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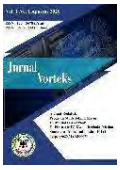

OPTIMIZATION OF RAW MATERIAL INVENTORY CONTROL THROUGH THE IMPLEMENTATION OF THE ECONOMIC ORDER QUANTITY METHOD: A CASE STUDY AT UD. SUWARNO BAMBOO WEAVING INDUSTRY

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Abstrac

Efficient inventory control is a critical factor in maintaining cost-effective production, especially for small and medium-sized enterprises (SMEs) such as UD. Suwarno, a bamboo weaving industry in North Sumatra, is a prime example of this phenomenon. The company has historically relied on unstructured ordering based on customer demand, which frequently results in either excessive stock or emergency procurement, thereby increasing total inventory costs. The objective of this research is to analyze the company's current inventory system and apply the Economic Order Quantity (EOQ) method as a quantitative solution to optimize raw material procurement. The study employs a descriptive quantitative approach, grounded in primary data from observations and interviews, complemented by secondary data sources such as purchasing records and inventory expenses. The primary benefit of this research is its capacity to assist SMEs in implementing a systematic inventory management approach and achieving cost minimization by employing the EOQ method. The novelty of this study lies in its application of the EOQ model to the context of a traditional bamboo craft business, a subject that has been largely overlooked in extant literature. The findings indicate that implementing the EOQ method results in an optimal ordering quantity of 3,885 sticks per order and a reorder point of 288 sticks. This strategy led to a significant reduction in total inventory costs, from Rp 242,100,000 to Rp 83,462,136 per year, representing a cost saving of approximately 66%. Therefore, the results of this study demonstrate that the EOQ model is an effective tool for improving inventory efficiency and sustainability in traditional craft-based SMEs.

Abstrak

Kontrol inventaris yang efisien merupakan faktor penting dalam menjaga produksi yang hemat biaya, terutama untuk usaha kecil dan menengah (UKM) seperti UD. Suwarno, sebuah industri anyaman bambu di Sumatera Utara. Perusahaan ini telah lama mengandalkan pemesanan yang tidak terstruktur berdasarkan permintaan

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pelanggan, yang sering kali menyebabkan stok yang berlebihan atau pengadaan darurat, sehingga meningkatkan total biaya persediaan. Penelitian ini bertujuan untuk menganalisis sistem persediaan perusahaan saat ini dan menerapkan metode Economic Order Quantity (EOQ) sebagai solusi kuantitatif untuk mengoptimalkan pengadaan bahan baku. Penelitian ini menggunakan pendekatan kuantitatif deskriptif berdasarkan data primer dari hasil observasi dan wawancara, serta data sekunder yang meliputi catatan pembelian dan biaya persediaan. Manfaat utama dari penelitian ini terletak pada kemampuannya untuk memandu UKM dalam mengelola persediaan secara sistematis dan meminimalkan total biaya dengan menerapkan metode EOQ. Kebaruan dari penelitian ini adalah penerapan model EOQ dalam konteks bisnis kerajinan bambu tradisional, yang sebagian besar diabaikan dalam literatur yang ada. Temuan menunjukkan bahwa penerapan metode EOQ menghasilkan jumlah pemesanan optimal sebesar 3.885 batang per pesanan dan titik pemesanan kembali sebesar 288 batang. Pendekatan ini mengurangi total biaya persediaan dari Rp 242.100.000 menjadi Rp 83.462.136 per tahun, yang mewakili penghematan biaya sekitar 66%. Oleh karena itu, model EOQ terbukti menjadi alat yang efektif untuk meningkatkan efisiensi dan keberlanjutan persediaan di UKM berbasis kerajinan tradisional.

Kata Kunci: EOQ, pengendalian persediaan, industri bambu

INTRODUCTION

An essential component of manufacturing companies' operating framework is the efficient management of their raw material inventory. It has been shown that maintaining optimal inventory levels reduces operating expenses while guaranteeing efficient production procedures [1]. In order to establish the ideal inventory level to be maintained, the best time to place orders, and the necessary order quantity, inventory control, as proposed by [2], consists of a set of policies. Suwarno, a producer of bamboo tepas, faces the difficulty of managing its raw material inventory as efficiently as possible. The corporation now purchases raw materials based on order quantities, a method that is known to cause problems as demand rises. Due to supply chain difficulties, the company has been forced to place urgent orders for raw materials. As a result, inventory expenses have gone up. On the other hand, it has been shown that having too much inventory causes raw materials to build up in warehouses, raising storage expenses [3]. By identifying the economic order quantity that minimizes overall inventory costs, the Economic Order Quantity (EOQ) technique is a theoretical framework that seeks to optimize inventory levels [4] stress that the amount of raw materials bought in each order at the lowest feasible cost is known as the Economic Order Quantity (EOQ). It has been shown that SMEs can significantly reduce costs and improve their competitiveness in markets by implementing the EOQ approach [5]. Effective inventory planning can increase SMEs' operational efficiency by up to 25%, according to recent research by [6] Concurrently, [7] show that, in comparison to traditional techniques, the use of EOQ can save typical storage expenses by 30%.

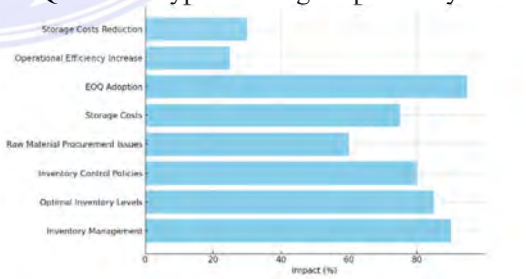

Figure 1 impact of inventory management strategies on manufacturing enterprises

UD Suwarno is a commercial entity specialising in bamboo handicrafts, with a history dating back to 1992. The company's

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primary product is tepas, which is derived from bamboo weaving. As an industry predicated on natural raw materials, the company is confronted with the challenge of managing its bamboo raw material supply [8]. At present, the company's raw material procurement is contingent upon the number of orders received [9]. It is evident that this strategy is not without its shortcomings, particularly in circumstances where there is an unexpected surge in orders. In the event of inadequate inventory levels in the warehouse, the company is compelled to make immediate additional purchases, resulting in escalated ordering costs [10]. Moreover, should the raw materials required by the company be unavailable from its primary supplier, it is incumbent upon the company to seek alternative suppliers, albeit with delivery times that are by no means certain, thus with the potential to cause significant disruption to production schedules and deliveries to customers [11].

Figure 2 bamboo processing

The following paper sets out to explore the inventory control issues that are prevalent in SMEs, with a particular focus on UD. Suwarno's approach is characterised by its systematic and measurable nature. As asserted by [12], the implementation of suitable inventory control methodologies has the potential to reduce total inventory expenses by 30-40% in SMEs in Indonesia. The Economic Order Quantity (EOQ) method is a well-established and effective approach for determining the optimal order quantity that minimises total inventory costs [1]. As demonstrated in the research conducted by [13], the implementation of suitable inventory planning methodologies within coffee processing MSMEs has been shown to enhance cost efficiency by up to 25%. Concurrently, a study by [11] on Pigope SMEs successfully minimized storage costs by optimizing the quantity of raw material orders. Nevertheless, the implementation of the EOQ method in bamboo craft SMEs remains comparatively restricted, particularly in light of the distinctive characteristics of the traditional craft industry.

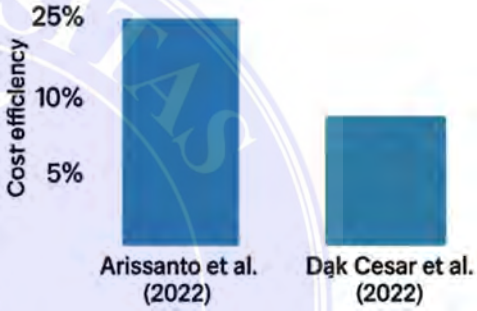

Figure 3 efficiency comparison

The present study proposes a novel application of the EOQ model to a bamboo processing company that is yet to implement an efficient inventory management system. The proposed quantitative solution is designed to reduce the costs associated with the ordering and storage of raw materials, whilst ensuring their availability in a timely manner for production requirements [14]. The application of EOQ can be a cost-effective model for small and medium-sized enterprises (SMEs) in similar industries.

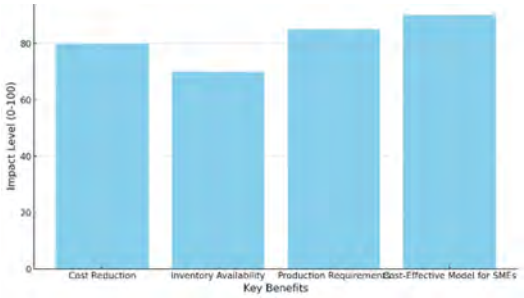

Figure 4 EOQ Model Benefits in Bamboo Processing Company

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Recent research on inventory management in small and medium-sized enterprises (SMEs) has increasingly focused on the application of the EOQ method. The EOQ model has been successfully implemented in various industries, including manufacturing and retail, with the objective of optimising inventory levels and reducing costs [15]. [16] posits that the implementation of EOQ in the context of raw material inventory control has been demonstrated to engender a substantial reduction in operational inefficiency, thereby ensuring the seamless facilitation of production. Furthermore, advances in software tools and real-time data analysis have enhanced the precision of EOQ calculations, empowering businesses to adopt dynamic models tailored to fluctuating demand [17].

Although the efficacy of EOQ has been demonstrated in numerous contexts, there is a paucity of research specifically addressing its application in the bamboo craft industry, including UD. Suwarno's occurrence remains sporadic. The present study thus offers empirical and applicable contributions that serve to fill the extant literature gap, while providing practical guidance for traditional craft entrepreneurs in managing raw materials more efficiently.

Table 1 State Of The Art

Researcher	Industry	Cost Efficiensy (%)	EOQ Method
Goyal & Gunasekaran (1995) [18]	General Manufacturing	15	Classic
Putra et al. (2021) [19]	SME Food Processing	23	Classic
Marwanto et al. (2020) [10]	Bamboo weaving Industry	12	Modified
Lestari & Nugroho (2022) [20]	Home-scale Batik Industry	18	Classic + Safety Stock
Wijaya et al. (2023) [21]	SME with Digitalized Warehouse	25	EOQ + Information System

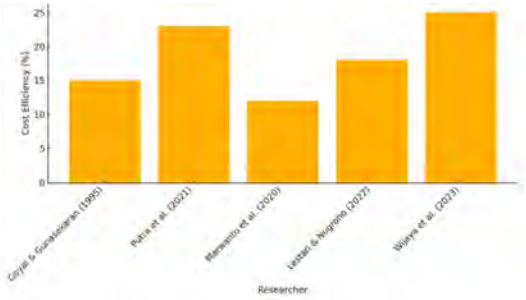

Figure 5 cost Efficiency after EOQ Implementation based on Research

RESEARCH METHODS

This research was conducted at UD. Suwarno, a bamboo craft business located in Desa Kwala Madu, North Sumatra. The study period started in March 2023, covering one year of procurement and usage data. This research is of a descriptive quantitative nature. The objective of this study is to provide a comprehensive analysis of the current state of raw material inventory control within the company, with a view to calculating the economic ordering value (EOQ), a key metric in reducing costs.

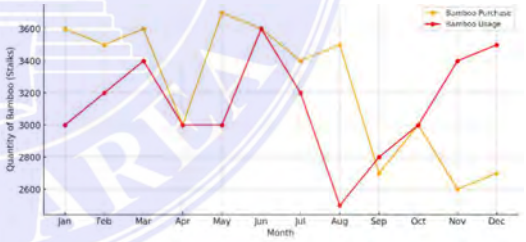

Figure 6 Bamboo purchase and usage chart in 2023

Data collection involved:

- Observation of production and inventory activities [22].
- Interviews with the owner and production staff.
- Documentation of inventory records, purchase quantities, and cost data.

Primary Data:
Obtained through field observation and interviews.

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Secondary Data: Includes purchasing records, inventory levels, ordering costs, storage costs, and literature such as textbooks, journals, and previous research.

Operational Definitions

- Inventory Control: Activities to determine the optimal amount and timing of raw material purchases.
- EOQ: A method to determine the most economical ordering quantity that minimizes total inventory costs.

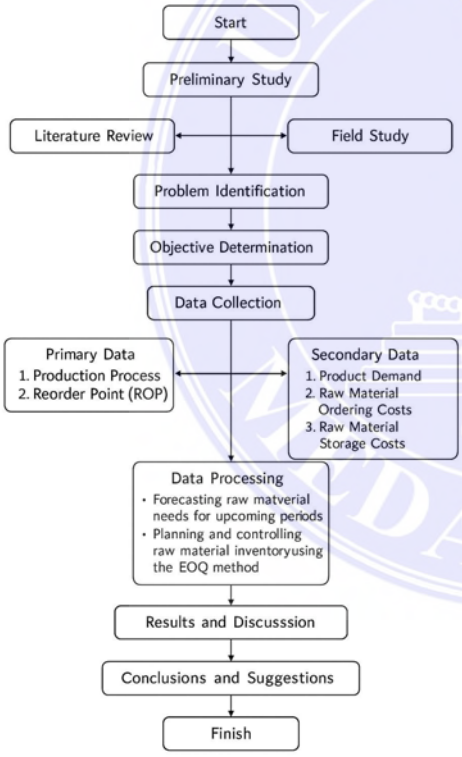

Figure 7 flowchart

Analytical Steps

- Preliminary Study: Identifying problems in inventory practices.
- Data Collection: Monthly data on bamboo usage, ordering, costs, and lead time.
- EOQ Calculation:

$$EOQ = \sqrt{\frac{2D}{H}} \quad \text{.....(1)}$$

- Reorder Point (ROP):

$$ROP = Lead\ Time\ x\ Daily\ Usage \quad \text{.....(2)}$$

- Total Inventory Cost (TC):

$$\left(\frac{D}{Q}xS\right) + \left(\frac{Q}{2}xH\right) \quad \text{.....(3)}$$

Table 2 Bamboo Procurement and Usage (2023)

Month	Procurement (Sticks)	Usage (Sticks)
January	3,600	3,000
February	3,500	3,200
March	3,600	3,400
April	3,000	3,000
May	3,700	3,000
June	3,600	3,600
July	3,400	3,200
August	3,500	2,500
September	2,800	2,800
October	3,000	3,000
November	2,600	3,400
December	2,700	3,500

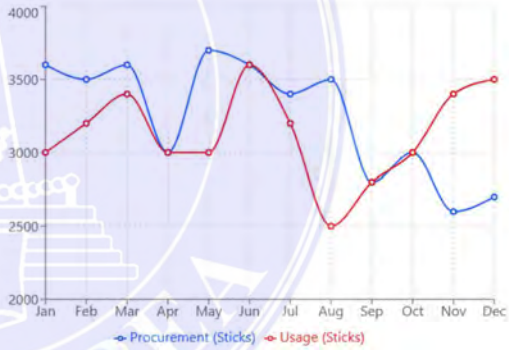

Figure 8 Bamboo Procurement and Usage (2023)

Table 3 Inventory Cost Comparison

Cost Component	Actual Method (Rp)	EOQ Method (Rp)
Ordering Cost	10,500,000	82,978,274
Holding Cost	1,200,000	483,862
Total Inventory Cost	242,100,000	**83,462,136**

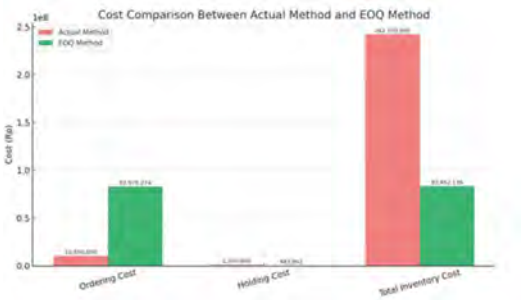

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Figure 9 cost comparison between actual method and EOQ method

ANALYSIS AND EVALUATION

The actual system at UD. Suwarno triggers orders roughly every 4 days, which incurs higher administrative and operational costs. The EOQ model shows that ordering less frequently in larger quantities (3885 sticks per order) reduces costs substantially.

Holding and Ordering Cost Balance

EOQ achieves an optimal trade-off between ordering cost and holding cost:

- Ordering cost increases in EOQ due to larger volume, but
- Holding cost dramatically decreases, resulting in a net lower total inventory cost.

Reorder Point (ROP)

Without a clearly defined ROP, the actual method risks stockouts, especially during peak demand. EOQ introduces ROP = 288 sticks, based on 2 days lead time and average daily consumption (144 sticks/day), ensuring smoother operations.

Table 4 Inventory Cost Comparison

Method	Ordering Cost (Rp)	Holding Cost (Rp)	Total Inventory Cost (Rp)
Actual (2023)	240,900,000	1,200,000	242,100,000
EOQ	82,978,274	483,862	**83,462,136**
Savings	–	–	**158,637,864**

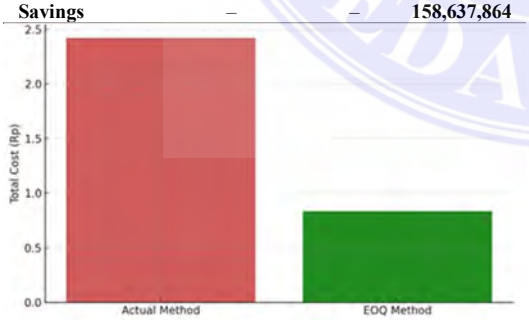

Figure 10 Inventory Cost Comparison

Table 5 Inventory Metrics Comparison

Metric	Actual Method	EOQ Method
Order Frequency (per year)	96	10
Order Quantity (sticks)	406 (avg.)	3,885
Reorder Point (ROP)	Not defined	288

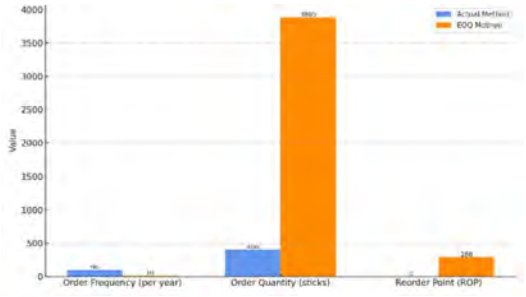

Figure 11 Inventory Metrics Comparison

- Efficiency: The EOQ method reduces total inventory cost by nearly 66%.
- Planning: The actual method lacks reorder point and standardized planning, increasing the risk of stockouts.
- Control: EOQ provides better inventory control through fixed order quantity and reorder timing.
- Sustainability: EOQ supports more predictable and efficient operations.

CONCLUSION

This study is founded on the research findings regarding the application of the Economic Order Quantity (EOQ) method to the raw material inventory system at UD. Suwarno's analysis yielded several noteworthy conclusions. An evaluation of the existing inventory control system at the company revealed its inefficiency, as evidenced by a high total inventory cost of Rp 242,100,000 per year. The underlying causes of this condition were identified as a lack of structured planning, the absence of a reorder point mechanism, and frequent ordering in small quantities.

The Enterprise Order Quantity (EOQ) method was implemented to determine the optimal order quantity and ideal ordering frequency. The EOQ model indicated that the optimal order quantity was 3,885 bamboo sticks per order, and the ideal ordering frequency was 10 times per year. Furthermore, the establishment of a reorder point at 288 sticks ensures that the company can avoid stockouts during lead time. The implementation of this

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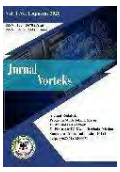

methodology led to a substantial reduction in total inventory costs, amounting to Rp 83,462,136. This represents a cost savings of approximately Rp 158,637,864, which is equivalent to nearly 66% of the previous system's costs.

The findings of this study demonstrate that the EOQ method provides a more efficient, structured, and cost-effective approach to inventory control. In addition to enhancing financial efficiency, the method facilitates more precise planning and contributes to production continuity by minimizing overstocking and stock shortages.

Therefore, it is strongly recommended that UD. Suwarno implements the EOQ-based inventory control model as a standard operating procedure. This course of action will have two primary benefits. First, it will enhance inventory performance. Second, it will support the company's operational sustainability and strategic decision-making in the long term.

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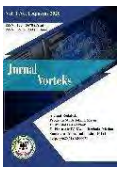

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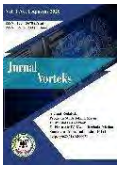

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