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EOQ AND EPQ MODELS FOR PROFIT MAXIMIZATION IN THE ANALYSIS OF AGRO-BASED PRODUCT INVENTORY MANAGEMENT

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ABSTRACT

As agricultural products are perishable, managing the inventories of the industry focused on agriculture is a challenging task. The relevance and functionality of the EOQ and EPQ models are essential for this kind of stock to be effectively supervised. There are numerous industries whose success is reliant on how they provide goods and provide services at the right time and right place. Employ of different firms and different inventory management approaches to keep an eye on their inventory and avoid stock-outs and overstocks. The created EOQ inventory management model and EPQ model's characteristics are described, together with probable variables derived from the body of existing literature, in order to find solutions that would satisfy customers and maximize profits.

KEYWORDS: Economic Order Quantity, Economic Production Quantity, Profit Maximization, Inventory

INTRODUCTION

Agro-based enterprises are those that use farming products as their primary raw material. These sectors are consumer-based. Agricultural raw materials are the foundation of the food processing industry because all types of farming raw materials are required for its output. Every branch of the agro-based industry is crucial because it increases the output of industrial goods, brings in foreign exchange, lifts income levels, employs women, and establishes the framework for the development of undeveloped areas.

The primary element affecting the organisation and the ratio of stocks to the total assets is the management of inventories. The expense of ordering and maintaining inventories as well as customer support, or possessing the appropriate goods at the appropriate time and location, are the two main issues that an inventory management system must address. These problems can be resolved using a number of techniques, such as Value stream mapping, JIT (just in time), EOQ, and EPQ.

In order to ensure streamlined sales processes, efficient client support, the reduction of carrying costs regulate inventory investment, maintain it at an ideal level, and allow for better utilisation of accessible stockpiles through the facilitation of departmental transfers within a company, Sufficient completed goods inventory should be maintained for an efficient inventory management system. While farm products and their inventory are a major problem today and require more attention, effective inventory management for manufactured goods can be achieved by applying a variety of models. This is because agriculture products have special characteristics that make managing their inventory challenging, such as their limited and erratic supply, perishable nature, costs, and the choice of how much to sell. In the Odisha industry, this is the actual situation.

The EOQ model is used as a tool to obtain closed form formulas for the best courses of action and the best discount rates in this scenario. It is necessary to characterize the best inventory (selling) policies for a range of cost functions. EOQ is a fixed order quantity inventory model that calculates the ideal order size by minimising the total of carrying costs and ordering costs. It requires demand forecasting for a specific area or the use of a specific product for which historical usage data is available.

The inventory management approaches known as Economic Order Quantity (EOQ) and Economic Production Quantity (EPQ) are both the extensively and successfully utilized. The optimal quantity of orders to place with a supplier to reduce money blocking, holding costs, and ordering expenses is known as the "economic order quantity." A sufficient amount of a product or component will guarantee continuous manufacturing or deals activity of a company. At the other side, in order to avoid unnecessary fund blockage and excessive storage costs, the optimal lot size for manufacturing in a production unit is known as the economic production quantity.

The successful management of an organization's

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inventory is essential to reducing costs and maximizing profits. Numerous academics have conducted research in this area of efficient inventory management and presented their results. In 1995, Aggarwal and Jaggi examined the exponentially degrading inventory model in the context of allowable payment delays Wee H M. (1999) Agriculture products are perishable goods, according to domestic and international research, and their model of inventory is founded on researching perishable goods. Additionally, the fundamental components of fragile goods are: three factors: desire, freshness, and loss rate Theo Toomy (2000), preserving a desirable Managing inventories is in charge of determining the stock level of each and every product item. Inventory management and control systems need to consider the good, the customer, and also the manufacturing process of the commodities that are kept on hand.

TATA & Prasad (2000) NGOS can reduce their transport costs by batching their goods, which will lower their overall supply chain costs. According to Wild (2002), inventory should be properly stored to minimise the cost of holding inventory Kavalya (2004) Ordered products ought to be stored in the warehouse or with the fewest number of items. feasible. In order for the business to maintain budgetary allocation for nongovernmental organizations while generating healthy profits, Maintaining minimal holding, ordering, and purchasing charges is necessary to balance the overall cost model. Beamon and Kotleba (2006) state that in order for human terrain organizations to function as efficiently and effectively as possible, reorder level (ROL) is essential. They must have two reorder levels: one for regular instances and one for urgent ones in the event of an emergency. Performance and client satisfaction are enhanced as a result. According to Lai and Chang (2009), maintaining a moderate inventory is beneficial because it allows an organisation to operate with low holding and setup costs, cut down on unnecessary wait times, and produce products in accordance with customer orders. As a result of the implementation of a company's value chain can benefit from efficient and effective supply chain management, this enables an organisation to accomplish total quality control. TB Ojera & T. Lwiki (2013), A firm needs inventory management because poor inventory management puts the enterprise's survival in jeopardy because extra inventory takes up space, adds to expenses, and raises the possibility of loss, damage, and spoiling. Baker and Urban (1988) have examined a comparable scenario, presuming that the amount of on hand inventory. D. Samal and A. Kalam (2021) discussed the ghee inventory in the RKL market in terms of preserving consumer pleasure and averting loss. Again Debasmita Samal et al (2022) discussed the inventory of agro product in Odisha market in terms of preserving consumer pleasure and averting loss.

2. THE STUDY'S OBJECTIVE IS:

1. To find the quantity of the economic order for the demand forecasting of different agricultural products across different locations.
2. To obtain suggestions for controlling the organization's inventory level.

3. PREMISES & NOTES:

Continuous Need and Simple Restocking

Each model presuppose a year-round level of demand. The product's easy availability on the open market is assumed by the EOQ model. As soon as it crosses the minimal threshold level, it will be replenished. In a similar vein, the EPQ model makes the assumption that the requirements and production capacity match. Additionally, the product may occur if the stock drops below a certain threshold. It will guarantee there won't be a stock-out. Also, all demands were satisfactorily met.

Fixed Cost

Both models presuppose that the product's pricing would remain consistent throughout the year. The pricing remains the same whether purchasing the goods under EOQ or creating it under EPQ. Furthermore, there are no value or quantity discounts available.

To obtain suggestions for controlling the organization's inventory level.

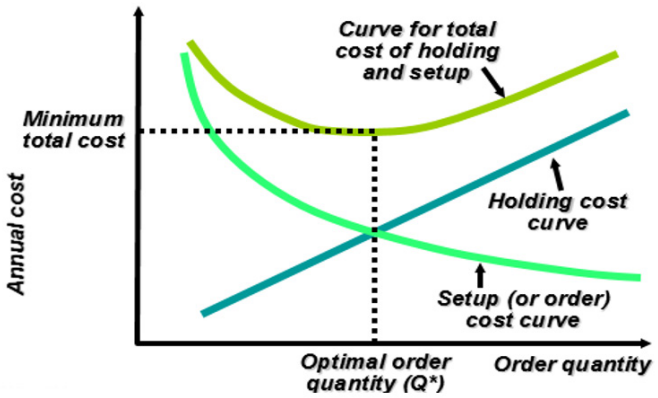


Figure 1: EOQ Model

The costs for ordering and holding don't vary.

The price of keeping and stocking goods is known as holding the cost of inventory. It may take the shape of energy costs, salary for employees managing the inventory, storage space rentals, repairs, upkeep, etc. The fees incurred when an order is placed for inventory are known as ordering costs. These may take the shape of shipping costs, packing and delivery fees, etc.

$$EOQ = \sqrt{\frac{2D.O}{H}}$$ Q= The EOQ order quantity.

We wish to optimize this variable. There are fixed amounts for each of the other variables.

D = product's yearly demand expressed in units of time and quantity.

O = Order cost (O) equals product cost. This is the one-time cost that is applied to all orders, regardless of Q.

H= Holding Cost

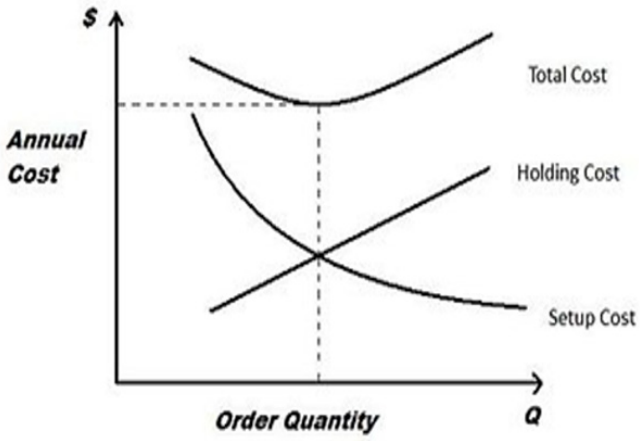


Figure 2: EPQ Model

$EPQ = \sqrt{\frac{2D.O}{H(1-x)}}$ Here, x= D/ P where P= Rate of Production

Restrictions of EOQ and EPQ Model:

Impractical Expectations:

The unreasonable assumptions in both models represent their biggest drawback.

Both models assume that the demand, price, quality, holding costs, ordering costs, and other factors for the good or part will remain same throughout the year. It is not practical in the real world.

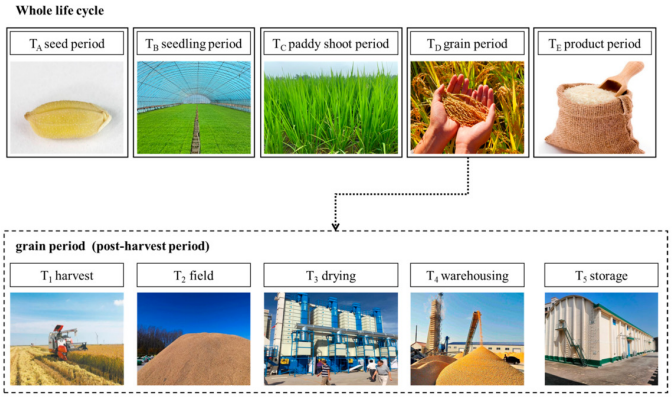
- Depending on changes in rental rates, employee pay, and other overhead charges, holding and ordering prices may differ.
- It is difficult for both steady demand and a product's price to remain constant. In the actual world, they are quite variable.

Consumer revenue, tastes and likings, input and raw material prices, seasonal variations in request, etc. are the main issues that affect demand and pricing. In a similar vein, the EPQ model makes the premise of a continuous product quality unrealistic. Every production batch typically results in a change in the product's quality. Factors such as power outages, repairs and breakdowns in equipment and plants, overheating, variations in input and raw material quality, etc. also cause the manufacturing process to fluctuate.

4. CALCULATION OF EOQ:

It establishes the ideal cost that is influenced by the quantity of inventory retained and the volume of orders placed. A small business's operating expenses will rise if it places large orders all at once since it will result in more inventory at the warehouse at the expense of less ordering. While the cost of ordering goes up, holding expenses go down as there are more orders. The EOQ model, which discovered a formula illustrating the relationships between the costs of ordering and maintenance and the yearly demand for the material, reduces the amount of these expenses. Here, the writers have used information from the owner of an agricultural land where rice is produced and vended. For production he needs raw materials. Ordering and holding expenses have a significant impact on determining the ideal inventory levels.

The formula can be used to reflect the overall expenses for various order quantities in order to obtain the Economic Order Quantity (EOQ). We require the annual demand data, ordering and holding costs in order to determine the EOQ'S. In this experiment paper, we are expected to compute EOQ and EPQ for the rice produced and which is sold. Here we have taken 4 years data's of different lands.



5. CALCULATION OF EOQ & EPQ USING THE DATAS:

	Year 2022-2023	Year 2021-2022	Year 2020-2021	Year 2019-2020
Area	10 Acre	5 Acre	7 Acre	2 Acre
Ploughing	15000	7500	8400	1600
Sowing	300	150	210	60
Transplanting	40000	20000	15000	8000
Weeding	24000	12000	18000	8000
Manure	38800	22400	28200	10300
Labour charge	3000	1000	1500	500
Spraying	7000	2500	3500	1000
Harvesting	50000	25000	35000	10000
Transportation	10000	5000	7000	2000
Clean out paddy	25000	15000	20000	8000
Total loss	24480	11760	16650	5550
Yield /Product (in Quintals)	240	120	180	50
Cost Price	**237580**	**122310**	**153460**	**55010**
Selling Price	4,48,800	196000	296000	92500
Profit	**211220**	**73690**	**142540**	**37490**
EOQ	200.00	141.42	167.33	89.44
EOQ per acre	20.00	28.28	23.90	44.72
EOQ per Quintal	0.83	1.18	0.93	1.79
EPQ	912.825	577.35	778.49	322.748
Yield /Product (in Quintals)	240	120	180	50
EPQ per 1 Quintal	3.8034375	4.81125	4.324944444	6.45496
EPQ per 1 acre	91.2825	115.47	111.2128571	161.374

10 Acres of land : Year 2022-23 (1st Data)

Here, D= 300kg, O= $\frac{6000}{300}$ =20, H=0.3

So, by the using the above EOQ formula, $EOQ = \sqrt{\frac{2DO}{H}}$

EOQ= $\sqrt{\frac{(2)(300)(20)}{(0.3)}}$ = 200 units

The Selling price for 1 quintal. is Rs 2040/-

Ordering cost per quintal is = $\frac{10000}{220}$ = 45.45

$$EPQ = \sqrt{\frac{2D.O}{H(1-x)}}$$

Here, x= D/ P, where P= Production rate

EPQ = $\sqrt{\frac{2\times220\times45.45}{0.3\times(0.08)}}$ = 912.825

5 Acres of land: Year 2021-22 (2nd Data)

Here, D= 150 kg ,O= $\frac{3000}{150}$ = 20 ,H= 0.3

So, by the using the above EOQ formula,

EOQ= $\sqrt{\frac{2DO}{H}}$

EOQ= $\sqrt{\frac{(2)(150)(20)}{(0.3)}}$ = 141.42 units

The Selling price for 1 quintal. is Rs 1960/-

Ordering cost per quintal is = $\frac{6000}{100}$ = 60 Average

$$EPQ = \sqrt{\frac{2D.O}{H(1-x)}}$$

Here, x= D/ P, where P= Production rate

EPQ = $\sqrt{\frac{2\times100\times60}{0.3\times(0.12)}}$ = 577.35

7 Acres of land :Year 2020-21 (3rd Data)

Here, D= 210kg , O= $\frac{4200}{210}$ = 20, H= 0.3

S0, by the using the above EOQ formula,

EOQ= $\sqrt{\frac{2DO}{H}}$

EOQ= $\sqrt{\frac{(2)(210)(20)}{(0.3)}}$ = 167.33 units

The Selling price for 1 quintal. is Rs 1850/-

Ordering cost per quintal is = $\frac{10000}{160}$ = 62.5 Average

$$EPQ = \sqrt{\frac{2D.O}{H(1-x)}}$$

Here, x= D/ P, where P= Production rate

EPQ = $\sqrt{\frac{2\times160\times62.5}{0.3\times(0.11)}}$ = 778.49

2 Acres of land :Year 2019-20 (4th Data)

Here, $D = 60\ kg$, $O = \frac{1200}{60} = 20$, $H = 0.3$

So, by the using the above EOQ formula,

$$EOQ = \sqrt{\frac{2DO}{H}}$$

$EOQ = \sqrt{\frac{(2)(60)(20)}{(0.3)}} = 89.44$ units

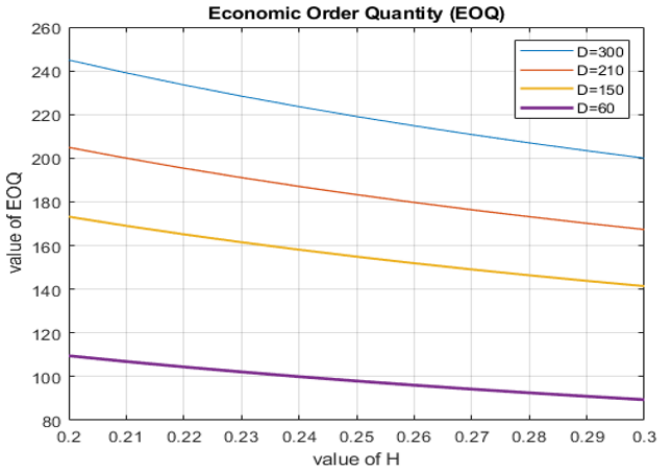
The Selling price for 1 quintal. is Rs 1850/-

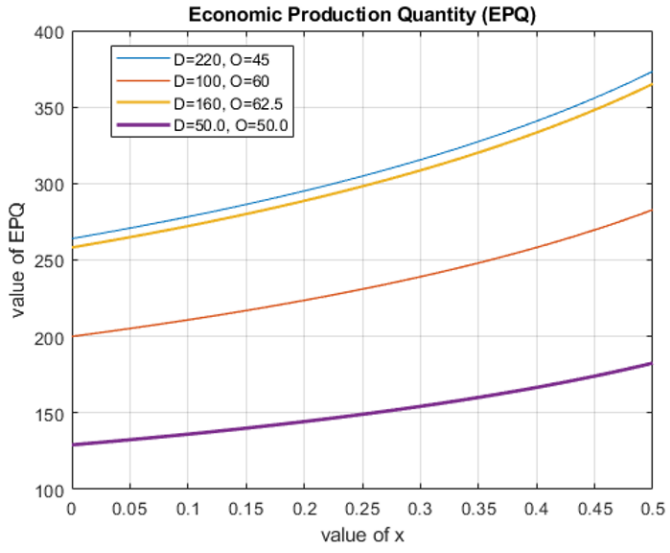
Ordering cost per quintal is = $\frac{2500}{50}$ = 50 Average

$$EPQ = \sqrt{\frac{2D.O}{H(1-x)}}$$

Here, x= D/ P, where P= Production rate

EPQ = $\sqrt{\frac{2\times50\times50}{0.3\times(0.16)}}$ = 322.748





5. CONCLUSION

When it comes to inventory management, the economic order quantity (EOQ) inventory model works well. Ordering, carrying, and overall costs should be decreased for the industry's profit maximization. This is also regarded as a promotional effort for consumer happiness and a developing price strategy. In this case, demand is projected using historical data, and store sales of a given product are aided by price fixing for the duration of the year, even though output remains constant. The computation and implications of inventory orders assist in lowering the retailer's risk. The customer will pay the retailer the set price, which remains the same all year long. A seller or shop can fulfil their social obligation in addition to maximizing profits and satisfying customers through efficient inventory management.

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