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THE IMPLEMENTATION OF ECONOMIC ORDER QUANTITY FOR REDUCING INVENTORY COST

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Abstract: Inventory management is focused with ensuring that all activities involved in labor storage and stock control are carried out efficiently and economically by those working in inventory storage. Then, there is a question for management regarding the efficiency of inventory management procedures because of inconsistencies in inventory levels that cause weaknesses such as losses incurred due to end-inventory stocks, low stock inventories, failure to meet targets and poor corporate morale. As a result, the inventory storage of the company is too busy making the job a difficult supply keeper, late in issuing materials to the department and in turn producing poor inventory service delivery. In inventory management, Economic Order Quantity (EOQ) is the number of orders that minimize total holding costs and booking costs. The EOQ model is one of the oldest classic production scheduling models. The EOQ mathematical models have been established within the scope of operations management to determine the optimal inventory level. The most widely used model is the EOQ model.

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1. INTRODUCTION

Inventory management refers to all activities involved in the development and management of raw material inventory levels, Work-In-Progress (WIP) and finishes so that adequate inventories are available and the cost of up or down stocks is low (Kotler, 2000). Inventories are essential to keep the wheels of production moving, keeping the market running and distribution systems intact. They serve as lubrication and spring for the organization's production and distribution system. Inventories enable the smooth and efficient operation of a manufacturing organization by separating individual segments from total operations (Wood, 2004). The purchase of inventory spares allows the purchasing and supply department personnel activities to be planned, controlled and inferred separately from store product operations. This inventory allows additional flexibility for suppliers in planning, producing and delivering orders for specific products (Lonergan, 2001).

Inventories are essential for organizing production activities, plant and machine maintenance and other operational needs. This results in the binding of money or capital that can be used more productively. Management of an organization becomes very concerned about high stock inventory. Inventories are part of the company's assets and are always reflected in the company's balance sheet. Therefore, this requires strict supervision by management, because management is very critical of the shortage of supplies required for production (Salleem, 2004). Any increase in engine redundancy or operation due to a shortage of inventory may lead to production losses and associated costs. Both of these aspects require continuous inventory control. Inventory control and management not only takes into account the physical balance of materials but also on aspects of minimizing inventory costs.

The main purpose of this journal is to explain the implementation of inventory management using the Economic Order Quantity (EOQ) method, the EOQ model is used to determine the quantity of inventory orders that can minimize storage costs and inventory ordering costs. A good contribution can be illustrated in this journal, that there is a need for good inventory management to manage the company budget in order to reduce inventory costs and research this journal using descriptive research pattern at a Japanese company engaged in the field of automotive in Indonesia. Proper inventory management plays a major role in enabling other operations such as production, purchasing, sales, marketing and financial management to run smoothly. However the basic challenge is to determine the level of inventory that works most effectively with the operating system or system within the organization (Dobler, 2006). A well-controlled and

efficient inventory can contribute to the effective operation of an enterprise and hence the overall profits of a company.

2. INVENTORY MANAGEMENT

The word of inventory has been defined in various ways and there are three definitions have been chosen that seem to be more in line with the topics developed in this paper, those three definitions (Ballou, 2004; Chase, Jacobs & Aquilano, 2004; Pycraft, Singh, Phihlela, Slack, Chambers & Johnston, 2000), namely: (i) Inventories are stockpiles of raw materials, suppliers, components, in-process work, and finished goods that appear at multiple points throughout the company's production and logistics channels, (ii) Inventory is the stock of items or resources used in an organization. The inventory system is a set of policies and controls that monitor inventory levels and determine which level to maintain, when stocks should be replenished, and how large orders should be, (iii) Eventually, inventory or stock as the accumulation of material sources stored in the transformation system. Thus, the manufacturing company will hold the material inventory, the tax office will store the stock of information and the amusement park will accommodate the customer's inventory or when the customer being processed we usually see the stock as a queue.

Every company must have adequate inventory. The main purpose of holding inventory is to reduce costs associated with investing in inventory and maintain efficiency in production and sales operations. If the company does not have sufficient inventory, and make purchases only when necessary for production and sales, then the company will not be able to offer on-time delivery according to customer orders.

There are many reasons that motivate companies to own inventories and there are five reasons for holding inventories have been identified (Bloomberg, Lemay & Hanna, 2002), namely: (a) Economic scale, a company can realize economies of scale in manufacturing, purchasing and transportation by conducting inventories. If a business buys in large quantities, then there will be a discount of goods. In turn, transportation can move larger volumes and gain economies of scale through better equipment utilization. Manufactures can have longer production if inventory is more inventoried, thus enabling a permanent unit cost reduction, (b) Balancing supply and demand, some companies must collect inventories to meet seasonal demand. For instance, a toy manufacturer sees some demand throughout the year, but 60 percent or more of sales will come in the Christmas season. With manufacturing for inventory, production can be maintained throughout the year. This reduces the capacity of idle factories and maintains a relatively stable workforce, thus reducing costs. If the demand is relatively constant but the input material is seasonal, as in the production of canned fruits, then the

finished inventory helps meet demand when the material is no longer available, (c) Specialization, inventory allows companies with subsidiaries to specialize. Instead of producing various products, each factory can manufacture the product and then deliver the finished product directly to the customer or to the warehouse for storage. With specialization, each manufacture can obtain economies of scale through the old production, (d) Protection from uncertainty, the main reason for holding inventory, for example to offset the uncertainty of demand. If demand increases and raw materials stock up, the production line will drop until there is more material delivered. Similarly, lack of work in the process means the product cannot be completed. Finally, if the customer's order exceeds the finished goods inventory, then the resulting stock out could cause the consumer to walk away, and (e) Buffer interface, inventory can support key interfaces, creating time and space utilities. Main interfaces include (1) suppliers and purchases, (2) purchases and production, (3) production and marketing, (4) marketing and distribution, (5) distribution and intermediaries, and (6) intermediaries and customers. Having inventory in this interface helps ensure that demand is met and stock allowance is minimized.

According to Miller (2010), inventory management involves all activities undertaken to ensure that the customer has the required product or service, because customer demand could improve products with shorter and more precise delivery at a lower cost (Srinivasan, 2012), then to respond to these demands, manufacturing companies must compete in several dimensions, such as cost efficiency, quality, delivery time and process flexibility (Olhager, 2013). Porter (1980) explained that there are three kinds of competitive strategies for a manufacturing company to select from. They are differentiation, cost leadership and focus. These strategies are the fundamental on combination of cost, time, service and quality. Manufacturing companies can use one of these strategies to obtain a competitive benefit (Lysons & Farrington, 2012).

Manufacturing companies that face problems in their filling processes force upstream suppliers to build excessive stock (Battini, Faccio, Persona & Sgarbossaa, 2009). In order to compete in today's global marketplace, manufacturing companies must have control over their inventory levels (Yuanjie, 2013). The more companies that produce supply stay open, they face the uncertainty of costs associated with holding them back. High inventory levels can lead to scraps, obsolete products, increased inventory costs and warehousing costs (Jonsson & Mattsson, 2011).

The challenges of managing and controlling inventory have long existed, especially in areas of distinction, theft, cheating, obsolescence, deterioration and breakages. Too much inventory consumes physical space, constructs financial trouble, and rises the probability of disadvantage, damage and loss. If a manufacturing company has a low inventory level, it could lead to problems of delivery and cessation of production (Miltenburg, 2005). On the other hand manufacturing companies strive to have the lowest inventory levels but can still respond to customer demand (Pong & Mitchell, 2012). If customer demand is not met, the manufacturing company may lose money due to loss of sales. Therefore, it

is important for manufacturing companies to have control over their inventory levels (Pong & Mitchell, 2012).

Inventory plays an indispensable role in the growth and survival of an organization in the sense that failure in effective and efficient inventory management will mean that the organization will lose customers and sales will decline. Emphasizing the importance of inventory on the company's balance sheet, Coyle, Bardi & Langley (2003) stated that inventory as assets on the company's balance sheet has increased significantly due to the strategy of many firms to reduce their investment in fixed assets, i.e. crops, warehouses, office buildings, and machines, and so on.

There was a research in the United States testified that the $700 million inventory held by American businesses is financed by bank loans with items pledged as collateral. An important industry marketing relationship exists between the inventory manager and the commercial loan officer who writes this inventory loan. Inventory managers need to give their creditor enough information to get financing at the lowest level. Loan officers need to assess the level of inventory risk to establish the right interest rate. The risk issues and repayment of inventory loans are essential for inventory managers and creditors (Holden & Hollingshead, 1999).

Inventory management is an important concern for managers in all types of businesses. For a company like JC Penny Limited, which operates on relatively low profit margins, poor inventory management can actually damage the business. The challenge is not to reduce inventory completely to reduce costs or to have many things to meet all demands, but to have the right amount to achieve competitive priorities for the most efficient business (Krajewski & Ritzman, 1999).

Eventually, according to the US Census Bureau (Ballou, 2004), inventories are found in places such as warehouses, yards, shop floors, transportation equipment and on retail store shelves. With this inventory, the cost is between 20 to 40 percent of their value per year. Thus, carefully managing inventory levels makes economic sense. Although many steps have been taken to reduce inventory through Just-In-Time (JIT), time compression, rapid response and collaborative practices implemented across supply channels, annual investment in inventories by manufacturers, retailers and wholesalers, whose sales represent approximately 99 percent of Gross National Product (GNP), about 12 percent of US Gross Domestic Product (GDP).

Inventories can be categorized into six distinct forms (Stock & Lambert, 2001), those types of inventories can be defined as: (a) Cycle stock. Cycle stock is the inventory generated from the refilling process and is required to meet demand under conditions of certainty, such as when the firm can predict the timing of demand and the lead time is almost perfect. For instance, if a constant selling rate of 20 units per day and a lead time is always 10 days, an out-of-stock supply cycle will be required. While the assumption of constant demand and waiting time eliminates the complexity involved in inventory management, let's look at an example to clarify the basic inventory principle, (b) In-transit Inventories.

Inventories in transit are goods traveling from one location to another. They may be considered part of the cycle inventory even though it is not available for sale and/or delivery until they arrive at their destination. For the calculation of inventory carrying costs, inventories in transit shall be deemed to be inventories in place of origin of shipment as they are not available for future buyers, sales, or shipments, (c) Safety or Buffer stock. A safety stock or a buffer is held in excess of the stock cycle due to demand uncertainty or delivery time. The idea is that some of the average inventory should be devoted to cover short-term variations in demand and delivery times. The average inventory at stock storage locations experiencing demand variability or lead time is equal to half the order amount plus safety stock, (d) Speculation stock. Speculation stock is inventory owned by reason other than satisfying current demand. For example, materials can be purchased in volumes larger than necessary to obtain quantity discounts, due to an estimate of price increases or material deficiencies, or to protect the possibility of a strike, (e) Seasonal stock. Seasonal stock is a form of speculative stock that involves the accumulation of inventories before the season begins to maintain a stable working style and stable production runs or, in the case of agricultural products, inventories accumulate as a result of a growing season that limits year-round availability, and (f) Dead stock. It is a type of inventory that no one wants, at least immediately. The question is why each organization will bear the costs associated with holding these items instead of just throwing them away. One reason may be that management expects requests to continue at some point in the future. As an alternative, it may be more expensive to get rid of items that it does not have. But the most powerful reason to keep this stuff is customer service. Perhaps important buyers have occasional needs for some of these items, so management keeps them on hand as a gesture of goodwill.

There are three forms of charges to examine in setting inventory characteristics (Gourdin, 2001) and those three forms can be described as, (a) Holding costs (or carrying costs) are costs such as storage, handling, insurance, taxes, obsolescence, theft and interest on funds that fund the goods. The increase in cost is in line with the increase in inventory levels. The high inventory levels held in stockpiles affect the purchase carrying out of materials from affecting capital budget in cash flow thereby reducing the potency, usefulness and twisted functions (Koin, Cheruiyot & Mwangangi, 2014). In order to minimize transportation costs, management often makes small orders. Holding costs are generally assessed as a percentage of the unit value, which is 15 percent, 20 percent, rather than trying to lower the monetary value for each of these costs separately. This practice is a reflection of the inherent difficulty in lowering the cost per unit for, for example, obsolescence or theft, (b) Ordering costs are costs which associated with the reservation, including the charges integrated with personnel in the purchasing department, communication and handling of attributed documents. Lowering these costs will be done by placing small quantities of orders, each for large quantities. Unlike freight costs, booking fees are generally expressed as monetary value per order, and (c) Stock-out costs

include lost sales, both short-term and long-term. This charge may be the most difficult to calculate, but arguably the most important because it represents the cost incurred by the customer (internal or external) when the inventory policy becomes weak. Default to put across these expenses may yield in control maintaining a higher (or lower) inventory level than a justifiable customer requirement.

3. INVENTORY MANAGEMENT AND EOQ THEORY

Inventories refer to the value or quantity of raw materials, stockpiles, Work-in-Progress (WIP) and finished inventory that are held or stored for use as needed (Lysons & Gillingham, 2003). Raw materials in the form of commodities such as steel and wood usually go into the final product. Inventories include items such as Maintenance, Repair and Operations (MRO) inventories not included in the final product. Ongoing work or WIP is material that has been partially created but not yet completed. Finished goods finished ready-to-be (Kothari, 1992).

Inventory management is the art and science to keep inventory levels of certain item groups that generate the lowest cost in accordance with other relevant targets and objectives set by management. It is important that the organizational managers who handle the inventory, have in mind, the goals to meet customer requirements and store inventory costs to a minimum level. Drury (2004) asserts that inventory costs include detention fees, booking fees and lower costs. Carrying costs associated with physical inventory costs. This includes insurance costs, conservatism and opportunities related to funds that may be made elsewhere but are associated with inventories.

In inventory management, Economic Order Quantity (EOQ) is the number of orders that minimize total holding costs and booking costs. The EOQ model is one of the oldest classic production scheduling models. The EOQ mathematical models have been established within the scope of operations management to determine the optimal inventory level. The most widely used model is the EOQ model. This model was developed by Ford W. Harris in 1913, but R.H. Wilson, a consultant who applied it extensively, and K. Andler were commended for their in-depth analysis (Hax & Candea, 1984). The model of EOQ is also known as the Wilson EOQ model. According to this model, some costs (ordering costs) decline with inventory holdings, while others (holding costs) rise and that the total inventory associated cost curve has a minimum point. This is the point where total inventory costs are minimized.

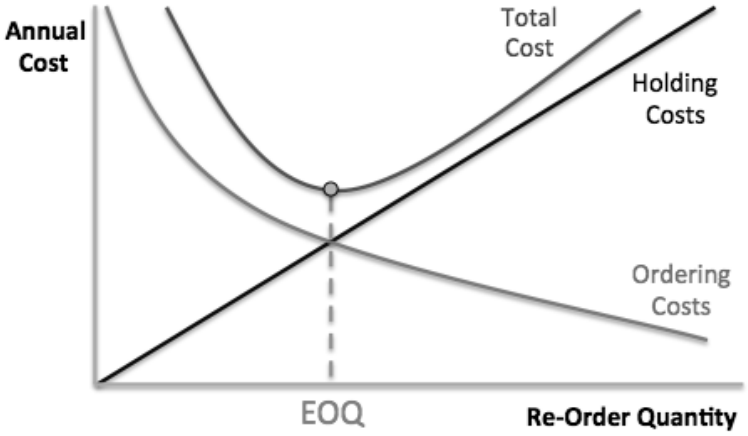

Fig. 1. Economic Order Quantity

The above graphic method of determining EOQ may not provide the most accurate result. In sensitivity analysis can be taken a given scenario and make changes to the variables built into that scenario to develop that the changes made will significantly affect the outcomes. This model is generally insensitivity to change around the EOQ, small error in the numbers to be ordered do not make much difference to the overall result. However Economic Order Quantity (EOQ) can be calculated mathematically with a great degree of accuracy.

EOQ is the inventory cost that minimizes the total cost of inventory management. The Economic Quantity Order is defined as an accounting formula that determines the point at which the combination between order cost and inventory cost is the least. The quantity of economic orders is the number of units that the firm should add to inventory with each order to minimize total inventory costs, such as holding fees, ordering costs and inventory costs. EOQ is used as part of a continuous review system where level inventories are monitored at any time and quantity is ordered whenever inventory reaches a certain reorder point (Lysons & Gillingham, 2003). Muckstadt and Sapra (2010) discusses that the EOQ model is determined by minimizing the total annual cost incurred by the firm based on the ordering cost and the holding cost.

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