

Supply Chain Performance Measurement in Non-Manufacturing Industries

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Abstract— Most supply chain performance metrics are designed for manufacturing industries and often fail to reflect the characteristics of service-oriented or non-manufacturing industries. These industries deal with real-time service delivery, and high customer interaction, making traditional metrics insufficient. There has been a growing need to develop industry-specific performance indicators that emphasize service quality, responsiveness, customer satisfaction, and operational flexibility. Tailored metrics enable more accurate evaluation and improvement of supply chain performance in sectors like service, retail, food, fashion, and IT, where standard manufacturing measures are not applicable. In this paper, the existing studies related to supply chain performance measurement are reviewed by major non-manufacturing industry sectors.

Keywords—supply chain management; key performance indicator; performance evaluation

I. INTRODUCTION

Traditional supply chain performance metrics have been largely developed with the manufacturing industry in mind. These metrics, such as inventory turnover, production lead time, and order fulfillment rate are highly relevant in environments where tangible products are produced, stored, and delivered through standardized, repeatable processes. While these indicators have proven effective for tracking efficiency and productivity in manufacturing settings, they fall short when applied to the inherently different nature of service-based and non-manufacturing industries.

One key example of a manufacturing-centric metric is inventory turnover, which measures how frequently inventory is sold and replaced over a given period. This is crucial for manufacturers, as it reflects production efficiency, demand forecasting accuracy, and cost control. However, in industries like healthcare, education, or hospitality—where services are intangible and cannot be stored—inventory turnover is either irrelevant or misleading.

The inadequacy of these metrics in service and non-manufacturing contexts highlights the urgent need for new performance measurement frameworks that account for the unique characteristics of these industries. Service supply chains are typically more complex and human-centric, involving intangible outputs, greater variability, and a high degree of customer interaction. As such, key performance indicators (KPIs) for these sectors should focus on aspects such as customer satisfaction, service flexibility, staff responsiveness, process transparency, and overall service quality.

Moreover, non-manufacturing sectors often face challenges related to real-time decision-making, data integration across

departments, and the management of knowledge rather than physical goods. Traditional manufacturing-based supply chain metrics have laid a solid foundation for performance management, they do not adequately address the needs of non-manufacturing sectors. Developing tailored performance indicators that reflect the dynamic, customer-driven, and intangible nature of services is essential for organizations in non-manufacturing industries to optimize their operations, enhance service delivery, and remain competitive in today's evolving economy.

The following sections examine the existing studies for supply chain performance measurement in major non-manufacturing industries individually. The final section conclude this paper with a few key observations.

II. SERVICE INDUSTRY

Traditional manufacturing-centered supply chain performance evaluation methods have limitations in reflecting the unique characteristics of the service industry. Most existing supply chain performance indicators are designed based on the premise of physical products, inventory, and process-oriented flows, which makes their direct application to the service industry inappropriate. The service industry is characterized by intangibility, non-standardization, and the simultaneity of production and consumption, which makes it difficult to quantitatively measure and evaluate performance in service supply chain management. To overcome these challenges, a structured measurement model is needed to evaluate the overall performance of service supply chains at strategic, tactical, and operational levels.

It is necessary to derive detailed performance indicators focusing on key processes such as service demand management, customer and supplier relationship management, capacity and resource management, service performance management, information technology management, and financial management. Each of these processes consists of elements that must be managed to improve operational efficiency, customer satisfaction, and profitability in service organizations. By presenting a performance measurement system that reflects the unique characteristics of the service industry, a theoretical and practical foundation can be established to enable service organizations to achieve operational efficiency, customer satisfaction, and competitiveness simultaneously.

The performance measurement system should be structured so that decision-makers at each organizational level can use it appropriately. For example, at the strategic level, metrics such as customer retention, service portfolio, and the level of partnership with suppliers are emphasized. At the tactical level,

forecast accuracy, capacity utilization, and schedule adherence are highlighted. At the operational level, order processing speed, customer inquiry response time, and real-time service accuracy are considered key performance indicators.

A universal performance evaluation structure that can be applied to various industries—such as healthcare, hospitality, and finance—is required. In particular, the importance and measurement method of indicators should vary depending on the intangibility of the service and the level of customer participation. For instance, the hotel supply chain involves frequent customer interactions, requires collaboration across various departments, and operates in an industry where service quality is directly linked to customer loyalty and profitability. Therefore, it is necessary to measure a wide range of metrics—such as response time, employee satisfaction, customer loyalty, cost efficiency, supplier quality, customer feedback handling speed, and service delivery flexibility—and determine the priority among these indicators.

Another example in the service industry is hospitals, which operate in complex and unpredictable environments. In addition to clinical outcomes, financial and operational performance must be carefully managed. In this context, developing and utilizing reliable KPIs for hospital supply chain performance is emerging as a key factor in enhancing hospital competitiveness. KPIs can be broadly categorized into financial, managerial, and clinical areas. Financial KPIs include cost efficiency, resource utilization, and return on investment, reflecting the hospital's financial sustainability. Managerial KPIs address supply chain process efficiency, operational strategy, and human resource management. Clinical KPIs are used to evaluate patient safety, treatment outcomes, and the quality of medical services. These KPIs can serve as effective tools for monitoring and analyzing various aspects of hospital operations. KPIs provide important criteria for hospital administrators to make strategic decisions and can positively influence improvements in patient satisfaction and the quality of care.

III. RETAIL INDUSTRY

Supply chain performance measurement indicators have mostly been designed based on manufacturing contexts, with a primary focus on the flow of physical goods, such as productivity, efficiency, and cost reduction. However, the retail industry operates under a very different structure and environment compared to manufacturing, involving various service elements at the consumer interface, a high-mix low-volume sales model, highly volatile demand, sophisticated logistics systems, and complex distribution channels. Therefore, directly applying existing metrics to retail supply chains presents significant limitations.

KPIs suitable for retail supply chains can be categorized into several performance areas—transport optimization, inventory optimization, information technology optimization, and resource optimization. Each of these areas reflects the major operational flows of the retail supply chain and must be designed to simultaneously address both customer-centricity and operational efficiency. Transport optimization consists of indicators that measure overall logistics activities within the supply chain, such as on-time delivery rate, lead time, loading/unloading efficiency, load utilization, delivery error rate, and transportation cost. These indicators directly reflect the

speed, accuracy, and cost-efficiency of delivering products to customers, making them core drivers of customer satisfaction. Even if retail companies offer products of the same quality, they may fail to win customer preference without competitive advantage in delivery speed and reliability. Inventory optimization focuses on assessing the balance between supply and demand through indicators such as inventory turnover, inventory accuracy, stock-out rate, order fill rate, and inventory holding cost.

Retailers constantly face the opposing challenges of excess inventory and stock shortages, which can lead to lost sales or unnecessary costs. Therefore, accurate demand forecasting and flexible inventory management are critical to supply chain performance. Information technology optimization measures the reliability and speed of information flow through indicators such as IT system integration, the use of POS and EDI systems, real-time data accessibility, and information accuracy. In today's retail environment, multiple stakeholders are connected in real-time, and information flow is just as crucial as the flow of physical goods to respond promptly to changes in customer demand. Performance in this area significantly affects overall supply chain agility, forecast accuracy, and decision-making speed. Resource optimization is a complex category that includes indicators such as labor costs, cost of goods sold (COGS), productivity, customer satisfaction, return on investment (ROI), supplier performance, and labor flexibility. This area reflects not only the financial health of the organization but also non-financial values, demonstrating that the supply chain contributes to customer-oriented strategic outcomes beyond mere cost efficiency.

There is a growing need to move away from a single-metric management approach and adopt an integrated perspective that analyzes and optimizes the causal relationships among performance outcomes throughout the entire supply chain. For example, improving inventory accuracy leads to a higher order fulfillment rate, which then results in increased customer satisfaction and repeat purchase rates, indicating that performance indicators are interdependent rather than isolated. As retail supply chains become increasingly complex due to advancements in digital technology and the proliferation of omnichannel strategies, retail-specific performance metrics and evaluation systems can drive performance improvements across multiple dimensions—including data-driven decision-making, strategic resource allocation, supplier collaboration, and customer satisfaction enhancement.

IV. AGRI-FOOD INDUSTRY

In the agri-food industry, increasing consumer and stakeholder demands for quality, safety, and sustainability, along with the rapid expansion of global distribution, horizontal and vertical collaboration, and IT-based system adoption, are transforming the industry into a complex supply chain network. These changes imply that supply chain performance can no longer be measured solely through traditional, finance-centered methods. Instead, an integrated performance evaluation approach that incorporates relevant factors is required.

The main components of an agri-food supply chain include network structure, chain business processes, governance structure, and resource configuration, all of which have a significant impact on supply chain performance. KPIs should be

designed around core value propositions including differentiation, quality integration, and network optimization. Each of these should take into account financial, non-financial, and socio-environmental performance in a holistic manner.

For example, factors such as quality, hygiene, animal welfare, and environmental impact—traditionally excluded from conventional supply chain metrics—must be incorporated into the performance measurement of agri-food supply chains. Performance evaluation should be approached through a hierarchical structure that spans the entire supply chain network, the organizational level, and individual process levels. These layers interact with one another, and higher-level metrics are constructed based on the indicators from lower levels. For instance, supply chain lead time and product quality are influenced by the processing time and quality at each stage. A dynamic and hierarchical performance measurement framework that reflects the diverse expectations of stakeholders within the unique value chain of the agri-food sector is essential. Such an approach to performance measurement can make a meaningful contribution to the sustainable development and strategic operational improvement of agri-food supply chains.

With the recent global rise in demand for food quality and safety, supply chain management for fresh and perishable agricultural products has emerged as a critical factor in corporate competitiveness. In the agri-food industry, it is essential to develop and manage KPIs that effectively assess the performance of cold chains. These KPIs should be applicable across the entire agricultural supply chain—production, storage, processing, distribution, and sales—and can be categorized into four performance areas: customer service, internal supply chain management, financial performance, and supply chain agility. In terms of customer service, product variety and cold chain infrastructure are rated as highly important, while product quality is identified as the most impactful indicator. This suggests that consumers are especially sensitive to the freshness of agricultural products and that maintaining quality is a decisive factor in supply chain performance. For internal supply chain management, supply chain flexibility and supplier performance evaluation are key indicators. Inventory and processing costs are important in measuring financial performance, while total supply chain cycle time and distributor lead time stand out in the area of agility, both in terms of importance and effectiveness.

In industries handling highly perishable items such as fresh food, proper cold chain operation and a customer-oriented approach to quality control are confirmed to be essential elements for supply chain success. Conventional supply chain performance measurement tools are primarily designed for general manufacturing or mass production industries, and thus have limitations when applied to the traditional food sector, which is characterized by geographic, cultural, and production method diversity. In traditional food supply chains, five core goals—preserving tradition, improving efficiency, responding quickly, enhancing quality, and maintaining balance—can be identified as shared objectives among participants, including suppliers, focal companies, and consumers. If performance indicators are selected in alignment with these goals, for example, distribution cost and profit margin for efficiency, and taste, safety, and eco-friendliness for quality, they can more accurately reflect stakeholder expectations. Participants tend to place high importance not only on typical business goals but also on

preserving traditional and cultural food heritage. However, some indicators—such as regional identity, inventory cost, and information exchange—may be seen as less important or vary significantly depending on the country or stakeholder. This reflects the complexity and localized nature of traditional food supply chains.

By proposing a supply chain performance measurement system tailored to the agri-food industry, it becomes possible to manage the supply chain in a balanced way that simultaneously considers value creation, quality preservation, and consumer trust.

V. FASHION INDUSTRY

The types of supply chain strategies adopted by companies in the luxury fashion industry influence corporate performance in various ways. In addition, the KPIs appropriate for each strategy may also differ. The main types of supply chain strategies include lean, agile, and hybrid strategies. The lean strategy is suitable for predictable demand and low-cost, high-efficiency supply chains, while the agile strategy is appropriate for supply chains that must respond quickly to volatile demand and short product life cycles. The hybrid strategy combines the strengths of both, allowing for flexible product differentiation.

Luxury fashion companies adopt different supply chain strategies depending on the product type (e.g., shoes, leather goods, apparel) and product line (carry-over items versus seasonal items), and it has been confirmed that multiple strategies are often applied simultaneously within a single company. In particular, the product line is the most decisive factor influencing the actual choice of supply chain strategy and KPIs. Contrary to the theoretical expectation that carry-over products should be managed using a lean strategy, most companies operate with a hybrid strategy and a Make-to-Order (MTO) production approach. These strategic choices reflect the complex operational realities specific to the luxury fashion industry, such as difficulties in demand forecasting, supplier capacity management, and parallel management of diverse product categories. In contrast, seasonal products are typically managed using agile or hybrid strategies, which align with theoretical expectations. Lean strategies tend to focus on cost-related KPIs such as inventory cost and on-time delivery rate, while agile strategies emphasize service-level indicators like customer response speed and order accuracy. High-end brands tend to place a greater emphasis on customer value-oriented KPIs such as quality and delivery precision, in addition to cost. Amid intensifying global competition in the apparel industry, garment manufacturers—often located in developing countries—face increasing pressure to measure and improve their supply chain performance in areas such as lead time, quality, and flexibility to maintain a competitive edge. There is a growing need for systems that evaluate supply chain efficiency using actual performance data and selected KPIs based on the core operational areas such as source, plan, make, and deliver.

VI. OTHER NON-MANUFACTURING INDUSTRIES

The construction industry possesses unique characteristics compared to other industries, such as non-repetitive and complex projects, insufficient collaboration among diverse stakeholders, and a site-based working environment. These industrial features often lead to inefficiency and waste within the

supply chain. While supply chain management has been widely and successfully implemented in manufacturing—resulting in cost reduction, shorter delivery times, and improved quality—its application in construction remains relatively limited. A lack of integration among key parties such as designers, contractors, subcontractors, and suppliers has been identified as a major factor hindering performance. Problems within the construction supply chain typically manifest at the interfaces between suppliers and clients, such as inefficient information transmission, scheduling delays, and quality degradation. These issues tend to occur not within individual processes, but rather at the connection points between processes. This highlights the need to manage the supply chain as an integrated value-creation flow rather than a collection of isolated activities. There are several key strategies that can improve the construction supply chain. Enhancing the capabilities of suppliers and subcontractors is necessary to stabilize the supply base. Establishing a performance measurement system allows for systematic diagnosis of operations at each stage of the supply chain. Benchmarking best practices and setting performance targets can drive continuous improvement. Knowledge management should be used to disseminate on-site experience and expertise throughout the supply chain. Identifying and eliminating waste is essential. Actively utilizing IT can enhance communication and coordination. Lastly, strengthening education and training for human resources can build greater supply chain competency. The construction industry can adopt proven supply chain management concepts from manufacturing, which not only promotes operational efficiency but also contributes to improved project quality, higher customer satisfaction, and long-term competitiveness.

In the IT industry, which encompasses both hardware and software, the market environment changes rapidly, and the supply chain structure is inherently complex and technology-driven. For this reason, conventional performance measurement models are not well suited to the IT sector, and more refined, industry-specific approaches are required. To measure supply chain performance effectively, indicators can be categorized according to core processes such as strategy, procurement, production, and delivery. The selection of performance metrics should reflect lean thinking principles, emphasizing the elimination of waste and a focus on customer value. In the hardware domain, key indicators may include material costs during procurement, production costs and quality in the manufacturing stage, delivery performance and inventory control during logistics, and customer satisfaction and profitability in customer service. For software, performance is indirectly measured at each stage such as requirements analysis, design, development, testing, and deployment through metrics such as lead time, defect rate, and customer response time. Defect rate, customer inquiry response time, accurate demand forecasting rate, and supplier lead time are considered highly important performance indicators.

VII. CONCLUDING REMARKS

The conventional approach to supply chain performance measurement—centered on metrics designed for manufacturing, such as inventory turnover, production lead time, and order fulfillment—proves insufficient when applied to the increasingly diverse, complex, and service-oriented industries

that define today's global economy. While these metrics work well in production environments characterized by predictable processes and tangible goods, they fall short in capturing the dynamics of non-manufacturing sectors like services, retail, agri-food, fashion, construction, and IT. Each of these industries exhibits unique characteristics that require tailored performance measurement systems.

A one-size-fits-all approach to supply chain performance measurement is no longer viable. Instead, what is needed is an industry-sensitive, multi-layered evaluation framework that integrates financial and non-financial metrics, reflects industry-specific dynamics, and supports strategic, operational, and customer-facing objectives. By embracing customized KPIs and measurement systems tailored to the nature of each industry, organizations can enhance transparency, drive continuous improvement, and achieve long-term competitive advantage in their respective markets.

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