International Journal of Economic Social and Technology, Vol. 2 (1) (2023)

Published by: Lembaga Riset Ilmiah, Yayasan Mentari Meraki Asa

International Journal of Economics Social and Technology

Journal homepage: https://jurnal.risetilmiah.ac.id/index.php/ijest

A Systematic Literature Review: Analysis of Cost Control Methods on Inventory (Case Study in Indonesia)

Asri Usman[1], Mediaty[2], Mutiara Nur Qalbi[3], Nurul Latifah Nurdin[4], Elfina Damayanti[5]

Department of Accounting, Universitas Hasanuddin

A R T I C L E I N F O

Article history:
Received: June 04, 2023
Revised: June 18, 2023
Accepted: June 19, 2023

Keywords:
Cost Control Methods,
Inventory,
Inventory Management,
SLR

ABSTRACT

The purpose of this study is to determine and analyze the methods used in the industry related to the management of their inventory to minimize inventory costs due to inventory mismanagement which can harm the company and the costs do not provide added value to the product. There are several methods that we analyze including Just In Time, Economic Order Quantity, Safety Stock, Reorder Point, Period Order Quantity, Material Requirement Planning, Min and Max, and Weight Moving Average we compare among all the existing methods, which one is the most widely used in the industry, this research uses the Systematic Literature Review method of journals stored on Google Scholar, with the period 2017-2023 based on case studies in Indonesia. This study found that the most widely used methods are EOQ and JIT, these two methods are used to adjust the needs and types of inventory owned by the company.

Correspondence:
Asri Usman
asriusman@unhas.ac.id

Introduction

Nowadays, business activities in all sectors and industries have grown rapidly, accompanied by the rapid development of science and technology. This condition causes increasingly fierce competition. The existence of increasingly fierce competition encourages every company to provide the best for consumers through the products it produces (Laoli et al., 2022). One way that can be done to achieve a competitive advantage for the company is to control costs. Inventory as the most crucial and important aspect for the company. Basically, the problem that often arises in a company is that cost planning by a company does not match what actually happens (cost realization). Therefore, in order to achieve efficient production, it is necessary to control the production costs that will be incurred (Dewi et al., 2019).

Inventory is a very important part of working capital, because the majority of the company's operating capital comes from inventory. In trading companies, inventory can be in the form of unsold merchandise, while in industrial companies, inventory is grouped into several types, including raw materials (raw material inventory), goods in process (WIP inventory), MRO inventory and finished goods inventory (Nugraha et al., 2022). Inventory for a company is a very important element in order to maintain the smooth production process. If the inventory of raw materials exceeds the need, it will cause high extra costs and if the inventory is stored in the warehouse for too long, it will cause damage. Meanwhile, if the amount of inventory is too small, it will cause losses, disrupt the production process and also result in a loss of opportunity for profit if demand is greater than expected (Dewi et al., 2019). So the company must maintain sufficient inventory so that operations are smooth and efficient (Laoli et al., 2022).

When raw material inventory exceeds the company's needs, it will increase maintenance and storage costs and the risk that will be borne if the stored raw materials become damaged or unfit for use. Conversely, if the company tries to reduce inventory, the company will be faced with the problem of running out of inventory (stock out) so that it will disrupt the smooth or continuous production process of the company (Lahu & Sumarauw, 2017). The inventory control system is one of the activities in the company's operating process in accordance with what is planned both in terms of time, quantity, and cost. The goal is to eliminate the risk of delays in goods or materials needed by the company, eliminate the risk of the quality of materials ordered so that the material must be returned, to be able to maintain a stock of seasonal materials, maintain the stability of company operations, achieve optimal machine usage, and maximize service to customers so that customer desires can still be met (Lukita, 2016). The right quantity and time of purchasing raw materials can reduce inventory costs, so that production costs can be reduced, most importantly without reducing

product quality. In accordance with this, it is necessary to develop an optimal inventory control method (Laoli et al., 2022). Because if a waste of resources occurs, a large loss in the existing company will ultimately affect the survival of the company (Aprilianti & Hidayat, 2019).

This research focuses on seeing how company policies are taken regarding the problem of suboptimal inventory control so that it can result in losses and is inefficient in terms of cost and time, and how inventory control methods are carried out, how effective the control is after being implemented in the company, and see what methods are most widely used by companies.

Research Question that has been determined in this study:

1. What control methods can be used for inventory costs?
2. What method is most widely used?

Literature Review

Inventory

Inventory is raw materials, work-in-progress, and finished goods that are considered part of business assets that are ready or will be ready for sale and inventory is one of the most important assets in business (Singh & Verma, 2018). Inventory control is the recording of inventory carried out by the company and must be checked through an ongoing audit where this audit is known by periodic counting or cycle counting (Sulaiman & Nanda, 2015). The inventory control system is a form of company effort in the process carried out by the company in accordance with what is planned both in terms of time, quantity, and cost (Lukita, 2016). If inventory is lacking, production will be hampered and production targets in accordance with consumer demand will not be achieved and vice versa, if inventory is too much, storage costs will increase (Sundah et al., 2019). Often companies store large amounts of inventory with the aim of obtaining price discounts and to avoid price increases in the future without thinking about the problems that will occur in the future so that companies must make policies in inventory so that problems can be anticipated (Palupi et al., 2018). The company must maintain an ideal inventory quantity so that it can ensure the smooth production process of the company (Purnama & Pulansari, 2020).

Purpose of Inventory

The main purpose of the inventory itself is to eliminate the effect of uncertainty (safety stock), provide free time for production and purchasing management, and anticipate changes in demand and supply (Utama et al., 2019).

Types of Inventory

According to Heizer and Render (2004: 61) in the book operations management Utama et al., (2019) to accommodate the inventory function, companies have four types of inventory, namely:

1. Raw material inventory
   Where raw materials that have not entered the production process where it has a use so that there is a separation of suppliers from the production process.
2. Semi-finished goods inventory
   Where raw materials or components that have gone through the production process, but are still imperfect or still not a finished product.
3. MRO (Maintenance/Repair/Operating)
   Where maintenance or repair is also needed just in case there is a machine breakdown in one of the production processes and this MRO must be scheduled or anticipated.
4. Finished goods inventory
   Where the final product is ready to be finished and ready to be sold.

Inventory Costs

The following are inventory costs (Utama et al., 2019):

1. Setup Costs

Setup costs are costs incurred since the company produces basic materials in its own factory. Thus, the company faces setup costs to produce certain components. These costs include idle machinery costs, direct labor preparation costs, scheduling costs, and expedition costs.

2. **Ordering (Purchasing) Costs**

   Every time materials are ordered, the company will incur ordering costs. Ordering costs include order processing and expediting costs, employee wages, telephone and Internet costs, correspondence expenses, packing and weighing costs, receiving inspection costs, shipping costs to the warehouse, and current debt costs.

3. **Holding Cost/Carrying Cost**

   Storage costs depend on the amount in inventory. The greater the amount of material stored, the higher the storage cost per period will be.

4. **Material Shortage or Exhaustion Costs**

   The cost of shortages or running out of materials (shortage cost) is the most difficult cost to estimate. This cost arises when inventory does not meet or meet demand. Where these costs include costs caused by lost sales, lost customers, additional special order costs, expedition costs, price differences, disruption of operations, and additional expenses for managerial activities.

Method

This research uses the Systematic Literature Review method entitled Analysis of Cost Control Methods in Inventory (Case Study in Indonesia). Article collection is based on several related previous studies, and is carried out with google scholar and Science Direct as well as other additional literature. The keywords used in the article collection process are "Inventory cost control methods" with a journal period of 2017 to 2023. This research uses the SLR method which consists of 3 stages conducted by Dyah et al., (2021) which is shown in Figure 1 below:

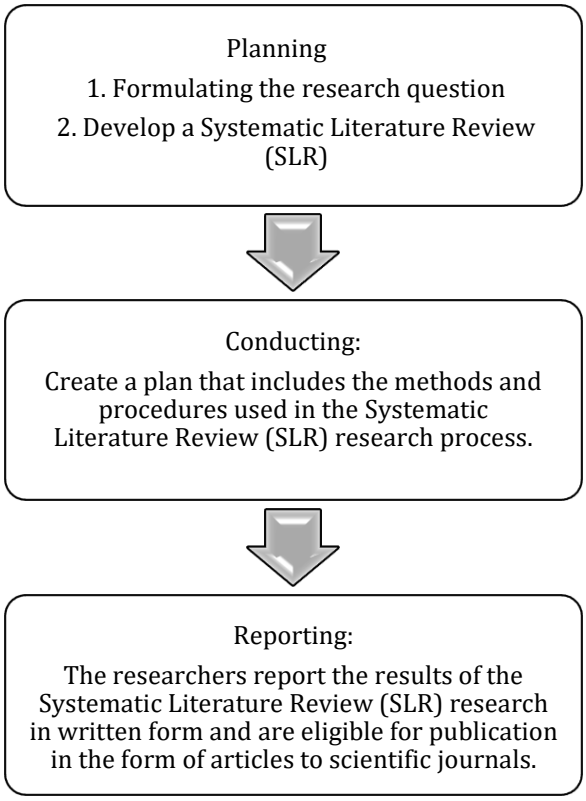

Figure 1. Systematic Literature Review method research stage

Research Question

At this stage, questions that are in accordance with the research topic are determined. The following are Research Question that has been determined in this study:

RQ1: What control methods can be used for inventory costs?

RQ2: What method is most widely used?

Research Process
The Research Process is carried out to obtain sources that are directly related to the problem under study to answer the Research Question (RQ) and other related references. The process of searching for data sources is carried out at the google scholar site address, science direct and other additional literature.

Study Selection
At this stage, the criteria for the data found are determined, whether the data is suitable for use as a data source for research or not. The following are the criteria for data to be said to be suitable as a source of research data, namely:

1. The data obtained has a time span from 2017 to 2023.
2. Data obtained from google scholar sources, science direct and other additional literature.

Quality Assessment
At this stage the data that has been found will be evaluated based on the following questions:

1. QA1: Was the paper published in 2017-2023?
2. QA2: Was the paper retrieved from Google Scholar?
3. QA3: Is the paper appropriate and able to answer the research question?

In the quality of the assessment described above, it will be re-evaluated based on the available value criteria. So that each paper will be given a value according to the questions on the quality of the assessment. The values used are as follows:

1. Yes: for journal papers that match the questions in the quality assessment.
2. No: for journal papers that are not in accordance with the questions in the quality assessment.

Data Collection
Secondary data in this study were obtained from several stages, namely:

1. Literature study, conducted by reviewing data in journals related to the Systematic Literature Review (SLR) method obtained from google scholar science direct and other additional literature.
2. Documentation, the data obtained will be saved into Mendeley software.

Results and Discussion

1. What control methods can be used for inventory costs?

Inventory management is the ability of a company to organize and manage every need for goods, both raw goods, semi-finished goods, and finished goods, so that they are always available in both stable and fluctuating market conditions (Laoli et al., 2022).

a. Just In Time

The beginning of Just in Time was in the 1970s, at that time Just in Time was a manufacturing technique centered around the kanban method and pull production systems, then Just in Time developed into a management philosophy and focused on waste reduction and continuous improvement (Sumanto & Marita, 2017). Just In Time can increase company productivity, especially reducing waste in the production process, so that the Just In Time system provides great benefits for companies to increase profits (Aprilianti & Hidayat, 2019). JIT is a comprehensive production system and inventory management system where raw materials are purchased and produced as much as needed and used at the right time in each production process (Pradana & Jakaria, 2020). The goal of Just In Time implementation is to produce products that consumers only need at the right time at the desired quality level (B & Nurcaya, 2019). Pradana & Jakaria (2020) explained several concepts of just in time:

a) Reduce supplier quantity
b) Reduce or eliminate the time and cost of negotiating with suppliers
c) Have customers with established purchasing programs
d) Eliminate or reduce activities and value that never add up
e) Reduce time and costs for quality inspection programs
f) Reduce or eliminate work in process

g) Reduce or eliminate lead time
h) Reduce or eliminate setup
i) Simplify product processing.

So that by applying the concepts above, the company can control production time on time and control costs so as to win price competition (Pradana & Jakaria, 2020).

b. EOQ (Economic Order Quantity)

Economic Order Quantity (EOQ) is one of the oldest and most widely known inventory control techniques, the inventory method answers two important questions, namely when to order and how much to order (Laoli et al., 2022). Economic Order Quantity (EOQ) is the amount of inventory purchases made efficiently so that the overall inventory cost is as small as possible. EOQ is calculated by taking into account the variable cost of inventory. There are 2 types of costs used as the basis for EOQ calculations, namely ordering costs and storage costs or carrying costs (Pradana & Jakaria, 2020). Economic order quantity (EOQ) is the optimal inventory quantity or one that causes inventory costs to reach the lowest point (Utama et al., 2019).

c. Safety Stock

Safety stock is important in determining the optimal amount of inventory because if there is too much inventory, the circulation of money in trade will stop and vice versa, if there is too little inventory, the company may experience stockouts so it is necessary to calculate the safety stock requirement in advance to determine the amount of inventory that needs to be prepared (Laoli et al., 2022).

The following is the formula for safety stock (Laoli et al., 2022):

Safety stock = (maximum daily sales x maximum lead time) - (average daily sales x average lead time)

Safety stock is needed because sometimes the actual amount of raw materials needed for the production process does not match the plan. If we don't have safety stock when the raw materials run out, the production process can stop and cause losses to the company (Rizky et al., 2016).

d. ROP (Reorder Point)

Reorder point is the time when the company must reorder raw materials or supplies, so that requests for raw materials can come on time (Andries, 2019). If reordering set too low, then the inventory of goods will run out before replacement supplies are received so that production can be disrupted so that customer demand cannot be met. However, if the re-supply point is set too high, when the new inventory comes, while there is still a lot of inventory in the warehouse, this situation results in wasteful costs and excessive investment (Rizky et al., 2016). Reorder Point (ROP) as a point where a reorder must be placed so that spare parts inventory is in a safety stock status and can be used to deal with inaccuracies when there is a buildup and shortage of inventory each period (Suhendra et al., 2021).

The formula is as follows (Laoli et al., 2022):

Reorder point = Lead time + safety stock.

e. POQ Method

POQ, also known as periodic order quantity, is an approach that utilizes the concept of economic order quantities to be used in periods with non-continuous demand. This technique is based on the EOQ method, where we use the basic calculations of the economic order method to determine the number of orders that must be placed during one ordering period (Yuwono & Saptadi, 2022).

f. MRP Method

MRP is a method used to determine the type, time, and amount of raw materials needed to fulfill a production plan where this method helps in determining what to

produce, when to produce, and how much raw material is needed to meet planned production needs (Eka et al., 2017).

g. Min and Max Method

The min-max method is a basic rearrangement mechanism that has been implemented and other types of inventory management software. "Min" is the inventory level value that triggers reordering and "Max" is the new inventory level value targeted to follow the reordering (Salam & Mujiburrahman, 2018). The concept of the Min-max method was developed based on a simple thought to maintain the continuity of the operation of a factory, certain types of goods in minimum quantities should be available in stock, so that if at any time something is damaged, it can be replaced immediately. But the goods available in stock should also not be too much, there is a maximum so that the cost is not too expensive (Rizky et al., 2016).

h. Weight Moving Average Method

Weight Moving Average (WMA) or moving average method can be used in determining the trend of a transaction time series. This method is used in inventory forecasting so that the arrival or receipt of ordered goods can be on time (Suhendra et al., 2021).

2. What is the most widely used method?

The following is a table describing the implementation of inventory control methods based on journals further analyzed by the authors, and it was found that the EOQ method is the most frequently used method and its use is inseparable from the calculation and use of other methods such as ROP and Safety Stock. Furthermore, the second most used method is Just in Time and then followed by Min and Max. The least used are POQ, MRP and WMA.

Journal	JIT	EOQ	SS	ROP	POQ	MRP	Min Max	WMA
Analisis Perbandingan Metode EOQ, POQ dan Min Max dalam pengendalian persediaan bahan baku PT Sidomuncul Pupuk Nusantara		✓			✓		✓	
Pengendalian persediaan bahan baku cup menggunakan metode EOQ, POQ, dan min max pada Perum Tirta Malang		✓	✓	✓	✓		✓	
Pengendalian persediaan bahan baku dengan menggunakan metode EOQ pada UD Adi Mabel		✓		✓				
Analisis pengendalian persediaan dengan metode EOQ guna optimalisasi persediaan bahan baku pengemas air mineral		✓	✓	✓				
Analisis Persediaan bahan baku kedelai pada Pabrik Tahu Nur Cahaya di Batu Kota dengan metode EOQ		✓		✓				

Pengendalian Persediaan Bahan Baku menggunakan Metode Min-Max Stock pada Perusahaan Konveksi Gober Indo							✓	
Penerapan metode EOQ untuk meningkatkan efisiensi biaya persediaan bahan baku PT Nusmulti Centralestati		✓						
Penerapan EOQ pada PT Woloan Permai Perkasa		✓	✓	✓				
Penerapan Metode EOQ untuk Analisa Penjualan Produk UMKM di Kabupaten Nganjuk		✓	✓	✓				
Perencanaan dan pengendalian bahan baku produksi kerupuk dengan metode MRP untuk meminimumkan biaya persediaan bahan baku di UD XYZ						✓		
Analisis Pengendalian Persediaan bahan baku guna meminimalkan biaya persediaan pada Dunkin Donuts Manado		✓	✓	✓				
Penerapan Just In Time untuk Efisiensi Biaya Persediaan	✓							
Penerapan sistem Just In Time Persediaan di produksi PT Nitto Materials Indonesia	✓							
Pengaruh Just In Time Terhadap Efisiensi Biaya Produksi Pada PT. Toyota Boshoku Indonesia	✓							
Pengendalian Persediaan bahan baku gula menggunakan metode EOQ dan JIT	✓	✓						
Penerapan Metode EOQ, ROP, dan SS dalam mengelol manajemen persediaan di Grand Katika Gunungsitoli		✓	✓	✓				
Sistem Peramalan Persediaan Sparepart Menggunakan Metode Weight Moving Average dan Reorder Point				✓				✓

Conclusion

Based on this research, it can be concluded that the methods that companies can use to control or minimize their inventory costs include Just In Time, Economic Order Quantity, Safety Stock, Reorder Point, Period Order Quantity, Material Requirement Planning, Min and Max, and Weight Moving Average. While the most widely used methods are EOQ (in the application of EOQ it is often followed by the implementation of the Safety Stock and Reorder Point methods) and Just In Time the next position is followed by Min and Max, and quite rarely used is Material Requirement Planning, and Weight Moving Average.

The method used is again adjusted to the type of inventory, the length of the inventory lead time, the location of the inventory supplier which can be factors that affect the company's inventory management. So each method used cannot be separated from the needs and analysis of the company adjusted for other factors related to their inventory. It is not absolute that one method is better than another due to the different inventory management needs of each company. The weakness of this study is the variety of types of inventory and types of companies that we do not group so that it allows bias in the type of company and type of inventory of each particular company. This study only uses 17 journals so that future researchers can add existing journals so that more inventory methods can be obtained. This research also only focuses on 2013-2023 so that future researchers can add research years.

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