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Manage warehousing goods and funds flows

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***Abstract*---**The cost of inventory management depends mainly on two basic units, the cost of keeping inventory and the cost of orders, as these two units, one complements the other. To show the total cost of inventory through laws, the authors suggested many techniques for this purpose. The cost of this operation gradually decreases with the use of its materials. In this work, the authors proposed some techniques in order to obtain the minimum cost by dividing the agreed period in three percentages after it was divided into two periods, meaning that the percentage of the costs paid by the company in the first part, middle part, and in last part of the period in order to reduce the cost as much as possible through several equations. That is we try to reduce the number of times that the goods are ordered to the minimum by increasing the number of units of goods in one order and to know the total inventory costs.

Keywords---inventory keeping cost, cost of orders, minimum cost.

Introduction

The main goal of the general flow process is to reduce the cost and maintain the flow, meaning that the flow entering a certain path is equal to the flow out of it, because they may be consumption of a part of the flow through a certain path, which causes a loss such as the transmission of electrical energy from the station to the houses [1, 2]. The authors try to decrease the distance between them so that the electrical energy does not lose part of its strength. They also try to make the water transport pipelines tight so that they do not lose part of them through leakage or evaporation, or when transporting a commodity from one city to another. Also, they try to provide the appropriate atmosphere for the product in

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order to preserve the safety of the product from damage, such as transporting 100 boxes of eggs from one city to another, it must be not in a humid atmosphere or with a high temperature to reach the intended target without losses. Also, when depositing money to participate in a particular investment may cause profit or loss of part of the money.

Manage Warehousing Goods and Funds Flows

It is an integrated process that starts from managing the flow, balancing supply and demand, and optimizing the management of resources through which the value of mutual and economic benefits is maximized [3, 4]. It is also the process of the flow of a network of activities through different channels, or rather, there is a supply of inputs that are processed and then converted into value. Added and delivered as results such as a flow of goods, a flow of information, or a flow of financial resources and materials must move from the point of origin to the point of consumption through a series of chains. One of which is a supplier of inputs to the consumer who represents the second level and who is in turn after the value-added presentation to the next consumer and thus the chain continues until the final consumer associated with the flow of materials [5, 6].

Network Optimization

In fact, the increasing complexity of networks is the main reason for the need of supply chain networks. It includes the planning and management of all activities involved in sourcing, production, storage and distribution of products [7, 8]. The network is essential to the product, it is continuously flows from the point of manufacture to the end of process. This network can significantly improve margins and support expansion into new markets.

Inventory Management

Inventory management is the finished products that the company keeps for the purpose of selling or raw materials and under-manufacturing materials for the purpose of manufacturing and selling. So, the inventory consists the following elements [9- 12]:

- Raw materials.
- Processed materials or unprocessed materials.
- Finished products.

The authors introduced many papers in different fields of sciences such as reliability [13- 22] and optimization [23- 33], but in this work we suggest a technique to reduce the cost and maintain the flow. Inventory is usually formed as a result of market conditions, supply and demand, or because it is affected by the general economic situation. Goods can accumulate in the company in a large and unintended way. In this case, it is difficult to get rid of the stock because if the company managed to sell the stock, it would have sold it in advance and it did not accumulate. In the stores, and in order for the company to face the sudden customer demand for the company's products, the company must keep a stock of finished products [34, 35]. It is also important that the stock includes raw and under-manufacturing materials to ensure that the company's operational cycle is not disrupted and that the amount of stock that the company keeps it includes costs borne by the company, so the amount of inventory should not be exaggerated, as it includes the costs of disabling funds and storage costs, and it was previously shown that inventory management aims to balance two conflicting goals [36, 37]:

- The higher of the inventory volume, the higher of the costs, and to reduce the cost of holding inventory requires reducing the volume of inventory.
- The balance between the two previous goals is done by determining the optimal size of the stock, through consistency between the returns and costs resulting from the operations of keeping the stock [38, 39].

Inventory costs include many parts that we will summarize in two main parts, the first is the costs of maintaining inventory and the second is the costs of orders, and these two parts will be linked to obtain inventory costs completely according to the suggestions of previous authors and the preliminary information for this issue [40- 43].

Inventory holding cost = cost to hold one unit × (Quantity of units required at one time ÷ 2)

$$C = u\ (q \div 2) \qquad \text{--------------------------- (1)}$$

Cost of orders = cost of one order × (the company's total need of goods ÷ quantity of units required at one time)

$$O = p\ (s \div q) \qquad \text{---------------------------- (2)}$$

Total inventory costs = inventory holding costs + ordering costs

$$T = C + O$$
$$T = u(q \div 2) + p\ (s \div q) \qquad \text{------------------------ (3)}$$

Through the previous equation to find the value of q, it is possible to obtain the optimal order size, and this makes the total costs of inventory in minimum:

$$q^* = \sqrt{\frac{2 \times s \times p}{u}} \qquad \text{------------------------ (4)}$$

Where: (q^*) is the optimum order size, (s) is the company's total need of merchandise, (p) is the cost per order, and (u) is the cost of holding one unit of inventory.

Example 1: A company for the manufacture of home furniture needs 70,000 planks of wood annually, and the cost of maintaining one unit was one dinar, while the cost of the order was 135 dinars. What is the optimal order size for that company, where the stock is at the lowest possible? Then calculate the total inventory costs if the company orders 7,000 units at a time?

Sol:

$q^* = \sqrt{\frac{2\times s\times p}{u}}$, $T = u(q \div 2) + p\,(s \div q)$, s=70000, p=135, u=1, q=7000, $q^* = \sqrt{18900000}$
$q^* = 4347.41$, $T = 4850$ Total inventory cost

Example 2: A company of production milk and dairy needs 50,000 liters of cow's milk during a month to produce types of milk of different fats. The cost of maintaining one unit was half a dinar, while the cost of the order amounted is 125 dinars. Calculate the optimal order size for this company, where it would be Inventory cost minimal? Then calculate the total inventory cost if this company orders 5,000 units at a time? Then calculate the total cost if the company orders 10,000 units at a time?

Sol: $s = 50000$
$q^* = \sqrt{\frac{2\times s\times p}{u}}$, $u = 0.5$, $\Rightarrow q^* = 5000$, $T = 3125$ Total inventory cost when $q = 10000$

Improvement Manage Warehousing Goods and Funds Flows
Inventory retention costs

The costs incurred by the company as a result of keeping goods in stores and these costs are variable. Examples of these costs are the cost of storage, the cost of goods that are subject to damage and destruction, the cost of insurance on goods, the cost of providing an appropriate environment for the goods, and the cost of disrupting goods accumulated in warehouses instead of investing in profitable areas. It is worth noting that the costs of maintaining inventory increase with the increase in the number of stored units, so that the company pays the variable cost of one unit at the time of storage only.

$$C = u\,(q \div 0.3) \qquad \text{------------------------ (5)}$$

C : Inventory holding cost, u : The cost of holding one unit of inventory
q : Quantity of units required at one time to be placed in stock

Order costs

They are the costs that are within the company's scope of bearing when it orders a shipment of goods. These costs are considered somewhat fixed for a single order, regardless of the quantity. Among the types of these costs are the costs of contacting suppliers, as well as the costs of postage and sending costs purchase requisition, as the greater the number of times the goods are ordered during the specified period for the project or for manufacturing, the higher the costs of the orders, and we will show the cost of the orders through this equation

$$O = p\,(s \div q) \qquad \text{------------------------ (6)}$$

O: Represents the costs of orders , p: Cost per order, q: Quantity of units required at one time
s: The company's total need of goods during the specified period

by calculating the total costs of inventory through the following general equation:

$$T = C + O \qquad \text{------------------------ (7)}$$
$$T = u(q \div 0.3) + p\,(s \div q) \qquad \text{------------------------ (8)}$$
$$q^* = \sqrt{\frac{0.3 \times s \times p}{u}} \qquad \text{------------------------ (9)}$$

Where T is the total costs of inventory and q* represents the optimum order size, then the total inventory cost is minimal.

Example 3: A company for the manufacture of home furniture needs 70,000 planks of wood annually, and the cost of maintaining one unit was one dinar, while the cost of the order was 135 dinars. What is the optimal order size for that company, where the stock is at the lowest possible? Then calculate total inventory costs if the company orders 7,000 units at a time? (Same example 1)

Sol:

$$q^* = \sqrt{\frac{0.3 * s * p}{u}}, \quad s = 70000, \qquad p = 135, \qquad u = 1 \Rightarrow q^* = 1683.745$$

$T = 24683.333$ Total inventory cost per year

Issuance of Purchase Order for Raw Materials

Here, the company has the duty to issue an order to purchase raw materials before stock runs out completely while ensuring that the company's old stock is sufficient to operate the company until the arrival of the new goods, it is necessary to calculate the appropriate time to order the raw materials before the entire quantity runs out, and this will be explained by the equation below

$$D = y \div 365 \qquad \text{------------------------ (10)}$$

D : Represents the company's daily need for raw materials
Y : Represents the company's need during the total period (if it is a year divided by the number of days in that year, which is) 365 days.

When the stores approach to running out of their quantity of raw materials, especially if the period of those materials from the day they are requested to the day they arrive is several days, then the company must issue an order to purchase the raw materials in order not to have to stop work and that the stored materials are sufficient to work until the materials arrive and we will explain this through the following equation

$$F = D \times R \qquad \text{------------------------ (11)}$$

Where:
(F) represents the quantity of stock to be ordered.
(D) represents the company's daily need for raw materials.
(R) represents the number of days it takes to reach the stores.

Example 5: If you know that Al-Marai milk and dairy production company takes about 10 days to reach the company’s warehouses, what is the quantity of inventory at which the order for the goods should be issued? (Same as example 2).

SOL:
$D = y \div 30$, $y = 50000,$ $D = 50000 \div 30 = D = 1666.66$
$F = D \times R$, $R = 10 \Rightarrow F = 16666.6$

That is, when the materials in the warehouse reach 16666.6 units, Almarai Company must issue a purchase order

Conclusion

In this work, we tried to show the total cost of inventory through laws and to obtain the minimum cost. We suggested the rate of what a company pays during the agreed period, meaning that the percentage of the costs paid by the company in three parts, first, middle, and last part of the period in order to reduce the cost. We try to reduce the number of times that the goods are ordered to the minimum by increasing the number of units of goods in one order and to know the total inventory costs. We introduced several examples which showed the efficiency of the new technique.

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