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An Analysis of Steel Material Inventory Management Using the Just-in-Time (JIT) Approach: A Case Study at PT XYZ

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Abstract

This study investigates the problem of excessive raw material inventory at PT XYZ, driven by a misalignment between procurement planning and actual production demand, which has led to higher storage costs and operational inefficiencies. The research aims to analyze the root causes of inventory control issues and design an optimized inventory management system using the Just-In-Time (JIT) approach. A qualitative methodology with a social situation framework was applied, incorporating direct observations, in-depth interviews with warehouse managers and staff, and secondary document analysis. Triangulation techniques were used to ensure data credibility and reliability. Findings indicate that JIT implementation reduces inventory excess, optimizes storage utilization, strengthens coordination between departments and suppliers, lowers unnecessary costs, and improves service quality. The study contributes to the understanding of JIT application in the automotive industry, with novelty demonstrated through PT XYZ's shift from traditional inventory methods to JIT. The research concludes that JIT is an effective solution for addressing inventory control challenges and suggests that its adoption could serve as a model for other manufacturing firms seeking to enhance inventory efficiency and competitiveness.

Keywords: Inventory Control; Just-In-Time; Raw Material Management; Manufacturing Industry; PT XYZ

INTRODUCTION

The manufacturing sector in Indonesia has experienced rapid growth and has become the backbone of national economic development. Its contribution to the Gross Domestic Product (GDP) is significant, accompanied by a high ability to create added value. The Ministry of Industry recorded that in 2020, the industrial sector's contribution reached 19.8%, surpassing the global average of 16.5% (Sebtaoui et al., 2020). This confirms the vital role of this sector as a leading sector, meaning it is capable of driving the growth of other sectors, such as agriculture and services (Kumar & Sasirekha, 2024).

The growth of the manufacturing industry also affects various aspects of development, from the supply of raw materials to the establishment of supporting institutions such as finance and marketing (Heitasari et al., 2025). However, data from the Central Statistics Agency shows fluctuations in Indonesia's manufacturing industry growth: 4.27% in 2018, declining to 3.8% in 2019, even contracting to -2.93% in 2020 (Vamsi Krishna Jasti & Kodali, 2014). Nevertheless, recovery began in 2021 with growth of 3.39% and continued increasing to 4.89% in 2022. This recovery highlights the need for stronger strategies and managerial efficiency to maintain sustainable growth in the manufacturing sector (Hamal et al., 2024).

One crucial aspect of the manufacturing industry is raw material inventory management. Inefficient management can cause imbalance between demand and stock availability, leading to storage costs, product damage, and disruption in the production process (Roy, 2020). Therefore, companies need to design an efficient and adaptive inventory management system responsive to market demand dynamics (Suflani et al., 2023).

PT XYZ, a manufacturing company engaged in producing vehicle components such as coil springs and U-bolts, faces similar challenges. As part of the APM Group operating regionally in ASEAN, PT XYZ is strongly committed to becoming a global player with high production and service standards. However, internal data shows that in September 2024, raw material iron inventory accumulated up to 2,820 units due to inaccurate inventory planning based on forecasts from business partners like Daihatsu (Ratnamurni et al., 2022).

The main problem faced by the company is the absence of a systematic and efficient inventory control system, resulting in excess stock that burdens operational costs (Kim & Takeda, 1996). On the other hand, stock shortages can also hinder smooth production. To address this, the implementation of the Just In Time (JIT) method becomes a relevant alternative solution. This method focuses on continuous improvement through waste reduction, production efficiency enhancement, and strengthening supplier relationships (Wafa & Yasin, 1998).

Just In Time aims to provide raw materials in the right amount, at the right time, and in the right place, allowing the company to reduce storage costs, improve product quality, and accelerate response to market demand (Aprila et al., 2023). By applying this approach, PT XYZ is expected to optimize its inventory system, reduce unnecessary costs, and increase its competitiveness in the global market.

This study offers novelty in the application of the Just In Time (JIT) method specifically focused on controlling iron material inventory rather than general raw materials in the automotive industry, particularly in companies producing coil springs and U-bolts (Suci Nurrohimmah et al., 2023). This approach has rarely been integrated into medium-scale manufacturing companies in Indonesia, especially in managing stock based on actual demand from key customers such as Daihatsu. The study also utilizes actual stock and forecast data, which are often overlooked in inventory decision-making, thus filling a gap in supply chain management research in the automotive component sector.

The objective of this research is to design an iron material inventory control system using the Just In Time (JIT) approach at PT XYZ so that the company can manage stock efficiently and responsively to market demand. Through this approach, the company is expected to avoid both excess and shortage of stock, which impact operational costs and production continuity. In addition, this study aims to provide systematic recommendations for management in formulating raw material procurement policies, thereby creating a leaner, more effective, and sustainable production process.

METHODS

This study employs a qualitative approach using a case study method aimed at an in-depth examination of the iron material inventory control system at PT XYZ and analyzing the application of the Just In Time (JIT) method to improve storage efficiency and accuracy

in raw material procurement (Madanhire & Mbohwa, 2016). This approach was chosen because it can capture the dynamics of company policies and operational practices contextually through direct interaction with parties involved in raw material management. The study also refers to Spradley's concept of the "social situation," which includes three main elements: place, actors, and activities. The place in this study is the operational environment of PT XYZ, with the main actors being the Warehouse Manager and warehouse staff who are actively involved in inventory control activities. The activity performed was the warehouse manager demonstrating the entire process, from the initial material intake to the final packing stage for shipment to the customer. The research was conducted from November 2024 to January 2025.

Snowball sampling technique was used to determine informants, starting from a key informant namely the Head of Warehouse at PT XYZ, the scope was then expanded to include warehouse staff and production staff, aiming to enrich data and understanding of the system being implemented. The data sources consist of primary and secondary data (Quan et al., 2022). Primary data were obtained through direct observation of warehouse activities and raw material distribution processes, as well as in-depth interviews with the Warehouse Manager and staff responsible for inventory management (Kelkar, 1999). The purpose of the interviews was to understand the existing work procedures, challenges faced, and their perceptions regarding the possible implementation of the JIT method (Khoza et al., 2022). Meanwhile, secondary data were collected from company documentation, such as inventory reports, data on order discrepancies, and standard operating procedure (SOP) documents related to inventory management (Truong, 2023).

To ensure the credibility and validity of the data, the researcher applied source and method triangulation, comparing data from observations, interviews, and documents to obtain more valid information. This study also adopted qualitative validity principles, including credibility (truth value), transferability (contextual generalizability), dependability (consistency), and confirmability (objectivity) (Sugiyono, 2024).

RESULTS

Identification of Order Discrepancies and Their Impact on Inventory Control

Based on the inventory control data for Daihatsu coil spring raw materials at PT XYZ from September 2023 to September 2024, a significant mismatch was identified

between the available stock and the production requirements. This discrepancy is evident in the recurring remaining stock levels exceeding the company's maximum threshold of 2%. Such a pattern highlights underlying issues in the planning and procurement processes for raw materials.

Tabel 1. Monthly Remaining Stock Exceeding Threshold Limit

Month	Remaining Stock (pcs)	(%)
Sep-23	2.400	3,81
Nov-23	4.300	6,56
Dec-23	8.800	12,83
Jan-24	4.900	7,45
Feb-24	7.050	10,19
Mar-24	2.300	3,65
Apr-24	4.600	6,91
May-24	3.150	5,03
Jun-24	4.350	6,68
Sep-24	2.820	4,32

From Table 1, it is evident that for 10 out of the 13 months monitored, the percentage of remaining stock exceeded the company's established threshold limit of 2%, with the highest peak observed in December 2023, reaching as much as 12.83%. This recurring pattern clearly indicates that the issue of excess inventory is not a one-off event but a persistent problem faced by PT XYZ. Such a pattern suggests systemic inefficiencies in inventory management, particularly in accurately aligning stock levels with actual production requirements. The consistency of this excess stock over an extended period raises concerns about the effectiveness of the existing forecasting and procurement strategies, which appear unable to adapt to changing demands or correct discrepancies in a timely manner.

The buildup of surplus raw materials results in multiple negative consequences for the company's operational and financial health. Firstly, increased storage costs arise from the need to allocate warehouse space for excess stock that remains unused for extended durations. Maintaining such inventory involves expenses related not only to physical space but also to security, handling, and maintenance. Secondly, prolonged storage times elevate the risk of quality degradation of the raw materials. In the case of iron materials used for coil springs, extended storage without proper conditions may lead to corrosion, physical damage, or other quality impairments that render the materials unsuitable for production. This quality

decline can lead to increased wastage, higher rejection rates during production, and ultimately compromises the reliability of the finished products.

Moreover, the inefficiencies associated with managing excess inventory have direct implications for the company's working capital management. Funds that could otherwise be invested in operational improvements, innovation, or expansion are instead tied up in idle stock, limiting the company's financial flexibility. Excess inventory also leads to suboptimal use of storage capacity, constraining the ability to stock materials that are actually needed for current production cycles. This scenario can result in bottlenecks or delays when new or urgent materials cannot be accommodated due to the overcrowded warehouse, thus affecting production schedules and customer delivery times.

The root causes of these inventory mismatches appear to stem primarily from inadequate demand forecasting and lack of coordination between the production and warehouse departments. The disconnect between actual demand signals and procurement planning causes procurement decisions to be based on inaccurate or outdated information. Additionally, the existing forecasting methods may not sufficiently account for fluctuations in customer orders, lead times, or supplier reliability, further compounding the risk of either overstocking or stockouts. Without a dynamic and integrated approach to planning and communication, the company faces continuous challenges in synchronizing supply with demand.

In light of these issues, there is a clear need for PT XYZ to adopt a more agile and responsive inventory control system that can better align procurement with real-time production requirements. One promising approach is the implementation of the Just In Time (JIT) method, which emphasizes the procurement of materials precisely when needed and in exact quantities. This method not only minimizes inventory holding costs but also reduces waste by preventing overstocking. JIT encourages continuous communication and collaboration with suppliers to ensure timely deliveries that match production schedules, ultimately supporting leaner and more efficient operations.

By applying JIT, PT XYZ could potentially reduce the excessive stock accumulation while simultaneously improving the overall flow of the production process. This method fosters a production environment where inventory levels are kept low without risking shortages, which helps to lower costs associated with storage and material obsolescence. Additionally, JIT strengthens the partnership between suppliers and the company, promoting

greater transparency and responsiveness throughout the supply chain. Such collaboration can lead to improvements in lead time accuracy, quality assurance, and supply reliability.

Table 2. Company Efforts to Improve Management

No	Aspect Referred To	Efforts Made by the Company	HRM Aspect Explored
1	Company	a) Improving policies b) Striving for clarity in cash flow c) Unassisted cash flow d) Transaction insecurity	*Just In Time* Method
2	Employees	a) Striving for smooth performance and freedom from uncertainty	*Just In Time* Method

Table 2 illustrates the company's efforts to improve its management system by addressing two key areas: internal operations and human resources. On the company side, actions include improving policies, clarifying cash flow processes, addressing unsupported cash management, and minimizing transaction insecurity all aligned with the Just In Time method to enhance efficiency and reduce waste. On the employee side, the company aims to ensure smooth performance and reduce uncertainty in the workplace, also guided by the Just In Time approach. Overall, these efforts reflect a strategic initiative to create a more responsive, efficient, and stable organizational environment.

In conclusion, the adoption of JIT as an inventory control strategy is expected to enhance PT XYZ's operational efficiency and competitiveness in the automotive parts manufacturing industry. The ability to effectively manage inventory not only reduces waste and costs but also allows the company to respond faster to market changes and customer demands. This is particularly crucial in a highly competitive sector where timely delivery and product quality are key differentiators. Ultimately, the implementation of JIT will contribute to a more sustainable and profitable business model for PT XYZ.

Steel Raw Material Inventory Control Planning

The primary objective of inventory control planning is to ensure smooth production operations and cost efficiency. The planning framework is based on three core objectives:

1. Ensuring the availability of inventory to prevent production disruptions and maintain customer satisfaction.

2. Avoiding excessive inventory accumulation to minimize storage and ordering costs.
3. Preventing frequent small-scale purchases that contribute to higher procurement expenses.

Key planning considerations include:

1. **Reduction of Supplier Lead Time**: The company aims to significantly reduce supplier lead time through the implementation of the Just-In-Time (JIT) strategy, thereby minimizing inventory buildup.
2. **Increased Delivery Frequency in Smaller Quantities**: Transitioning from bulk ordering patterns to more frequent, small-quantity deliveries that are immediately used in production.
3. **Implementation of a Pull Production System**: Production activities are initiated strictly based on actual customer demand, reducing the risk of overproduction of finished or semi-finished goods.
4. **Enhancing Quality and Minimizing Defects (Zero Defect Policy)**: Emphasizing perfect quality standards to eliminate the need for buffer inventory due to defective items.
5. **Reduction of Machine Setup Time**: Applying techniques such as Single-Minute Exchange of Dies (SMED) to shorten setup time, enabling smaller production batches.

Control actions are implemented through:

- (1) Determination of optimal inventory levels and revision procedures to balance the risks of stockouts and overstocking.
- (2) Establishment of control levels based on the value and criticality of inventory items.
- (3) Designing control systems that include workflow design, Standard Operating Procedures (SOPs), information systems, inventory policies, and physical storage arrangements.

  Additionally, organizational planning is conducted to clearly define roles, responsibilities, and interdepartmental communication mechanisms.

Implementation of Steel Raw Material Inventory Control

1. **Ensuring Supply Availability**: Maintaining adequate raw material supply to sustain continuous production, thus avoiding schedule disruptions and delayed customer orders due to stockouts.
2. **Optimizing Inventory Quantity**: Focusing on maintaining an efficient inventory volume to avoid overstocking and reduce associated costs such as storage, insurance, maintenance, and working capital allocation.
3. **Optimizing Order Frequency and Quantity**: Preventing high ordering costs (administration, supplier coordination, transportation) by determining the most economical order quantities.

The implementation of JIT factors includes: reducing supplier lead time, increasing delivery frequency in smaller batches, applying a pull-based production system, improving product quality and reducing defects, and minimizing machine setup time. Control measures are executed through interviews, document analysis (SOPs, internal reports), and direct observation to assess stock level determination practices and resource allocation. Organizational planning is reflected in clearly defined roles, responsibilities, and effective interdepartmental communication.

Evaluation of Steel Raw Material Inventory Control

1. **Objective Evaluation**: Assessing success in maintaining supply availability (minimal stockouts), optimizing inventory levels (minimal overstock and related costs), and optimizing order frequency and quantity (reduced ordering costs).
2. **Evaluation of JIT Implementation Factors**: Measuring the impact of reduced supplier lead time, increased delivery frequency, pull system adoption, improved quality, and reduced setup time on inventory efficiency and minimization.
3. **Evaluation of Control Measures**: Comparing the execution stages against initial control planning, including optimal inventory level setting, control level definition, control system design, and organizational planning—to identify issues and corrective actions.

Corrective Actions for Steel Raw Material Inventory Control

Regular evaluations aim to ensure inventory levels remain within safe thresholds and achieve optimal balance. The implementation of Just-In-Time (JIT) has shown transformative and significant impacts on operational efficiency and overall company performance. Key corrective actions focus on continuous optimization informed by JIT results, including:

1. **Inventory Efficiency**: Reducing the average remaining stock percentage from 5.41% to a target of 1.5%, indicating successful minimization of inventory buildup and meeting the efficiency benchmark of under 2%.
2. **Inventory Turnover Acceleration**: Increasing inventory turnover from 329.84 to 1,147.95 times per year, indicating highly dynamic inventory movement.
3. **Reduction in Days Inventory on Hand**: Decreasing average inventory days from 1.11 days to 0.32 days, suggesting near-real-time material usage consistent with JIT ideals.
4. **Cost Optimization**: Significant reductions in storage costs and average stock remaining further validate JIT's effectiveness in minimizing operational expenses.
5. **Production Efficiency Gains**: Reduced machine setup times, lower defect rates, and improved queuing efficiency reflect enhanced production process quality and flexibility for small-batch manufacturing.

In cases where stockouts or overstocking cause operational disruptions, inventory control strategies must be adjusted accordingly. Likewise, if ordering costs become excessive due to inefficient ordering frequencies, procurement volumes must be recalibrated. The comprehensively applied Just-In-Time strategy serves as a continuous improvement mechanism to achieve leaner, more efficient, and market-responsive inventory control.

DISCUSSION

Data on the inventory control of Daihatsu coil spring raw materials at PT XYZ from September 2023 to September 2024 reveals a recurring and significant accumulation of stock. Ten out of thirteen months showed remaining stock percentages exceeding the company's threshold limit of 2%, indicating inefficiencies in the inventory planning and control system. This condition not only results in excessive use of storage space but also increases the risk

of raw material quality deterioration due to prolonged storage periods. Consequently, excess inventory becomes a financial burden that reduces the company's working capital efficiency and weakens its competitiveness in the highly dynamic manufacturing market.

The mismatch between demand planning and raw material procurement is strongly suspected to be caused by suboptimal communication and coordination among the production, warehouse, and purchasing planning departments. The company's conventional forecasting system, which lacks real-time data integration, slows down and diminishes the accuracy of the company's response to demand fluctuations. This finding aligns with Cuatrecasas-Arbós et al. (2015), who emphasize that data integration and cross-functional communication are critical factors determining the effectiveness of inventory control in the manufacturing sector. Therefore, improvements in information systems and internal communication management should become a primary focus.

From a financial perspective, excess stock results in large amounts of working capital being tied up, thereby limiting flexibility for investment in more strategic areas such as technology development and product innovation. This opportunity cost creates potential losses not only in the short term but may also hamper the company's long-term growth. Research by Capkun et al. (2009) confirms that inefficient inventory management significantly impacts the liquidity and profitability of manufacturing firms.

Warehouse management complexity increases as inventory volumes grow. The company must allocate more resources for stock management, security, and maintenance, which adds to operational costs. Errors in record-keeping and the risk of item loss also rise, potentially leading to additional losses. Previous studies by Chira & Muşetescu, (2017) demonstrate that suboptimal stock control directly contributes to operational losses in manufacturing companies.

The Just In Time (JIT) method emerges as a strategic solution proposed to address this issue. JIT eliminates inventory waste by synchronizing raw material procurement precisely with production needs, thereby optimizing storage space utilization and reducing costs related to excess stock. JIT implementation also supports improved end-product quality since the raw materials used are always fresh, minimizing the risk of defects caused by quality degradation during storage. This aligns with the principle of continuous improvement practiced in JIT systems.

The success of JIT implementation also depends on the organization's readiness regarding cross-functional coordination and adequate information technology. PT XYZ must ensure effective communication among suppliers, production, and warehouse teams so that the procurement and usage flow of raw materials runs smoothly and responsively. Without the support of a real-time monitoring system and strong top management involvement, the risk of JIT implementation failure is considerable, as found in Singh et al. (2018).

The practical implications of this study are broad for PT XYZ and similar manufacturing industries. By adopting JIT, the company can reduce storage costs, increase capital efficiency, and continuously improve product quality. From a theoretical perspective, this study reaffirms the importance of integrating information systems and interdepartmental coordination as the foundation for successful inventory control, complementing previous studies that primarily focused on the technical aspects of stock management.

Overall, this research not only identifies the key problems in inventory control at PT XYZ but also offers concrete solutions to improve the company's operational performance. When compared with earlier studies, it is evident that inventory control issues and JIT implementation remain central topics across various manufacturing firms. However, successful adoption heavily relies on the company's internal readiness and the appropriate use of information technology. A limitation of this study is its limited duration. The relatively short duration of the research may not be sufficient to observe the long-term impact of inventory issues or the full results of the JIT implementation. This study focuses more on analyzing the current conditions and providing recommendations rather than evaluating the long-term effects of JIT.

CONCLUSION

This study identifies that PT XYZ faces a serious problem in controlling the inventory of iron material raw materials, characterized by recurring and significant stock accumulation due to a misalignment between procurement planning and production needs. Inventory control planning at PT XYZ focuses on three main objectives: maintaining supply availability without accumulation, avoiding excessive costs from stock accumulation, and suppressing ordering costs from small purchases. Key factors considered in this planning are the implementation of a Just-In-Time (JIT) strategy to reduce supplier lead times, increase

delivery frequency in small quantities, apply a pull system, improve quality (zero defects), and reduce machine setup times. The planned control measures include determining optimum inventory levels, control based on item value and criticality, and designing workflows, Standard Operating Procedures (SOPs), information systems, and the physical arrangement of goods. Organizational planning is also important for establishing roles and responsibilities.

In the implementation of inventory control, PT XYZ strives to maintain supply availability and optimize order quantity and frequency for cost efficiency. JIT factors such as reduced lead time, high-frequency deliveries in small quantities, a pull system, improved quality, and reduced machine setup times are applied. This implementation is supported by interviews, document analysis, and direct observation to understand control practices and resource allocation. The evaluation of inventory control is carried out periodically to assess success in achieving the objectives of availability, optimal quantity, and order frequency. The evaluation also covers the impact of implementing JIT factors (reduced lead time, small deliveries, pull system, quality, setup time) on inventory efficiency. In addition, the implemented control measures are compared with the initial plan to identify problems and opportunities for improvement.

The results of the corrective actions show the transformative impact of JIT implementation, evident from a decrease in the average remaining stock from 5.41% to 1.5%, an increase in inventory turnover from 329.84 to 1,147.95 times/year, and a reduction in days of inventory on hand from 1.11 days to 0.32 days. This also resulted in cost optimization and increased production efficiency through reduced machine setup times, decreased defective products, and increased queue time efficiency. If stockouts or overstocks, as well as high ordering costs, are found, JIT strategy adjustments are made continuously to achieve leaner, more efficient, and responsive inventory control. Overall, this study affirms that JIT implementation can be an effective strategy to reduce excess stock, optimize storage space, and improve the operational efficiency of PT XYZ, while also increasing product quality and company competitiveness.

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