

## Performance Improvement Strategies for Vendor Managed Inventory (VMI) to Support the Three Pillars of Higher Education: A Case Study at Institut Teknologi Bandung

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Keywords	Abstract
Vendor Managed Inventory; Service Level Agreement (SLA); Gap Analysis; Higher Education Logistics; SWOT–TOWS; QSPM; Three Pillars of Higher Education	Vendor Managed Inventory (VMI) is a strategic approach in inventory management that enhances supply chain efficiency and integration. In higher education institutions, the availability of office supplies, paper, and printer ink is essential to ensure the smooth implementation of education, research, and community service activities. However, studies evaluating the implementation of VMI in Indonesian higher education institutions remain limited. This study aims to evaluate the performance of the VMI system implemented at Institut Teknologi Bandung (ITB) and formulate strategies to improve VMI performance in order to strengthen its support for the implementation of the Three Pillars of Higher Education. The research employed a mixed-methods approach, consisting of a quantitative survey of 32 work units and qualitative analysis through open-ended responses and in-depth interviews with vendors, VMI administrators, and the Directorate of Logistics. The analysis includes validity and reliability tests, descriptive statistics, gap analysis, thematic coding, triangulation, SWOT–TOWS analysis, and prioritization of strategies using the QSPM method. The results show that VMI significantly improves procurement efficiency, item availability, and data transparency. However, gaps remain in system integration, catalog completeness, and SLA compliance particularly for printer ink. The SWOT–TOWS and QSPM analyses produced four priority strategies: system integration and SLA monitoring; improvement of catalog quality; implementation of early-warning mechanisms and buffer stock; and development of SOPs for risk mitigation and multi-vendor options. Study concludes that strengthening and developing VMI in a structured manner has a direct impact on the operational sustainability of ITB and significantly supports the implementation of the Three Pillars of Higher Education. The resulting strategies also have the potential to become a replicable VMI implementation model for other higher education institutions.

### INTRODUCTION

Global inventory problems are widely associated with supply chain disruptions and administrative inefficiencies. A study by Disney and Towill (2003) shows that demand uncertainty and weak coordination among supply chain actors generate the bullwhip effect, resulting in excess inventory on one end and shortages on the other. The COVID-19 pandemic further emphasized the vulnerability of global inventory systems, including delays in the distribution of learning and research materials, which directly affected the continuity of academic activities in universities around the world. Ivanov and Dolgui (2021) confirmed that the ripple effect of the pandemic drove the bullwhip effect to unprecedented levels, with supply chains experiencing cascading disruptions across all tiers. Similarly, Queiroz et al. (2022)

demonstrated that COVID-19 created a fundamental trade-off between supply chain efficiency and resilience, compelling organizations to reassess their inventory management frameworks.

Vendor Managed Inventory (VMI) is one of the collaborative strategies in supply chain management widely adopted globally. Holmström (1998) demonstrated that a simple implementation of VMI can improve distribution efficiency and reduce inventory levels in European case studies. Disney and Towill (2003) emphasized that VMI plays a crucial role in mitigating the bullwhip effect through information integration between suppliers and buyers. Research by Yao, Evers, and Dresner (2007) also showed that VMI can reduce total supply chain costs and enhance customer satisfaction, particularly in the retail and manufacturing sectors. In addition, Van der Vaart and Van Donk (2008) highlighted the importance of information technology integration as a key success factor for VMI implementation across industries in Europe. These findings illustrate that, globally, VMI is recognized as an effective approach for achieving cost efficiency, supply stability, and information flow transparency. More recently, De Giovanni (2021) demonstrated that smart VMI systems incorporating digital coordination mechanisms significantly outperform traditional VMI approaches in terms of both environmental and economic performance. Van den Bogaert and Van Jaarsveld (2022) further highlighted that understanding supplier heterogeneity is essential to effective VMI implementation, as different suppliers adopt divergent replenishment strategies that can undermine buyer-side performance if not actively managed.

In the context of higher education, inventory items are routine necessities that support the Three Pillars of Higher Education (*Tridarma Perguruan Tinggi*) by enabling the administration of education, research, and community service. A study conducted by Rostiani et al. (2021) states that consumable goods in universities can absorb more than 20% of non-personnel operational budgets. However, current practices often still involve manual record-keeping, uneven distribution across units, and the absence of transparent monitoring systems. These issues may lead to waste and inefficiencies in budget utilization. Gbadamosi and Ogunode (2024) found comparable patterns in Nigerian polytechnics, where VMI adoption produced measurable improvements in supply reliability and operational sustainability, underscoring the need for structured inventory governance in higher education institutions.

The need for office supplies (stationery, paper, and ink) is a recurring inventory category because each year universities consistently require paper for examinations, reports, and official documents; stationery as teaching materials and daily work tools; and printer ink for printing academic and administrative documents. Data from LKPP (2023) shows that stationery and printing materials are among the top spending items in the education and government sectors, with transaction values reaching billions of rupiah annually. This aligns with BPK's (2022) report, which confirms that office supplies (stationery, paper, and ink) constitute one of the largest operational expenditure groups in public higher education institutions.

Research within educational institutions also shows that stockouts of office supplies frequently occur due to the lack of accurate and real-time inventory systems. For example, the report "*Pelayanan Pengeluaran Barang Habis Pakai ATK di Pascasarjana Universitas Negeri Malang*" describes that the graduate school unit experiences delays in fulfilling consumable supply requests (including stationery) due to multi-layered and non-automated submission and distribution procedures

In the context of logistics management at Institut Teknologi Bandung (*ITB*), each work unit essentially has diverse and specific needs according to its academic and administrative functions and activities. Until now, most work units have managed their inventory independently, from needs planning to storage. This condition has resulted in high variation in the types, quantities, and frequency of requests, making it difficult to consolidate institutional-level needs (*ITB Logistics Director*).

The inventory management pattern carried out separately at the unit level has not fully implemented efficiency principles. Several issues arise, including stockpiling of goods in unit warehouses, lack of monitoring of released items, and inventory records that are not systematically integrated. These inefficiencies lead to increased storage costs, potential waste, and limited visibility of institutional stock data (*ITB Logistics Director*).

To overcome these issues, *ITB* has taken a strategic step by implementing the Vendor Managed Inventory (VMI) model, a system in which the responsibility for managing and monitoring inventory is assigned to the vendor. *ITB* implements VMI using a consignment contract scheme. VMI is an inventory management method in which the supplier (vendor) is responsible for managing and maintaining inventory levels at the customer's location. In a VMI system, the vendor monitors product inventory in real time and proactively replenishes stock according to customer needs without waiting for purchase orders. This helps ensure that inventory is always available in the right quantity, reducing the risk of stockouts and excessive stock accumulation in unit warehouses (*ITB Logistics Director*).

The main principle applied by *ITB* is selecting vendors that are not only capable of providing goods but also delivering after-sales service and proportional value-added benefits. Through this approach, *ITB* obtains two key advantages: service reliability and cost effectiveness through more competitive pricing and simplified administrative processes (*ITB Logistics Director*).

In practice, vendors are required to fulfill the Service Level Agreement (SLA), whereby each procurement activity is expected to meet specific service time targets to ensure user satisfaction. With an integrated ordering system, the procurement process particularly for office supplies such as stationery, paper, and printer ink can be carried out more efficiently using an online catalog, accelerating administrative flows from ordering to verification and goods receipt. The VMI system also supports more accurate data management through electronic records, facilitates transaction tracking, and minimizes manual errors in inventory administration. If the vendor fails to meet the established SLA targets, administrative or evaluative sanctions will be imposed according to contract provisions. This mechanism aims to maintain service quality consistency and ensure the reliability of the procurement system at *ITB* (*ITB Logistics Director*).

Higher education institutions, as organizations that provide educational services, require a reliable logistics system to support academic activities, research, and community engagement, known as Three Pillars of Higher Education (TPHE) or Tridarma. The primary challenges in inventory management include procurement delays, item discrepancies, high administrative workload, and a lack of inventory data transparency. *ITB* implements Vendor Managed Inventory (VMI) to address these challenges through a collaborative mechanism with vendors, in which stock management responsibilities are transferred to the supplier.

However, the effectiveness of VMI in the context of higher education institutions has not been extensively studied, particularly concerning its contribution to supporting the smooth execution of the TPHE. Therefore, this study evaluates the implementation of VMI at *ITB* within the established Service Level Agreement (SLA), measures its performance based on operational and information system indicators, and formulates development strategies using SWOT–TOWS and QSPM frameworks.

## **METHOD**

### **Research Design**

This study employed a mixed-methods approach, combining quantitative methods (questionnaires) and qualitative methods (open-ended responses and interviews) to obtain a comprehensive understanding of the performance of the VMI system at *ITB*.

### **Population and Sample**

The survey consisting of questionnaires and open-ended responses was administered to 32 work units using VMI, complemented by interviews with the Head of Procurement, the Vendor, and the VMI Administrator using a purposive sampling technique.

### **Research Instruments: Variables and VMI Performance Indicators**

This study focuses on variables related to the implementation of Vendor Managed Inventory (VMI) at the Institut Teknologi Bandung (*ITB*), with the aim of analyzing the gap between the targets specified in the Service Level Agreement (SLA) and the actual performance in practice. These variables are translated into several indicators derived from previous literature, the VMI SLA contract at *ITB*, and direct observations of stock management practices for office supplies, paper, and printer ink.

The selected indicators reflect not only operational aspects, such as item availability and ordering speed, but also the effectiveness of the information system, organizational performance, support for the Three Pillars of Higher Education, and user satisfaction. Accordingly, the variables and indicators utilized in this study are expected to provide a comprehensive representation of VMI performance at *ITB* while identifying areas requiring improvement.

1. SLA Indicators
  - a) Item availability
  - b) Ordering speed
  - c) Order fulfillment accuracy
  - d) Ease of payment
  - e) Administration and documentation
  - f) Data transparency
  - g) Purchases below IDR 10 million
2. Effectiveness of the VMI Information System
  - a) System reliability (minimal errors)
  - b) Dashboard monitoring for stock and usage
  - c) Vendor proactiveness in replenishment (restocking without waiting for orders)
  - d) Quality assurance (non-defective/non-expired items)

3. Logistics Organizational Performance
  - a) Procurement process efficiency (time and administrative cost savings)
  - b) Simplified coordination between vendors, VMI administrators, and work units
  - c) Reduction of stockout or overstock risks
4. Support for the Three Pillars of Higher Education
  - a) Education: Supports the smooth operation of teaching and academic administration
  - b) Research: Availability of supplies ensures uninterrupted research activities
  - c) Community Service: Supports smooth documentation and reporting activities
5. Data Analysis Techniques
  - a) KMO analysis and factor testing
  - b) Data reliability analysis (Cronbach's Alpha)
  - c) Descriptive analysis
  - d) Gap analysis
  - e) Qualitative analysis (Thematic Coding)
  - f) Synthesis analysis (Mixed Discussion)
  - g) SWOT analysis.

## **RESULT AND DISCUSSION**

The findings indicate that the implementation of Vendor Managed Inventory (VMI) at the Institut Teknologi Bandung (*ITB*) has made a significant contribution to improving procurement efficiency, item availability, and administrative convenience across all work units. Questionnaire data show that most performance indicators scored high average values (Mean 3.56–4.53), reflecting a positive user perception of the VMI system. Item availability, item quality, ease of payment, and user satisfaction are among the highest-ranked aspects. These results are consistent with the findings of Owusu Kwateng et al. (2022), who established that VMI positively and significantly influences operational performance, particularly when combined with digitization and strong leadership support. Weißhuhn and Hoberg (2021) further corroborate this by demonstrating that smart replenishment systems leveraging IoT-enabled VMI significantly reduce stockout occurrences and improve end-consumer service levels.

However, qualitative data from open-ended responses and interviews reveal several operational challenges not fully captured by the quantitative results. These challenges include limited availability of certain items (especially printer ink), inconsistent catalog price updates, delays in invoice issuance, and the need for further system feature improvements such as item search functions and non-PO transactions. Additionally, interviews with VMI administrators and vendors highlight the need for enhanced information system integration, an early warning mechanism for critical supplies, and updated logistics SOPs to ensure service reliability. This finding aligns with Salas-Navarro et al. (2023), who found that VMI systems applied to supply chains with deteriorating or demand-variable items require proactive buffer stock management and dynamic replenishment policies to maintain SLA compliance. The importance of SLA enforcement in VMI contracts is also underscored by Jovanovic et al. (2022), whose model demonstrates that optimal service level agreements with linear penalty structures can significantly reduce the risk of stockouts under vendor-held consignment arrangements.

**Table 1. Synthesis Table (Triangulation Matrix)**  
**Combining the results of the questionnaire (quantitative), open-ended responses**  
**(qualitative), and interviews (in-depth qualitative)**

<b>Code</b>	<b>Indicator</b>	<b>Questionnaire Result (Mean)</b>	<b>Open-Ended Responses</b>	<b>Interview Findings</b>	<b>Synthesis (Triangulation)</b>
<b>Q1</b>	Item availability	4.41 (Very High)	Generally available; a few rare items	Vendor conducts routine stock checks, not yet automated	Availability good; min-max system & automatic alerts needed
<b>Q2</b>	Request processing speed	4.06 (High)	Process considered fast; price not always updated	Ordering is fast; catalog updates still manual	Speed effective; catalog & price update improvement needed
<b>Q3</b>	Item quality	4.47 (Very High)	Items are high quality & match needs	Vendor maintains quality & brand standards	Stable quality; data-based quality audits recommended
<b>Q4</b>	Mismatches/delays	4.19 (High)	Frequent issues: late ink/toner	Causes: manufacturer lead time & limited stock	Early warning + buffer stock for ink/toner required
<b>Q5</b>	Response to urgent requests	3.78 (Medium-High)	Fast response, but items not always available	Vendor: urgent requests difficult without safety stock	Special SLA for urgent needs & critical-stock notifications needed
<b>Q6</b>	Administrative /logistics issues	4.16 (High)	Issues: slow invoice, unstable application	Tax invoices & invoices often delayed	Administration good; backend processes need refinement
<b>Q7</b>	Procedural flexibility	3.56 (Medium-High)	Flexible but LS not allowed; cannot take items before payment	Units want more flexibility for urgent activities	Flexible SOP & hybrid payment (LS/VAD) recommended
<b>Q8</b>	SLA for ATK/Paper ≤ 2 days	4.22 (Very High)	Fast & on-time delivery	Vendor uses priority lane for stationery	SLA achieved; buffer stock must be maintained
<b>Q9</b>	SLA for ink ≤ 5 days	3.69 (High)	Ink often out of stock & late	Producer lead time & minimal inventory	Special safety stock for ink/toner required
<b>Q10</b>	Ease of payment (VAD)	4.53 (Very High)	Very easy & flexible	Finance: invoice processing	Effective payment system; backend acceleration needed

				needs acceleration	
<b>Q11</b>	Monitoring purchases < IDR 10M	4.06 (High)	Data recorded; non-PO transactions not automated	Need integration for small purchases	Monitoring good; system integration for non-PO needed
<b>Q12</b>	VMI service satisfaction	4.53 (Very High)	High satisfaction; catalog improvements requested	All parties consider VMI effective & efficient	VMI performs very well; requires continuous improvement

The synthesis analysis demonstrates general consistency between the questionnaire results and qualitative findings. Indicators that scored lower in the survey such as procedural flexibility, SLA performance for ink, and response to urgent requests also emerged as primary user concerns in open-ended responses. Interviews provide additional insights into root causes, including vendor capacity limitations, warehouse distance, and internal administrative processes.

Thus, the integration of the three data sources shows that while the VMI system is functioning effectively, improvements are still needed in information system performance, SLA compliance, stock management, and operational governance. This synthesis forms the basis for developing enhancement strategies using SWOT–TOWS and QSPM, resulting in prioritized recommendations such as VMI–ERP integration, early warning systems, buffer stock, and catalog improvements. This is consistent with the findings of Napitupulu et al. (2024), who demonstrated that ERP-based digital transformation of inventory management systems in educational institutions in developing countries significantly enhances transparency, reduces manual errors, and supports real-time decision-making across organizational units.

### Strategy Evaluation

This section evaluates the strategies for improving the performance of the Vendor Managed Inventory (VMI) system at Institut Teknologi Bandung (*ITB*) based on internal and external analyses (IFE–EFE), the SWOT matrix, TOWS strategy formulation, and the prioritization of strategies using the Quantitative Strategic Planning Matrix (QSPM). The evaluation is prepared to provide strategic recommendations that can enhance the effectiveness of VMI in supporting the implementation of the Three Pillars of Higher Education.

#### 1. Evaluation of Internal Factors (Internal Factor Evaluation – IFE)

The IFE results indicate that *ITB*'s VMI has several dominant strengths, including:

- a) High item availability, based on SLA realization and survey scores (mean 4.41).
- b) Consistently good item quality (mean 4.47).
- c) Ease of payment through the VAD system (mean 4.53).
- d) Very high overall service satisfaction (mean 4.53).

However, several significant weaknesses were also identified:

- a) Limited catalog and inconsistent item naming, which hinders item searching.
- b) Suboptimal SLA performance for printer ink ( $\leq 5$  days; actual mean only 3.69).
- c) Dependence on a single vendor (single vendor risk).
- d) Limited recording of non-PO transactions and purchases below IDR 10 million.

Overall, the IFE results show that VMI's strengths outweigh its weaknesses, but the existing weaknesses require serious attention as they directly impact the operational continuity of work units.

## 2. Evaluation of External Factors (External Factor Evaluation – EFE)

The EFE results indicate several opportunities that ITB can leverage, including:

- a) Integration of real-time data and information systems aligned with ITB's digital transformation roadmap.
- b) Opportunities to expand the catalog and item categories to include laboratory needs, academic activities, and public service operations.
- c) Implementation of automated min-max stock mechanisms to improve unit-level demand planning.
- d) Expansion of VMI services across multiple *ITB* campus locations.

Meanwhile, external threats include:

- a) Variability in supplier/manufacturer supply, which may cause delays in order fulfillment.
- b) Market price fluctuations, requiring periodic VMI price updates.
- c) Logistics dependency on the vendor, which poses risks during distribution disruptions.
- d) Sudden or urgent unit-level needs, requiring system and operational flexibility.

The EFE results indicate substantial external opportunities, providing strategic room for continuous VMI development.

## 3. SWOT and TOWS Matrix Formulation

Based on the IFE and EFE results, a SWOT Matrix was developed to map the relationships between internal and external factors. The matrix produced four groups of strategies:

- a) SO Strategies (Strength–Opportunity): Leverage VMI's internal strengths such as an effective information system and efficient processes to capture opportunities in digitalization and logistics integration.
- b) WO Strategies (Weakness–Opportunity): Address weaknesses such as catalog updates and system flexibility by utilizing technological advancements and expanding procurement modules.
- c) ST Strategies (Strength–Threat): Use internal strengths such as SLA monitoring and vendor coordination to anticipate supply delays and price volatility.
- d) WT Strategies (Weakness–Threat): Develop risk mitigation measures, improve SOPs, and explore multi-vendor options to reduce dependency and address potential supply chain disruptions.

The TOWS formulation was then used to derive more operational strategies such as early warning systems, buffer stock, VMI–ERP integration, and strengthened administrative mechanisms.

## 4. Strategy Prioritization Using QSPM

The Quantitative Strategic Planning Matrix (QSPM) was used to evaluate the feasibility and priority level of each alternative strategy generated from the TOWS Matrix. QSPM calculates the Total Attractiveness Score (TAS) for SO, WO, ST, and WT strategies based on the weighted internal and external factors. David et al. (2017) affirm that QSPM provides an objective, analytical basis for comparing mutually exclusive strategies by quantifying their

relative attractiveness in light of the organization’s key internal and external success factors. Malik et al. (2015) further demonstrated that integrating AHP weighting with SWOT and QSPM yields more reliable strategy prioritization in higher education institutions, reducing the risk of overlooking critical factors in strategic decision-making.

**Table 2. QSPM Calculation**

<b>Strategy</b>	<b>TAS</b>	<b>Priority</b>
<b>SO</b>	4.40	1 (Very High)
<b>WO</b>	2.66	2 (High)
<b>ST</b>	2.46	3 (Medium)
<b>WT</b>	2.43	4 (Medium)

The results indicate that the SO strategy is the most superior strategy because it aligns with ITB’s main strengths and the greatest opportunities within the digital transformation initiative.

### 1. SO Strategy

The SO strategy promotes:

- a) comprehensive integration of stock data,
- b) increased accuracy and speed of information,
- c) automated min–max–based ordering,
- d) transparent SLA monitoring.

This strategy serves as the foundation for a modern, adaptive, and responsive logistics service that supports the operations of all ITB work units.

### 2. WO Strategy

The WO strategy addresses the weaknesses most frequently reported by respondents, including:

- a) inconsistent item naming,
- b) limited item variations,
- c) outdated price information,
- d) unrecorded non-PO transactions.

Improving these aspects can significantly enhance user satisfaction and overall service efficiency.

### 3. Roles of ST and WT Strategies

These strategies focus on risk mitigation:

- a) maintaining supply continuity,
- b) reducing the risk of delays,
- c) minimizing dependence on a single vendor.

Although not the top priority, these strategies are essential for long-term service sustainability.

## **Strategic Implications for the Three Pillars of Higher Education**

The strategy evaluation shows that strengthening the VMI system has a direct impact on the three pillars of Education:

1. Education
  - a) Ensuring the availability of teaching materials, office supplies, and academic administration needs.
  - b) Reducing disruptions to the learning process due to logistical delays.
2. Research
  - a) Accelerating the provision of basic research materials (office supplies, ink, documents, printing instruments).
  - b) Reducing the risk of halted experiments due to unmet supply needs.
3. Community Service
  - a) Speeding up procurement for field activities.
  - b) Enabling a more adaptive response to sudden community needs.

### **Strategic Recommendations**

Based on the quantitative and qualitative findings, as well as the strategy evaluation using SWOT–TOWS and QSPM, this study proposes four prioritized strategic groups to enhance the performance of the Vendor Managed Inventory (VMI) system at *ITB*.

#### 1. First Priority (SO Strategy)

##### a) Strengthening the Centralized Inventory Planning and Monitoring System

*ITB* needs to develop an integrated inventory planning system connected directly to the vendor and VMI administrator. This system should utilize minimum–maximum inventory parameters to ensure that the replenishment process is automatic and real-time. Implementing this strategy will reinforce cross-unit stock transparency, reduce stockout risks, and support more accurate logistics budget planning.

##### b) Optimization of Performance-Based SLA Evaluation

The implementation of a Performance-Based SLA Dashboard containing indicators such as fulfillment time, item accuracy, and user satisfaction will enhance vendor accountability. Periodic evaluations will determine vendor ratings and serve as the basis for decisions regarding contract extension or termination. This strategy strengthens a culture of continuous improvement in VMI services.

#### 2. Second Priority (WO Strategy)

##### a) Regular Price Synchronization and Updates

Price benchmarking should be conducted quarterly and supported by a price-update feature within the VMI system, enabling users to provide inputs when market prices are lower. Price validation by the Logistics Directorate allows renegotiation with vendors. This strategy increases system credibility and ensures consistent implementation of the value-for-money principle.

##### b) Integration of Non-PO Purchases and Transactions Below IDR 10 Million

This integration eliminates “blind spots” in expenditure monitoring and enhances demand planning accuracy. The result is improved data transparency, strengthened budget planning quality, and more effective internal oversight.

#### 3. Third Priority (ST Strategy)

##### a) Implementation of Early Warning Mechanisms for Supply Delays

A proactive alert system is required to detect potential distribution delays so corrective action can be taken before academic and administrative activities are affected.

b) Increasing Buffer Stock for Critical Items

Providing buffer stock for essential commodities such as paper and printer ink is necessary to maintain supply stability. This strategy directly enhances SLA consistency and ensures the continuity of teaching and research activities.

4. Fourth Priority (WT Strategy)

a) Development of SOPs for Operational Risk Mitigation

Risk mitigation SOPs should be developed to anticipate potential system or service disruptions, including handling delays, data errors, and distribution issues.

b) Assessment of Multi-Vendor VMI Implementation

An initial assessment of adopting a multi-vendor approach is required to reduce reliance on a single provider. This strategy will strengthen supply chain resilience, expand service flexibility, and stabilize operations in the event of supply fluctuations or market changes.

### Comparative Study

This comparative study is included to position the research findings within a broader literature framework and to assess the alignment of ITB’s VMI implementation with previous empirical studies. Given that most VMI research focuses on the manufacturing and retail sectors, conducting a comparative analysis is essential to determine whether performance patterns, challenges, and success factors observed in industry settings also appear in higher education environments. In a systematic review of VMI models in sustainable supply chains, Lotfi et al. (2025) noted that the integration of VMI with risk-mitigation frameworks and blockchain technology significantly enhances supply chain viability, a principle increasingly applicable to public sector organizations including universities. Furthermore, Rof et al. (2022) and Tungpantong et al. (2021) have established that digital transformation in higher education institutions is no longer peripheral but a strategic priority that directly determines the effectiveness of administrative and logistical systems.

Through systematic comparison with relevant studies particularly those addressing SLA indicators, information system effectiveness, organizational performance, and supply chain integration this section provides an empirical foundation for assessing ITB’s position within the VMI implementation curve and identifying potential best practices for future strengthening of VMI strategies. Alhubaishy and Aljuhani (2021) emphasize that the successful adoption of information systems in higher education depends critically on institutional readiness, user acceptance, and the quality of system integration, all of which are dimensions directly relevant to ITB’s VMI performance gaps identified in this study.

**Table 3 Comparison with Global Literature**

Aspect	International Literature	ITB Findings	Conclusion
Service Level	VMI increases fill rate and reduces stockouts (Yao et al.)	SLA for stationery is fulfilled; SLA for printer ink remains unstable	Early warning and buffer stock are required
Information System	System adaptability strongly determines VMI effectiveness (Zhang et al.)	System is adequate but not fully integrated	ERP–VMI–dashboard integration is recommended

Operational Efficiency	VMI improves coordination and efficiency (Owusu)	Units report faster and more efficient processes	Effectiveness confirmed; catalog improvement needed
Higher Education	Limited literature available	VMI directly supports the Three Pillars of Higher Education (Tridarma)	ITB can serve as a VMI implementation model for universities

## CONCLUSION

The findings of this study show that the implementation of Vendor Managed Inventory (VMI) at Institut Teknologi Bandung plays a strategic role in ensuring the continuity of academic operations while directly contributing to the realization of the Three Pillars of Higher Education (Tridarma Perguruan Tinggi). VMI has been proven to enhance procurement efficiency, accelerate the fulfillment of logistical needs, and provide inventory data transparency through improved information system integration. In the field of education, VMI ensures the timely availability of materials needed to support lectures and academic administration activities. In research, the system facilitates smooth execution of research activities by providing stable and predictable access to essential supplies. In community service, VMI simplifies the mobilization of field logistics and accelerates required administrative processes. Strategic analysis indicates that *ITB's* VMI is on the right track but still requires strengthening in system integration, catalog refinement, improved SLA compliance, and the development of risk mitigation mechanisms. The strategy formulation based on SWOT–TOWS and prioritization using QSPM provides clear and implementable directions for development, including full integration of VMI–ERP–dashboard systems, early warning mechanisms for supply risks, buffer stock for critical items, and more adaptive operational SOPs. These findings confirm that VMI is not merely a technical solution in inventory management but a strategic enabler for sustaining academic services in higher education institutions. Purnasari (2025) similarly confirmed that the integration of VMI with business intelligence platforms and sustainability performance frameworks creates measurable improvements in organizational efficiency, a conclusion that reinforces the strategic importance of the SO-priority approach identified in this study. The successful implementation of VMI at *ITB* demonstrates that this model has strong potential to be replicated by other universities, especially those requiring efficient, transparent logistics governance capable of supporting the complex demands of the Three Pillars of Higher Education. With continuous development, VMI can evolve into a national best practice for inventory management within higher education environments. As Alfaro and Rábade (2020) note, the success of supply chain management strategies ultimately depends on their alignment with institutional strategic objectives—a condition that is increasingly being met through the integration of data-driven VMI systems within the broader governance frameworks of higher education.

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