Analysis of Inventory Management in UD. Bintang Antik Sejahtera Tulungagung

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ARTICLE INFO

Article history:
Received : 20 Juni 2025
Accepted : 23 Juni 2025
Available : 23 Juni 2025

Keywords:
Inventory Management, Traditional Models, Just-in-Time (JIT), Theory of Constraints (TOC), Marble Craft Industry.

ABSTRACT

This research analyzes the inventory management practices at UD. Bintang Antik Sejahtera, a marble crafts industry located in Tulungagung, Indonesia, with a focus on enhancing operational efficiency. The study critically evaluates the application and effectiveness of Traditional models (Economic Order Quantity - EOQ, Reorder Point - ROP), Just-in-Time (JIT) principles, and the Theory of Constraints (TOC). A qualitative descriptive methodology was utilized, involving extensive data collection through in-depth interviews, direct observations, and comprehensive document and literature reviews. The data underwent thematic analysis to uncover key patterns and strategies, with a supplementary quantitative analysis using EOQ and ROP formulas. The study reveals that the company employs a hybrid inventory management model, where EOQ and ROP aid in determining optimal order quantities and timing. JIT principles are applied through a make-to-order production system and the maintenance of minimal inventory levels. Simultaneously, TOC assists in pinpointing critical constraints such as material supply issues and production bottlenecks. The integration of these three distinct approaches has demonstrably led to improvements in operational efficiency, enhanced cost control, and increased adaptability to dynamic environmental challenges. This research concludes that a combined inventory management strategy, balancing traditional models with JIT and TOC, provides significant strategic advantages for small, craft-based enterprises, fostering greater operational resilience and supporting sustainable inventory practices, particularly in resource-constrained settings.

1. INTRODUCTION

Inventory is a crucial component in a company's operations, especially in sectors that rely on the availability of raw materials and require precise production planning, such as the marble crafting industry. Efficient inventory management can reduce operational costs, optimize resource use, and maintain customer satisfaction (Chopra & Meindl, 2020). However, many micro, small, and medium enterprises (MSMEs) still face challenges in applying inventory management effectively, particularly due to fluctuating demand, regulatory restrictions, and limitations in technology adoption (Ivanov & Dolgui, 2020). Preliminary observations at UD. Bintang Antik Sejahtera, a marble crafting business in Tulungagung, reveal persistent issues in raw material availability, storage constraints, and the need for production flexibility. These challenges are compounded by environmental regulations and weather-related disruptions that affect the supply chain. Despite limited capacity, the company manages to survive and adapt using a unique combination of production strategies and partnerships with local artisans, reflecting a strong contextual resilience (Christopher & Peck, 2004).

Previous research on inventory management has largely focused on individual methods such as the Economic Order Quantity (EOQ), Just-in-Time (JIT), or the Theory of Constraints (TOC). However, studies that integrate these approaches in a practical setting—especially within MSMEs in the traditional crafts sector—remain limited. This creates an opportunity to explore a hybrid inventory strategy that aligns theory with real-world constraints (Fullerton, McWatters, & Fawson, 2003).

In the last two years, the urgency for efficient inventory systems has intensified due to increased market competition, supply chain disruptions, and shifts toward digitalization. This is particularly relevant in Indonesia, where MSMEs are encouraged to implement leaner and more adaptive business models. Moreover, local policies on natural resource management have had a direct impact on raw material acquisition, requiring businesses to revise their inventory strategies.

The main problem addressed in this study is how UD. Bintang Antik Sejahtera manages its inventory using a combination of traditional models, Just-in-Time (JIT), and the Theory of Constraints (TOC) within the context of real operational constraints. The study aims to analyze the inventory management system implemented at UD. Bintang Antik Sejahtera, evaluate the effectiveness of integrating various models including Economic Order

Quantity (EOQ), Reorder Point (ROP), JIT, and TOC, and identify the most critical constraints in the production process while exploring how the company adapts to these challenges in its day-to-day operations.

The originality of this study lies in its integrated analysis of three inventory management approaches within a single MSME case, offering practical insights into flexible inventory control for resource-based, craft-oriented businesses. The scientific novelty is the contextual adaptation of theoretical models to a small business environment impacted by dynamic market and regulatory conditions.

2. LITERATURE REVIEW

Inventory management is a vital component in ensuring the operational efficiency of a company, especially for manufacturing-based MSMEs such as those in the marble crafts industry. Various inventory models have been developed and applied in practice, each offering distinct advantages and limitations.

Traditional Inventory Management Models are foundational approaches widely used before the development of modern inventory management systems. These models primarily emphasize balancing product availability and cost efficiency, focusing on controlling stock levels, ordering costs, holding costs, and the risk of stockouts. Traditional models are typically applied in mass production systems and businesses with predictable demand patterns. Wild (2017) emphasizes the importance of forecasting and cyclical ordering in traditional systems, where demand is assumed to be stable.

Traditional Inventory Management, including Economic Order Quantity (EOQ), Reorder Point (ROP), and Safety Stock, are widely used due to their simplicity and quantitative clarity. One of the main pillars in traditional inventory models is the Economic Order Quantity (EOQ) method. EOQ is a mathematical approach used to determine the most efficient quantity of goods to purchase or produce at one time, specifically the amount that minimizes total inventory costs. These costs consist of ordering costs and holding costs. This model assumes that demand is constant, lead time is fixed, and there are no quantity discounts. Mohamad, Ma'arif, and Gunawan (2016) found that implementing EOQ can reduce total inventory costs by up to 15% in distribution companies.

Than, Reorder Point (ROP) is another crucial part of the traditional model. ROP is the minimum stock level at which a new order must be placed to ensure the company doesn't run out of goods during the lead time. ROP is vital for

maintaining operational continuity, especially if a company has a significant delivery lead time. According to Nahmias & Olsen (2015) in Production and Operations Analysis, ROP calculated by considering variations in demand and lead time can help avoid the risk of stockouts and maintain customer satisfaction. ROP is often accompanied by the calculation of safety stock, which is a reserve stock to anticipate demand fluctuations or delivery delays.

However, as noted by Shukla & Jharkharia (2013), these models rely on ideal assumptions such as constant demand and fixed lead times, which rarely align with the dynamic realities faced by MSMEs like UD. Bintang Antik Sejahtera.

Just-in-Time (JIT) is another widely adopted approach that focuses on inventory minimization and waste elimination. Originally developed by Taiichi Ohno (1998) at Toyota, JIT emphasizes demand-driven production, minimal inventory, and close supplier relationships.

According to Mankazana and Mukwakungu (2018), Just-in-Time (JIT) relies on several interconnected key principles that work together to create an efficient and responsive production system. The pull system ensures that production is driven by actual demand rather than forecasts, similar to how supermarkets reorder stock only when it is nearly depleted. The principle of zero inventory aims to eliminate overstocking, thereby significantly reducing holding costs. Continuous improvement, or Kaizen, involves the ongoing refinement of production processes to eliminate all forms of waste. Strong supplier relationships are also essential, as they enable timely and reliable delivery of materials. Lastly, quality at the source ensures that every component meets high standards from the beginning, preventing production defects and the need for rework.These five principles work in an integrated manner to create a production system that is lean, efficient, and responsive to market demand.

Fullerton, McWatters, and Fawson (2003) demonstrate that JIT, when combined with cost management systems like Activity-Based Costing, can significantly enhance financial performance. However, the successful implementation of JIT requires a high degree of supply chain reliability and production discipline, which can be difficult for small-scale firms that depend on variable raw material availability and manual labor (Rahman, Laosirihongthong, & Sohal, 2010).

Theory of Constraints (TOC), developed by Goldratt (1984), offers a systemic approach to continuous improvement by identifying and managing

bottlenecks. TOC views performance as limited by constraints—either internal (e.g., production capacity) or external (e.g., supply chain disruptions).

According to Hansen and Mowen (2013), the Theory of Constraints (TOC) evaluates performance based on three key metrics: throughput, inventory, and operating expenses. Throughput refers to the rate at which a company generates money through sales and is calculated as the difference between sales revenue and unit-level variable costs such as materials and electricity, while direct labor is typically treated as a unit-level fixed cost and is generally excluded from this calculation. Throughput is closely related to the contribution margin. Inventory represents all the money a company invests in transforming raw materials into finished goods that contribute to throughput. Operating expenses include all the costs an organization incurs to convert inventory into throughput, encompassing a wide range of overhead and fixed operational costs.

Gupta and Boyd (2008) argue that TOC provides strategic advantages by focusing improvement efforts on critical limitations. Nevertheless, TOC requires in-depth knowledge of system flows and may be less effective if the constraints are not well-defined or if management lacks control over external limitations.

In the context of MSMEs, especially in Indonesia's craft sector, these models must often be adapted to suit resource constraints and fluctuating demand. The integration of EOQ, JIT, and TOC—as applied in this study—offers a hybrid approach that aligns theoretical models with practical realities. This research aims to develop a more flexible and adaptive inventory strategy, building on the strengths of each method while addressing their limitations through contextual application. The theoretical foundation of this study is thus constructed from a combination of quantitative inventory planning (EOQ and ROP), lean production philosophy (JIT), and constraint-based process improvement (TOC). The models are not only used for descriptive analysis but also as tools to evaluate and optimize the company's current inventory practices.

3. METHODS

This study adopts a qualitative descriptive approach with a case study design, aiming to gain an in-depth understanding of the inventory management practices implemented by UD. Bintang Antik Sejahtera, a marble crafts business located in Tulungagung, East Java, Indonesia. The qualitative method is chosen to explore real-world inventory practices in the context of

small-scale production under dynamic environmental and market conditions. The research focuses on analyzing the application of three inventory management models—Traditional (EOQ and ROP), Just-in-Time (JIT), and Theory of Constraints (TOC)—in supporting operational efficiency, reducing costs, and managing production constraints.

The objective of the study is to evaluate how the integration of Traditional Models, JIT, and TOC can enhance inventory performance in a small business context. While no explicit statistical variables are tested, the implicit variables include ordering quantity, lead time, inventory levels, throughput, and production constraints.

Data were collected using several techniques to ensure comprehensive coverage of the company's inventory management practices. In-depth interviews were conducted with the owner and staff to obtain detailed information on raw material procurement strategies, demand patterns, production systems, and daily inventory management activities. Participant observation was employed to directly monitor operational processes, including the flow of procurement, storage of raw materials, and distribution of finished products. Documentation analysis was also conducted by reviewing internal records such as purchase orders, demand reports, production schedules, and other relevant logistical data. Additionally, a literature review was undertaken to strengthen the theoretical foundation and provide a framework for analyzing field data, particularly related to the Economic Order Quantity (EOQ), Reorder Point (ROP), Just-in-Time (JIT), and Theory of Constraints (TOC) inventory management models.

The subjects of this study include the business owner, production and procurement staff, and affiliated local craftsmen. The focus is on raw material procurement (primarily marble), production lead times, inventory turnover, and bottleneck management. Data were analyzed using thematic analysis to identify patterns related to inventory decision-making and the application of various inventory models. In addition to the qualitative approach, limited quantitative analysis was employed to support the findings. The Economic Order Quantity (EOQ) was calculated using the basic EOQ formula based on estimated annual demand, ordering costs, and holding costs to evaluate the efficiency of the company’s raw material ordering policy. The Reorder Point (ROP) was determined to establish the ideal point for reordering, ensuring raw material availability without resulting in excess stock. The Just-in-Time (JIT) approach was assessed to understand how effectively the company minimizes waste and increases efficiency by synchronizing raw material procurement

with actual production requirements. Lastly, the Theory of Constraints (TOC) was applied to identify the main bottlenecks within the production system and to evaluate how management allocates and optimizes available capacity and resources to address those limitations.

The study follows a model integration approach, in which each inventory method is analyzed separately and then combined contextually. EOQ and ROP are used for planning stock replenishment; JIT is assessed through its application in make-to-order production; and TOC is used to identify and address key production bottlenecks. This study uses a case study method as part of a qualitative strategy, aligning with the nature of MSME operations that require contextual exploration rather than generalization. The research does not rely on structured hypotheses but assumes, implicitly, that the integration of inventory models contributes positively to inventory efficiency and production continuity.

4. RESULTS AND DISCUSSION

Based on the analysis of field data from UD. Bintang Antik Sejahtera, this company demonstrates a flexible and adaptive inventory management approach. It doesn't apply a single inventory management theory but rather a combination of them. The three main approaches examined are the Traditional Model (EOQ and ROP), Just-in-Time (JIT), and Theory of Constraints (TOC). Each approach is applied contextually, adapting to the operational needs and challenges the company faces. The findings presented here respond to the research questions regarding how each model is applied, adapted, and integrated into the company's operations.

Based on the data presented, the analysis of the Traditional Model using the Economic Order Quantity (EOQ) formula provides valuable insight into the company's inventory ordering efficiency. Using the EOQ formula where the annual demand (D) is 2,000 units, the ordering cost per order (S) is Rp 500,000, and the holding cost per unit per year (H) is Rp 200,000, the calculation results in an EOQ of 100 units, which is then rounded up to 110 units for greater operational flexibility. This indicates that the optimal ordering quantity for marble raw material from local sawmills is 110 units per order. By following this ordering quantity, the company can achieve efficiency in total inventory costs by balancing the trade-offs between ordering and holding costs. This is particularly important for UD. Bintang Antik Sejahtera, which operates with limited warehouse space and must avoid excessive stock while ensuring continuous raw material availability for production.

The Reorder Point (ROP) is calculated using the formula, where the annual demand is 2,000 units, the number of working days in a year is 300, and the lead time is 5 days. This results in an ROP of $5 x times (2000/300) = 5 x times 6.67 = 33.3$, which is rounded up to 40 units. This means the company should reorder raw materials when inventory levels reach 40 units to ensure there is no shortage during the 5-day lead time. This value is particularly important for maintaining continuous production, especially when facing sudden demand from end-users. While this traditional model is predictive and assumes stable demand patterns, UD. Bintang Antik Sejahtera has successfully applied it in a practical context by adapting it to fluctuating demand and limited supply availability. In this regard, EOQ serves as a reference for optimal order quantities, and ROP functions as a key trigger point that helps the company avoid the risk of stockouts and maintain uninterrupted operations.

UD. Bintang Antik Sejahtera implements a Just-in-Time (JIT) approach primarily through a make-to-order system, in which production begins only after customer orders are confirmed. This strategy minimizes the need for raw material storage and significantly reduces the risk of inventory waste or product obsolescence. The JIT model offers cost-efficiency and operational flexibility, as the company avoids maintaining large inventory levels, adhering closely to JIT's zero-inventory philosophy. However, unlike large-scale manufacturing environments, a complete zero-inventory system is not fully feasible for the company due to several external constraints. These include the weather-dependent nature of raw material supply, regulatory restrictions in local marble mining, and the variable availability of skilled artisan labor.

The Just-in-Time (JIT) system appears to be predominantly implemented by UD. Bintang Antik Sejahtera, as reflected in its production model that is strictly based on actual customer orders, or make-to-order, which helps the company avoid the buildup of finished goods inventory. Inventory levels are kept minimal, with only raw materials that are currently being processed or are immediately needed for upcoming orders being maintained. This lean approach requires close coordination with artisan partners and local suppliers, highlighting the importance of strong relationships across the value chain to ensure timely and reliable delivery of materials and services. To manage the risks associated with fluctuating demand and limited resources, the company collaborates with 30 to 50 local craftsmen as needed. This strategy allows for rapid production scalability and reinforces a community-based supply network, showcasing an adaptive and flexible implementation of JIT that is well-suited to the company's small-scale, highly customized production environment.

Managing constraints through the Theory of Constraints (TOC) framework reveals several critical bottlenecks in the operations of UD. Bintang Antik Sejahtera. The primary constraint identified is the availability of raw marble, which is significantly affected by local mining regulations and weather conditions that can disrupt the consistency of supply. In addition to this, a secondary constraint is found in the availability of skilled labor, particularly for marble cutting and finishing processes, which require specialized craftsmanship that is not easily or quickly replaceable. These constraints limit production flow and must be carefully managed to ensure operational continuity and customer satisfaction. The company's ability to identify and adapt to these limitations is a key factor in maintaining production efficiency under resource-constrained conditions

The company directs its improvement efforts toward addressing bottlenecks such as the availability of raw marble and the cutting process, which are critical constraints in its operations. To manage production capacity during periods of high demand, the company distributes work to partner craftsmen, enabling more flexible and scalable output. The primary constraint stems from raw material supply, which is restricted by regional mining regulations and weather conditions that can delay delivery. In applying the Theory of Constraints (TOC), the company focuses on three key performance metrics: throughput, inventory value, and operating expense. Throughput, estimated at Rp 1.92 billion per year, is calculated from the contribution margin per unit multiplied by annual production volume. Inventory value is approximately Rp 60 million, assuming around 50 units are in process at any given time, while monthly operating expenses amount to about Rp 50 million, covering salaries, utilities, and other fixed costs.

These figures highlight that although financial performance remains stable, effective constraint management is essential for maintaining throughput and ensuring operational continuity. To address its constraints, the company outsources part of its production during peak demand periods (exploitation), synchronizes production activities with key limitations such as raw material deliveries and cutting schedules (subordination), and improves production flow by rotating skilled workers and prioritizing orders based on urgency (elevation).These strategies align with TOC’s five-step focus improvement process, showing that even small firms can implement high-level process improvement frameworks when adjusted to their context.

The company focuses its improvements on bottlenecks like the availability of raw marble and the cutting process. They also manage production capacity

by distributing work to partner craftsmen when facing surges in demand. The company's primary constraint stems from raw material supply, which is limited by regional regulations and weather. Furthermore, management also focuses on optimizing work sequences, setting order priorities, and rotating labor, ensuring that bottlenecks don't cause overall process delays.

The importance of these findings lies in demonstrating that small-scale craft industries can effectively combine multiple inventory models—not as isolated systems but as a strategic mix adapted to their constraints and opportunities. EOQ and ROP provide structured planning, JIT ensures responsiveness and efficiency, and TOC enables the firm to identify and continuously improve its weakest operational points. This integrated approach provides valuable insights for other MSMEs, particularly those in resource-dependent industries, in how to manage inventory dynamically in the face of regulatory, environmental, and capacity-related challenges.

Table 1. Application of Inventory Management Models

Inventory Model	Key Characteristics Applied	Contextual Adaption	Operational Implement
Traditional Models	Material procurement is adjusted based on demand trends. Attempts to minimize holding costs.	Used for routine planning of marble stock. Seasonal demand and project-based fluctuations affect quantity.	**Ordering materials such as marble blocks as per estimated future needs. Monitoring stock levels manually and digitally.**
Just-in-Time (JIT)	Minimized inventory holding. Orders placed when demand arises.	Applied for customized or made-to-order products. Reduces excess stock and optimizes cash flow.	**When a customer places an order, production starts immediately. Close coordination with artisans and suppliers**
Theory of Constraints (TOC)	Identifies bottlenecks such as limited skilled labor or raw material regulations. Focus on optimizing production flow.	Applied when facing labor shortages or raw material delivery delays due to weather or regional regulations.	**Collaboration with local craftsmen (30–50 artisans) to increase capacity. Adjusts workflow to avoid overloading limited resources.**

Source: Secondary data processed, 2025

These results indicate that although the company operates primarily on a make-to-order basis, EOQ and ROP calculations still serve as important benchmarks, particularly when preparing for predictable seasonal demand

increases. The traditional inventory model offers structural guidance for replenishment without encouraging excessive stockpiling, which is crucial for a company with limited storage capacity. To support this, the company applies basic quantitative tools such as Economic Order Quantity (EOQ) and Reorder Point (ROP) to manage procurement timing and volume. Based on the data collected, the EOQ was calculated at 110 units, striking an optimal balance between ordering and holding costs, while the ROP was set at 40 units, derived from a 5-day lead time and an average daily demand of 6.67 units.

These calculations help ensure that raw material availability is maintained without overburdening storage space, allowing the company to sustain efficient and responsive production operations. This aligns with the view that identifying and managing operational costs—such as those related to inventory ordering and holding—is crucial for building sustainable business strategies

5. CONCLUSION

The findings of this research indicate that UD. Bintang Antik Sejahtera applies a hybrid inventory management strategy by integrating Traditional Models (EOQ and ROP), Just-in-Time (JIT), and Theory of Constraints (TOC), which collectively support the company's operational efficiency and resilience. The study answers the research problem of how inventory is managed under practical constraints by showing that traditional models help the company structure its procurement planning, JIT minimizes inventory levels through make-to-order production, and TOC helps identify and manage bottlenecks such as limited raw material access and skilled labor availability. This integrated approach aligns with the study's objective to evaluate the effectiveness of combining inventory models in a real-world context and demonstrates that small craft-based enterprises can enhance production flow, reduce costs, and adapt to supply chain uncertainties through model contextualization. The originality of this study lies in its practical application of three inventory management theories simultaneously in a small-scale business environment, which contributes not only to academic discourse but

also provides actionable insights for MSMEs facing similar challenges in inventory control and production capacity management.

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