Volume 5 Issue 1 (2025) Pages 148-165
Amkop Management Accounting Review (AMAR)
ISSN: 2828-2248 (Online)

Performance Analysis of Premium and Medium Rice Supply Chain of Bulog in Bogor

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Abstract

This study aims to evaluate the performance of Bulog's rice supply chain in Bogor, focusing on two product categories: premium rice and medium rice under the SPHP program. The objective is to identify strengths and gaps in operational performance across key supply chain metrics and provide actionable insights for future improvement. A mixed-methods approach was used, combining qualitative interviews with supply chain stakeholders and quantitative analysis using the SCOR-AHP (Supply Chain Operations Reference – Analytical Hierarchy Process) framework. Performance indicators, such as Perfect Order Fulfillment (POF) and Upside Supply Chain Adaptability (USCA), were analyzed using benchmark comparisons and priority weight calculations. The overall performance of Bulog's rice supply chain in 2024 was rated very good. Premium rice achieved a performance score of 95.31%, while medium rice (SPHP) scored 86.61%. However, medium rice showed notable weaknesses in POF (72.5%) and USCA (46.67%), indicating challenges in order fulfillment precision and responsiveness to sudden demand increases. In contrast, premium rice performed better in these areas, with a POF of 96.55% and a USCA rating of 71.43%. The findings highlight areas for operational refinement, particularly in improving adaptability and delivery accuracy. These insights are valuable for supply chain practitioners and policymakers seeking to enhance national food distribution systems.

Keywords: *Rice Supply Chain; Performance; Premium and Medium Rice (SPHP); Perfect Order Fulfillment (POF); Supply Chain Adaptation.*

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INTRODUCTION

As the fourth most populous nation globally, Indonesia continues to experience a growing demand for staple food commodities, with rice remaining the most critical. Serving as the primary carbohydrate source, rice is an essential dietary component for over 270 million Indonesians, and it is a symbol of national food sovereignty and socio-economic stability. The country's vast agricultural landscape and favorable climatic conditions theoretically support large-scale rice production. However, the practical reality presents a more complex picture. Indonesia continues to face multifaceted challenges, including climate variability, inefficient production systems, logistical bottlenecks, price volatility, and unequal distribution networks, which disrupt the rice supply chain and compromise food security goals

DOI: 10.37531/amar.v5i1.2447

(Fathurrohman & Pambudi, 2020). Maintaining an efficient, responsive, and reliable rice supply chain becomes a national priority as the population grows and urbanization accelerates. Recent data from Badan Pangan Nasional (Bapanas) highlights these concerns. In 2023, Indonesia's rice consumption reached 81.23 kg per capita annually, with total household consumption hitting 22.64 million tons—the highest level in the past five years. While this represents only a 0.15% decline from 2022, it underscores an overall upward trend in national rice demand. This situation underscores the urgency to ensure that supply chain systems function optimally, from upstream to downstream. In particular, there is a pressing need to evaluate the performance of state-managed supply chains, such as those overseen by BULOG, which are tasked with safeguarding rice availability and affordability. Investigating how BULOG's rice distribution—especially for premium and medium rice types—performs at the regional level becomes vital to uncovering inefficiencies and designing targeted policy interventions.

Previous studies have underscored the importance of analyzing rice supply chain performance in Indonesia, particularly in the operations managed by Biro Logistik Indonesia (BULOG). As a state-owned enterprise, BULOG plays a pivotal role in stabilizing rice prices and ensuring nationwide food availability (Fathurrohman & Pambudi, 2020). To evaluate supply chain efficiency and responsiveness, models such as the Supply Chain Operations Reference (SCOR) and Analytic Hierarchy Process (AHP) have been employed, identifying reliability as a key attribute of effective rice procurement (Novar et al., 2018). BULOG faces persistent challenges in regions like Gorontalo, including limited supplier options and low consumer interest in its rice offerings. Research using the Economic Order Quantity (EOQ) model has revealed the need for optimized purchasing frequencies and quantities to improve the efficiency of both premium and medium rice categories (Djama et al., 2023). Complementary studies have demonstrated that enhancing supply chain structures and marketing channels significantly improve urban food access and contribute to food resilience (Septya et al., 2024). Government interventions such as the Toko Tani Indonesia (TTI) program have also positively impacted supply chain sustainability and performance (Anugrah et al., 2023). These studies emphasize the strategic necessity of performance monitoring through frameworks like FSCN, EOQ, SCOR, and DEA to bolster food supply chains (Djama et al., 2023; Norita & Munita, 2024).

Despite the increasing scholarly attention to rice supply chain management in Indonesia, a significant gap persists in the literature regarding a comparative performance evaluation of rice types under a unified institutional framework, such as BULOG. Most existing studies have focused on national-level operations or specific regional challenges without disaggregating performance by rice quality categories. For instance, while Fathurrohman & Pambudi (2020) emphasized BULOG's role in stabilizing rice prices and ensuring food availability, they did not differentiate how premium and medium rice supply chains perform. Similarly, Novar et al. (2018) utilized the SCOR and AHP models to assess procurement performance. They identified reliability as the most critical attribute, but the study remained limited to general rice supply functions rather than category-specific evaluations. Although Djama et al. (2023) applied the EOQ model to suggest optimal purchasing strategies for premium and medium rice, the study lacked a deeper operational assessment across multiple performance dimensions, such as

DOI: 10.37531/amar.v5i1.2447

responsiveness, efficiency, and service reliability. The existing literature has yet to integrate mixed-methods approaches to holistically examine the unique logistical, structural, and demand-side dynamics influencing each rice category within the same geographic and institutional setting. This presents a theoretical and empirical gap, as a nuanced understanding of how different rice supply chains operate under identical governance remains underexplored. Addressing this gap is crucial for developing targeted and adaptive strategies to enhance BULOG's supply chain performance and ensure long-term food resilience.

To address the identified gap, this study offers a novel contribution by employing a mixed-methods approach to conduct a comparative performance analysis of premium and medium rice supply chains managed by BULOG within the same regional context of Bogor. Unlike previous studies that examined rice supply chains in aggregate or focused solely on technical or logistical aspects, this research integrates qualitative and quantitative data to assess multiple performance dimensions, including efficiency, responsiveness, and reliability. The novelty lies in its disaggregated focus on rice categories under a uniform institutional system, allowing for a more precise understanding of operational differences and bottlenecks that may otherwise remain hidden in generalized evaluations. By capturing stakeholder perspectives, operational realities, and performance metrics across both rice types, the study aims to generate actionable insights for optimizing supply chain strategies. The primary objective is to evaluate and compare the overall condition and effectiveness of BULOG's premium and medium rice supply chains in Bogor, thereby informing policy and managerial decisions to improve food distribution systems and strengthen national food security.

Supply Chain Operations Reference (SCOR) Model

The Supply Chain Operations Reference (SCOR) model is a standardized framework developed by the Supply Chain Council to manage and enhance supply chain performance by integrating processes, performance metrics, best practices, and enabling technologies. The model encompasses five core management processes—Plan, Source, Make, Deliver, and Return—which collectively represent the end-to-end activities within any supply chain system (Becker, 2025). SCOR provides a structured, hierarchical approach that allows organizations to systematically analyze and compare their performance across departments or even with other enterprises using a common language. This model has gained widespread adoption in both manufacturing and service industries due to its ability to identify operational bottlenecks, enhance process efficiency, and align strategic objectives with operational capabilities (Stadtler et al., 2015). A key advantage of SCOR is its ability to integrate seamlessly with enterprise systems, such as ERP, making it adaptable to digital supply chains. In the current era of rapid technological evolution, SCOR is particularly relevant as it supports the incorporation of automation, Internet of Things (IoT), and artificial intelligence into supply chain operations (Tjahjono et al., 2017). As global supply chains become increasingly complex and data-driven, the SCOR model offers a coherent and consistent structure to map, measure, and manage performance, ensuring that organizations can remain resilient and competitive in a dynamic market landscape.

The application of the SCOR model in agri-food supply chains, including staple commodities like rice, has proven effective in providing structured and data-

DOI: 10.37531/amar.v5i1.2447

driven evaluations of operational performance. SCOR's performance attributes—reliability, responsiveness, agility, cost, and asset management efficiency—enable practitioners to assess the health and adaptability of supply chains from both strategic and tactical perspectives (Kamble et al., 2018). In previous studies, SCOR has been utilized to assess BULOG's rice procurement and distribution operations in Indonesia, with findings emphasizing reliability as the most critical attribute affecting supply consistency and price stability (Novar et al., 2018). This emphasis is significant in public food distribution systems where consumer trust and food security are at stake. Additionally, recent literature has called for the integration of sustainability metrics into SCOR, arguing that environmental and social considerations must be embedded in modern supply chain performance frameworks to meet the challenges of sustainable development (Stohler et al., 2018). As supply chains face increasing pressure from climate change, geopolitical disruptions, and technological transformations, SCOR provides a flexible structure for strategic adaptation and continuous improvement (Stadtler et al., 2015). Its ability to align cross-functional teams under shared goals and measurable performance indicators also enhances inter-organizational collaboration.

Supply Chain Performance

Supply chain performance refers to the extent to which a supply chain system achieves its operational and strategic objectives, encompassing dimensions such as cost efficiency, delivery reliability, market responsiveness, and asset utilization. According to Mishra et al. (2018), evaluating supply chain performance requires a comprehensive approach that considers not only financial indicators but also non-financial aspects, including service speed, information quality, and system flexibility. Traditional performance measurement systems often focused solely on cost and efficiency; however, modern supply chains demand a more holistic perspective that integrates qualitative metrics as well. With the emergence of Industry 4.0, performance measurement frameworks must now incorporate elements of digital intelligence and technological adaptability. As noted by Xie et al. (2020), the application of innovative technologies such as the Internet of Things (IoT), artificial intelligence (AI), and big data analytics has revolutionized the way performance is monitored and evaluated, enabling real-time decision-making and predictive analytics capabilities. These technologies enable supply chain managers to track performance indicators in real-time, adapt to demand fluctuations, and optimize processes with greater accuracy than ever before. Thus, the definition of supply chain performance has evolved beyond static efficiency metrics and now encompasses the ability of a supply chain to learn, adapt, and continuously improve within a rapidly changing environment driven by digital transformation and competitive pressure.

In practical contexts, measuring supply chain performance presents significant challenges due to the inherent complexity of supply chain networks and the variability of operational environments. As highlighted by Rehman et al. (2018), organizations frequently struggle to define and maintain consistent performance metrics due to data limitations, shifting business strategies, and differing perspectives among stakeholders. These challenges become even more pronounced in industries with high levels of uncertainty and dynamic conditions. For instance, Panayides et al. (2018) argue that performance evaluation frameworks in the maritime and logistics sectors must be robust enough to accommodate both internal

DOI: 10.37531/amar.v5i1.2447

operational fluctuations and external market disruptions. Consequently, there is a growing need for integrated and adaptive performance measurement systems that align with strategic goals while being responsive to contextual changes. Advanced analytical methods, such as Structural Equation Modeling (SEM), have been increasingly adopted to assess the interrelationships among key performance variables, particularly within small and medium-sized enterprises (Malesios et al., 2020). Moreover, the integration of digital technologies and collaborative platforms has enhanced information sharing, process synchronization, and overall transparency across supply chains. Neubert et al. (2004) emphasize that such technological integration fosters higher levels of coordination and efficiency, leading to measurable improvements in supply chain performance.

Perfect Order Fulfillment (POF)

Perfect Order Fulfillment (POF) is a critical key performance indicator in supply chain management that evaluates a company's ability to fulfill customer orders without errors, delivering the right product in the correct quantity to the correct location at the right time, with complete and accurate documentation. This metric reflects the reliability and synchronization of all functions across the supply chain, from inventory planning and order processing to final delivery and customer service. According to Mishra et al. (2018), POF is considered a comprehensive measure of supply chain effectiveness, as it captures operational precision and customer satisfaction. In an era where consumer expectations are increasingly demanding, measuring and improving POF is essential for companies seeking to maintain competitiveness and service excellence. Furthermore, Xie et al. (2020) argue that the digitization of supply chains under Industry 4.0 has elevated the role of real-time performance metrics, such as POF, given the increased need for rapid decision-making, transparency, and responsiveness. They highlight that the ability to consistently fulfill orders perfectly is a function of logistical capabilities and seamless integration of information and process coordination across the entire supply chain. Hence, POF is a strategic performance indicator that bridges operational efficiency and customer-centric service, making it a focal point for academic research and industrial application in supply chain performance management.

Implementing advancements in logistics technology and data-driven systems increasingly supports the implementation of POF as a central performance measure. Merschformann et al. (2019) emphasize that robotic mobile fulfillment systems have significantly improved the accuracy and speed of order processing, directly contributing to higher POF levels. These systems automate picking, sorting, and packaging processes, reducing human error and minimizing delays that could compromise order quality. Meanwhile, Agarwal (2018) demonstrates that validating inventory models using discrete-event simulation plays a pivotal role in mitigating stockouts and overstocks, which can negatively impact the ability to fulfill orders perfectly. Effective inventory management ensures product availability at the right time, which is crucial for maintaining consistent product on floor (POF) performance. Pansart et al. (2018) argue that precise order picking—another crucial stage in order fulfillment—can be optimized through exact algorithmic solutions, thereby increasing fulfillment accuracy. In addition to operational enhancements, real-time point-of-sales (POS) information is essential for forecasting demand more accurately, allowing upstream supply chain processes to adjust proactively (Abolghasemi et al.,

DOI: 10.37531/amar.v5i1.2447

2023). Accurate demand forecasting reduces the risk of a supply-demand mismatch, ensuring higher order completion rates.

Upside Supply Chain Adaptability (USCA)

Upside Supply Chain Adaptability (USCA) is defined as the ability of a supply chain system to rapidly and efficiently increase output capacity in response to short-term surges in customer demand without compromising operational efficiency or service quality. This capability is a core component of the agility attribute outlined in the SCOR (Supply Chain Operations Reference) model. It is frequently used as a performance indicator to assess how well a supply chain can respond to volatile market conditions. Ivanov and Dolgui (2021) emphasize that in the era of Industry 4.0, USCA reflects both digital agility and physical flexibility, enabling firms to adapt in real-time to disruptions or market opportunities. Their research highlights the application of digital twin models to dynamically monitor and adjust production capacity in alignment with fluctuations in demand, thereby enhancing adaptability. Wieland & Durach (2021) argue that the USCA is critical to overall supply chain resilience. Organizations that can scale operations upward efficiently during periods of high demand are more likely to survive and thrive during crises such as pandemics, natural disasters, or geopolitical conflicts. As markets become increasingly volatile and customer expectations continue to rise, the USCA has evolved from purely operational concerns into a strategic imperative that intersects with technology adoption, resource planning, and organizational design to foster responsiveness and competitiveness in dynamic environments.

Building on this perspective, Kamalahmadi & Parast (2017) identified several disruption mitigation strategies—such as supplier diversification, collaborative planning, and flexible capacity allocation—that significantly improve the USCA. Their findings suggest that firms with highly agile and resource-diverse supply chains are better equipped to scale up operations quickly in response to unexpected demand shocks. Similarly, Pettit et al. (2019) stress the importance of scenario planning as a proactive mechanism to enhance adaptiveness. They argue that preparing for multiple contingencies improves organizational readiness and facilitates quicker responses, ultimately supporting USCA in high-stakes situations. From a capabilities-based perspective, Chowdhury and Quaddus (2017) developed a conceptual scale of USCA, grounded in the theory of dynamic capabilities. They found that rapid decision-making and integrated information systems are foundational for cultivating adaptive excellence in supply chain performance. Moreover, Scholten et al. (2019) examined the organizational learning aspect of adaptability. They demonstrated that firms that institutionalize learning routines from past non-routine events tend to develop higher levels of adaptability. These firms create internal mechanisms to recognize early warning signals and deploy resources more effectively during disruptions. As such, the USCA should not be viewed solely as a function of physical infrastructure, but rather as a multidimensional capability that encompasses strategic partnerships, organizational flexibility, and real-time data-driven decision-making.

METHODOLOGY

This study employed a mixed-methods design, integrating both qualitative and quantitative approaches to provide a comprehensive assessment of Bulog's rice

DOI: 10.37531/amar.v5i1.2447
supply chain performance in Bogor. These two approaches enabled a more holistic understanding of the operational dynamics, strategic issues, and performance outcomes within the studied supply chain. The research was conducted at the Bulog Branch Office and its affiliated warehouse in Bogor from November 2024 to March 2025. The sample population consisted of key stakeholders in the rice distribution network, including Bulog executives, distributors affiliated with the Rumah Pangan Kita (RPK) program, experienced retail practitioners, and academic experts specializing in supply chain management and food logistics.

For data collection, the study utilized both primary and secondary sources. Primary data were obtained through in-depth, semi-structured interviews with selected respondents. An interview guide was developed to ensure consistency across sessions while maintaining the flexibility to explore emerging themes. Secondary data were gathered from government publications, operational reports from the National Food Authority (Bulog), academic literature, and relevant institutional documentation. These sources enriched the context and supported the triangulation of the findings. In terms of analysis, qualitative data were interpreted thematically, while quantitative evaluation was conducted using the Supply Chain Operations Reference–Analytical Hierarchy Process (SCOR-AHP) model. This technique facilitated performance measurement based on predefined criteria, with resulting scores categorized into five performance levels: abysmal, marginal, average, sound, and excellent, following the classification framework proposed by Rakhman et al. (2018).

Table 1. Definition and Formulas of Supply Chain Performance Metrics Used in This Study

Performance Metrics Definition

No	Performance Attribute	Performance Metrics	Definition	Explanation / Formula
1	Reliability	Perfect Order Fulfillment (POF)	Percentage of orders fulfilled perfectly	(Perfect delivery quantity / Total deliveries) x 100%
		Order Fulfillment Cycle Time (OFCT)	Total time to fulfill a single order	Ordering Time + Processing Time + Delivery Time
2	Responsibility	Delivery Retail Lead Time (DRLT)	Time required to deliver products to retail customers (RPK)	Number of delivery days from Bogor Warehouse to RPK
3	Agility	Upside Supply Chain Adaptability (USCA)	Ability to respond to sudden increases in demand	Comparison of actual time achievement against target time (Total additional capacity that can be accommodated / the average daily demand)
		Load Utilization Rate (LUR)	Standard delivery capacity to meet shipment volume or tonnage	(Actual weight transported / Maximum vehicle capacity) x 100%
4	Cost	Cost Of Good Sold (COGS)	Direct costs associated with the production of goods sold	Raw Material Costs + Direct Labor Costs + Production Overhead Costs
5	Asset	Inventory Days Of Supply (IDS)	Number of days of supply that can be met with existing inventory	IDS = (Total Inventory / Average Daily Usage (ADU)) ADU = (Sales in Specific Period / Number of Specific Period)
		Cash to Cash Cycle Time (CCCT)	Time required to convert investment into cash	Inventory Days + Receivable Days (distributor receivable days) – Payable Days (supplier payable days)

This table outlines the key performance attributes and associated metrics used to evaluate the rice supply chain. It includes definitions and formulas for each metric under five core performance attributes: Reliability, Responsibility, Agility, Cost, and Asset. Metrics such as Perfect Order Fulfillment (POF), Order Fulfillment Cycle Time

(OFCT), and Delivery Retail Lead Time (DRLT) help assess the efficiency, responsiveness, and overall performance of supply chain operations.

RESULTS AND DISCUSSION

To determine the priority of various elements in the rice supply chain, the research began with expert questionnaires, followed by in-depth interviews. This two-step approach ensured that the prioritization accurately reflected the realities of Bulog's business processes. The analysis was supported by Super Decisions software version 3.2, which was used to calculate priorities using the SCOR-AHP method. All supply chain actors were given equal weight, based on the assumption that each plays an equally important role in the rice distribution process in Bogor. Among the main business processes, the "Plan" process emerged as the top priority, with a weight of 0.365. This highlights the critical role of planning activities, such as forecasting demand and supply, as the foundation for ensuring smooth and coordinated operations throughout the supply chain. When evaluating performance attributes, reliability ranked highest, with a weight of 0.321, followed by responsiveness (0.236), agility (0.192), asset management (0.131), and cost (0.116). Reliability in this context refers to the consistency with which the supply chain delivers products on time, in the correct quantity, and with the expected quality. Among the individual performance metrics, Perfect Order Fulfillment (POF)—a key indicator of reliability—had the highest priority with a weight of 0.241. This was closely followed by Delivery Retail Lead Time (DRLT) at 0.236. Importantly, the results met the required consistency threshold, with an inconsistency ratio of less than 10%, indicating that the judgments made throughout the SCOR-AHP process were logically sound and acceptable, as suggested by Saaty (1994).

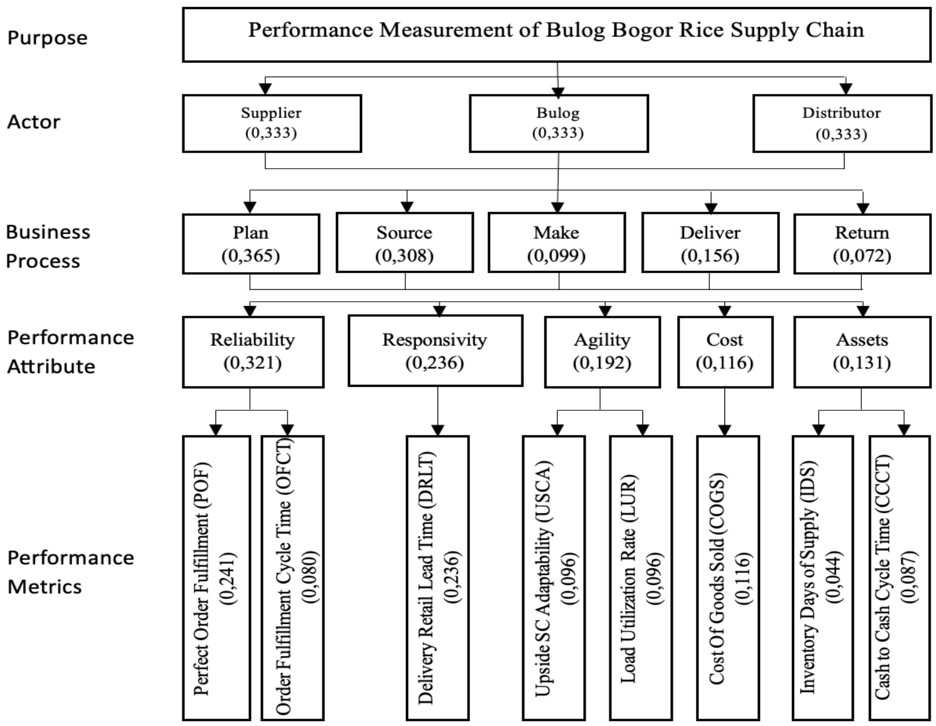

Figure 1. Weighting Results of Bulog Rice Supply Chain Performance Using SCOR-AHP

DOI: 10.37531/amar.v5i1.2447

As shown in Figure 2, each actor involved in the supply chain was assigned equal weight. This reflects the idea that every participant plays an equally important role in ensuring the smooth operation of the rice supply chain in the Bogor region. This result aligns with the findings of Wijaya (2024), who also emphasized that all supply chain actors carry equal importance in executing business processes.

Table 1. Supply Chain Actor Weights

No	Actor	Weight	Inconsistency Ratio
1	Supplier	0,333	
2	Bulog	0,333	<10%
3	Distributor	0,333	

Table 2 presents the weights of the five business processes. An inconsistency ratio of less than 10% indicates that the assessments made during the AHP process are sufficiently consistent and acceptable. Among the processes, planning received the highest weight in Bulog's rice supply chain performance. Based on the table, the analysis shows that the planning process holds the highest priority weight at 0.365.

Table 2. Supply Chain Business Process Weights

No	Business Process	Weight	Rank	Inconsistency Ratio
1	Plan	0,365	1	
2	Source	0,308	2	
3	Make	0,099	4	<10%
4	Deliver	0,156	3	
5	Return	0,072	5	

The sourcing process ranked second in priority with a weight of 0.308. This process involves several crucial activities, including the procurement of raw materials, selection of suppliers, scheduling deliveries, receiving goods, and ensuring quality control of unhusked rice (gabah). Its high score reflects the strategic importance of securing raw material availability at the farm level, selecting the right suppliers, and maintaining strong supplier relationships to ensure a steady flow of high-quality inputs for further processing.

The delivery process came in third, with a weight of 0.156. This process includes managing customer orders, selecting the appropriate delivery fleet, handling finished goods in warehouses, and inspecting the rice at the point of delivery. Quality checks—such as verifying moisture levels and ensuring the correct quantity according to customer specifications—are essential here. The relatively high priority given to delivery underscores the company's commitment to ensuring products arrive on time and meet quality expectations. The production process (make) received the fourth highest priority, with a weight of 0.099. This stage focuses on converting gabah into ready-to-consume rice through steps such as production scheduling, product testing, managing semi-finished inventory, and maintaining production equipment. The return process was assigned the lowest priority, with a weight of 0.072. It includes handling returns from Bulog warehouses back to MRMP or partner suppliers, evaluating product condition, obtaining return authorizations, and executing the logistics for returns. The relatively low importance of this process may be attributed to the strict quality controls in place at the processing plants,

DOI: 10.37531/amar.v5i1.2447

which result in very few defective or rejected products, minimizing the need for returns due to quality issues. Additionally, as shown in Table 4, the AHP analysis also revealed the weights of each performance attribute. Reliability had the highest weight at 0.321, followed by responsiveness (0.236), agility (0.192), asset management (0.131), and cost (0.116). Reliability plays a pivotal role in supply chain performance—it reflects the system's ability to deliver products or services consistently, on time, and at the expected quality and quantity. Ensuring high reliability is essential for maintaining customer trust and staying competitive in the marketplace.

Table 3. Weighting of Attributes and Performance Metrics

Performance Attribute	AHP Weight	Performance Metrics	AHP Weight	Inconsistency Ratio
Reliability	0,321	Perfect Order Fulfillment	0,241	<10%
		Order Fulfillment Cycle Time	0,080	
Responsiveness	0,236	Delivery Retail Lead Time	0,236	
Agility	0,192	Upside Supply Chain	0,096	
		Load Utilization Rate	0,096	
Cost	0,116	COGS	0,116	
Assets	0,131	Cash to Cash Cycle Time	0,044	
		Inventory Days of Supply	0,087	

Each performance attribute is associated with specific performance metrics. Among the eight performance metrics presented in this study, Perfect Order Fulfillment (POF), which falls under the reliability attribute, holds the highest weight at 0.241, followed by Delivery Retail Lead Time (DRLT) with a weight of 0.236.

Performance of the Premium Rice Supply Chain at Bulog Bogor

Table 4. SCOR Metrics for Premium Rice

Performance Metrics	Actual Data	Benchmark Data	Performance Value (%)	Performance Indicator
Perfect Order Fulfillment (POF)	96.55%	100%	96.55	Excellent
Order Fulfillment Cycle Time (OFCT)	4 days	4 days	100	Excellent
Delivery Retail Lead Time (DRLT)	1 day	1 day	100	Excellent
Load Utilization Rate (LUR)	19,28 tons	20 tons	96,40	Excellent
Upside Supply Chain Adaptability (USCA)	7 days	5 days	71,43	Good
Cost Of Goods Sold (COGS)	13.289/kg	13.000/kg	97,83	Excellent
Inventory Days Of Supply (IDS)	29,42 days	30 days	100	Excellent
Cash to Cash Cycle Time (CCCT)	30,42 days	30 days	98,62	Excellent

Based on the analysis presented in Table 5, which evaluates the supply chain performance for Bulog's premium rice in the Bogor region, the assessment considers various performance attributes, metrics, indicators, and measurement units. This

DOI: 10.37531/amar.v5i1.2447

evaluation utilizes both actual and benchmark data, referencing standards set by APICS (2017), internal company KPIs, and benchmarks from major rice retailers.

The results indicate that the premium rice supply chain demonstrates strong performance across all key attributes—reliability, responsiveness, agility, cost, and asset management. Metrics such as Perfect Order Fulfillment (POF), Order Fulfillment Cycle Time (OFCT), Delivery Retail Lead Time (DRLT), Upside Supply Chain Response Time, Load Utilization Rate, Cost of Goods Sold (COGS), and Inventory Days of Supply (IDS) all fall within the "very good" to "excellent" performance categories, according to classification guidelines by Rakhman et al. (2018). This suggests that Bulog has established a solid and efficient supply chain structure, reinforcing its role in ensuring food security in the Bogor region. Focusing on reliability, which reflects the ability to meet expectations consistently, the Perfect Order Fulfillment metric serves as the primary indicator. In 2024, Bulog achieved a 96.55% perfect delivery rate for premium rice, meaning 28 out of 29 delivery events were completed without any issues. The single imperfect delivery was flagged during a quality check at the Bulog Bogor warehouse, where the moisture content of the rice exceeded the 15% acceptable threshold. When analyzed by delivery volume, the performance was even better—430,000 kilograms of rice were delivered without defects out of a total of 440,000 kilograms, resulting in a 97.72% perfect delivery rate. The remaining 10 tons were returned to MRMP Karawang after being deemed unsuitable for distribution due to quality non-compliance. This shows that not only is the supply chain process reliable, but it also includes strict quality control mechanisms that ensure only rice meeting the required standards is delivered to partners and consumers.

Responsiveness and Other Performance Attributes of the Premium Rice Supply Chain

The responsiveness attribute—referring to how quickly tasks are completed—is assessed using two key metrics: Order Fulfillment Cycle Time and Delivery Retail Lead Time. In 2024, the Order Fulfillment Cycle Time achieved an excellent score of 100%, meaning every order was processed and completed within the expected timeframe. On average, it took just 4 days from the time an order entered Bulog's internal system to the point it was processed by the rice plant, fully meeting the operational targets set by Perum Bulog. The Delivery Retail Lead Time—which measures the time it takes to deliver rice to retail outlets, such as Rumah Pangan Kita (RPK)—was also outstanding, clocking in at just 1 day. This result aligns perfectly with the company's performance goals and reflects strong delivery efficiency. Next, in terms of agility, which reflects the supply chain's ability to adapt to external changes and sudden demand spikes, the metric used is Upside Supply Chain Response Time. Here, performance was slightly lower, with a score of 71.43%. The lower rating was mainly due to a delayed response to an urgent request from the Ministry of Trade, which required 40 tons of rice for a market operation in Bogor. While the target was to fulfill the request within 5 days, it took 7 days: 4 days to procure unhusked rice (gabah) from farmers, 3 days for processing, and 1 day for delivery.

Another agility-related metric, Load Utilization Rate, showed strong results. The transport efficiency was high, with a utilization rate of 96.40%. On average, each truckload carried 19.28 tons of rice using 20-ton capacity Colt Diesel Double (CDD)

DOI: 10.37531/amar.v5i1.2447

trucks, indicating near-optimal transport efficiency. For the cost attribute, performance was measured using the Cost of Goods Sold (COGS). The average cost performance reached 97.83% of the target. While the target cost per kilogram of premium rice was Rp 13,000, the actual cost came in slightly higher at Rp 13,289. This total included Rp 12,744 for raw materials, Rp 440 for packaging, Rp 91 in taxes, and Rp 14 for provisioning. The rice was sold to distributors at Rp 13,900 per kilogram, providing Bulog with a margin of approximately Rp 611 per kilogram (4.4%). This margin includes the company's minimum profit target of 1%, with the rest covering other operational expenses. Lastly, the asset attribute reflects how well Bulog utilizes its resources. One key metric here is Inventory Days of Supply (IDS), which indicates how many days the current stock can fulfill customer demand. The IDS for premium rice was 29.42 days, just below the target of 30 days, placing it in the outstanding category. This was calculated from an average monthly inventory value of Rp 2,009,725,000 and a daily average sales value of Rp 68,304,724. Another asset-related metric, Cash-to-Cash Cycle Time, which measures how long it takes for the company to recover its cash investment, also performed well. The actual cycle time was 32.50 days, just slightly over the 30-day target, suggesting efficient cash flow management overall.

Supply Chain Performance of SPHP Medium Rice at Bulog Bogor

Referring to the data presented in Table 6, which outlines the performance metrics for medium rice under the SPHP (Stabilisasi Pasokan dan Harga Pangan) program, the analysis shows promising results.

Table 5. SCOR Metrics for Medium Rice (SPHP)

Performance Metrics	Actual Data	Benchmark Data	Performance Value (%)	Performance Indicator
Perfect Order Fulfillment (POF)	72,50%	100%	72,50	Good
Order Fulfillment Cycle Time (OFCT)	7 days	7 days	100	Excellent
Delivery Retail Lead Time (DRLT)	1 day	1 day	100	Excellent
Load Utilization Rate (LUR)	30.000 tons	30.000 tons	100	Excellent
Upside Supply Chain Adaptability (USCA)	15 days	7 days	46,67	Marginal
Cost Of Goods Sold (COGS)	11.000	11.000	100	Excellent
Inventory Days Of Supply (IDS)	32,5 days	30 days	92,31	Excellent
Cash to Cash Cycle Time (CCCT)	33,5 days	30 days	89,55	Good

The supply chain performance attributes—including reliability, responsiveness, agility, cost, and asset management—along with their associated metrics (such as Perfect Order Fulfillment, Order Fulfillment Cycle Time, Delivery Retail Lead Time, Upside Supply Chain Response Time, Load Utilization Rate, COGS, and Inventory Days of Supply) are mainly within the average to very good or even excellent range, based on performance classification criteria from Rakhman et al. (2018). These results suggest that Bulog has successfully maintained a well-functioning supply chain for its SPHP medium rice in Bogor. This is a notable

DOI: 10.37531/amar.v5i1.2447

strength, particularly in fulfilling the program's core mission—stabilizing supply and ensuring food security—by consistently making affordable rice available to the public in the region.

Discussion

The findings of this study reveal that the overall performance of the rice supply chain managed by Bulog in Bogor City, encompassing both premium rice and medium rice under the SPHP (Stabilization of Supply and Food Prices) program, is highly commendable. This assessment was conducted using the SCOR-AHP method, which incorporates five key performance attributes: reliability, responsiveness, agility, cost, and asset management. Each attribute is represented by specific performance metrics that offer a detailed view of how well each aspect of the supply chain functions. Using SCOR-AHP allowed for a structured, multi-criteria evaluation of the supply chain, ensuring that operational, strategic, and tactical levels were considered. This analytical framework shows that Bulog's rice supply chain demonstrates robust coordination and execution across all primary functions. This reflects the organization's capacity to maintain consistent service levels and signals strong internal integration and alignment with national food security objectives. The dual focus on premium and medium rice categories offers a comprehensive view of supply chain performance. It highlights the adaptability of Bulog's distribution systems in addressing market-driven and government-mandated demands. The results show that Bulog's system can deliver high levels of service efficiency, which is essential in ensuring that rice, as a strategic staple food, remains accessible and affordable to the general population. This strong performance builds trust and credibility among stakeholders, including consumers, government agencies, and distribution partners.

The highest performance for the premium rice category was observed in the reliability attribute, particularly through the Perfect Order Fulfillment (POF) metric, which scored 96.55% and was classified as "excellent." This indicates Bulog's high capability to deliver orders on time, in the correct quantity, and meet quality standards. Such performance aligns with the fundamental principles of supply chain management, wherein reliability is regarded as a cornerstone for building a resilient and trustworthy food distribution system. Furthermore, when measured by delivery volume, the POF improved to 97.72%, underscoring the effectiveness of quality control mechanisms within the supply chain. This high reliability assures stakeholders that Bulog's operations are well-managed and can sustain consistent service despite fluctuating demand. From the responsiveness perspective, the performance was equally impressive. The Order Fulfillment Cycle Time was 4 days, and the Delivery Retail Lead Time was just 1 day, meeting operational targets and classified as "excellent." These figures reflect Bulog's efficiency in internal processing and last-mile distribution, which is critical to maintaining an uninterrupted supply to end consumers, particularly during peak periods or when immediate needs arise. This level of responsiveness is crucial in a supply chain that serves a basic necessity like rice, where delays can have a direct impact on household consumption. The premium rice supply chain's high reliability and responsiveness position Bulog as a leading public organization that maintains food distribution excellence in a highly strategic and sensitive market segment.

DOI: 10.37531/amar.v5i1.2447

The findings regarding agility are mixed. While the Load Utilization Rate demonstrated strong performance at 96.40%, indicating optimal use of transport capacity, the Upside Supply Chain Adaptability (USCA) metric only reached 71.43%, categorized as "good" but not "excellent." This score reveals a critical area for improvement, especially in responding to sudden and large-scale demand increases. A case in point was a delayed response to an urgent request from the Ministry of Trade for 40 tons of rice for a market operation in Bogor. The expected response time was 5 days, but it took a total of 7 days—4 days to procure unhusked rice from farmers, followed by 3 days of processing and 1 day for final delivery. The lag highlights coordination gaps between procurement, processing, and logistics functions. Agility, as defined in the SCOR model, reflects the supply chain's ability to rapidly adjust and scale up operations in response to market disruptions or unforeseen spikes in demand. While Bulog has demonstrated operational strength, the findings suggest that more investment in proactive planning, flexible sourcing contracts, and contingency resource allocation would be necessary to improve adaptability. Strengthening this aspect will ensure that the organization can maintain performance consistency even during emergencies or policy-driven interventions. Enhancing agility is particularly important in a government-linked supply chain, where responsiveness to external mandates is crucial. Thus, agility remains a key performance dimension that requires targeted improvement to match the excellence demonstrated in other areas, such as reliability and responsiveness.

In the context of cost performance, Bulog has achieved a commendable outcome. The Cost of Goods Sold (COGS) metric reached 97.83% of the established target, placing it in the "excellent" performance category. Although the actual unit cost of IDR 13,289 slightly exceeded the target of IDR 13,000, the margin generated still meets profitability expectations while maintaining competitive pricing for distribution partners. The detailed cost breakdown shows that IDR 12,744 was allocated for raw materials, IDR 440 for packaging, IDR 91 for taxes, and IDR 14 for provisioning—demonstrating high transparency and control in cost structure management. The premium rice was sold at IDR 13,900 per kilogram, resulting in a profit margin of approximately IDR 611 (around 4.4%), which exceeds the organization's minimum profitability benchmark of 1%. This balance between cost efficiency and service quality illustrates Bulog's ability to manage public service mandates and financial sustainability. It is a significant achievement in a state-owned enterprise responsible for food distribution, where maintaining affordability must be balanced with operational integrity. Furthermore, in the asset management domain, Inventory Days of Supply (IDS) and Cash-to-Cash Cycle Time (CCCT) recorded values of 29.42 days and 30.42 days, respectively—very close to their targets. These metrics indicate that stock turnover is healthy and that cash flow is managed efficiently, which are critical for long-term operational viability. Collectively, these results affirm that Bulog's premium rice supply chain is not only operationally effective but also financially sound and resource-optimized.

In the case of SPHP medium rice, the overall performance of the supply chain also indicates solid outcomes, although not as strong as those observed in the premium rice category. The Perfect Order Fulfillment (POF) metric reached 72.50%, suggesting that a majority of deliveries were completed accurately and on time. While this score is categorized as "good," it still lags behind the premium rice's POF score of 96.55%, indicating potential areas for improvement in consistency and

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execution. Despite the lower reliability score, the responsiveness of the SPHP supply chain remained highly satisfactory. The Order Fulfillment Cycle Time was recorded at 7 days, while the Delivery Retail Lead Time was just 1 day. These figures fall within the expected performance targets and demonstrate efficient internal processing and timely delivery to retail endpoints. In terms of agility, the supply chain's ability to adapt to sudden increases in demand showed some limitations. The Upside Supply Chain Adaptability (USCA) metric was recorded at 46.67%, which is categorized as "marginal." This relatively low score suggests that the system is not yet fully equipped to respond quickly to sudden demand spikes, particularly within the operational constraints of public service distribution. However, the Load Utilization Rate scored 100%, reflecting excellent transport efficiency and effective capacity use. The Cost of Goods Sold (COGS) also achieved a perfect score, signaling strong cost control in sourcing, production, and distribution processes. Lastly, asset management indicators—including Inventory Days of Supply (32.5 days) and Cash-to-Cash Cycle Time (33.5 days)—were slightly above target thresholds but remained within acceptable performance margins.

These findings are consistent with foundational theories in supply chain management, which emphasize the critical importance of reliability, cost efficiency, and responsiveness as key determinants of a successful food distribution system. Within the framework of the Supply Chain Operations Reference (SCOR) model, reliability is considered a primary attribute for evaluating the effectiveness of a supply chain. It reflects an organization's ability to consistently fulfill orders in alignment with customer expectations regarding time, quantity, and quality. Christopher (2016) Asserts that maintaining a high level of service performance is a fundamental component of competitive advantage in modern supply chains. A supply chain that can consistently deliver on its promises builds trust with stakeholders and enables long-term operational stability. The concept of agility, particularly as outlined by Yusuf et al. (2004)Underscores the importance of an organization's capacity to rapidly and effectively adapt to fluctuations in demand and environmental disruptions. This theoretical perspective suggests that supply chains must be efficient under normal conditions and flexible and responsive when faced with unexpected challenges or shifts in market behavior. The ability to scale up operations and adjust resources quickly is considered a strategic asset that enhances the overall resilience and longevity of the supply chain system. Therefore, the strong reliability and responsiveness shown in Bulog's rice supply chain affirm the theoretical expectations of SCOR and supply chain agility frameworks, indicating adaptability as an area with room for targeted improvement to align more closely with these conceptual standards.

Compared to prior research, the findings of this study align well with existing literature and reinforce several earlier conclusions. The study supports the results reported by Wijaya (2024), who emphasized that all actors within the supply chain—suppliers, distributors, and regulators—play equally vital roles in maintaining the fluidity and reliability of food distribution processes. The present research confirms that assigning equal weight to supply chain actors using the SCOR-AHP model accurately reflects the operational reality at Bulog, where interdependence and coordinated efforts are essential for achieving supply chain goals. This study aligns with the work of Ivanov and Dolgui (2021), who emphasized the importance of reliability and responsiveness in developing resilient food supply chains. The

DOI: 10.37531/amar.v5i1.2447

consistently high scores in Perfect Order Fulfillment and Order Fulfillment Cycle Time observed in Bulog's operations demonstrate a precise alignment with their framework, emphasizing stable delivery and swift response to demand. In addition, this study confirms the findings of Parast (2017), who argued that risk mitigation strategies, such as supplier diversification and demand management, are crucial for enhancing upside adaptability. Although Bulog exhibits strong reliability and cost efficiency, the study highlights some limitations in agility, particularly in responding to unanticipated demand surges. This outcome contrasts with the findings by Scholten et al. (2019), who determined that organizations with robust organizational learning systems exhibit higher adaptability to non-routine events. While Bulog's system is operationally strong, the adaptability dimension—particularly Upside Supply Chain Adaptability—remains an area that needs development to match the capabilities identified in such agile organizations fully.

CONCLUSION

This study aimed to evaluate the performance of Bulog's rice supply chain in Bogor by employing the SCOR-AHP method, integrating both qualitative and quantitative analyses. The research explored the performance of two rice categories—premium and medium (SPHP)—across five key SCOR attributes: reliability, responsiveness, agility, cost, and asset management. The study established the priority of business processes, performance attributes, and indicators using expert judgments, structured interviews, and quantitative scoring techniques via Super Decisions software. The research provides a comprehensive and structured response to the central research question regarding the efficiency and effectiveness of Bulog's rice supply chain in a regional public logistics setting.

This research contributes both scientifically and practically by offering a methodological framework that combines SCOR and AHP to evaluate public food distribution performance—a relatively underexplored context in the supply chain literature. From a scientific perspective, the study enriches the literature on public sector supply chain performance and introduces a multi-criteria decision-making model applicable in state-owned enterprise contexts. The findings provide actionable insights for Bulog and similar institutions to optimize supply chain planning, enhance responsiveness, and develop adaptive strategies that improve resilience. The originality of this study lies in its focus on the comparative evaluation of premium and medium rice performance, as well as the integration of stakeholder perspectives with a data-driven evaluation framework. Managerially, the results can inform strategic improvements in forecasting accuracy, inventory control, transport efficiency, and supply chain agility while guiding government policies in food logistics and public procurement.

Despite its strengths, the study has several limitations. First, the analysis was limited to a single geographical area (Bogor), which may not fully represent other regions where Bulog operates under different logistical and socio-economic conditions. Second, the study relied heavily on expert judgment, which, although systematically analyzed, still carries inherent subjectivity. Additionally, the study focused on the distribution aspect of the supply chain, without an in-depth exploration of upstream agricultural production dynamics. Future research is encouraged to expand the study to other regions for comparative analysis and incorporate dynamic simulation modeling to test the responsiveness and adaptability

DOI: 10.37531/amar.v5i1.2447

of supply chains under various disruption scenarios. Researchers should also consider longitudinal studies to assess the sustainability of implemented improvements over time. Future studies can further strengthen the theoretical foundation and practical relevance of supply chain performance evaluation in the public sector by addressing these limitations.

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