

Comparative Evidence on Inventory Control, Logistics Capability, and Operating Cost Efficiency in Indonesian Manufacturing Companies

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ABSTRACT: Inventory control is a strategic component of manufacturing operations influencing working capital, supply chain performance, and cost efficiency. This study examines how inventory control is associated with operating cost efficiency by comparing pharmaceutical, herbal, and cement manufacturers with distinct logistics characteristics. Using a quantitative exploratory comparative case-study design, secondary financial data from audited annual reports of PT Kalbe Farma Tbk, PT Indocement Tunggul Prakarsa Tbk, and PT Sido Muncul Tbk (2020–2024) were analyzed through descriptive statistics, trend analysis, financial ratio analysis, and comparative case analysis. Key metrics included Days Inventory, Inventory Turnover, COGS-to-Sales Ratio, Operating Expense Ratio, and Cost-Efficiency Proxy. Findings show all three companies improved performance through distinct strategies. Kalbe Farma reduced Days Inventory from 147 to 119 days while expanding logistics revenue contribution. Indocement increased Inventory Turnover from 4.17 to 4.54 times while reducing inventory value by 10.7%. Sido Muncul lowered its Operating Expense Ratio from 21.17% to 20.12%, improving cost efficiency. Comparative analysis confirms that inventory optimization strategies differ substantially across subsectors due to varying product characteristics, regulatory requirements, and distribution systems. The study concludes that improved inventory control associates with better cost performance, though efficiency pathways vary across manufacturing industries.

Keywords: Inventory Control, Inventory Turnover, Days Inventory, Operating Cost Efficiency, Manufacturing Companies, Working Capital Management, Comparative Analysis



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INTRODUCTION

Inventory management has become one of the most critical operational functions in manufacturing companies because it directly influences production continuity, customer service, working capital utilization, and overall organizational efficiency. In increasingly competitive manufacturing environments, firms are expected to maintain sufficient inventory to meet customer

demand while simultaneously minimizing inventory-related costs, including storage, handling, insurance, deterioration, and obsolescence. Achieving an appropriate balance between inventory availability and inventory investment is therefore fundamental to sustainable operational performance. As supply chains become more complex and customer expectations continue to increase, manufacturing companies are required to adopt inventory management practices that improve operational responsiveness without imposing excessive financial burdens. Consequently, inventory control has evolved from a routine warehouse function into a strategic component of supply chain management that contributes significantly to operational excellence and long-term business competitiveness(Bo & Huang, 2025; Simbolon & Lolyta, 2021).

The strategic importance of inventory control has become even more evident following global supply chain disruptions experienced during the coronavirus disease pandemic. Manufacturing companies were forced to cope with interruptions in procurement, transportation, production scheduling, and distribution activities, leading many firms to temporarily increase inventory levels to mitigate supply uncertainty. Although larger inventory buffers enhanced operational resilience during periods of disruption, they also increased carrying costs and tied up substantial amounts of working capital. As global supply chains gradually recovered, manufacturers shifted their focus toward inventory normalization, seeking to reduce excessive stock while maintaining production continuity and service quality. This transition highlights the importance of evaluating inventory performance not only from the perspective of inventory availability but also from its contribution to operating cost efficiency. Consequently, understanding how inventory control influences operational efficiency has become an increasingly important research topic in manufacturing management, logistics, and supply chain literature(Sutejo et al., 2023; Taufik & Ahmad, 2014).

Existing studies consistently suggest that effective inventory management contributes to improved operational performance by reducing unnecessary inventory investment and improving asset utilization. Inventory control influences operating cost efficiency through its effect on inventory holding costs, ordering costs, stockout risks, and the utilization of working capital. Empirical evidence from Indonesian manufacturing firms demonstrates that inventory-related indicators, including inventory turnover, total asset turnover, and other working capital measures, explain variations in profitability, asset utilization, and firm value(Dogan et al., 2013; Idell et al., 2021). Better inventory management enables firms to accelerate inventory movement, reduce capital tied up in stock, and improve operational efficiency, thereby strengthening financial performance and competitive advantage (Bakir & Sadersah, 2023; Kusuma, 2021; Maulina & Natakusumah, 2020; Wibowo & Ryalvin, 2023). Likewise, studies on working capital management indicate that shorter inventory holding periods, as reflected in lower Days Inventory Outstanding and a shorter Cash Conversion Cycle (CCC), are generally associated with higher profitability because firms incur lower inventory carrying costs while utilizing assets more efficiently (Feliana & Bagus, 2020; Maulida & Kurniawan, 2023; Tomewi & Yolandafitri Zulvia Haris Kurniawan Khairi Murdy, 2023).

Despite this broad consensus, previous research also reveals that the relationship between inventory control and operating performance is not universally consistent(Cholodowicz & Orłowski, 2022; Nirmala et al., 2022). Several empirical studies report that the impact of inventory

management on profitability depends on firm characteristics, industrial structure, macroeconomic conditions, and the interaction between inventory, receivables, and payables within the overall working capital cycle. During periods of economic uncertainty, for example, longer inventory periods may represent deliberate managerial decisions to secure production continuity rather than operational inefficiency. Similarly, some Indonesian studies report insignificant or context-dependent relationships between Cash Conversion Cycle components and profitability, suggesting that inventory indicators should not be interpreted in isolation but rather as part of a broader working capital management strategy (Hastuti et al., 2023; Aryawan & Indriani, 2020; Maitriyadewi & Yadnyana, 2022). These findings indicate that improvements in inventory control should be evaluated within the operational context of each manufacturing industry rather than through universal performance benchmarks.

Inventory turnover and Days Inventory remain among the most widely accepted indicators for evaluating inventory efficiency. Higher inventory turnover generally reflects faster conversion of inventory into sales, indicating more efficient inventory utilization, lower carrying costs, and improved operational performance. Empirical evidence from Indonesian manufacturing companies demonstrates that inventory turnover contributes to profitability, return on assets, and return on equity, particularly when combined with other working capital indicators such as receivable turnover and payable turnover (Bakir & Sadersah, 2023; Rosidawaty, 2023). Sector-specific studies in the cement industry further show that declining inventory turnover often coincides with weaker financial performance, illustrating the close relationship between inventory efficiency and operational effectiveness (Riany et al., 2021). Conversely, Days Inventory provides a complementary perspective by measuring the average period inventory remains in storage before being sold or consumed in production. Shorter inventory holding periods generally indicate more efficient inventory management and lower capital commitment, although the optimal level depends on production characteristics, supply uncertainty, and customer service requirements (Maulida & Kurniawan, 2023; Tomewi & Murdy, 2023).

Beyond inventory indicators themselves, transportation planning and logistics capabilities have emerged as important determinants of inventory performance. Efficient transportation systems reduce replenishment lead times, improve delivery reliability, enhance inventory visibility, and minimize safety stock requirements. Recent studies emphasize that digital logistics systems, enterprise resource planning, real-time tracking technologies, and integrated transportation planning improve synchronization between production, warehousing, and distribution activities, thereby strengthening inventory control while reducing logistics costs (Sardjono et al., 2023; Saryatmo & Sukhotu, 2021; Tseng et al., 2021; Winata, 2024). These developments are particularly relevant within the Indonesian manufacturing sector, where logistics costs remain relatively high and distribution networks vary substantially across industries. Accordingly, transportation planning should be viewed as an enabling capability that supports inventory optimization rather than merely a downstream logistics activity.

METHOD

Research Design

This study employed a quantitative, exploratory comparative case-study design using secondary financial statement data. The research aimed to examine the association between inventory control and operating cost efficiency among Indonesian manufacturing companies representing three subsectors with different logistics characteristics: pharmaceutical, herbal consumer products, and cement manufacturing. Unlike explanatory studies that seek to establish causal relationships through large panel datasets, this research emphasizes comparative operational analysis by integrating trend analysis, financial ratio analysis, and cross-company interpretation.

Secondary-data research has become one of the most widely adopted approaches for evaluating inventory management because audited annual reports provide standardized and reliable financial information that enables longitudinal performance assessment. Previous studies commonly apply panel-data regression, fixed-effects or random-effects models, and generalized method of moments (GMM) to investigate the relationship between inventory management, working capital management, profitability, and firm value using archival financial statements of publicly listed companies (Abbas et al., 2022; Kinasih et al., 2020). However, because the present study contains only twelve company-year observations, the analysis is positioned as exploratory rather than causal. Consequently, descriptive, comparative, and trend-based approaches constitute the primary analytical framework.

Data Source and Sample Selection

The study utilized secondary data extracted from the officially published annual reports of three manufacturing companies listed on the Indonesia Stock Exchange (IDX). These companies were purposively selected because they represent manufacturing industries with substantially different production processes, inventory characteristics, and logistics systems.

The sample consisted of:

- PT Kalbe Farma Tbk (KLBF), representing the pharmaceutical and healthcare distribution subsector, observed from 2020 to 2024.
- PT Indocement Tungal Prakarsa Tbk (INTP), representing the cement and heavy manufacturing subsector, observed from 2020 to 2024.
- PT Industri Jamu dan Farmasi Sido Muncul Tbk (SIDO), representing the herbal and consumer pharmaceutical subsector, observed from 2023 to 2024.

The final dataset comprised twelve company-year observations. Financial information was collected directly from audited annual reports to ensure consistency, transparency, and comparability across firms.

Purposive sampling is widely employed in manufacturing and supply-chain research when researchers investigate specific industrial contexts or compare firms with distinct operational

characteristics (Bakir & Sadersah, 2023; Riany et al., 2021; Rosidawaty, 2023). Although this sampling approach limits statistical generalization, it enables richer contextual interpretation of operational practices and inventory-management strategies across heterogeneous manufacturing subsectors.

Variable Measurement

The study focused on operational indicators that have been extensively used in previous inventory-management and working-capital studies.

The dependent variable was Cost-Efficiency Proxy (CEP), representing the proportion of sales remaining after deducting the Cost of Goods Sold (COGS) ratio and the Operating Expense Ratio (OER). Higher values indicate greater operating cost efficiency.

$$[CEP = 100 - CSR - OER]$$

where:

- CSR = Cost of Goods Sold-to-Sales Ratio
- OER = Operating Expense-to-Sales Ratio

Inventory control was represented by an Inventory Control Proxy (ICP). Because inventory disclosure differs among companies, two operational measures were employed. For PT Kalbe Farma Tbk, inventory performance was represented by Days Inventory, with lower values indicating faster inventory movement. For PT Indocement Tunggul Prakarsa Tbk, inventory performance was represented by Inventory Turnover (ITO), where higher turnover indicates more efficient inventory utilization.

Inventory Turnover was calculated as:

$$[ITO = \frac{COGS}{(Beginning\ Inventory + Ending\ Inventory)/2}]$$

Sales Growth (SG) was calculated as the annual percentage change in sales:

$$[SG = \left(\frac{Sales_t}{Sales_{t-1}} - 1 \right) \times 100]$$

The Transportation Planning Proxy (TPP) was evaluated using publicly disclosed logistics information, particularly the contribution of Kalbe Farma's distribution and logistics segment and qualitative evidence describing logistics integration. Because transportation costs were not consistently disclosed across all companies, no estimated or artificial transportation-cost values were introduced, thereby preserving data validity.

The operational indicators selected in this study are consistent with prior literature, which identifies Inventory Turnover, Inventory Days, Cash Conversion Cycle components, Operating Expense

Ratio, and Cost of Goods Sold Ratio as the most frequently used measures of inventory performance and operating efficiency (Riany et al., 2021; Rosidawaty, 2023; Abbas et al., 2022).

Data Analysis

Data analysis was conducted in four sequential stages.

First, descriptive statistics were used to summarize company characteristics and the distribution of operational indicators.

Second, trend analysis evaluated changes in sales, inventory performance, operating expenses, inventory turnover, and distribution indicators over the observation period. This approach enabled identification of operational improvements within each company rather than relying solely on cross-sectional comparisons.

Third, ratio analysis examined changes in Inventory Turnover, Days Inventory, Cost of Goods Sold-to-Sales Ratio, Operating Expense Ratio, and Cost-Efficiency Proxy. Percentage-change analysis was subsequently performed to quantify operational improvements, including reductions in inventory duration, improvements in inventory turnover, and changes in operating cost efficiency.

Finally, comparative case analysis was employed to interpret similarities and differences among the three manufacturing subsectors. Comparative case-study methods are widely used in manufacturing and supply-chain research because they integrate quantitative financial indicators with qualitative operational characteristics, enabling researchers to explain why inventory-performance patterns differ across industries. Previous studies similarly employ comparative approaches to evaluate sectoral differences, digital logistics implementation, governance characteristics, and inventory-management practices in manufacturing firms (Sardjono et al., 2023; Tseng et al., 2021; Saryatmo & Sukhotu, 2021).

Exploratory Analytical Model

To illustrate the conceptual relationship among the variables, the following exploratory model was formulated:

$$[CEP_i = \beta_0 + \beta_1 ICP_i + \beta_2 TPP_i + \beta_3 SG_i + \varepsilon_i]$$

where:

- CEP = Cost-Efficiency Proxy;
- ICP = Inventory Control Proxy;
- TPP = Transportation Planning Proxy;
- SG = Sales Growth;
- ε = error term.

Because the dataset contains only twelve observations, the regression model is presented solely as an exploratory framework. The principal findings of the study rely on descriptive evidence, ratio analysis, trend analysis, and comparative interpretation rather than statistical significance testing. This methodological choice is consistent with recommendations in previous studies that emphasize careful interpretation when sample sizes are limited and operational contexts differ substantially across manufacturing subsectors.

Reliability, Validity, and Research Limitations

The reliability of the study was strengthened by using audited annual reports published by publicly listed companies as the exclusive data source. Variable definitions followed established financial and operational formulas widely adopted in inventory-management and working-capital literature, enhancing measurement validity and comparability.

To avoid measurement bias, variables that were not publicly disclosed—particularly detailed transportation costs—were intentionally excluded rather than estimated. This decision preserves the transparency and credibility of the dataset while preventing the introduction of artificial observations.

The study has several limitations. First, the sample consists of only twelve company-year observations, restricting statistical generalization and causal inference. Second, inventory indicators differ across companies because financial disclosures are not fully uniform; therefore, inventory control is represented using the most appropriate indicator available for each company. Third, the transportation-planning variable relies primarily on publicly disclosed qualitative information rather than detailed logistics expenditure. Nevertheless, these limitations do not diminish the value of the research as an exploratory comparative study. Instead, they provide a transparent basis for understanding how inventory control and operating cost efficiency vary across manufacturing subsectors with different logistics characteristics and offer directions for future research employing larger panel datasets and more comprehensive logistics variables.

RESULT AND DISCUSSION

Sales and Revenue Performance

The financial data demonstrate that all three sample companies experienced positive revenue growth during their respective observation periods, although the magnitude and operational characteristics of the growth differed across manufacturing subsectors. Overall, the results indicate that revenue expansion was accompanied by improvements in selected inventory and operating efficiency indicators, suggesting that sales growth was supported by effective operational management rather than by simple increases in production volume.

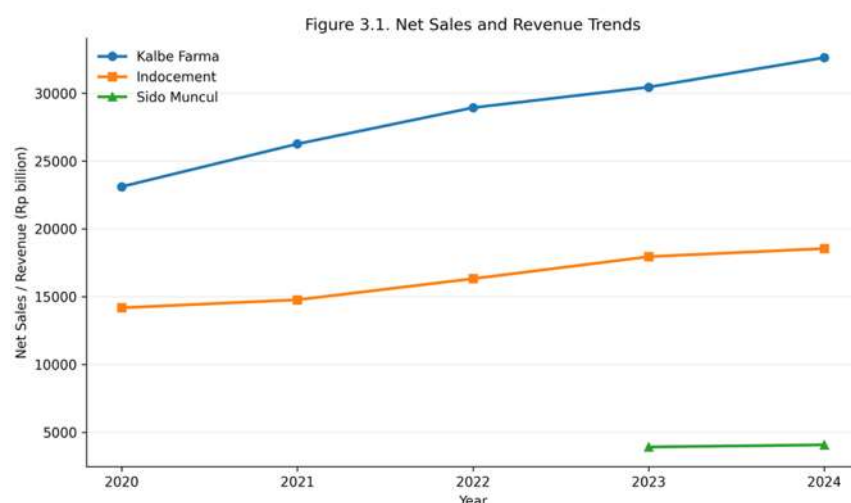
Table 1. Net Sales and Revenue Performance.

Company	Year	Net Sales / Revenue (Rp billion)
Kalbe Farma	2020	23,113
	2021	26,261
	2022	28,934
	2023	30,449
	2024	32,628
Indocement	2020	14,184
	2021	14,772
	2022	16,328
	2023	17,950
	2024	18,549
Sido Muncul	2023	3,919.084
	2024	4,079.659

Kalbe Farma exhibited the strongest long-term sales growth within the sample. Net sales increased continuously from Rp23.11 trillion in 2020 to Rp32.63 trillion in 2024, representing cumulative growth of approximately 41%. This upward trend suggests that the company successfully expanded its commercial activities while maintaining operational continuity throughout the post-pandemic recovery period. Importantly, sales growth coincided with subsequent improvements in inventory performance, indicating that revenue expansion was achieved without prolonged inventory accumulation.

Indocement Tungal Prakarsa also demonstrated a consistent increase in revenue throughout the observation period. Revenue increased from Rp14.18 trillion in 2020 to Rp18.55 trillion in 2024, reflecting cumulative growth of approximately 30.8%. Although the cement industry experienced considerable pressure from energy prices, transportation costs, and fluctuations in construction demand, the company maintained positive revenue growth while simultaneously improving inventory utilization during the final years of observation.

Sido Muncul reported net sales of Rp3.92 trillion in 2023, increasing to Rp4.08 trillion in 2024. Although the absolute increase was smaller than that of the other two companies, annual sales still grew by approximately 4.10%. This positive performance occurred despite increasing production costs, suggesting that operational improvements and expense management contributed to maintaining business growth.



Source: Manuscript Table 1; audited annual-report data.

Figure 1 (to be inserted) illustrates the sales trends of the three companies during the observation period. Kalbe Farma presents the steepest upward trajectory, followed by Indocement, whereas Sido Muncul demonstrates relatively stable year-to-year growth over its shorter observation period.

The observed revenue patterns are generally consistent with previous studies reporting that sales growth contributes to stronger operational performance when accompanied by efficient working capital management. Rather than revenue growth itself determining profitability, prior research argues that sustainable growth depends on how effectively firms manage inventory, receivables, and other working-capital components (Kinasih et al., 2020; Aryawan & Indriani, 2020; Wang et al., 2020). Consequently, increasing revenue should be interpreted together with operational indicators rather than as an isolated measure of business success.

The present findings support this perspective. Kalbe Farma and Indocement achieved continuous revenue growth while later improving inventory-related indicators, suggesting that operational improvements accompanied commercial expansion. Similarly, Sido Muncul maintained positive sales growth while reducing its operating-expense intensity, indicating that revenue expansion was not achieved through proportionally higher operating expenditures.

Previous empirical studies further suggest that efficient asset utilization, inventory turnover, and working capital management mediate the relationship between sales growth and profitability (Kinasih et al., 2020; Riany et al., 2021; Abbas et al., 2022). These mechanisms appear consistent with the observed company trends. Although the present study does not estimate causal relationships because of the limited sample size, descriptive evidence indicates that firms exhibiting stronger operational discipline also maintained positive sales trajectories.

The literature also emphasizes the importance of supply-chain capability in sustaining revenue growth. Digital logistics integration, transportation planning, inventory visibility, and real-time replenishment have been shown to reduce stockouts and improve customer service, thereby supporting stable revenue expansion (Sardjono et al., 2023; Tseng et al., 2021; Winata, 2024). Among the sampled companies, Kalbe Farma provides the clearest illustration of this relationship through the increasing contribution of its distribution and logistics segment, which expanded from 32.21% of consolidated sales in 2023 to 33.41% in 2024. This operational development suggests

that distribution capability contributed to maintaining product availability while supporting continued sales growth.

Taken together, the sales evidence indicates that revenue expansion across the three companies was accompanied by improvements in selected operational indicators rather than by inefficient inventory accumulation. Although the specific operational mechanisms differed among pharmaceutical, cement, and herbal manufacturing, the overall pattern supports previous literature emphasizing that sustainable sales growth is closely associated with effective inventory management, prudent working capital practices, and efficient logistics coordination.

Inventory Control Performance

Inventory control constitutes the primary operational focus of this study because it directly influences working capital utilization, production continuity, warehouse capacity, and operating cost efficiency. Although the three sampled companies operate in different manufacturing subsectors and disclose inventory information using different indicators, the available data consistently demonstrate improvements in inventory performance during the observation period.

Inventory Performance of PT Kalbe Farma Tbk

Kalbe Farma reports inventory performance using Days Inventory, which measures the average number of days inventory remains in storage before being sold or consumed in production. Lower values indicate faster inventory movement and more efficient inventory utilization.

Table 2. Days Inventory of PT Kalbe Farma Tbk

Year	Days Inventory (Days)
2021	122
2022	147
2023	131
2024	119

The data indicate that Days Inventory increased substantially from **122 days in 2021** to **147 days in 2022**. This increase coincided with the post-pandemic recovery period, during which many manufacturing companies maintained higher inventory levels to reduce supply uncertainty and prevent production interruptions.

Following this temporary increase, inventory performance improved considerably. Days Inventory declined to **131 days in 2023** and further decreased to **119 days in 2024**. Relative to the 2022 peak, inventory holding time decreased by approximately **19.05%**, indicating a significant improvement in inventory utilization.

This downward trend suggests that Kalbe Farma successfully normalized inventory levels while continuing to expand sales. Rather than reflecting declining production activity, shorter inventory duration indicates that inventory circulated more rapidly through the production and

distribution system. Simultaneously, consolidated net sales increased from Rp30.45 trillion in 2023 to Rp32.63 trillion in 2024, demonstrating that inventory reduction occurred alongside business growth.

The empirical evidence is consistent with previous studies reporting that shorter inventory periods reduce capital tied up in stock, decrease carrying costs, improve liquidity, and strengthen working capital efficiency (Feliana & Bagus, 2020). Nevertheless, previous literature also emphasizes that inventory days should not be interpreted independently because profitability depends on the broader interaction among inventory, receivables, and payables within the cash conversion cycle (Kinasih et al., 2020; Aryawan & Indriani, 2020). Accordingly, the present findings are interpreted as evidence of improved operational efficiency rather than direct proof of higher profitability.

Inventory Performance of PT Indocement Tunggal Prakarsa Tbk

Unlike Kalbe Farma, Indocement discloses sufficient inventory information to calculate Inventory Turnover (ITO), representing the frequency with which inventory is converted into sales during a fiscal year. Higher Inventory Turnover generally reflects more efficient inventory utilization.

Table 3. Inventory Turnover of PT Indocement Tunggal Prakarsa Tbk

Year	Inventory Turnover (Times)
2023	4.17
2024	4.54

Inventory Turnover increased from **4.17 times in 2023** to **4.54 times in 2024**, representing an improvement of approximately **8.87%**. At the same time, ending inventory declined from **Rp2.905 trillion** to **Rp2.593 trillion**, equivalent to a reduction of approximately **10.7%**.

Table 4. Inventory Value of PT Indocement Tunggal Prakarsa Tbk

Year	Inventory (Rp billion)
2023	2,905
2024	2,593

Interestingly, revenue continued to increase despite lower inventory levels. Revenue rose from **Rp17.95 trillion** in 2023 to **Rp18.55 trillion** in 2024, indicating that improved inventory efficiency did not compromise production or sales performance.

These findings suggest that Indocement achieved more effective inventory utilization by accelerating inventory movement rather than maintaining excessive stock. Given the heavy-product characteristics of the cement industry, where inventory storage and transportation costs are substantial, improvements in inventory turnover represent meaningful operational gains.

Previous studies consistently identify Inventory Turnover as one of the most reliable indicators of inventory management efficiency because it reflects the speed at which inventory is transformed into revenue-generating output (Riany et al., 2021; Rosidawaty, 2023). International studies similarly report that higher Inventory Turnover is generally associated with stronger operational performance, improved asset utilization, and lower inventory holding costs (Idrees & Siddiqui, 2021; Wang et al., 2020). However, excessively high turnover may also indicate insufficient inventory buffers or stockout risk. Therefore, inventory turnover should be interpreted together with sales performance and production continuity.

Comparative Inventory Performance Across Subsectors

Although the sampled companies employ different inventory indicators, the comparative evidence demonstrates a consistent pattern of operational improvement.

Kalbe Farma improved inventory efficiency by shortening inventory holding periods, reflecting faster movement of pharmaceutical products through its production and distribution network. Indocement improved inventory utilization by increasing Inventory Turnover while simultaneously reducing inventory value and maintaining revenue growth. These improvements illustrate different operational strategies shaped by subsector characteristics.

The pharmaceutical industry generally prioritizes inventory availability, regulatory compliance, product traceability, and distribution responsiveness. Consequently, inventory optimization focuses on reducing unnecessary inventory without compromising service levels or product availability. Recent studies emphasize that digital logistics integration, Track-and-Trace systems, and Pharma 4.0 technologies improve inventory visibility, reduce obsolescence, and support efficient replenishment (YAO et al., 2021).

By contrast, the cement industry emphasizes throughput, storage efficiency, and transportation planning because products are bulky, have relatively low value-to-weight ratios, and incur substantial logistics costs. Consequently, higher Inventory Turnover reflects improved utilization of storage capacity and more efficient production scheduling rather than merely faster product sales (Bakir & Sadersah, 2023; Kusuma, 2021; Riany et al., 2021).

The literature further indicates that inventory optimization strategies vary according to industrial context. Lean manufacturing, Just-in-Time (JIT), Vendor-Managed Inventory (VMI), demand forecasting, Sales and Operations Planning (S&OP), and digital inventory monitoring have all been shown to reduce inventory holding costs while maintaining operational reliability (Fontenelle & Sagawa, 2021; Wahyuni et al., 2024; Ali et al., 2022; Tarighi et al., 2024). Nevertheless, the effectiveness of these approaches depends on product characteristics, regulatory requirements, supplier integration, and information-system maturity.

Overall, the comparative findings indicate that both Kalbe Farma and Indocement demonstrated measurable improvements in inventory performance despite employing different inventory-

management approaches. These results reinforce the proposition that inventory optimization should be evaluated according to the operational characteristics of each manufacturing subsector rather than through direct comparison of absolute inventory indicators.

Cost Structure and Operating Cost Efficiency

Cost structure provides an important perspective for evaluating how efficiently manufacturing companies convert sales revenue into operating performance. In addition to inventory indicators, the present study examines the Cost of Goods Sold-to-Sales Ratio (CSR), Operating Expense Ratio (OER), and Cost-Efficiency Proxy (CEP) to assess changes in operational cost management across the sampled companies. These indicators collectively illustrate how inventory control is reflected in production costs, operating expenditures, and the proportion of revenue remaining after major operating costs have been deducted.

Cost of Goods Sold Performance

The Cost of Goods Sold (COGS) represents the largest cost component for manufacturing companies and therefore provides an important indicator of production efficiency. Table 3.5 summarizes the COGS performance of PT Indocement Tungal Prakarsa Tbk and PT Industri Jamu dan Farmasi Sido Muncul Tbk.

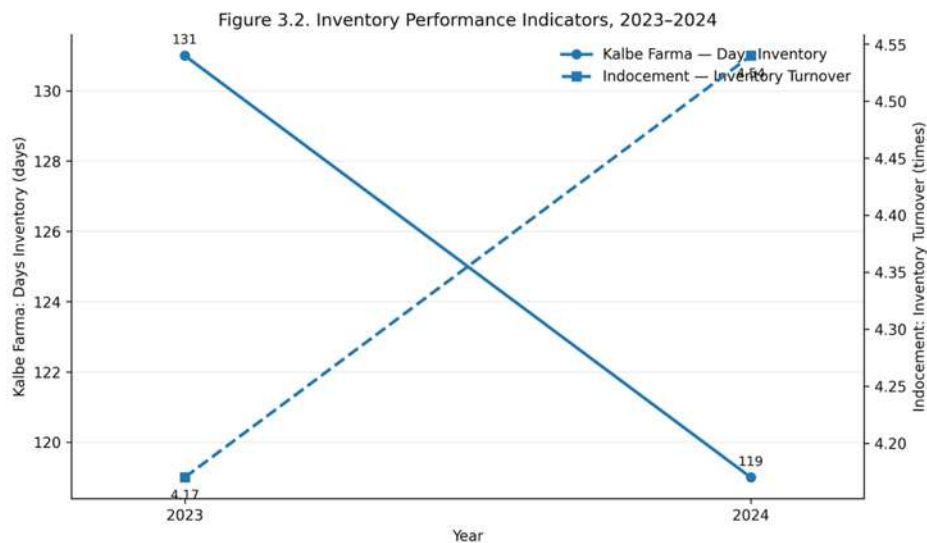
Table 5. Cost of Goods Sold and COGS-to-Sales Ratio

Company	Year	COGS (Rp billion)	COGS-to-Sales Ratio (%)
Indocement	2020	9,071	63.95
	2021	9,646	65.30
	2022	11,185	68.50
	2023	12,103	67.43
	2024	12,488	67.32
Sido Muncul	2023	1,618.095	41.29
	2024	1,714.566	42.03

Indocement consistently reported a relatively high COGS-to-Sales Ratio, fluctuating between 63.95% and 68.50% during the observation period. Although production costs increased in absolute terms, the ratio remained relatively stable after 2022, decreasing slightly from 67.43% in 2023 to 67.32% in 2024 despite continued revenue growth. This stability indicates that increases in production costs were largely offset by corresponding increases in sales revenue.

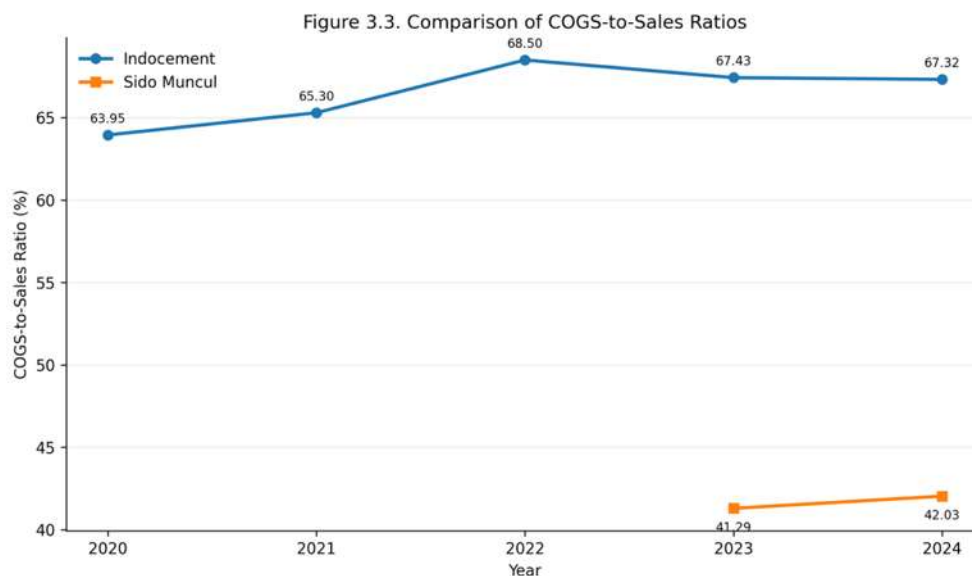
By comparison, Sido Muncul recorded a substantially lower COGS-to-Sales Ratio of approximately 41–42%. The difference does not necessarily imply superior production efficiency; rather, it reflects fundamental differences in industrial characteristics. Cement manufacturing requires high energy consumption, extensive transportation activities, large-scale production facilities, and substantial storage capacity. Consequently, production costs naturally represent a larger proportion of total revenue than in consumer herbal products.

Figure 2. illustrates the substantial difference in cost structure between the cement and herbal manufacturing subsectors.



Source: Manuscript Tables 2-3. Different y-axes reflect different inventory metrics.

Figure 3. Comparison of COGS-to-Sales Ratios across Manufacturing Subsectors.



Source: Manuscript Table 5; audited annual-report data.

Operating Expense Performance

Operating expenses represent expenditures incurred to support marketing, administration, distribution, and corporate operations after production activities have been completed. Changes in operating expenses therefore provide additional evidence regarding organizational efficiency beyond manufacturing costs.

Table 6. Operating Expenses

Company	Year	Operating Expenses (Rp billion)
Kalbe Farma	2023	8,129.883
	2024	8,776.932
Sido Muncul	2023	829.506
	2024	820.976

Kalbe Farma reported an increase in operating expenses between 2023 and 2024. However, this increase occurred simultaneously with higher sales revenue and expanding distribution activities. Consequently, the higher operating expenditure should be interpreted alongside the company's broader operational expansion rather than as evidence of declining efficiency. Kalbe also disclosed that beginning in 2024, distribution fees were allocated to manufacturing business units to better reflect end-to-end operational performance, making year-to-year comparisons more meaningful within the revised reporting structure.

In contrast, Sido Muncul reduced operating expenses from Rp829.51 billion in 2023 to Rp820.98 billion in 2024 despite achieving higher sales revenue. This pattern indicates improved cost discipline, as revenue increased while administrative and selling expenses declined slightly.

The resulting Operating Expense Ratios are presented in Table 7.

Table 7. Operating Expense Ratio

Company	Year	Operating Expense Ratio (%)
Sido Muncul	2023	21.17
	2024	20.12

The Operating Expense Ratio declined by approximately **1.05 percentage points**, indicating that operating expenses represented a smaller proportion of revenue in 2024 than in the previous year. Such improvement suggests enhanced operational efficiency because additional sales were generated without proportional increases in operating expenditure.

Cost-Efficiency Performance

To provide a more integrated assessment of operational efficiency, this study employs the Cost-Efficiency Proxy (CEP), calculated as the remaining percentage of sales after deducting the COGS-to-Sales Ratio and the Operating Expense Ratio.

Table 8. Cost-Efficiency Proxy

Company	Year	Cost-Efficiency Proxy (%)
Sido Muncul	2023	37.55
	2024	37.85

The Cost-Efficiency Proxy increased from **37.55%** to **37.85%**, indicating a modest but positive improvement in overall operating cost efficiency. Although COGS increased slightly during the year, the reduction in operating expenses was sufficient to improve the proportion of revenue remaining after major operating costs.

The observed improvement is consistent with the company's stable sales growth and indicates that cost management practices successfully prevented operating expenses from increasing at the same rate as revenue.

Distribution Capability as an Operational Efficiency Indicator

Beyond conventional financial ratios, Kalbe Farma provides additional evidence regarding operational capability through its distribution and logistics segment.

Table 9. Distribution and Logistics Contribution

Year	Contribution to Consolidated Sales (%)
2023	32.21
2024	33.41

The contribution of distribution and logistics increased by **1.20 percentage points** between 2023 and 2024, demonstrating the growing importance of integrated logistics within Kalbe's business model. Rather than functioning solely as a support activity, distribution became an increasingly significant contributor to consolidated performance.

Previous supply-chain studies emphasize that logistics capability enhances inventory visibility, improves delivery reliability, shortens replenishment lead times, and supports customer service quality through better coordination of transportation and warehousing activities (Sardjono et al., 2023; Tseng et al., 2021; Winata, 2024). Kalbe's increasing logistics contribution therefore complements the observed reduction in Days Inventory, suggesting that stronger distribution capability may have facilitated faster inventory movement across the supply chain.

Comparative Assessment of Cost Efficiency

The comparative findings reveal that improvements in operating cost efficiency were achieved through different operational mechanisms across the three manufacturing subsectors.

Kalbe Farma primarily demonstrated operational improvement through inventory normalization and strengthening of distribution capability while maintaining continuous sales growth. Indocement achieved efficiency by reducing inventory levels and increasing Inventory Turnover despite the inherently high production and logistics costs associated with heavy manufacturing. Sido Muncul improved operational performance through tighter control of operating expenses, allowing the Cost-Efficiency Proxy to increase despite moderate growth in production costs.

These differences highlight the importance of interpreting efficiency indicators within the operational context of each manufacturing subsector. Pharmaceutical companies emphasize

inventory availability, distribution responsiveness, and regulatory compliance; cement manufacturers focus on throughput, transportation efficiency, and asset utilization; whereas herbal-product manufacturers benefit from tighter administrative and operating cost control combined with relatively lower production-cost intensity.

Overall, the empirical findings indicate that inventory improvement is accompanied by favorable changes in operating cost performance across all three companies. Nevertheless, the operational pathways through which efficiency is achieved differ substantially according to industrial characteristics. Consequently, comparisons based solely on absolute financial ratios would overlook important structural differences in production technology, logistics intensity, and distribution systems.

The findings of this study indicate that improvements in inventory control were accompanied by favorable changes in operating cost performance across the three manufacturing companies, although the mechanisms through which efficiency was achieved differed according to subsector characteristics. Rather than demonstrating a uniform relationship between inventory management and organizational performance, the results suggest that inventory optimization should be interpreted within the broader context of working capital management, logistics capability, and production characteristics. This interpretation is consistent with previous studies emphasizing that inventory performance contributes to operational efficiency when supported by effective management of other working capital components rather than being evaluated as an isolated indicator (Kinasih et al., 2020; Rosidawaty, 2023; Aryawan & Indriani, 2020; Abbas et al., 2022; Wang et al., 2020).

The positive sales trends observed across Kalbe Farma, Indocement, and Sido Muncul demonstrate that revenue growth can coexist with improvements in operational efficiency when inventory resources are managed effectively. Kalbe Farma increased net sales continuously while reducing Days Inventory during the post-pandemic period, suggesting that inventory normalization did not constrain market responsiveness or product availability. Likewise, Indocement achieved higher revenue despite reducing inventory investment and increasing Inventory Turnover, indicating that improved inventory utilization supported operational performance without limiting production capacity. Sido Muncul also maintained positive sales growth while reducing its operating expense intensity, illustrating that revenue expansion can occur simultaneously with tighter expenditure control. These findings reinforce previous evidence that sustainable sales growth depends not only on increasing demand but also on efficient asset utilization and disciplined working capital management (Kinasih et al., 2020; Abbas et al., 2022; Wang et al., 2020).

The empirical evidence further supports the argument that inventory efficiency moderates the relationship between sales growth and operational performance. Earlier studies have shown that firms experiencing rapid revenue expansion may nevertheless encounter declining profitability when inventory accumulation, receivable collection, or liquidity management deteriorates (Sari & Wijaya, 2022; Yusra et al., 2023; Sritharan & Sivalingam, 2020). The present findings differ from such situations because sales growth was accompanied by either shorter inventory holding periods,

higher inventory turnover, or lower operating expense intensity. Consequently, the observed operational improvements appear to reflect more efficient resource utilization rather than revenue expansion driven by excessive inventory accumulation or increasing operating expenditures.

The reduction in Days Inventory observed at Kalbe Farma provides additional evidence supporting the importance of inventory optimization within working capital management. Following the temporary increase in inventory during the supply-chain disruption period, the company successfully reduced inventory holding time by approximately nineteen percent while maintaining continuous revenue growth. Previous research consistently identifies shorter inventory periods as a mechanism for reducing carrying costs, improving liquidity, and strengthening asset utilization through a shorter cash conversion cycle (Maulida & Kurniawan, 2023; Feliana & Bagus, 2020; Tomewi & Murdy, 2023; Tjandra, 2022). The present findings align with this perspective by suggesting that inventory normalization enabled Kalbe Farma to improve operational efficiency without compromising commercial performance. Nevertheless, previous studies also caution that Days Inventory should not be interpreted independently because profitability depends on the combined effects of inventory, receivables, and payables management (Kinasih et al., 2020; Aryawan & Indriani, 2020; Abbas et al., 2022). Accordingly, the reduction in Days Inventory reported in this study should be viewed as one component of broader operational improvement rather than as a direct determinant of profitability.

The improvement in Inventory Turnover observed at Indocement similarly supports existing inventory-management theory. Inventory Turnover increased from 4.17 to 4.54 times while inventory value declined by more than ten percent and revenue continued to increase. This combination indicates more effective utilization of inventory resources, allowing the company to generate higher sales with lower inventory investment. Previous studies consistently identify Inventory Turnover as one of the strongest operational indicators of inventory management efficiency because it reflects the speed with which inventory is converted into revenue-generating output (Riany et al., 2021; Rosidawaty, 2023; Abbas et al., 2022; Wajo, 2021). International evidence likewise associates higher Inventory Turnover with improved operational responsiveness, lower inventory carrying costs, and stronger asset utilization (Idrees & Siddiqui, 2021; Bukwimba & Ngata, 2022; Wang et al., 2020). The findings of the present study therefore reinforce the practical importance of maintaining efficient inventory circulation, particularly in capital-intensive industries such as cement manufacturing where storage and transportation costs constitute a substantial proportion of operating expenditure.

The findings also demonstrate that operating cost efficiency can be achieved through different operational pathways depending on industry characteristics. Sido Muncul exhibited only moderate sales growth but improved its Cost-Efficiency Proxy because operating expenses declined despite increasing production costs. This result indicates that inventory management should not be evaluated solely through inventory-related indicators, but also through complementary measures such as operating expense intensity and overall cost structure. Previous literature similarly emphasizes that efficient working capital management should be integrated with prudent cost management, receivable collection, and asset utilization to achieve sustainable operational performance (Rosidawaty, 2023; Aryawan & Indriani, 2020; Abbas et al., 2022). The present

findings therefore extend earlier studies by illustrating that inventory control and operating expense management may jointly contribute to improvements in operating cost efficiency even when manufacturing companies operate under substantially different production environments.

The comparative findings further demonstrate that logistics capability and transportation planning should be considered integral components of inventory management rather than independent operational functions. Inventory performance is influenced not only by internal warehouse policies but also by the efficiency of procurement, transportation scheduling, distribution networks, and information flows across the supply chain. In the present study, Kalbe Farma provides the clearest example of this relationship through the increasing contribution of its distribution and logistics segment, which rose from 32.21% of consolidated sales in 2023 to 33.41% in 2024 while Days Inventory continued to decline. Although the available secondary data do not permit direct estimation of transportation efficiency, this pattern suggests that stronger logistics capability may have supported faster inventory circulation and improved operational responsiveness. Previous studies similarly argue that transportation planning, digital supply chain integration, and real-time inventory visibility reduce replenishment lead times, improve service reliability, and lower inventory carrying costs by enabling better synchronization between production and market demand (Sardjono et al., 2023; Saryatmo & Sukhotu, 2021; Tseng et al., 2021; Winata, 2024). Consequently, the present findings reinforce the proposition that inventory optimization should be interpreted within the broader framework of integrated supply chain management.

The differences observed among the three companies also confirm that inventory optimization is highly dependent on subsector characteristics. Pharmaceutical manufacturing emphasizes product availability, regulatory compliance, distribution coverage, and product traceability, requiring inventory systems that balance operational efficiency with service reliability. Recent developments associated with Pharma 4.0 highlight the importance of digital track-and-trace systems, serialization, and integrated logistics in maintaining inventory visibility while reducing product obsolescence and improving distribution integrity (Sardjono et al., 2023; YAO et al., 2021; Yusra et al., 2023). Herbal manufacturing shares several characteristics with pharmaceutical production, particularly regarding quality assurance and product consistency, although it generally faces greater variability in raw material availability and slightly less stringent regulatory requirements. Consequently, inventory management within the herbal subsector tends to emphasize balancing raw-material availability with efficient operating expense management. By contrast, cement manufacturing is characterized by high-volume production, heavy products, long transportation distances, and relatively low value-to-weight ratios. Inventory management therefore focuses primarily on maximizing inventory turnover, improving storage utilization, and coordinating production with transportation capacity to minimize logistics costs (Bakir & Sadersah, 2023; Kusuma, 2021; Riany et al., 2021). These structural differences explain why identical inventory indicators should not be interpreted uniformly across heterogeneous manufacturing industries.

The present findings also provide practical implications for manufacturing managers seeking to improve operational performance. First, inventory optimization should not be pursued solely by minimizing inventory levels, because excessively aggressive inventory reduction may increase stockout risk and reduce customer service quality. Instead, managers should seek an optimal

inventory level that balances product availability, production continuity, and inventory carrying costs. Second, inventory performance should be monitored together with complementary working capital indicators, including receivable collection periods, payable management, and overall cash conversion cycle performance. Previous studies consistently demonstrate that inventory management contributes most effectively to profitability when integrated with broader working capital policies rather than managed independently (Kinasih et al., 2020; Aryawan & Indriani, 2020; Abbas et al., 2022). Third, investment in digital supply chain technologies, demand forecasting systems, enterprise resource planning, transportation planning, and inventory visibility tools may strengthen operational coordination and improve decision-making quality. Earlier studies suggest that digitalization supports better inventory control through more accurate demand forecasting, shorter replenishment cycles, and enhanced logistics coordination, ultimately contributing to stronger operational efficiency and service performance (Tseng et al., 2021; Sardjono et al., 2023; Aguirre-Manrique et al., 2023).

From a theoretical perspective, this study contributes to the inventory management and working capital management literature by demonstrating that the relationship between inventory control and operating cost efficiency is not represented by a single universal indicator. Instead, different industries require different operational proxies that reflect their underlying logistics characteristics and production systems. The findings support previous arguments that inventory turnover, Days Inventory, and operating cost indicators should be interpreted together with industrial context, organizational strategy, and supply chain configuration rather than through direct comparison of absolute values. By integrating pharmaceutical, herbal, and cement manufacturing within a single comparative framework, this study extends earlier research that has predominantly focused on individual industries or profitability outcomes. The results also demonstrate the value of comparative secondary-data analysis for identifying operational patterns when detailed logistics expenditure data are unavailable.

Several limitations should be acknowledged when interpreting the findings. First, the dataset comprises only twelve company-year observations, limiting statistical generalizability and preventing robust causal inference. Consequently, the proposed analytical model is presented as an exploratory framework rather than a confirmatory regression model. Second, the availability of inventory-related variables differs among companies because public financial disclosures are not fully standardized. Kalbe Farma reports Days Inventory, whereas Indocement provides sufficient information to calculate Inventory Turnover, and Sido Muncul primarily provides operating cost information. Although these differences restrict direct statistical comparison, they also reflect the reality that manufacturing subsectors monitor inventory performance using indicators most relevant to their operational environments. Third, transportation planning could only be represented through publicly disclosed qualitative and segment-level information because detailed transportation cost data were not consistently reported. Estimating undisclosed transportation costs would have introduced artificial observations and reduced the validity of the analysis. Finally, the study relies exclusively on publicly available annual reports and therefore does not capture internal operational practices such as warehouse policies, forecasting methods, supplier collaboration, or production scheduling, all of which may influence inventory performance.

Despite these limitations, the findings provide consistent exploratory evidence that improvements in inventory control are accompanied by favorable changes in operating cost performance across Indonesian manufacturing companies. More importantly, the study demonstrates that inventory optimization should be interpreted within the operational context of each manufacturing subsector, recognizing differences in logistics intensity, regulatory requirements, product characteristics, and distribution systems. Rather than proposing a universal inventory strategy, the evidence supports the adoption of subsector-specific inventory management approaches that integrate working capital management, logistics capability, and operational planning. This perspective provides a stronger foundation for understanding how inventory control contributes to sustainable operational efficiency and establishes the basis for the concluding remarks presented in the following chapter.

CONCLUSION

This study examined the relationship between inventory control and operating cost efficiency in Indonesian manufacturing companies through a comparative analysis of three manufacturing subsectors represented by PT Kalbe Farma Tbk, PT Indocement Tunggul Prakarsa Tbk, and PT Industri Jamu dan Farmasi Sido Muncul Tbk. Using secondary financial statement data covering the 2020–2024 period, the study integrated trend analysis, financial ratio analysis, percentage-change analysis, and comparative case analysis to explore how differences in inventory management practices are reflected in operational cost performance.

The empirical findings indicate that all three companies demonstrated improvements in operational efficiency, although the mechanisms underlying these improvements varied according to subsector characteristics. Kalbe Farma reduced Days Inventory from 147 days in 2022 to 119 days in 2024 while simultaneously maintaining continuous sales growth and strengthening the contribution of its distribution and logistics segment. These findings suggest that inventory normalization was achieved without compromising product availability or commercial performance. Indocement improved Inventory Turnover from 4.17 to 4.54 times while reducing inventory value by approximately 10.7% and maintaining positive revenue growth. The results indicate more efficient utilization of inventory assets within a heavy manufacturing environment characterized by high logistics and storage costs. Sido Muncul demonstrated improvements in operating cost efficiency by reducing the Operating Expense Ratio from 21.17% to 20.12%, resulting in an increase in the Cost-Efficiency Proxy from 37.55% to 37.85% despite moderate increases in production costs.

Collectively, these findings support the proposition that improved inventory control is associated with better operating cost performance. However, the study also demonstrates that the relationship is not uniform across manufacturing industries. Pharmaceutical companies emphasize inventory availability, regulatory compliance, and distribution responsiveness; cement manufacturers focus on inventory turnover, production planning, and logistics efficiency; whereas herbal-product manufacturers achieve operational improvements primarily through balanced inventory management and tighter operating expense control. Consequently, inventory

performance should be interpreted within the operational context of each subsector rather than through direct comparison of absolute financial indicators.

From a theoretical perspective, this research contributes to the literature by integrating inventory control, operating cost efficiency, and logistics capability within a comparative framework covering multiple Indonesian manufacturing subsectors. Unlike many previous studies that concentrate primarily on profitability or working capital indicators, the present study combines inventory-related indicators with operational cost measures to provide a broader understanding of manufacturing efficiency. The findings also demonstrate that different inventory-control proxies including Days Inventory, Inventory Turnover, and Cost-Efficiency Proxy can be used complementarily when financial disclosures differ across companies.

The study further contributes methodologically by illustrating the value of comparative secondary-data analysis using publicly available annual reports. Although the dataset is relatively small, the combination of trend analysis, ratio analysis, and comparative interpretation provides meaningful insights into operational performance without relying exclusively on regression-based inference. This approach is particularly appropriate when financial disclosures are heterogeneous and when logistics-related variables are only partially available.

The practical implications of the study are equally important. Manufacturing companies should view inventory management as part of an integrated operational strategy involving working capital management, logistics planning, demand forecasting, and distribution coordination. Inventory optimization should not focus solely on reducing stock levels but rather on achieving an appropriate balance between product availability, customer service, production continuity, and inventory carrying costs. Investments in digital supply chain technologies, inventory visibility systems, transportation planning, and integrated logistics management are expected to strengthen inventory performance while improving operating cost efficiency.

Several limitations should be acknowledged. The analysis is based on twelve company-year observations and therefore provides exploratory rather than causal evidence. Differences in financial disclosure also required the use of different inventory indicators across companies, while detailed transportation cost information was unavailable in public reports. Consequently, transportation planning was evaluated using publicly disclosed operational information rather than direct logistics expenditure. These limitations do not diminish the relevance of the findings but indicate opportunities for further research.

Future studies should employ larger panel datasets covering additional manufacturing companies and longer observation periods to enable more robust statistical analysis. Future research may also incorporate additional operational variables such as transportation costs, warehousing expenses, order fulfillment performance, supplier lead times, digital supply chain maturity, and environmental sustainability indicators. Comparative studies involving additional manufacturing subsectors or cross-country datasets would further enhance understanding of how industry characteristics shape the relationship between inventory control, logistics capability, and operational efficiency.

In conclusion, this study demonstrates that effective inventory control is closely associated with improved operating cost performance in Indonesian manufacturing companies. Although inventory optimization strategies differ across pharmaceutical, herbal, and cement manufacturing, the evidence consistently indicates that efficient inventory management, supported by appropriate logistics capability and sound operational planning, contributes to stronger operational performance. These findings provide both theoretical insights and practical guidance for managers seeking to improve manufacturing efficiency while supporting sustainable business growth.

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