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THE INFLUENCE OF VENDOR CAPABILITY ON SUPPLY CHAIN COLLABORATION AND FIRM PERFORMANCE WITH SUPPLIER INTEGRATION AS VARIABLE MODERATING

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ABSTRACT

Fuel supply shortages and price fluctuations pose significant challenges to the sustainability of fuel station business performance. These conditions require companies to strengthen vendor capabilities, integrate with supply chain partners, improve inventory management, and collaborate with them. This study aims to analyze the influence of vendor competency on vendor-managed inventory and supply chain collaboration, and the influence of vendor-managed inventory and supply chain collaboration on business performance, with supplier integration as a moderating variable. This study used a quantitative, survey-based approach. Data were collected via a Google Form questionnaire from 70 permanent fuel station employees. The sampling technique used was purposive sampling, while data analysis was conducted using Partial Least Squares-Structural Equation Modeling (PLS-SEM). The results show that vendor competency has a positive and significant effect on vendor-managed inventory but not on supply chain collaboration. Supplier integration has a positive and significant effect on vendor-managed inventory and supply chain collaboration. However, supplier integration moderates the relationships between vendor competency, vendor-managed inventory, and supply chain collaboration in a negative direction. In addition, vendor-managed inventory and supply chain collaboration have been shown to have a positive and significant effect on business performance. These findings suggest that improvements in fuel station business performance are more effectively achieved by strengthening inventory management systems, integrating information, and collaborating across the supply chain, rather than simply improving individual vendor competencies.

Keywords: vendor competency, vendor managed inventory, supply chain collaboration, business performance, fuel station.

INTRODUCTION

Fuel supply shortages and fluctuating fuel prices pose serious challenges to the sustainable performance of fuel station businesses amidst increasingly fierce competition. After activity returned to normal in the post-COVID-19 period, fuel demand increased alongside increased mobility of motorcycles, cars, trucks, and public transportation users. When fuel supplies at fuel stations are inadequate, this situation can trigger public panic and encourage excessive or impulsive buying (Meuthia et al., 2023). In some cases, fuel stations have even been forced to temporarily suspend operations until fuel stocks are restocked (Istiningrum et al., 2023). This phenomenon has prompted fuel station owners to strive to maintain a sustainable supply by replenishing more frequently within short periods (Tampubolon et al., 2023).

Supplier integration is a crucial aspect of supply chain management because it strengthens coordination between companies, suppliers, intermediaries, and market needs. Colin et al. (2015) stated that a properly designed supply chain can increase organizational attractiveness by supporting efficient product flow and improving the quality of managerial relationships with stakeholders involved in the business process. In an increasingly competitive global business environment, supplier capability is a crucial factor in helping companies understand the relationship between production capabilities and organizational competitiveness (Siagian et al., 2022). In the retail sector, supplier capability is determined not only by the supplier's own capacity but also by the reciprocal relationship between the supplier, the company, and the customer (Tarigan et al., 2021).

Supplier integration reflects supplier involvement in a company's business processes through the exchange of operational information, coordination of production plans, and synchronization of material requirements and market demand (Baah et al., 2022). This integration enables companies and suppliers to forecast demand more effectively, manage inventory levels, adjust product requirements, and leverage supplier capabilities and cost structures. Basana et al. (2023) explain that supplier integration is a form of cross-

functional external integration, namely the integration between a company's internal functions and the vendor's business functions. Thus, supplier integration is not only about purchasing activities but also about aligning processes, information, and operational decisions between the company and its suppliers.

In practice, supplier integration can strengthen supply chain capabilities and improve a company's business performance (Yuan et al., 2022). Supply chain integration also plays a role in mitigating supply chain risks through information sharing, synchronous planning, and operation coordination (Qiao & Zhao, 2023). Pirmanta et al. (2021) added that supplier integration is a form of business-process and organizational-function integration that supports downstream integration. One form of implementation is vendor-managed inventory, a trust-based collaboration between companies and suppliers in managing inventory (Sainathan & Groenevelt, 2019). In this system, vendors are given the authority and responsibility to determine the timing of material procurement and the required inventory levels, thereby reducing operational costs and improving stock management efficiency (Guimarães et al., 2013).

Vendor managed inventory (VMI) is a form of supply chain collaboration that provides vendors with greater confidence in managing inventory planning and control. In this system, vendors not only act as suppliers but also help determine optimal inventory levels, set replenishment schedules, and maintain stock availability to more effectively reduce inventory costs (Han et al., 2017). VMI also relates to replenishment decisions aimed at maintaining supply stability when demand fluctuates (Taleizadeh et al., 2020). Therefore, the success of VMI depends heavily on the quality of collaboration between companies and vendors, particularly in terms of information sharing, joint planning, and operational coordination (Chilkapure & Pillai, 2019). Through integrated information exchange, companies and supply chain partners can make inventory decisions more accurately, responsively, and in line with market needs (Golpîra, 2020).

The implementation of vendor-managed inventory (VMI) allows vendors to play a more strategic role in improving demand forecasting accuracy and inventory planning flexibility (Rad et al., 2014). In this context, a supply chain network's capability depends heavily on a company's ability to coordinate effectively with suppliers (Golpîra, 2020). A company's vendor capability is defined as its internal vendor competence and its ability to collaborate with the company to implement vendor-managed inventory. Vendors with strong competencies can foster supply chain integration and improve company responsiveness, including in inventory management (Yuan et al., 2022). Therefore, companies need to strengthen supplier integration to enable more collaborative information sharing, problem solving, and idea development with supply chain partners (Tarigan et al., 2020).

Through a VMI system, manufacturers can manage inventory more effectively by setting production levels that align with market needs and operational capacity (De Giovanni, 2021). This can be achieved through effective collaboration within the supply chain, particularly in understanding customer needs and desires and translating them into appropriate products (Hu et al., 2018). Effective coordination among supply chain parties in managing inventory, facilities, and transportation can also help lower inventory costs. Furthermore, supplier collaboration between companies and their partners helps strengthen inventory control, enabling companies to manage operational costs in line with lean manufacturing and VMI goals (Riofiandi & Tarigan, 2022).

A company's ability to manage product variation and reduce obsolescence is also crucial for minimizing unforeseen supply chain risks (Vu et al., 2020). Furthermore, strengthening vendor capability is determined not only by the vendor's technical capabilities but also by the company's implemented control mechanisms. Process control and outcome control are crucial factors in ensuring that vendors can effectively execute business processes and support improved business process outsourcing performance (Liu et al., 2017).

Supplier integration is a form of strategic connectedness between a company and its external partners, demonstrated through the exchange of accurate, timely, standardized, and relevant information to the supply chain's operational needs (Vafaei-Zadeh et al., 2020). This integration will be more effective when supported by good coordination, trust between parties, and interconnected business processes. This condition enables companies to build a more agile, flexible supply chain in response to changes in demand and market dynamics (Fayezi & Zomorrodi, 2015). In practice, supplier relationships can be strengthened through long-term contracts, support for supplier production process improvements, quality development, investment in supplier assets, supplier involvement in new product development, supplier capability enhancement, and joint sharing of risks, benefits, and development outcomes (Echtelt et al., 2008).

Strong supply chain collaboration can contribute to increased productivity, customer satisfaction, and cost efficiency, making it a crucial component of achieving business performance (Golpîra et al., 2023). In manufacturing companies in Thailand, supply chain collaboration has been shown to improve company performance by enabling better coordination between companies and their supply chain partners (Panahifar et al., 2018). Collaboration can also be strengthened through benefit and cost-sharing mechanisms between the company and its partners, including in managing inventory-related costs (Baah et al., 2022). Furthermore, collaboration with suppliers and customers can improve economic performance by reducing costs, increasing sales, and improving profit margins (Ardakani et al., 2023). With supplier and customer integration, companies can build partnerships, improve communication, and respond to partner feedback more effectively, thereby sustainably improving company performance (Teng et al., 2022). Based on this description, this study aims to analyze the relationships among vendor competency, vendor-managed inventory, supply chain collaboration, and business performance, with supplier integration as a moderating variable.

LITERATURE REVIEW

Relationship between Vendor Competence and Vendor-Managed Inventory and Supply Chain Collaboration

Vendor capability encompasses two main aspects. First, the vendor's internal capability, reflected in vendor Competence, such as resource capacity, technological capabilities, process quality, and reliability in meeting company needs. Second, the vendor's ability to build partnerships with companies, particularly in implementing vendor-managed inventory. Through this capability, the vendor acts not only as a material provider but also as a strategic partner involved in inventory planning, stock control, and replenishment decision-making in a more coordinated manner.

Vendor competency refers to a supplier's capacity to manage and improve human resource capabilities, technology utilization, and work processes that support the delivery of products to meet customer needs (Samuelsson et al., 2016). In increasingly fierce global competition, supplier competency is a crucial element because it helps strengthen the relationship among production capacity, market fulfillment quality, and supply chain competitiveness. This competency stems not only from the supplier's internal capabilities but is also influenced by the quality of interactions among the supplier, the company, and the customer, the ultimate beneficiary of the product (Pirmanta et al., 2021).

Suppliers with strong competencies tend to be better able to meet company needs by providing high-quality products, adequate supply quantities, and timely delivery. This helps companies reduce the risk of supply disruptions, such as delays, quality discrepancies, or failure to meet customer demand. Furthermore, stronger supplier competencies can support a company's competitive position by improving operational efficiency, supply reliability, and creating higher value for customers. Therefore, vendor competency can be seen as an important source for strengthening a company's competitiveness and increasing customer value relative to competitors (Hwang & Min, 2015; Doan, 2020).

In a vendor-managed inventory (VMI) system, vendors can generate more accurate demand forecasts and increase flexibility in inventory planning (Taleizadeh et al., 2020). Access to buyer demand information helps vendors better understand customer demand patterns, enabling more informed inventory and replenishment decisions. This can help vendors increase profits and reduce potential losses due to mismatches between supply and demand (Rad et al., 2014). Vendor competency also plays a crucial role in supporting VMI implementation, particularly through suppliers' ability to use real-time inventory-tracking systems. These systems are useful for managing storage resources, including warehousing facilities and distribution centers, allowing for more effective inventory monitoring and control. In a dynamic business environment, competitive advantage is determined not only by production capacity but also by an organization's ability to build overall flexibility, including through strong and adaptive relationships with raw material suppliers (Golpîra et al., 2023).

A company's ability to build supply chain collaboration plays a crucial role in improving operational performance. Effective collaboration enables companies and supply chain partners to align activities, improve coordination, and accelerate decision-making for operational needs (Siagian & Tarigan, 2021). Partnerships between suppliers and buyers need to be designed to produce optimal product acceptance plans, so that all parties involved in the supply chain can benefit (Siagian & Tarigan, 2021; Mabrouk, 2020).

As the party receives materials from suppliers, companies play a crucial role in determining the size, quantity, and quality of the products received. Furthermore, companies are responsible for inspecting materials, managing production process requirements, and ensuring product delivery to customers as requested (Vafaei-Zadeh et al., 2020). In this context, flexibility is a crucial factor supporting smooth supply chain integration. Flexibility allows companies to collaborate directly through interdepartmental information exchange, joint decision-making, and alignment of operational goals (Fayezi & Zomorrodi, 2015). Therefore, strong partnerships between companies and suppliers need to be continuously developed to ensure sustainable collaboration and improved performance (Tarigan et al., 2020). Based on the explanation above, the following research hypothesis can be formulated:
H_1: Vendor competency affects vendor-managed inventory.
H_2: Vendor competency influences supply chain collaboration.

Relationship between Vendor Competency and Vendor-Managed Inventory and Supply Chain Collaboration with Supplier Integration as A Moderating Variable

Vendor competency is a crucial factor in supporting the successful implementation of vendor-managed inventory (VMI) and supply chain collaboration. Suppliers with high competency tend to provide more accurate information, maintain supply quality, meet delivery schedules, and respond more effectively to changes in demand. This capability helps companies manage inventory more effectively by allowing replenishment decisions, stock levels, and procurement schedules to be adjusted to actual demand conditions. Therefore, the higher the supplier competency, the greater the company's opportunity to optimally implement VMI. Vendor competency also plays a role in strengthening supply chain collaboration.

The influence of vendor competency on VMI and supply chain collaboration can be strengthened if a company has strong supplier integration. Supplier integration enables companies and suppliers to connect through information exchange, process coordination, planning synchronization, and mutual trust. Supply chain integration can be understood as the interconnectedness among supply chain members in sharing critical information about markets, products, customers, and new market opportunities to support strategic decision-making (Beheshti, 2014). This integration encompasses three main dimensions: supplier integration, internal integration, and customer integration (Flynn et al., 2010). In practice, advances in information technology have increasingly enabled companies to build connections with upstream parties, especially suppliers, through faster, more accurate, and coordinated data exchange (Tarigan et al., 2021). Suppliers with strong technical, managerial, and operational capabilities are easier to collaborate with in sharing information, developing joint plans, solving problems, and adapting business processes to the company's needs. Supply chain collaboration requires more than just transactional relationships; it also requires partners to actively engage in decision-making, solution development, and joint performance improvement. Therefore, strong supplier competencies can serve as a foundation for more effective supply chain collaboration.

When supplier integration is well-functioning, supplier competencies can be optimally utilized in inventory management and supply chain collaboration (Basana et al., 2022). Conversely, if supplier integration is weak, high supplier competencies may not deliver optimal impact because information, processes, and decisions across organizations are not well-coordinated. Internal integration focuses on aligning business processes within a company, particularly between related functions and departments. This integration emphasizes the importance of managing connected processes and utilizing cross-functional data to support internal company coordination (Basana et al., 2023). Meanwhile, supplier-customer integration emphasizes strategic coordination between the company and external partners to ensure more effective collaboration (Qiao & Zhao, 2023; Siagian et al., 2022).

Thus, supplier integration can be viewed as a moderating variable that strengthens the relationships among vendor competency, vendor-managed inventory, and supply chain collaboration. This means that supplier competency will have a greater influence on the success of VMI and supply chain collaboration when the relationship between the company and its suppliers is well integrated. External integration between companies and their supply chain partners is reflected in information sharing, planning alignment, and demand forecasting synchronization (Kim, 2017; Chang et al., 2016). Through this integration, companies can build strategic partnerships with suppliers and customers to solve problems together, streamline

operations, and create mutually beneficial value for all parties in the supply chain (Jacobs et al., 2016). This integration helps transform supplier capabilities into tangible benefits for the company, particularly through more efficient inventory control, more responsive supply planning, and more productive supply chain collaboration. Based on the explanation above, the following research hypothesis can be established:

H_3: Vendor competency affects vendor-managed inventory, with supplier integration as a moderating variable.

H_4: Vendor competency influences supply chain collaboration with supplier integration as a moderating variable.

Relationship between Vendors' Competency, Vendor Managed Inventory, and Supply Chain Collaboration on Business Performance

Vendor-managed inventory (VMI) plays a crucial role in improving business performance by enabling companies and vendors to manage inventory more cohesively. In a vendor-managed inventory (VMI) system, information sharing is crucial because it enables vendors to gain a more comprehensive understanding of inventory conditions, demand patterns, distributor and buyer policies, and production decisions for each buyer (Han et al., 2017). Through VMI, vendors gain access to on-demand information on inventory levels and replenishment needs, enabling more accurate replenishment decisions. This information serves as the basis for vendors to develop more accurate and responsive inventory planning. When designing a VMI system, vendors need to consider optimal inventory levels to minimize total costs, maintain material quality, and adapt procurement decisions based on information shared with supply chain partners (Guimarães et al., 2013). This helps companies reduce the risk of stockouts, reduce excess inventory, accelerate response to changes in demand, and lower holding costs. The implementation of VMI also benefits retailers because inventory management is no longer solely the company's responsibility but is supported by vendors who have access to demand and replenishment data. With more comprehensive information, vendors can improve the accuracy of demand forecasts and have greater flexibility in inventory planning. This helps companies reduce the risk of stockouts, avoid excess inventory, and improve the efficiency of supply chain inventory management (Lee et al., 2016). With more efficient inventory management, companies can improve operational performance, enhance service accuracy, and better meet customer needs.

Supply chain collaboration also plays a crucial role in driving improved business performance. Strong collaboration between companies, suppliers, vendors, and customers enables information exchange, joint planning, process coordination, and faster problem resolution. Supply chain collaboration is a form of cooperation built through intra-organizational and inter-organizational integration. This collaboration is carried out through communication, information exchange, and knowledge sharing between parties in the supply chain to ensure that the quality of the products or services produced meets customer requirements (Vafaei-Zadeh et al., 2020). Through this collaboration, companies can reduce supply chain uncertainty, increase process efficiency, improve decision quality, and align operational activities with market needs. Through this collaboration, companies and supply chain partners can better understand customer needs and desires, thereby enabling them to produce products that better meet market demand (Baah et al., 2022). This impacts productivity increases, cost savings, delivery accuracy, customer satisfaction, and improved business performance.

Collaboration with partners also supports more effective inventory, facility, and transportation management. Good coordination among parties in the supply chain can help reduce inventory levels and storage and distribution costs (Ardakani et al., 2023). VMI can also strengthen business performance through supply chain collaboration. Implementing VMI requires open information, trust, and intensive coordination between companies and vendors. Targeted collaboration can help companies reduce obsolescence, minimize operational errors, and mitigate the risk of delays that can disrupt supply chain efficiency (Tarigan & Siagian, 2021). Continuous information exchange between manufacturers and retailers can also narrow information gaps, improve product conformance to established criteria, and ultimately increase customer satisfaction (Teng et al., 2022; Vu et al., 2020). VMI functions not only as an inventory control system but also as a tool to enhance collaboration between supply chain partners. Improved collaboration can ultimately strengthen VMI's impact on business performance by enhancing cost efficiency, smoother supply, faster market response, and higher-quality customer service. Based on the explanation above, the research hypothesis can be determined:

H_5: Vendor-managed inventory has an impact on supply chain collaboration.
H_6: Vendor-managed inventory has an impact on business performance.
H_7: Supply chain collaboration has an impact on business performance.

Based on the explanation above, the research framework is shown in Figure 1.

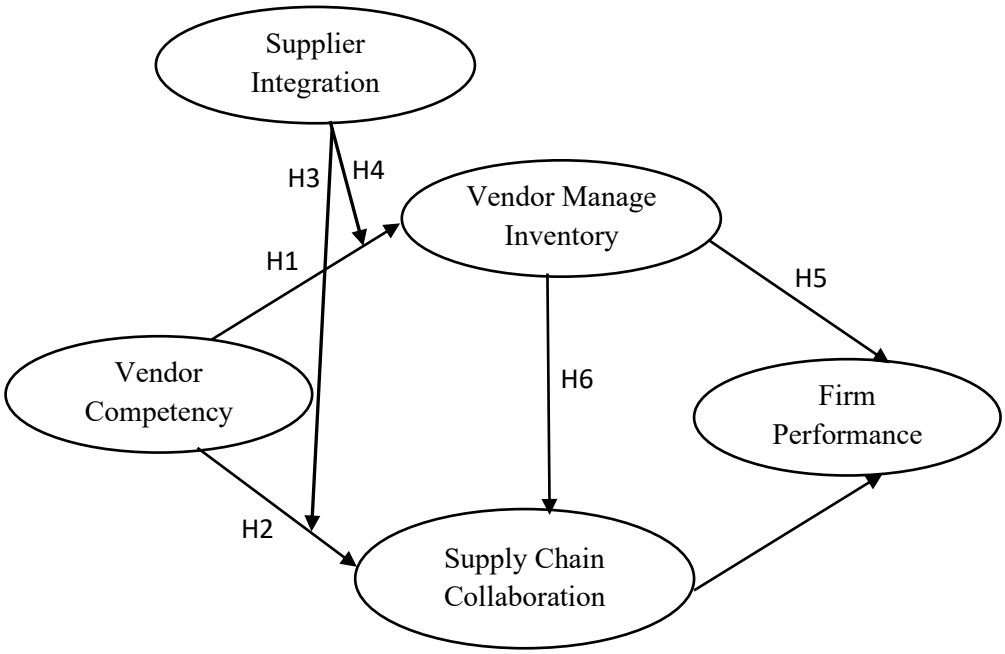

Figure 1. Research conceptual framework

METHODOLOGY

This study employed a quantitative, survey-based approach. This approach was chosen because the study aimed to empirically test the relationships among the variables in the research model. Data collection was conducted via a Google Form questionnaire distributed to respondents working at fuel stations. The questionnaire was used to obtain respondents' perceptions of research variables related to supply chain management, vendor managed inventory, supply chain collaboration, and business performance. The research instrument was structured as a closed-ended Likert-scale statement. This scale was used to measure respondents' level of agreement with each research indicator. The scale ranged from 1 to 5: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Each research variable was measured using several indicators developed from a literature review and adapted to the fuel station's context.

The measurement items in this study are organized by the variables used in the research model. The vendor competency variable is measured through five indicators, namely the vendor's ability to ensure the availability of fuel stock according to fuel station needs (VC1), the vendor's ability to deliver fuel on time (VC2), the vendor's ability to respond quickly to changes in fuel station demand (VC3), the vendor's ability to meet fuel supply needs according to predetermined plans (VC4), and the vendor's ability to support operational cost efficiency in the fuel procurement and distribution process (VC5). Furthermore, supplier integration is the interconnection between the company and suppliers that supports coordination, information exchange, and the smooth running of fuel station business processes. This variable is measured through four indicators, namely the company exchanges information regarding fuel stock needs and demand (SI1), the company has adequate internal integration to support coordination (SI2), the company communicates regularly regarding inventory, delivery, and replenishment needs (SI3), and the company coordinates in preparing and establishing fuel supply plans (SI4).

Vendor-managed inventory (VMI) is measured through five statements. VMI1 indicates the vendor's ability to accurately estimate fuel station fuel needs based on customer demand patterns. VMI2 describes the vendor's ability to manage supply quantities to ensure they do not exceed operational needs. VMI3 indicates the

vendor's ability to maintain stock availability to prevent fuel stations from running out of fuel. VMI4 describes the vendor's ability to determine inventory quantities that are appropriate to the fuel station's needs. VMI5 indicates the vendor's ability to efficiently manage inventory costs across procurement, storage, and distribution of fuel. Supply chain collaboration is measured through five indicators that reflect cooperation among fuel stations, vendors, and other supply chain participants. SCC1 indicates cooperation in maintaining fuel quality to meet established standards. SCC2 describes coordination among parties to ensure fuel deliveries are carried out on schedule. SCC3 indicates collaboration in maintaining occupational safety and health during the processes of fuel receiving, storage, and distribution. SCC4 describes cooperation between parties in the supply chain to address emerging operational constraints. SCC5 indicates the parties' willingness to share resources or costs required during the collaboration process.

Business performance is measured through five indicators that reflect the fuel station's performance. BP1 indicates growth in fuel sales and other supporting products. BP2 illustrates the fuel station's ability to achieve its established profit targets. BP3 demonstrates the company's ability to respond quickly and appropriately to customer needs. BP4 reflects the timely receipt of fuel supplies from vendors. BP5 demonstrates the fuel station's ability to drive customer satisfaction through product availability, service quality, and service speed.

The study population consisted of employees at fuel stations. The sampling technique used was purposive sampling, which selects respondents based on criteria aligned with the research objectives. The respondents in this study were employees with permanent company status. This criterion was determined because permanent employees are considered to have a better understanding of operational processes, inventory management, supplier relationships, and fuel station business activities. The number of respondents in this study was 70. The collected data were analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM). This method is used because it can test causal relationships among latent variables and is suitable for relatively small sample sizes. PLS-SEM analysis is carried out in two main stages: evaluation of the measurement model (outer model) and evaluation of the structural model (inner model).

Outer model evaluation was conducted to assess construct validity and reliability. Convergent validity was tested using outer loading and Average Variance Extracted (AVE) values, while construct reliability was assessed using Cronbach's Alpha and Composite Reliability values. Furthermore, an inner-model evaluation was conducted to examine the relationships among the variables in the research model. The analysis results were used to determine whether the relationships between variables in the research model were empirically significant.

ANALYSIS AND DISCUSSION

Questionnaires were distributed to 70 fuel stations in Timor Leste. The respondents were 64 (91.4%) male and 6 (8.6%) female. 28 (40%) had a bachelor's degree, and 42 (60%) had a high school education. The descriptive analysis of the study is shown in Table 1.

Based on Table 1, in the vendor competency variable, the mean value of each indicator ranges from 2.029 to 2.543. The highest mean value is found in VC5 (vendor's ability to support operational cost efficiency in the fuel procurement and distribution process) at 2.543, indicating that the vendor's ability to support operational cost efficiency is considered stronger than that of other indicators. Meanwhile, the lowest mean value is found in VC4 (vendor's ability to meet fuel supply needs according to predetermined plans) at 2.029, indicating that the vendor's ability to meet customer demand remains low. The mean of the vendor competency variable is 2.177, indicating that vendor competency remains generally suboptimal. The standard deviation value ranges from 0.481 to 0.863, with the highest variation in VC5. This indicates that respondents' perceptions of vendor operational cost efficiency are more diverse than other indicators.

For the supplier integration variable, the mean value ranges from 2.171 to 3.014. Indicator SI4 (the company coordinates in preparing and determining fuel supply planning) has the highest mean value of 3.014, indicating that the company's coordination with partners in determining planning is considered better than other indicators. Meanwhile, SI1 (the company exchanges information on fuel stock needs and demand) has the lowest mean value of 2.171, indicating that information exchange with partners still needs improvement. The average value of the supplier integration variable is 2.457, indicating that integration with supply chain

partners remains moderate to low. The highest standard deviation value is found in SI4 at 1.028, indicating a significant difference in perception among respondents regarding planning coordination with partners.

Table 1. Descriptive Analysis of the Research

Item measurement	Mean	Standard Deviation	Loading Factor
Venor Competency (Composite reliability = 0.915, Cronbach Alpha = 0.883, AVE = 0.683)			
VC1	2.057	0.611	0.790
VC2	2.214	0.611	0.865
VC3	2.043	0.494	0.788
VC4	2.029	0.481	0.881
VC5	2.543	0.863	0.778
Supplier Integration (Composite reliability = 0.904, Cronbach Alpha = 0.858, AVE = 0.704)			
SI1	2.171	0.659	0.744
SI2	2.457	0.736	0.919
SI3	2.186	0.748	0.866
SI4	3.014	1.028	0.807
Vendor Managed Inventory (Composite reliability = 0.923, Cronbach Alpha = 0.895, AVE = 0.705)			
VMI1	2.557	0.792	0.855
VMI2	2.400	0.769	0.868
VMI3	2.443	0.792	0.860
VMI4	2.757	0.788	0.849
VMI5	3.171	0.884	0.752
Supply Chain Collaboration (Composite reliability = 0.866, Cronbach Alpha = 0.804, AVE = 0.569)			
SCC1	2.186	0.748	0.595
SCC2	2.357	0.762	0.742
SCC3	1.986	0.434	0.677
SCC4	2.957	0.875	0.866
SCC5	2.986	0.860	0.832
Business Performance (Composite reliability = 0.848, Cronbach Alpha = 0.775, AVE = 0.531)			
BP1	2.357	0.703	0.686
BP2	2.343	0.611	0.852
BP3	2.357	0.682	0.784
BP4	2.686	0.910	0.587
BP5	2.814	0.982	0.701

For the vendor-managed inventory variable, the mean ranges from 2.400 to 3.171. The VMI5 indicator (vendor's ability to efficiently manage inventory costs, including procurement, storage, and distribution of fuel) has the highest mean of 3.171, indicating that the vendor's ability to determine efficient inventory costs is the best among the indicators. Conversely, VMI2 (the vendor's ability to manage supply quantities so that inventory does not exceed operational needs) has the lowest mean value of 2.400, indicating that the vendor's ability to adjust inventory to avoid excess inventory still needs improvement. The average for the vendor-managed inventory variable is 2.666, indicating that VMI implementation is beginning to take shape but is not yet running smoothly. The standard deviation value ranges from 0.769 to 0.884, indicating that respondents' answers vary relatively across all VMI indicators.

In the supply chain collaboration variable, the mean value ranges from 1.986 to 2.986. Indicator SCC5 (the willingness of the parties involved to share resources or costs required during the collaboration process) has the highest mean of 2.986, indicating that the parties' willingness to share costs during the collaboration is considered relatively high. Indicator SCC3 (collaboration in maintaining occupational safety and health during the process of receiving, storing, and distributing fuel) has the lowest mean of 1.986, indicating that collaboration in ensuring occupational safety and health remains low. The average mean of the supply chain collaboration variable is 2.494, indicating that supply chain collaboration has not been running optimally. The highest standard deviation values are found in SCC4 (cooperation between parties in the supply chain to address emerging operational constraints) at 0.875 and in SCC5 at 0.860, indicating variations in respondents' perceptions of operational problem-solving and cost involvement in collaboration. In the business performance variable, the mean value ranges from 2.343 to 2.814. Indicator BP5 has the highest mean value of 2.814, indicating that the fuel station's ability to provide customer satisfaction is relatively better than that of other indicators. Meanwhile, BP2 has the lowest mean of 2.343, indicating that achieving profit

targets remains a priority. The average of the business performance variable is 2.511, indicating that the fuel station's business performance is generally moderate to low. The highest standard deviation values are found in BP5 (0.982) and BP4 (0.910), indicating that respondents' perceptions of customer satisfaction and the timeliness of goods receipt are quite diverse.

Based on Table 1, for validity testing with loading factor and AVE values greater than 0.500, and reliability with values of composite reliability and Cronbach's Alpha were above 0.700. These results indicate that the outer loading value meets the established requirements, allowing the research hypothesis to proceed.

Table 2. Results of the research hypothesis

Research Hypothesis	Original sample (O)	T statistics	P values
VC -> VMI	0.352	2.789	0.005
VC -> SCC	0.164	1.369	0.171
SI x VC -> SCC	-0.331	5.844	0.000
SI x VC -> VMI	-0.168	2.967	0.003
SI -> SCC	0.501	3.908	0.000
SI -> VMI	0.355	4.146	0.000
VMI -> SCC	-0.176	1.575	0.115
SCC -> BP	0.434	4.595	0.000
VMI -> BP	0.46	5.862	0.000

The test results in Table 2 show that vendor competency has a positive and significant effect on vendor-managed inventory, with an original sample value of 0.352, a t-statistic of 2.789, and a p-value of 0.005. These results indicate that the higher the vendor competency, the better the implementation of vendor-managed inventory at the fuel station. Vendors who can guarantee stock availability, deliver efficiently, respond to changes in demand, and support cost efficiency will help companies manage inventory more effectively. However, vendor competency did not significantly impact supply chain collaboration. This is indicated by the original sample value of 0.164, t-statistics of 1.369, and p-values of 0.171. Thus, vendor competency has not been directly able to improve supply chain collaboration. This condition can occur because collaboration is not only determined by vendor capabilities but also requires communication, trust, transparency of information, willingness to share risks, and ongoing coordination between the company and its supply chain partners. The test results also show that supplier integration has a positive and significant impact on supply chain collaboration, with an original sample value of 0.501, a t-statistic of 3.908, and a p-value of 0.000. This means that the better the company's integration with its supply chain partners, the stronger the collaboration formed. Information exchange, regular communication, and planning coordination can foster more effective cooperation to ensure product quality, accurate delivery, operational problem-solving, and cost-effective collaboration.

Supplier integration also has a positive and significant effect on vendor-managed inventory, with an original sample value of 0.355, a t-statistic of 4.146, and a p-value of 0.000. These results indicate that integration with supply chain partners is a crucial factor in supporting the success of VMI. When companies and vendors have an integrated relationship, decisions on demand forecasting, inventory levels, preventing stock-outs, and controlling excess inventory can be made more accurately. Furthermore, the moderating effect of supplier integration on the relationship between vendor competency and supply chain collaboration shows a negative, significant effect, with an original sample value of -0.331, a t-statistic of 5.844, and a p-value of 0.000. These results indicate that supplier integration moderates the relationship, with a negative effect. This means that as supplier integration increases, the effect of vendor competency on supply chain collaboration actually weakens. This can be interpreted to mean that supply chain collaboration is more determined by the quality of integration and coordination between parties than by internal vendor competency alone.

The moderating effect of supplier integration on the relationship between vendor competency and vendor-managed inventory also showed a negative and significant influence with an original sample value of -0.168, a t-statistic of 2.967, and a p-value of 0.003. These results indicate that supplier integration also moderates the relationship between vendor competency and VMI, but in a negative direction. In other words, when the integration between the company and the vendor is strong, the additional contribution of vendor competency to VMI implementation becomes smaller. This may indicate a substitution effect, namely that good integration

is sufficient to help the company in implementing VMI, so the direct influence of vendor competency is not as large as when integration is still low. The relationship between vendor-managed inventory and supply chain collaboration was not significant, with an original sample value of -0.176, a t-statistic of 1.575, and a p-value of 0.115. These results indicate that implementing VMI has not directly improved supply chain collaboration. In fact, the negative sign of the coefficient indicates that VMI does not necessarily encourage collaboration if its implementation is more oriented toward inventory control than toward strategic cooperation between parties.

Supply chain collaboration has a positive and significant effect on business performance, with an original sample value of 0.434, a t-statistic of 4.595, and a p-value of 0.000. These results indicate that the better the supply chain collaboration, the higher the fuel station business performance. Good collaboration can improve delivery accuracy, service quality, operational problem-solving, cost efficiency, and customer satisfaction. Vendor managed inventory also has a positive and significant effect on business performance, with an original sample value of 0.460, a t-statistic of 5.862, and a p-value of 0.000. These results indicate that VMI is an important factor in improving fuel station business performance. Good inventory management helps companies reduce the risk of stock-outs, avoid excess inventory, improve supply accuracy, and support sales and profit achievement.

The results of this study imply that fuel stations need to view vendor competency as a critical factor in supporting fuel inventory management. Vendor competency is not only measured by the ability to provide products, but also by the ability to deliver on time, respond to changes in demand, maintain stock availability, and support cost efficiency. Because vendor competency has been shown to impact vendor-managed inventory significantly, fuel stations need to select and evaluate vendors based on tangible operational capabilities, not just price or short-term business relationships. The next implication relates to the importance of supplier integration in strengthening coordination between fuel stations and vendors. The study's results indicate that supplier integration significantly influences vendor-managed inventory and supply chain collaboration. This means that successful fuel inventory management is highly dependent on the quality of information exchange, regular communication, and planning coordination between the company and its supply chain partners. Fuel stations need to establish more transparent information systems, regular communication schedules, and joint planning mechanisms to enable more accurate decisions on stock requirements, deliveries, and replenishment. The results also indicate that vendor-managed inventory and supply chain collaboration significantly impact business performance. Consequently, fuel stations need to strengthen VMI practices to maintain fuel availability, reduce the risk of stockouts, suppress excess inventory, and improve the accuracy of supply receipts. Furthermore, supply chain collaboration should focus on improving service quality, delivery accuracy, operational problem resolution, and customer satisfaction. Therefore, improving fuel station business performance depends not only on sales activities but also on the company's ability to manage vendor relationships more systematically and collaboratively.

The negative moderation finding indicates that supplier integration does not always strengthen the influence of vendor competency on VMI and supply chain collaboration. This indicates that when integration with vendors is already strong, the additional contribution of individual vendor competencies becomes smaller. Therefore, fuel stations need to balance two things: selecting competent vendors and building an effective integration system. Vendor competency remains important, but its benefits will be more optimal if supported by clear work procedures, information-sharing agreements, trust between parties, and shared responsibility for maintaining a smooth fuel supply.

CONCLUSION

Vendor management, integration with partners, implementation of vendor-managed inventory, supply chain collaboration, and fuel station business performance still need improvement, especially in meeting supply requirements on time, information exchange, preventing excess inventory, ensuring work safety, and achieving profitability. The results of the hypothesis test indicate that vendor competency has a positive and significant effect on vendor-managed inventory. This finding shows that vendor competency in ensuring stock availability, making timely deliveries, responding to demand changes, and supporting cost efficiency is crucial to successful fuel inventory management. However, vendor competency does not have a significant effect on supply chain collaboration. This means that internal vendor capabilities are insufficient to build supply chain

collaboration without the support of communication, trust, coordination, and information transparency among parties. Supplier integration has been shown to have a positive, significant effect on vendor-managed inventory and supply chain collaboration. These results indicate that integration between fuel stations and supply chain partners is a crucial factor in supporting inventory management and establishing better collaboration. Information exchange, regular communication, and planning coordination can help companies determine stock requirements, manage replenishment, prevent stockouts, and resolve operational issues more effectively. However, the moderating effect of supplier integration on the relationships between vendor competency, vendor-managed inventory, and supply chain collaboration was negative. This finding indicates that when integration with partners is strong, the additional influence of vendor competency diminishes because coordination and information-exchange systems assume a more dominant role. This study also found that vendor-managed inventory and supply chain collaboration have a positive and significant impact on business performance. Thus, fuel station business performance can be improved through more precise inventory management, inventory cost control, stockout prevention, timely supply, and more effective supply chain collaboration. Conversely, vendor-managed inventory did not have a significant impact on supply chain collaboration. Therefore, VMI implementation should focus not only on stock control but also on strengthening collaborative relationships between fuel stations and vendors. Overall, this study confirms that improving business performance at fuel stations depends not only on vendor competency but also on the company's ability to build integration, collaboration, and a coordinated inventory management system.

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REFERENCES

Ardakani, D.A., Soltanmohammadi, A. and Seuring, S. (2023). The impact of customer and supplier collaboration on green supply chain performance. *Benchmarking: An International Journal, 30*(7), 2248-2274. https://doi.org/10.1108/BIJ-12-2020-0655

Baah, C., Opoku Agyeman, D., Acquah, I.S.K., Agyabeng-Mensah, Y., Afum, E., Issau, K., Ofori, D. and Faibil, D. (2022). Effect of information sharing in supply chains: understanding the roles of supply chain visibility, agility, collaboration on supply chain performance. *Benchmarking: An International Journal, 29*(2), 434-455. https://doi.org/10.1108/BIJ-08-2020-0453

Basana, S.R., Suprapto, W., Andreani, F. & Tarigan, Z.J.H. (2022). The impact of supply chain practice on green hotel performance through internal, upstream, and downstream integration. *Uncertain Supply Chain Management, 10*(1), 169-180, DOI: 10.5267/j.uscm.2021.9.010

Basana, S.R., Ubud, S., Malelak, M.I. & Tarigan, Z.J.H. (2023). The effect of key user capability on supply chain digital and flexibility in improving financial performance. *Uncertain Supply Chain Management*, *11*(1), 267-276, DOI: 10.5267/j.uscm.2022.9.016

Beheshti, H.M., Oghazi, P., Mostaghel, R., Hultman, M. (2014). Supply chain integration and firm performance: An empirical study of Swedish manufacturing firms. *Compet. Rev. 2014, 24*, 20–31

Chang, W., Ellinger, A.E., Kim, K., Kate & Franke, G.R. (2016). Supply chain integration and firm financial performance: a meta-analysis of positional advantage mediation and moderating factors. *Eur. Manag. J. 34*(3), 282–295. https://doi.org/10.1016/j.emj.2015.11.008

Chilkapure, A.J.S.N. & Pillai, V.M. (2019). Literature review on supply chain collaboration: comparison of various collaborative techniques. *Journal of Advances in Management Research, 16*(4), 537-562. https://doi.org/10.1108/JAMR-10-2018-0087

Colin, M., Galindo, R., & Hernández, O. (2015). Information and communication technology as a key strategy for efficient supply chain management in manufacturing SMEs. *Procedia Computer Science, 55*, 833-842

De Giovanni, P. (2021). Smart supply chains with vendor managed inventory, coordination, and environmental performance. *European Journal of Operational Research*, *292*(2), 515-531, https://doi.org/10.1016/j.ejor.2020.10.049

Doan, T.T.T. (2020). Supply chain management drivers and competitive advantage in the manufacturing industry. *Uncertain Supply Chain Management, 8*(3), 473–480, https://doi.org/10.5267/j.uscm.2020.5.001

Echtelt, F., Wynstra, F., Weele, A., & Duysters, G. (2008). Managing Supplier Involvement in New Product Development: A Multiple-Case Study. *The Journal of Product Innovation Management, 25*(2), 180–201. https://doi.org/10.1111/j.1540-5885.2008.00293.x

Flynn, B.B., Huo, B., Zhao, X. (2010). The impact of supply chain integration on performance: a contingency and configuration approach. *J. Oper. Manag. 28*(1), 58–71. https://doi.org/10.1016/J.JOM.2009.06.001

Fayezi, S. and Zomorrodi, M. (2015). The role of relationship integration in supply chain agility and flexibility development: An Australian perspective. *Journal of Manufacturing Technology Management, 26*(8), 1126-1157. https://doi.org/10.1108/JMTM-11-2014-0123

Golpîra, H. (2020). Optimal integration of the facility location problem into the multi-project multi-supplier multi-resource Construction Supply Chain network design under the vendor managed inventory strategy. *Expert Systems With Applications, 139*, 112841. https://doi.org/10.1016/j.eswa.2019.112841

Golpîra, H., Tirkolaee, E.B., Maihami, R., & Karimi, K. (2023). A robust Tri-Objective optimization to supply chain configuration under Vendor-Managed inventory policy considering supply chain visibility. *Expert Systems with Applications, 224*, 119916, https://doi.org/10.1016/j.eswa.2023.119916

Guimarães, CM, Crespo de Carvalho, J. and Maia, A. (2013). Vendor managed inventory (VMI): evidences from lean deployment in healthcare. *Strategic Outsourcing: An International Journal*, *6*(1), 8-24. https://doi.org/10.1108/17538291311316045

Han, J., Lu, J. & Zhang, G. (2017). Tri-level decision making for decentralized vendor-managed inventory. *Journal of Informal Sciences*. https://dx.doi.org/10.1016/j.ins.2017.08.089

Hwang, D., & Min, H. (2015). Identifying the drivers of enterprise resource planning and assessing its impacts on supply chain performances. *Industrial Management & Data Systems, 115*(3), 541-569. https://doi.org/10.1108/IMDS-10-2014-0284

Hu, B., Meng, C., Xu, D., & Son, Y.-J. (2018). Supply chain coordination under vendor managed inventory-consignment stocking contracts with wholesale price constraint and fairness. *International Journal of Production Economics, 202*, 21-31, https://doi.org/10.1016/j.ijpe.2018.05.009

Istiningrum, A. A., Sono, & Heitasari, D. N. (2023). Reducing Pertamax inventory costs at a gas station by eliminating shortage using probabilistic economic order quantity. *Advances in Engineering Research, 225*. https://doi.org/10.2991/978-94-6463-284-2_50

Jacobs, M.A., Yu, W., Chavez, R. (2016). The effect of internal communication and employee satisfaction on supply chain integration. *Int. J. Prod. Econ. 171*, 60–70. https://doi.org/10.1016/J.IJPE.2015.10.015

Kim, H.J. (2017). Information technology and firm performance: the role of supply chain integration. *Operations Management Research 10*(1–2), 1–9. https://doi.org/10.1007/s12063-016-0122-z

Lee, J.-Y., Cho, R.K., & Paik, S.-K. (2016). Supply chain coordination in vendor-managed inventory systems with stockout-cost sharing under limited storage capacity. *European Journal of Operational Research*, *248*(1), 95-106, https://doi.org/10.1016/j.ejor.2015.06.080

Liu, S., Wang, L., & Huang, W. (2017). Effects of process and outcome controls on business process outsourcing performance: Moderating roles of vendor and client capability risks. *European Journal of Operational Research*, *260*, 1115-1128, http://dx.doi.org/10.1016/j.ejor.2017.01.020

Mabrouk, N.B. (2020). Interpretive structural modeling of critical factors for buyer-supplier partnerships in supply chain management. *Uncertain Supply Chain Management, 8(*3), 613–626. https://doi.org/10.5267/j.uscm.2020.2.002

Meuthia, M., Lita, R. P., & Rahmahdian, R. (2023). An explanatory framework of palm oil panic buying behavior in Indonesia: Do perceived scarcity and perceived price being enablers? *Cogent Business & Management, 10*(3), 2258624. https://doi.org/10.1080/23311975.2023.2258624

Panahifar, F., Byrne, P.J., Salam, M.A. and Heavey, C. (2018). Supply chain collaboration and firm's performance: The critical role of information sharing and trust. *Journal of Enterprise Information Management, 31*(3), 358-379. https://doi.org/10.1108/JEIM-08-2017-0114

Pirmanta, P., Tarigan, Z., & Basana, S. (2021). The effect of ERP on firm performance through information quality and supply chain integration in Covid-19 era. *Uncertain Supply Chain Management*, *9*(3), 659-666. DOI: 10.5267/j.uscm.2021.5.004

Qiao, R. and Zhao, L. (2023). Reduce supply chain financing risks through supply chain integration: dual approaches of alleviating information asymmetry and mitigating supply chain risks. *Journal of Enterprise Information Management*, https://doi.org/10.1108/JEIM-01-2023-0016

Riofiandi, D. & Tarigan, Z.J.H. (2022). The effect of supplier collaboration on company performance through lean manufacture and inventory control. *Petra International Journal of Business Studies*, *5*(1), 74-86, DOI: https://doi.org/10.9744/ijbs.5.1.74-86

Sainathan, A. & Groenevelt, H. (2019). Vendor managed inventory contracts – coordinating the supply chain while looking from the vendor's perspective. *European Journal of Operational Research, 272*, 249-260. https://doi.org/10.1016/j.ejor.2018.06.028

Siagian, H. & Tarigan, Z.J.H. (2021). The central role of IT capability to improve firm performance through lean production and supply chain practices in the COVID-19 era. *Uncertain Supply Chain Management*, *9*(4), 1005-1016, DOI: 10.5267/j.uscm.2021.6.012

Siagian, H., Tarigan, Z.J.H., & Basana, S.R. (2022). The role of top management commitment in enhancing competitive advantage: The mediating role of green innovation, supplier, and customer integration. *Uncertain Supply Chain Management*, *10*(2), 477-494, DOI: 10.5267/j.uscm.2021.12.003

Taleizadeh, A.A., Shokr, I., Konstantaras, I., & VafaeiNejad, M. (2020). Stock replenishment policies for a vendor-managed inventory in a retailing system. *Journal of Retailing and Consumer Services, 55*, 102137, https://doi.org/10.1016/j.jretconser.2020.102137

Tampubolon, R. B., Zai, S. N. P., & Agustin, H. (2023). The impact of fuel oil increase on stock prices: an event study approach on the IDX80 Indonesia Stock Exchange 2022. *International Journal of Economics, Business and Accounting Research (IJEBAR), 7*(3), 979–988. https://doi.org/10.29040/ijebar.v7i3.10167

Tarigan, Z.J.H. & Siagian, H. (2021). The effects of strategic planning, purchasing strategy and strategic partnership on operational performance. *Uncertain Supply Chain Management*, *9*(2), https://doi.org/10.5267/j.uscm.2021.2.006

Tarigan, Z.J.H., Jiputra, J.A. & Siagian, H. (2021). The effect of supply chain practices on retailer performance with information technology as moderating variable. *International Journal of Data and Network Science*, *5*(1), 47-54, DOI: 10.5267/j.ijdns.2020.11.003

Tarigan, Z.J.H., Tanuwijaya, N.C. & Siagian, H. (2020). Does top management attentiveness affect green performance through green purchasing and supplier collaboration? *Academy of Strategic Management Journal*, *19*(4), 1-10

Teng, T., Tsinopoulos, C. and Tse, Y.K. (2022). IS capabilities, supply chain collaboration and quality performance in services: the moderating effect of environmental dynamism. *Industrial Management & Data Systems, 122*(7), 1592-1619. https://doi.org/10.1108/IMDS-08-2021-0496

Vafaei-Zadeh, A., Ramayah, T., Hanifah, H., Kurnia, S. & Mahmud, I. (2020). Supply chain information integration and its impact on the operational performance of manufacturing firms in Malaysia. *Information & Management, 57*, 103386, https://doi.org/10.1016/j.im.2020.103386

Vu, T.H., Tran, H.L., Le, T.T., Nguyen, M.D., & Duong, B.N. (2020). Relationship between supply chain activities in Vietnamese retailer business enterprises. *Uncertain Supply Chain Management*, *8*, 321-330.

Yuan, Y., Liu, L. & Liu, L. (2022). How does information integration enhance SMEs' credit quality: the mediating role of supply chain capabilities. *Industrial Management & Data Systems, 122*(2), 544-561. https://doi.org/10.1108/IMDS-10-2020-0621