



THE EFFECT OF APPLYING THE MATERIAL REQUIREMENT PLANNING (MRP) METHOD AND THE ECONOMIC ORDER QUANTITY (EOQ) METHOD ON RAW MATERIAL COST EFFICIENCY IN THE MANUFACTURE OF ALIFA COLLECTION MUKENA

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Abstract: This study aims to analyze the effectiveness of applying Material Requirement Planning (MRP) and Economic Order Quantity (EOQ) in improving raw material cost efficiency. The research employed a quantitative approach based on observations, interviews, and documentation. The results show that the implementation of MRP increased scheduling accuracy from 80% to 92% and reduced dead stock from 12% to 5%. Meanwhile, the application of EOQ decreased storage costs from IDR 120,000,000 to IDR 98,000,000. Overall, the integration of both methods proved effective in enhancing inventory control efficiency.

Keywords: material requirement planning (MRP); economic order quantity (EOQ); cost efficiency; raw materials; MSMEs.

1. Introduction

In an era of increasingly fierce business competition, garment manufacturers are required to manage raw materials efficiently in order to reduce production costs and maintain competitiveness. Effective raw material management has a direct impact on production flow and company profitability. Therefore, the application of inventory control methods such as Material Requirement Planning (MRP) and Economic Order Quantity (EOQ) is important in improving raw material cost efficiency.

Suboptimal inventory management often causes problems such as excess stock, which increases storage costs, or stock shortages, which hamper production. MRP helps ensure that raw materials are available according to the production schedule, while EOQ determines the most economical order quantity to reduce total inventory costs. Previous studies have also shown that these two methods can improve operational efficiency in the garment industry.

Alifa Collection, a small-scale mukena manufacturing enterprise in Tasikmalaya, faces challenges in maintaining efficient raw material availability due to fluctuations in demand and uncertainty in supplier lead times. These conditions may result in excess inventory, increased storage costs, and disruptions to production continuity when materials are not available as needed. Although Material Requirement Planning (MRP) and Economic Order Quantity (EOQ) are conceptually capable of supporting material planning and determining optimal order quantities, previous studies have predominantly focused on large-scale manufacturing firms with operational characteristics that differ significantly from those of MSMEs. Furthermore, empirical research applying both methods simultaneously in small-scale garment enterprises remains limited and seldom presents quantitative evidence demonstrating measurable improvements in efficiency. Therefore, this study aims to provide empirical contributions regarding the effectiveness of integrating MRP and EOQ in enhancing inventory control efficiency within MSME garment

production, thereby serving as a basis for more systematic and data-driven production decision-making.

In addition to cost efficiency, the implementation of MRP and EOQ can also improve production planning accuracy, accelerate decision making, and enhance the company's responsiveness to fluctuations in market demand. However, these benefits can only be realized if supported by adequate information systems and competent human resources in inventory management. Building on this perspective, the present study aims to analyze the application of MRP and EOQ in improving raw material cost efficiency at Alifa Collection MSMEs. The findings are expected to serve as a reference for garment manufacturers in managing raw materials more effectively and efficiently, as well as contribute to the development of operational management literature in the field of inventory control.

2. Literature Review

2.1 Material Requirement Planning (X_1)

Material Requirement Planning (MRP) is a material requirements planning system designed to ensure the timely availability of raw materials in appropriate quantities to support the production process. This system uses data such as Bills of Materials (BOM), production schedules, and available stock to calculate material requirements and determine the optimal ordering schedule (Nahmias, 2013). MRP helps reduce waste, lower storage costs, and improve production efficiency. The system was developed in the 1960s in response to the industry's need to manage inventory more effectively and in an integrated manner, thereby preventing shortages or surpluses of raw materials that result in high costs (Silver, Pyke, & Peterson, 1998).

2.2 Economic Order Quantity (X_2)

Economic Order Quantity (EOQ) is a mathematical model used to determine the optimal order quantity of raw materials in order to minimize total inventory costs, which consist of ordering and storage costs (Heizer & Render, 2014). This model assumes constant demand and fixed lead times, thereby helping companies avoid over-ordering, which increases storage costs and the risk of material damage. EOQ was first introduced by Ford W. Harris in 1913 and has since become an important basis in inventory management, as it is able to determine when and how much raw materials should be ordered in order to reduce total costs (Nahmias, 2013). In the mukena garment industry, the application of MRP and EOQ is highly relevant because it involves various materials such as fabric, thread, lace, and accessories, so that proper material management can avoid material shortages and reduce storage costs (Chopra & Meindl, 2016).

2.3 Raw Material Cost Efficiency (Y)

Raw material cost efficiency is defined as a company's ability to optimally manage the costs of purchasing, storing, and using raw materials so that total costs can be reduced without disrupting the smooth running of the production process (Chopra & Meindl, 2016). This efficiency includes reducing purchasing costs through proper ordering, reducing storage costs due to excess stock, and reducing raw material waste.

In the manufacturing industry, raw material cost efficiency is very important because raw materials are the largest cost component in the production process. Inefficient management can lead to waste, high storage costs, and the risk of material shortages that can hamper production (Nahmias, 2013). Efficiency can be measured by comparing raw material costs before and after

implementing the MRP and EOQ methods, or through an analysis of material utilization rates and reductions in production waste (Sari & Putra, 2018).

In the mukena garment industry, raw material cost efficiency has a direct impact on a company's competitiveness due to relatively small profit margins and intense market competition. Therefore, efficient raw material management is a key factor in business success (Ramadhan, 2024).

3. Methodology

3.1 Conceptual Framework

This study aims to analyze the effect of implementing Material Requirement Planning (MRP) and Economic Order Quantity (EOQ) on raw material cost efficiency at Alifa Collection SME in Tasikmalaya City. MRP is used to plan raw material requirements according to the production schedule, while EOQ determines the optimal order quantity to reduce inventory costs.

This study employs a quantitative descriptive approach to analyze the effect of implementing Material Requirement Planning (MRP) and Economic Order Quantity (EOQ) on raw material cost efficiency at Alifa Collection SME in Tasikmalaya. Data were collected through observations, interviews, and documentation, including inventory and production records from 2023–2024.

Cost efficiency was measured by comparing conditions before and after the implementation of MRP and EOQ using three indicators: order schedule accuracy, reduction in storage costs, and reduction in raw material waste.

EOQ calculations were conducted using the formula:

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

Efficiency was assessed by comparing total inventory costs before and after implementation. Data reliability was ensured through triangulation by cross-checking interview results with purchasing documents and raw material usage records. This method provides a quantitative assessment of efficiency improvements achieved through the application of MRP and EOQ.

Previous studies have shown inconsistent results regarding the effectiveness of MRP and EOQ methods in the context of small industries. Therefore, this study was conducted to re-examine the relationship between these two methods and raw material cost efficiency in MSMEs.

Hypotheses:

H1: The application of MRP has a positive effect on raw material cost efficiency.

H2: The application of EOQ has a positive effect on raw material cost efficiency.

H3: The simultaneous application of MRP and EOQ has a positive effect on raw material cost efficiency.

3.2 Research Model

The object of this study is Alifa Collection MSME, with a focus on the application of Material Requirement Planning (MRP) and Economic Order Quantity (EOQ) methods to raw material cost efficiency. The study uses a descriptive-associative quantitative approach to examine the relationship between independent variables (MRP and EOQ) and dependent variables (raw material cost efficiency).

The data used includes primary data (results of observations, interviews, and documentation) and secondary data (financial reports, production data, and inventory costs for the 2023–2024

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period). The analysis was conducted by comparing the conditions before and after the implementation of MRP and EOQ, using a quantitative descriptive approach to assess the level of raw material cost efficiency.

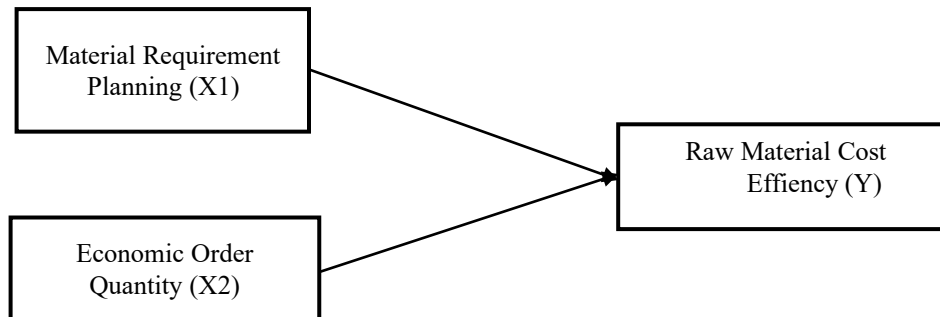


Figure 1. Research Model

4. Result and Discussion

4.1 Result

This research was conducted at Alifa Collection, a mukena manufacturing SME in Tasikmalaya City with an average production capacity of 1,000 pieces per month. Before implementing the MRP and EOQ methods, the company faced several problems in raw material management, such as overstock, dead stock, and high storage costs. The research data was obtained through direct observation of the production and procurement processes, interviews with management, and financial and production documents for 2023–2024.

The implementation of material requirement planning (MRP) and economic order quantity (EOQ) was followed by a comparative analysis of order scheduling accuracy, dead stock, storage cost, and raw material waste. These findings align with Heizer and Reders (2014) argument that MRP enhances efficiency by structuring material planning to reduce uncertainty and prevent excessive ordering. The improvement is further supported by the EOQ principle described by Chopra and Meindhl (2016), which emphasizes that determining the optimal order quantity lowers total inventory costs by balancing ordering and holding expenses. The operational mechanisms of both methods explain why efficiency improved, not merely how much it increased, as they enable more accurate material requirement and a more stable ordering rhythm, ultimately reducing unnecessary inventory related costs.

The results of the observations and calculations can be seen in the following table:

Table 1. Results of The Observations and Calculations

Aspects Observed	Before Implementation	After Implementation	Change
Order Schedule Accuracy	80%	92%	+12%
Dead Stock	12%	5%	-7%
Storage Costs	IDR 120.000.000	IDR 98.000.000	-18%
Raw Material Waste	7%	4%	-3%

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Aspects Observed	Before Implementation	After Implementation	Change
Total Cost Efficiency	-	IDR 37.000.000	Increase
Ordering Cost	Higher (18 orders/year)	Lower (12 orders/year)	- Frequency reduced by 33%
Total Inventory Cost	Higher and uncontrolled	More efficient and measurable	+ Significant efficiency gained

Source: Processed primary and secondary data

Based on the table above, it can be seen that the application of the MRP and EOQ methods has had a positive impact on raw material cost efficiency at Alifa Collection MSMEs. Order schedule accuracy increased from 80% to 92%, indicating that material requirements planning through MRP is able to more accurately adjust production schedules to raw material availability. Additionally, dead stock decreased from 12% to 5%, meaning that the raw material ordering system is more controlled and avoids the accumulation of unused goods.

In terms of costs, the use of the EOQ method reduced storage costs by 18%, from IDR 120,000,000 to IDR 98,000,000 per year. This was due to the determination of the optimal order quantity so that raw materials were not stored in the warehouse for too long. In addition, raw material waste decreased from 7% to 4%, indicating an increase in material usage efficiency in the production process. Overall, the combination of MRP and EOQ implementation resulted in total cost savings of IDR 37,000,000 per year, which is a significant efficiency improvement for MSMEs with annual turnover of around IDR 800 million to IDR 1 billion.

4.2 Discussion

4.2.1 The Effect of MRP (X_1) on Raw Material Cost Efficiency (Y)

The implementation of Material Requirement Planning (MRP) at Alifa Collection SME has been proven to increase raw material cost efficiency. Before MRP was implemented, material planning was done manually, which often resulted in late orders and excess stock. After implementing MRP, order schedule accuracy increased from 80% to 92%, and dead stock decreased from 12% to 5%. This shows that raw material planning has become more accurate and in line with the production schedule, thereby reducing storage costs.

With the help of the Master Production Schedule (MPS) and Bill of Materials (BOM), companies can adjust material purchases to actual production capacity. This efficiency helps reduce the risk of idle materials and improves the smoothness of the production process. These results are in line with the research by Sari & Putra (2018), which states that MRP can reduce excess inventory by up to 20% and significantly lower storage costs. Thus, the implementation of MRP has a positive effect on raw material cost efficiency at Alifa Collection.

4.2.2 The Effect of EOQ (X_2) on Raw Material Cost Efficiency (Y)

The application of Economic Order Quantity (EOQ) helps Alifa Collection determine the optimal number of raw material orders to reduce total inventory costs. Before EOQ was used, the company ordered 3,000 meters of fabric per order 18 times per year, which led to stockpiling and high storage costs. After the EOQ calculation was performed, the optimal quantity became 2,190 meters per order with a frequency of 12 times per year, allowing the company to balance ordering costs and storage costs.

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As a result, storage costs fell from IDR 120,000,000 to IDR 98,000,000 per year, or a saving of 18%. In addition, the company's funds became more liquid because they were not tied up in excess stock. These findings are consistent with Wijaya (2019), who found that the application of EOQ in the garment industry can increase cost efficiency by up to 15%. Therefore, EOQ is effective in reducing inventory costs and increasing the efficiency of working capital utilization.

4.2.3 The Simultaneous Effect of MRP (X_1) and EOQ (X_2) on Raw Material Cost Efficiency (Y)

The simultaneous application of MRP and EOQ results in greater efficiency than the application of either method alone. MRP determines the timing of material orders according to the production schedule, while EOQ determines the optimal order quantity. This combination reduces storage costs from IDR 120,000,000 to IDR 98,000,000 and raw material waste from 7% to 4%, with a total cost efficiency of around 18% or equivalent to savings of IDR 37,000,000 per year.

The synergy of these two methods also streamlines the production process because materials are available on time and as needed. In addition to cost efficiency, the company is able to maintain production stability and customer satisfaction. These results are in line with Ramadhan's (2024) research, which shows that the integration of MRP and EOQ in the mukena garment industry can increase raw material cost efficiency by up to 18%. Thus, the combination of MRP and EOQ has a significant effect on improving the efficiency and competitiveness of Alifa Collection.

5. Conclusion

Research on Alifa Collection MSMEs demonstrates that implementing material requirement planning (MRP) and Economic order Quantity (EOQ) methods significantly improves raw material cost efficiency. That application of MRP raised order schedule accuracy from 80% to 92% and decreased bead stock from 12% to 5%. Meanwhile, EPQ reduced annual storage costs from IDR 120,000,000 to IDR 98,000,000 and lowered raw material waste from 7% to 4%, resulting in total annual savings of IDR 37,000,000. These outcomes are consistent with Heizer and Render's (2014) assertion that MRP improves material coordination and reduces uncertainty, as well as Chopra and Meindl's (2016) view that EOQ minimizes overall inventory costs through optimal order sizing. Managerially, it is recommended that the company implement an ERP based information system, enhance demand forecasting, strengthen supplier relationships, and deliver targeted training for warehouse and procurement staff to sustain and further improve operational efficiency.

Academically, these findings enrich the inventory management literature for MSMEs by offering empirical evidence of the combined effectiveness of MRP and EOQ in reducing excess inventory and operational waste. The results support established theoretical models in operations and supply chain management by showing how structured planning and cost-optimization strategies positively impact material flows and financial outcomes in small enterprises. These findings are in line with the theoretical perspectives of Heizer and Render (2014) and Chopra and Meindl (2016), both of which emphasize the strategic role of planning and inventory optimization in operational decision-making. Future research should utilize broader quantitative methodologies to validate these results across various MSME sectors and deepen the theoretical understanding of inventory control in resource-limited contexts.

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