sqrt{\frac{96442.5}{1197}} = \sqrt{80.5701}$$

$$= 8.97608\ tons$$

[In the year 2017-2018]

Annual requirement/ Demand (in million ton) = 563.15

Ordering cost per order (in Rs) = 75

Annual Holding cost (%) = 5

Purchase price per ton (in Rs) = 30120

Carrying cost per ton (in Rs) = 1506

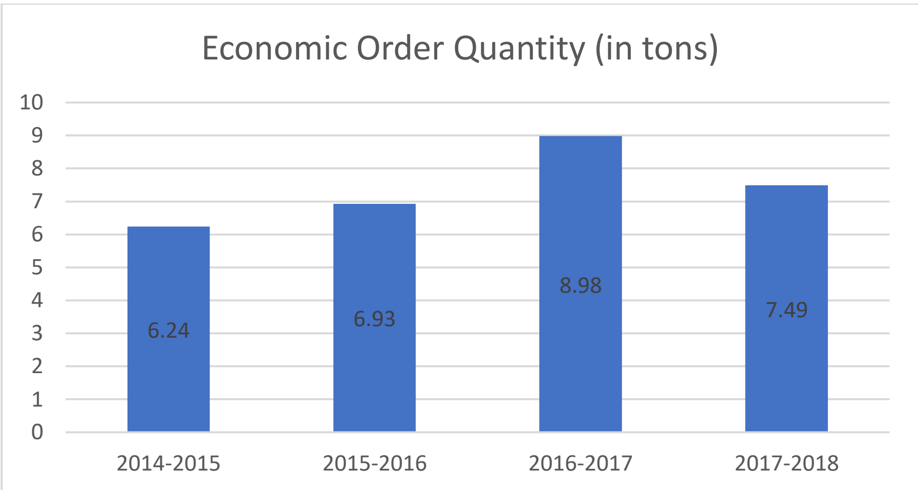
$$EOQ = \sqrt{\frac{2 \times 563.15 \times 75}{1506}}$$

$$= \sqrt{\frac{84472.5}{1506}} = \sqrt{56.09064}$$

$$= 7.48936\ tons$$

Particulars	**2014-2015**	**2015-2016**	**2016-2017**	**2017-2018**
Annual Requirement/Demand (Mt)	401.89	453.59	642.95	563.15
Ordering Cost Per Order (in Rs)	75	75	75	75
Annual Holding Cost (%)	5	5	5	5
Purchase Price Per Ton (in Rs)	30950	28323	23940	30120
Carrying Cost Per Ton (in Rs)	1548	1416	1197	1506
Economic Order Quantity (in Tons)	**6.2404**	**6.9318**	**8.9761**	**7.4894**

Table 1 – Calculation of EOQ



From above it is clear that EOQ in the year 2014-2015 is 6.24041 tons and increment in EOQ can be seen in the year 2015-2016 which is 6.9317 tons and in the year 2016-2017 EOQ is 8.97608 tons, after that EOQ is decreased in the year 2017-2018 (7.489 tons).

Profit of compony can be increased by using EOQ method for purchasing pig iron.

Calculation of Different Stock Levels

$$\boldsymbol{Reorder\ level = Maximum\ usages/consumption(per\ day) \times maximum\ delivery\ time}$$

[In the year 2014-2015]

Maximum usages (per day) = 2.63Million Ton(Mt)

Maximum delivery time (in days) = 5

$$Reorder\ level = 2.63 \times 5$$
$$= 13.15 \approx 13\text{Mt}$$

[In the year 2015-2016]

Maximum usages (per day) = 3.95Mt

Maximum delivery time (in days) = 5

$$Reorder\ level = 3.95 \times 5$$
$$= 19.75 \approx 20\text{Mt}$$

[In the year 2016-2017]

Maximum usages (per day) = 5Mt

Maximum delivery time (in days) = 5

$$Reorder\ level = 5 \times 5$$
$$= 25\text{Mt}$$

[In the year 2017-2018]

Maximum usages (per day) = 6Mt

Maximum delivery time (in days) = 5

$$Reorder\ level = 6 \times 5$$
$$= 30\text{Mt}$$

Table 2- Calculation of Reorder level

Particulars	**2014-2015**	**2015-2016**	**2016-2017**	**2017-2018**
Maximum Usages Per Day (in Million Ton)	2.63	3.95	5	6
Maximum Delivery Time (in days)	5	5	5	5
Reorder Level (in Million Ton)	**13**	**20**	**25**	**30**

Calculation of Minimum Stock level-

$$\boldsymbol{Minimum\ Stock\ Level = Reorder\ level - (\ Normal\ usages \times Normal\ Delivery\ \ Time)}$$

[In the year 2014-2015]

Normal usages (per day) = 1.84 Mt

Normal Delivery time (in days) = 4.5

Reorder level = 13

$$Minimum\ Stock\ Level = 13 - (1.84 \times 4.5)$$
$$= 13 - 8.28$$
$$= 4.72 \approx 5\ Mt$$

[In the year 2015-2016]

Normal usages (per day) = 2.46Mt

Normal Delivery time (in days) = 4.5

Reorder level = 20

$$Minimum\ Stock\ Level = 20 - (2.46 \times 4.5)$$
$$= 20 - 11.07$$
$$= 8.93 \approx 9\ Mt$$

[In the year 2016-2017]

Normal usages (per day) = 3.30 Mt

Normal Delivery time (in days) = 4.5

Reorder level = 25

$$Minimum\ Stock\ Level = 25 - (3.30 \times 4.5)$$
$$= 25 - 14.85$$
$$= 10.15 \approx 10\ Mt$$

[In the year 2017-2018]

Normal usages (per day) = 3.20 Mt

Normal Delivery time (in days) = 4.5

Reorder level = 30

$$Minimum\ Stock\ Level = 30 - (3.20 \times 4.5)$$
$$= 30 - 14.4$$
$$= 15.6 \approx 15\ Mt$$

Table – Calculation of Minimum Stock Level

Particulars	**2014-2015**	**2015-2016**	**2016-2017**	**2017-2018**
Normal usages (per day)	1.84	2.46	3.30	3.20
Normal delivery time (in days)	4.5	4.5	4.5	4.5

Reorder level (Mt)	13	20	25	30
Minimum Stock Level (Mt)	**5**	**9**	**10**	**15**

Calculation of Maximum Stock Level

$$\boldsymbol{Maximum\ Stock\ Level = Reorder\ Level + Reorder\ {\scriptstyle Quantity}(EOQ) - [Minimum\ Usages \times Minimum\ Delivery\ Time]}$$

[In the year 2014-2015]

Minimum usages (per day) = 1.04 Mt
Minimum Delivery Time (in days) = 4
Reorder Level = 13 Mt
Reorder Quantity = 6.24 Mt

$$Maximum\ Stock\ Level$$
$$= 13 + 6.24 - [1.04 \times 4]$$
$$= 19.24 - 4.16$$
$$= 15.08 \approx 15\ Mt$$

[In the year 2015-2016]

Minimum usages (per day) = 0.96 Mt
Minimum Delivery Time (in days) = 4
Reorder Level = 20 Mt
Reorder Quantity = 6.93 Mt

$$Maximum\ Stock\ Level = 20 + 6.93 - [0.96 \times 4]$$
$$= 26.93 - 3.84$$
$$= 23.09 \approx 23\ Mt$$

[In the year 2016-2017]

Minimum usages (per day) = 1.60 Mt
Minimum Delivery Time (in days) = 4
Reorder Level = 25 Mt
Reorder Quantity = 8.98 Mt

$$Maximum\ Stock\ Level$$
$$= 25 + 8.98 - [1.60 \times 4]$$
$$= 33.98 - 6.4$$
$$= 27.58 \approx 28\ Mt$$

[In the year 2017-2018]

Minimum usages (per day) = 1.40 Mt
Minimum Delivery Time (in days) = 4
Reorder Level = 30 Mt
Reorder Quantity = 7.49 Mt

$$Maximum\ Stock\ Level = 30 + 7.49 - [1.40 \times 4]$$
$$= 37.49 - 5.6$$
$$= 31.89 \approx 32 Mt$$

Table 3 –Calculation of Maximum Stock Level

Particulars	**2014-2015**	**2015-2016**	**2016-2017**	**2017-2018**
Minimum usages (Mt)	1.04	0.96	1.60	1.40
Minimum Delivery Time (in days)	4	4	4	4
Reorder Level (Mt)	13	20	25	30
Reorder Quantity (EOQ)	6.24	6.93	8.98	7.49
Maximum Stock Level (Mt)	**15**	**23**	**28**	**32**

Interpretation: - Table shows the increment in Maximum Stock Level at every year. There is a suggestion to maintain stock level (Maximum stock level) otherwise unnecessary increment in stock holding cost will perform.

Conclusion: - In this study we find that the stock level depends on the reordering level of inventory and the quantity of reorder. We find yearly the maximum stock level increasing if not synchronizing the reorder quantity and reorder point. The stock level directly affects the cost of inventory so stock level must be maintain.

References:-

1. H. Teunter, R., & Kuipers, S. (2022). Inventory control with demand substitution: new insights from a two-product Economic Order Quantity analysis. *Omega* .
2. Huang, F., Guo, P., & Wang, Y. (2022). Optimal group testing strategy for the mass screening of SARS-CoV-2. *Omega* .
3. Grygor, O., Fedorov, E., Nechyporenko, O., & Grygorian, M. (2022). Neural Network Forecasting Method for Inventory Management in the Supply Chain. *Computer Modeling and Intelligent Systems* , 14.
4. P. Gokhale, P., & B Kaloji, M. (2018). A Study on Inventory Management and Its Impact on Profitability in Foundry Industry at Belagavi,Karnataka. *International Journal of Latest Technology in Engineering, Management & Applied Science* , 9.

5. Susanto, R. (2018). Raw material inventory control analysis with economic order quantity method. *Materials Science and Engineering* .
6. Eme, O., Ugboaja C. A, U., Uwazuruike, F. O., & Ukpai, C. U. (2018). Computer – based Drug Sales and Inventory Control System and its Applications in Pharmaceutical Stores. *I.J. Education and Management Engineering,* , 30-39.
7. Šustrová, T. (2016). A Suitable Artificial Intelligence Model for Inventory Level Optimization. *TRENDY EKONOMIKY A MANAGEMENTU TRENDS ECONOMICS AND MANAGEMENT* , 48–55.
8. Andrade, A., Sikorski, C., & Alstott, J. (2016). Numerical Approximation of the Inverse Standardized Loss Function for Inventory Control Subject to Uncertain Demand. *Canadian Operations Research Society* .
9. S. White, A., & Censlive, M. (2016). Inventory Control Systems Model for Strategic Capacity Acquisition. *Journal of Industrial Engineering* , 16.
10. Yadav, A. S., Swami, A., & Ahlawat, N. (2018). A Green supply chain management of Auto industry for inventory model with distribution centers using Particle Swarm Optimization. *Selforganizology* .
11. Ramírez, A. P., & Labadie, N. (2017). Stochastic inventory control and distribution of blood products. *Industrial Engineering and Operations Management* , 9.
12. Kontuš, E. (2014). MANAGEMENT OF INVENTORY IN A COMPANY. *Eleonora Kontuš* .
13. Monov, V., & Tashev, T. (2011). A Programme Implementation of Several Inventory Control Algorithms. *CYBERNETICS AND INFORMATION TECHNOLOGIES* , 11.
14. Singh, S., & Kumar, T. (2011). Inventory Optimization in Efficient Supply Chain Management. *International Journal of Computer Applications in Engineering Sciences* , 428-436.