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Supply Chain Performance Measurement Using Scor Model-Based Key Performance Indicators

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ABSTRACT

This study presents a systematic approach to measuring supply chain performance using the Supply Chain Operations Reference (SCOR) model-based Key Performance Indicators (KPIs). Increasing global competition and post-pandemic supply chain disruptions have made performance measurement a critical priority for organizations seeking operational excellence. Despite the widespread adoption of the SCOR model, existing literature reveals significant gaps in its application within emerging economies and sector-specific contexts. This research employs a quantitative descriptive methodology, drawing on data from 120 respondents representing procurement, logistics, and operations functions across manufacturing firms. Using the five SCOR dimensions—Plan, Source, Make, Deliver, and Return—a total of 25 KPIs were assessed through structured surveys and validated through confirmatory factor analysis. Results indicate that the Deliver and Source dimensions record the lowest performance scores, signaling critical bottlenecks in distribution networks and supplier management. The study also reveals that organizations with integrated digital monitoring systems outperform traditional counterparts in three out of five SCOR dimensions. Findings contribute both theoretically, by extending the SCOR framework to manufacturing contexts in developing regions, and practically, by offering a diagnostic KPI dashboard for supply chain managers. This research underscores the urgency of evidence-based performance measurement as a foundation for supply chain resilience and sustainable competitive advantage.

INTRODUCTION

In the contemporary global business environment, supply chains have evolved into complex, multi-tiered networks that serve as the backbone of economic activity across all sectors. The relentless pressure of globalization, rapid technological change, and heightened customer expectations have intensified the need for organizations to achieve and sustain high levels of supply chain performance. According to the World Economic Forum (2023), supply chain disruptions cost the global economy an estimated USD 1.7 trillion annually, underscoring the systemic vulnerability inherent in global logistics and procurement networks. These disruptions—ranging from geopolitical tensions and climate-related events to pandemic-induced shocks—have exposed the inadequacy of traditional reactive management approaches, catalyzing a paradigm shift toward proactive, data-driven performance measurement frameworks. Within this context, the ability to accurately assess, monitor, and continuously improve supply chain operations has become not merely a competitive advantage but an existential necessity for firms seeking long-term sustainability.

The scale of global supply chain activity provides further motivation for rigorous performance measurement. The global supply chain management market was valued at approximately USD 19.3 billion in 2022 and is projected to grow at a compound annual growth rate (CAGR) of 11.2% through 2030, reaching an estimated USD 45.2 billion (Grand View Research, 2023). This growth trajectory reflects the increasing strategic importance attributed to supply chain functions across industries such as manufacturing, retail, healthcare, and technology. Despite this expansion, empirical evidence consistently reveals persistent performance gaps, particularly in emerging economies where infrastructural deficiencies, regulatory complexities, and limited access to advanced technologies constrain supply chain efficiency. The International Trade Centre (2022) reports that firms in developing nations experience supply chain inefficiencies that reduce their competitiveness by up to 30% compared to their counterparts in developed markets, highlighting a critical disparity that demands targeted research attention and actionable measurement tools.

Among the various frameworks developed to address supply chain performance measurement, the Supply Chain Operations Reference (SCOR) model stands out as the most comprehensive and industry-validated standard. First developed by the Supply Chain Council in 1996 and currently maintained by APICS (now merged into the Association for Supply Chain Management, ASCM), the SCOR model provides a structured, process-reference approach that integrates business process reengineering, benchmarking, and best practices into a unified performance measurement framework (ASCM, 2022). The model organizes supply chain activities into five primary management processes Plan, Source, Make, Deliver, and Return each associated with a set of Key Performance Indicators (KPIs) spanning four performance attributes: reliability, responsiveness, agility, costs, and asset management efficiency. The SCOR model's hierarchical structure allows organizations to assess performance at strategic, tactical, and operational levels, enabling both macro-level comparisons across industries and micro-level diagnostics within specific supply chain segments.

A specific and pressing challenge in supply chain performance management relates to the inconsistent and fragmented application of KPI systems in practice. Many organizations continue to rely on isolated, functionally siloed metrics that fail to capture cross-functional interdependencies within the supply chain (Gunasekaran et al., 2021). This fragmentation not only impedes accurate performance diagnosis but also undermines strategic alignment and inhibits coordinated improvement efforts. A study by Deloitte (2022) found that 79% of companies with high-performing supply chains achieve revenue growth significantly above their industry average, yet fewer than 15% of organizations globally have implemented a fully integrated, end-to-end supply chain performance measurement system. This paradox between the recognized value of performance measurement and its limited systematic application represents a critical organizational failure that has significant economic consequences, particularly in the manufacturing sector where margins are thin and operational efficiency is paramount.

Previous research has explored various dimensions of SCOR-based performance measurement, though several critical gaps remain. Ntabe et al. (2021) applied the SCOR model to the oil palm industry in Cameroon, demonstrating its adaptability to agro-industrial supply chains but noting limitations in the availability of sector-specific benchmarks. Similarly, Carvalho et al. (2022) examined SCOR implementation in Brazilian manufacturing firms and found that while the model effectively identifies performance bottlenecks, its application is often hampered by data quality issues and organizational resistance to standardized measurement practices. In the Asian manufacturing context, Pham et al. (2022) investigated SCOR adoption in Vietnamese garment supply chains, revealing that the Return dimension is frequently overlooked despite its growing significance in circular economy frameworks. More recently, Marbun and Sinaga (2023) applied SCOR-based KPIs to Indonesian palm oil supply chains and highlighted the underperformance of the Source process, particularly with regard to supplier lead times and order fulfillment accuracy. Collectively, these studies, while informative, share a common limitation: they do not provide a comprehensive, multi-industry quantitative analysis that integrates all five SCOR dimensions with statistically validated KPI instruments.

A significant research gap exists in the literature concerning the comprehensive quantitative operationalization of all five SCOR dimensions simultaneously within a single empirical study framework, particularly in the context of manufacturing industries in emerging economies. Most prior studies have either focused on a subset of SCOR processes, applied qualitative or case-study methodologies, or examined single-industry contexts that limit generalizability (Huan et al., 2004; Stephens, 2001; Min & Mentzer, 2004). Moreover, the intersection of digital transformation initiatives and SCOR-based performance measurement remains underexplored, despite the increasing integration of Industry 4.0 technologies—such as Internet of Things (IoT) sensors, blockchain for traceability, and advanced analytics—into supply chain management. This gap is especially pronounced in the Indonesian manufacturing context, where supply chain digitalization is at a nascent stage and standardized performance measurement frameworks have yet to be widely institutionalized (Badan Pusat Statistik, 2023).

The urgency of this research is further reinforced by recent empirical evidence on supply chain vulnerabilities in the post-COVID-19 era. The COVID-19 pandemic exposed fundamental weaknesses in global supply chains, disrupting production, creating unprecedented demand volatility, and rendering existing performance measurement systems inadequate for managing rapid change (Ivanov, 2020). A McKinsey Global Survey (2021) found that 93% of supply chain executives planned to increase supply chain resilience, yet only 37% had a systematic methodology for measuring their current performance baseline—a prerequisite for any meaningful improvement effort. In the Indonesian manufacturing sector specifically, the pandemic led to a 23.1% contraction in industrial production in the second quarter of 2020 (Bank Indonesia, 2020), with recovery trajectories heavily influenced by the effectiveness of supply chain management

practices. Against this backdrop, a rigorous, SCOR-based KPI assessment framework is not merely academically valuable but operationally imperative.

The novelty of this research lies in its systematic integration of all five SCOR model dimensions Plan, Source, Make, Deliver, and Return into a unified, statistically validated KPI measurement instrument designed for application in the Indonesian manufacturing context. Unlike prior studies that have applied the SCOR model selectively or qualitatively, this research operationalizes each SCOR process through a validated set of measurable indicators, assesses inter-dimensional performance relationships using structural analysis, and benchmarks findings against international SCOR performance standards. Furthermore, this study uniquely incorporates the mediating role of digital capability in supply chain performance, addressing the intersection of SCOR measurement and digital transformation—a nexus that has received insufficient empirical attention in the existing literature. The research also contributes a sector-specific diagnostic tool that practitioners can immediately deploy for performance auditing and strategic planning purposes.

The primary purpose of this research is to systematically measure and analyze supply chain performance using SCOR model-based Key Performance Indicators across manufacturing firms in Indonesia, with the dual objective of identifying performance gaps and providing evidence-based recommendations for improvement. Specifically, the study aims to: (1) develop and validate a comprehensive KPI instrument aligned with all five SCOR process domains; (2) assess the current level of supply chain performance across each SCOR dimension in the sampled organizations; (3) identify critical performance bottlenecks and their underlying drivers; and (4) examine how digital integration capabilities moderate supply chain performance outcomes. By addressing these objectives, the research seeks to bridge the gap between theoretical frameworks and practical implementation, providing organizations with a structured, data-driven basis for supply chain performance management decision-making.

This study makes several significant contributions to both the academic literature and managerial practice. Theoretically, it extends the application of the SCOR model to the Indonesian manufacturing context, enriching the body of knowledge on supply chain performance measurement in emerging economies and providing empirical validation of the SCOR framework's relevance across diverse industrial settings. Methodologically, the research contributes a rigorously validated KPI instrument that can be adapted for use in future studies examining supply chain performance in similar contexts. From a practical standpoint, the findings offer supply chain managers a clear, evidence-based diagnostic map of performance strengths and weaknesses, enabling targeted investment in improvement initiatives. The research implications extend to policymakers as well, as the identified systemic deficiencies in supply chain performance point to the need for infrastructural, regulatory, and capacity-building interventions that can enhance the competitiveness of the national manufacturing sector in global value chains.

METHOD

This study employs a quantitative descriptive research design, which is appropriate for measuring the current state of supply chain performance across multiple dimensions and organizations without manipulation of variables. The target population encompasses all manufacturing companies registered with the Indonesian Ministry of Industry (Kementerian Perindustrian) in West Java Province—a region that accounts for approximately 43% of national industrial output (Badan Pusat Statistik, 2023). The accessible population was narrowed to medium and large-scale manufacturing enterprises with at least three years of operational history and documented supply chain functions, yielding a frame of 420 companies across sub-sectors including food and beverage processing, textile and garment, electronics assembly, and automotive components. A proportional stratified random sampling technique was applied to ensure representation across sub-sectors, with sample size determined using the Slovin formula at a 5% margin of error. This yielded a final sample of 120 respondents—each a supply chain professional (manager, supervisor, or analyst) in their respective organizations—across 60 companies (two respondents per firm). Data collection was conducted through a structured self-administered questionnaire developed in alignment with the SCOR model version 12.0 framework (ASCM, 2022), comprising 25 KPI measurement items distributed across five dimensions: Plan (5 items), Source (5 items), Make (5 items), Deliver (5 items), and Return (5 items). Each item was measured using a five-point Likert scale anchored at 1 (Very Poor) to 5 (Excellent). A pilot test was conducted with 30 respondents outside the main sample to assess instrument quality prior to full deployment.

The research instrument underwent rigorous validity and reliability testing to ensure measurement quality. Content validity was established through expert panel review involving three academicians specializing in supply chain management and two industry practitioners with over ten years of experience in manufacturing operations. Construct validity was examined through Confirmatory Factor Analysis (CFA) using AMOS 26 software, with convergent validity assessed via Average Variance Extracted (AVE) values—all exceeding the threshold of 0.50—and discriminant validity verified through the Fornell-Larcker criterion (Fornell & Larcker, 1981). Reliability was assessed using Cronbach's alpha coefficients, with all five SCOR dimensions recording values above the acceptable threshold of 0.70 (Plan: $\alpha = 0.84$; Source: $\alpha = 0.81$; Make: $\alpha = 0.86$; Deliver: $\alpha = 0.83$; Return: $\alpha = 0.79$), indicating satisfactory internal consistency. The primary data collection was supplemented with secondary data from company annual reports, internal supply chain audits, and industry benchmark reports published by ASCM and the World Bank, which provided reference points for comparative performance analysis. Data collection was carried out over a period of three months (September–November 2025) through a combination of online surveys administered via Google Forms and face-to-face interviews conducted at company premises in the greater Bandung-Bekasi-Karawang industrial corridor.

Data analysis was conducted using several complementary statistical and analytical techniques. Descriptive statistics—including means, standard deviations, and

frequency distributions—were computed for each KPI and SCOR dimension using IBM SPSS Statistics 26 to profile the current state of supply chain performance. To identify significant differences in performance across industry sub-sectors and between firms with and without digital supply chain integration, independent samples t-tests and one-way Analysis of Variance (ANOVA) with post-hoc Tukey HSD tests were employed. The overall SCOR performance index for each firm was calculated using a weighted scoring model, with dimension weights derived from analytic hierarchy process (AHP) pairwise comparisons conducted with the expert panel. Performance benchmarking was performed against SCOR Level 1 parity and advantage benchmarks published in the ASCM SCOR 12.0 standard. Additionally, a radar/spider chart visualization technique was applied to graphically represent multi-dimensional performance profiles, enabling intuitive identification of bottleneck areas. The entire analytical procedure was conducted in adherence to ethical research standards, with respondent anonymity and data confidentiality maintained throughout, as governed by informed consent forms submitted to and approved by the institutional review board of the affiliated university prior to data collection commencement.

RESULTS AND DISCUSSION

Respondent Profile

Of the 120 respondents surveyed, the majority (58.3%) held managerial positions in supply chain, procurement, or logistics functions, while 31.7% were supervisors and 10.0% were operational analysts. In terms of organizational tenure in their current supply chain role, 45% had 5–10 years of experience, 30% had more than 10 years, and 25% had fewer than 5 years, providing a respondent pool with substantial operational knowledge. Industry sub-sector representation was as follows: food and beverage processing (30%), textile and garment (25%), electronics assembly (25%), and automotive components (20%). Regarding digital supply chain integration—operationalized as the use of at least one integrated digital platform (e.g., ERP, WMS, TMS, or IoT-enabled monitoring)—55 firms (91.7%) reported some level of digital tool usage, while only 22 firms (36.7%) classified themselves as having a fully integrated end-to-end digital supply chain management system. This distribution provides a meaningful basis for comparative analysis between digitally advanced and traditional firms.

SCOR Dimension Performance Scores

Table 1 presents the descriptive statistics for each of the five SCOR dimensions. The overall mean performance score across all dimensions was 3.24 out of 5.00 (SD = 0.61), indicating that sampled firms are, on average, performing below the SCOR Level 1 parity benchmark of 3.50 a finding consistent with the characterization of emerging market supply chains as underperforming relative to global standards (World Bank, 2023). The Make dimension recorded the highest mean score (M = 3.61, SD = 0.58), suggesting that core production processes are relatively well-managed, possibly reflecting the maturity of manufacturing operations in the West Java industrial corridor. In contrast, the Return

dimension yielded the lowest mean score (M = 2.87, SD = 0.72), followed by Deliver (M = 3.01, SD = 0.69). These findings align with Pham et al. (2022), who similarly identified the Return process as the most neglected SCOR dimension in Asian manufacturing supply chains.

Table 1. Descriptive Statistics by SCOR Dimension

SCOR Dimension	N	Mean	Std. Dev.	Min	Max
Plan	120	3.38	0.63	1.80	5.00
Source	120	3.15	0.67	1.60	5.00
Make	120	3.61	0.58	2.00	5.00
Deliver	120	3.01	0.69	1.40	4.80
Return	120	2.87	0.72	1.20	4.60
Overall SCOR Index	**120**	**3.24**	**0.61**	**1.60**	**4.88**

Source: Primary data processed (2025)

The Source dimension (M = 3.15, SD = 0.67) and Deliver dimension (M = 3.01, SD = 0.69) both fell below the overall SCOR parity benchmark, collectively representing the most critical bottleneck areas. A disaggregated analysis of Source sub-indicators revealed that supplier lead time consistency (M = 2.91) and supplier quality defect rates (M = 2.88) were the weakest performing KPIs within this dimension. These findings corroborate the observations of Marbun and Sinaga (2023), who reported similar challenges in Indonesian manufacturing supply chains, attributing poor Source performance to inadequate supplier development programs and weak contractual enforcement mechanisms. For the Deliver dimension, the KPIs with the lowest scores were on-time delivery rate (M = 2.78) and order fill rate accuracy (M = 2.83), suggesting that last-mile logistics and distribution network reliability require urgent intervention.

KPI-Level Analysis Across All Five SCOR Dimensions

Table 2 presents the full KPI-level performance scores across all five SCOR dimensions. Within the Plan dimension, the highest-scoring KPI was production planning accuracy (M = 3.72), while supply chain risk management plan coverage recorded the lowest score (M = 3.01). This contrast reveals a characteristic pattern in developing country manufacturing firms: operational planning tends to be relatively mature, whereas strategic risk planning remains underdeveloped (Ivanov, 2020). Within the Make dimension, overall equipment effectiveness (OEE) scored highest (M = 3.89), reinforcing the earlier observation that production processes are relatively well-managed—a finding consistent with the focus of continuous improvement programs (e.g., Total Productive Maintenance and Lean Manufacturing) that have been widely implemented in Indonesian factories over the past decade (Kementerian Perindustrian, 2022). Conversely,

manufacturing cycle time variability (M = 3.24) and rework/defect rates (M = 3.31) were lower, pointing to inconsistencies in process control and quality management.

Table 2. KPI Performance Scores Across SCOR Dimensions

No.	KPI Indicator	SCOR Dimension	Mean	Category
1	Supply Chain Planning Accuracy	Plan	3.72	Good
2	Demand Forecast Accuracy	Plan	3.45	Average
3	Inventory Planning Accuracy	Plan	3.41	Average
4	Supply Chain Policy Alignment	Plan	3.32	Average
5	Risk Management Plan Coverage	Plan	3.01	Poor
6	Supplier Delivery Lead Time	Source	2.91	Poor
7	Supplier Quality Defect Rate	Source	2.88	Poor
8	Purchase Order Cycle Time	Source	3.12	Average
9	Supplier On-Time Delivery Rate	Source	3.20	Average
10	Procurement Cost Efficiency	Source	3.64	Good
11	Overall Equipment Effectiveness (OEE)	Make	3.89	Good
12	Manufacturing Cycle Time	Make	3.56	Good
13	Manufacturing Cycle Time Variability	Make	3.24	Average
14	Rework and Defect Rate	Make	3.31	Average
15	Production Capacity Utilization	Make	4.03	Good
16	On-Time Delivery Rate	Deliver	2.78	Poor
17	Order Fill Rate Accuracy	Deliver	2.83	Poor
18	Delivery Cycle Time	Deliver	3.14	Average
19	Transportation Cost as % of Sales	Deliver	3.08	Average
20	Invoice Accuracy Rate	Deliver	3.24	Average
21	Return Processing Time	Return	2.76	Poor
22	Return Rate (Customer)	Return	2.95	Poor
23	Return Authorization Cycle Time	Return	2.81	Poor
24	Reverse Logistics Cost Efficiency	Return	2.91	Poor
25	Warranty & Recall Management	Return	2.93	Poor

Source: Primary data processed (2025). Scale: 1–2.49 = Very Poor; 2.50–3.49 = Average/Poor; 3.50–5.00 = Good

Sub-Sector Performance Comparison

One-way ANOVA results revealed statistically significant differences in overall SCOR performance scores across industry sub-sectors [$F(3, 116) = 6.83$, $p < .001$]. Post-hoc Tukey HSD analysis indicated that automotive components firms ($M = 3.52$, $SD = 0.54$) significantly outperformed food and beverage processing firms ($M = 3.07$, $SD = 0.62$; $p = .003$) and textile and garment firms ($M = 3.11$, $SD = 0.67$; $p = .008$). Electronics assembly firms ($M = 3.38$, $SD = 0.58$) showed intermediate performance, with no significant difference from the automotive sub-sector ($p = .214$). These differences likely reflect the more sophisticated supply chain management practices prevalent in the automotive industry, driven by stringent original equipment manufacturer (OEM) quality and delivery requirements, as well as the influence of global automotive supply chain standards such as IATF 16949 (International Automotive Task Force, 2016). The relatively poor performance in food and beverage supply chains is consistent with findings from Bosona and Gebresenbet (2013), who noted that the perishable nature of products in this sector, combined with infrastructure limitations, creates unique performance challenges that standard SCOR metrics may not fully capture without sector-specific adaptation.

Effect of Digital Integration on SCOR Performance

Independent samples t-tests were conducted to compare SCOR performance between firms classified as digitally integrated ($n = 22$) and those with partial or no digital integration ($n = 38$). Results revealed that digitally integrated firms significantly outperformed their non-integrated counterparts in three out of five SCOR dimensions: Plan [$t(58) = 4.21$, $p < .001$, $d = 1.08$], Deliver [$t(58) = 3.87$, $p < .001$, $d = 0.99$], and Source [$t(58) = 2.93$, $p = .005$, $d = 0.75$]. No significant differences were found for the Make dimension [$t(58) = 1.14$, $p = .259$] or the Return dimension [$t(58) = 1.48$, $p = .144$], suggesting that while digital tools substantially enhance planning accuracy and distribution efficiency, their impact on production and reverse logistics processes requires more targeted application—or that firms have not yet fully leveraged digital tools in these areas. These findings are consistent with those of Ivanov and Dolgui (2021), who demonstrated that digital supply chain twins significantly enhance planning and delivery performance, and with Bag et al. (2021), who found that Industry 4.0 technologies improved procurement performance through enhanced supplier visibility and automated order processing.

Comparison with Previous Research

The results of this study both corroborate and extend findings from previous research. The identification of the Deliver and Return dimensions as the weakest performance areas aligns with Ntabe et al. (2021), who reported deficiencies in distribution and reverse logistics in agro-industrial supply chains, and with Carvalho et al. (2022), who found that Brazilian manufacturers consistently underperformed in delivery reliability metrics. However, unlike prior studies that relied predominantly on qualitative case

methodologies, the present research provides statistically validated quantitative benchmarks across a broader multi-firm sample, enhancing the generalizability of findings. The high Make dimension scores observed in this study diverge somewhat from the findings of Huan et al. (2004), who reported production process inefficiencies as a primary SCOR underperformance driver—a divergence likely attributable to the significant improvements in Indonesian manufacturing capabilities that have occurred over the past two decades, particularly through government-led industrial upgrading programs under the Making Indonesia 4.0 initiative (Kementerian Perindustrian, 2022). The strong procurement cost efficiency scores (M = 3.64) within the Source dimension suggest that Indonesian manufacturers have developed competitive procurement capabilities, even as quality and lead time reliability remain problematic—a pattern also noted by Min and Mentzer (2004) in their analysis of supply chain management practices across emerging markets.

Solutions and Recommendations

Based on the diagnostic findings, this study proposes a tiered improvement strategy organized by SCOR dimension priority and implementation feasibility. For the Return dimension—the most critically underperforming area—organizations should prioritize the development of formal reverse logistics policies and dedicated return processing teams, supported by digital return management platforms. Implementing a standardized Return Merchandise Authorization (RMA) system and integrating it with the ERP backbone can significantly reduce return authorization cycle time (currently M = 2.81). This recommendation is grounded in the circular economy framework advanced by Geissdoerfer et al. (2017), which posits that reverse logistics performance is intrinsically linked to sustainable value creation and competitive differentiation. For the Deliver dimension, investment in last-mile logistics optimization—including route planning software, carrier performance management, and collaborative logistics models—is recommended. The adoption of vendor-managed inventory (VMI) arrangements with key customers can address the low order fill rate accuracy scores by transferring demand visibility and replenishment responsibility to a single accountable party, as demonstrated by Waller et al. (1999) in their seminal work on VMI adoption.

For the Source dimension, the implementation of a Supplier Development Program (SDP) that provides training, technical assistance, and performance incentive mechanisms to strategic suppliers is recommended as the highest-priority intervention. Supplier scorecards aligned with SCOR Source KPIs—particularly lead time consistency and defect rates—should be institutionalized as part of formal supplier contracts, with escalation protocols for persistent underperformance. This approach is consistent with Monczka et al.'s (2016) framework for strategic supplier relationship management, which emphasizes that supplier performance improvement requires structured engagement rather than purely transactional price-focused interactions. In the Plan dimension, the most impactful intervention would be the deployment of advanced demand sensing and planning tools—such as machine learning-based demand forecasting modules within

existing ERP platforms—to address the low risk management planning scores. Enhancing supply chain risk visibility through scenario planning exercises and supply chain mapping can improve preparedness for disruptions, as advocated by Christopher and Peck (2004) in their foundational work on supply chain resilience.

Theoretical Implications

The findings of this research contribute to the theoretical grounding of the SCOR model by demonstrating its empirical applicability and diagnostic validity in a developing economy manufacturing context—an application domain that has been relatively underexplored in the existing literature. The study provides empirical support for the SCOR model's construct validity, with CFA results confirming that the five process domains represent distinct but correlated performance dimensions (inter-factor correlations ranged from r = .38 to r = .67), consistent with the model's theoretical architecture. This finding reinforces the argument advanced by Stephens (2001) and Huan et al. (2004) that the SCOR framework's hierarchical process decomposition provides a theoretically coherent and practically actionable structure for supply chain performance assessment. Moreover, the differential impact of digital integration across SCOR dimensions provides empirical grounding for the Digital Supply Chain Theory (Farahani et al., 2017), which posits that digital technologies have uneven performance effects depending on the nature and maturity of the underlying supply chain process—a theoretical proposition that had previously lacked direct empirical validation across multiple SCOR dimensions simultaneously.

Practical Implications

The practical implications of this research are substantial for both supply chain managers and organizational decision-makers. The validated KPI instrument developed in this study provides a ready-to-deploy diagnostic tool that enables organizations to rapidly assess their supply chain performance against SCOR benchmarks, identify dimension-specific gaps, and prioritize improvement initiatives based on empirical evidence rather than managerial intuition alone. The study's finding that digital integration drives significant performance improvements in Planning, Sourcing, and Delivery dimensions provides a compelling evidence-based argument for accelerating digital supply chain investment—particularly in the Indonesian manufacturing sector, where digital adoption rates remain below regional peers (Asian Development Bank, 2022). Furthermore, the sub-sector performance differentials identified through ANOVA analysis suggest that industry associations and government bodies should develop sector-tailored supply chain performance standards and capacity-building programs, rather than applying generic performance benchmarks that may not reflect sector-specific operational realities. The research also highlights the need for educational institutions offering logistics and supply chain management programs to incorporate SCOR model-based performance measurement as a core curriculum component, equipping future supply

chain professionals with the diagnostic capabilities required for evidence-based management practice.

CONCLUSION

This research systematically measured supply chain performance across 60 Indonesian manufacturing firms using a validated SCOR model-based KPI instrument comprising 25 indicators distributed across the Plan, Source, Make, Deliver, and Return dimensions. The overall mean SCOR performance index of 3.24 indicates that sampled organizations are performing below international parity benchmarks, with the Return (M = 2.87) and Deliver (M = 3.01) dimensions identified as the most critical bottlenecks requiring urgent managerial intervention. The Make dimension demonstrated the strongest performance (M = 3.61), reflecting the maturity of core manufacturing operations in the West Java industrial corridor. Digital supply chain integration was found to significantly enhance performance in Plan, Source, and Deliver dimensions, underscoring the strategic importance of accelerating Industry 4.0 adoption in Indonesian manufacturing. Sub-sector analysis revealed significant performance differentials, with automotive components firms outperforming food and beverage and textile sub-sectors, suggesting that industry-specific supply chain standards and capability-building programs are needed to reduce performance gaps. This research contributes a validated measurement instrument, sector-specific performance benchmarks, and a tiered improvement roadmap that supply chain managers can immediately operationalize for performance auditing and strategic planning. Future research should longitudinally track supply chain performance improvements following targeted intervention programs to assess the effectiveness of SCOR-based KPI frameworks over time; explore the moderating role of organizational learning and supply chain culture on SCOR performance outcomes; extend the SCOR measurement framework to include sustainability and circular economy metrics (particularly within the Return dimension); and apply the validated instrument to additional regional and sectoral contexts—including service industries, agribusiness, and public sector supply chains—to build a comprehensive evidence base for supply chain performance management across the full spectrum of organizational contexts in Indonesia and comparable emerging economies.

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