p-ISSN: 1907-8056
e-ISSN: 2527-5410
AGROINTEK
Jurnal Teknologi Industri Pertanian
journal homepage: journal.trunojoyo.ac.id/agrointek

Enhancing retailer efficiency of agroindustrial product: A DEA approach based on SCOR perspective

Wike Agustin Prima Dania*, Alvina Ovilia Ardiasti, Wendra Gandhatyasari Rohmah, Naila Maulidina Lu'ayya

Agroindustrial Technology, Universitas Brawijaya, Malang, Indonesia

Article history
Received:
12 October 2024
Revised:
21 November 2024
Accepted:
12 January 2025

Keyword
DEA;
Efficiency;
Retailer Performance;
SCOR;
Supply Chain Management

ABSTRACT

Retailer performance is critical for enhancing supply chain operations and achieving a competitive advantage in the food industry. It directly impacts customer satisfaction, profitability, and overall supply chain effectiveness. CV. LMN is an Indonesian apple cider drink manufacturer that involves 36 retailers in distributing its products to consumers. While the success of the marketing process relies on the retailers, the company has not previously assessed their performance. This research aims to examine CV's retailer performance. LMN using Data Envelopment Analysis from the Supply Chain Operations Reference (SCOR) perspective. The SCOR model's attributes of plan, source, deliver, and return served as the foundation for selecting evaluation factors. A CRS output-oriented DEA model was utilized to assess how efficiently retailers can increase their output without altering their resource consumption. The results shows that 6 out of 36 retailers are marginally efficient, indicating a potential for performance improvement and getting closer to the efficient frontier related to cash-to-cash cycle time, order received damage-free, fill rate, and customer complaints. These retailers can enhance their efficiency by implementing strategies such as reducing inventory levels, applying safety stock, negotiating payment terms with distributors, improving material handling during storage, and pre-checking products before delivery.

* Corresponding author
Email : wikedania@ub.ac.id
DOI 10.21107/agrointek.v19i4.27724

INTRODUCTION

The supply chain is a mechanism by which an organization distributes its products and services to customers through three stages: the upstream supply chain, the internal supply chain, and the downstream supply chain. To gain a competitive advantage, the supply chain must seamlessly connect suppliers, companies, retailers, and consumers in business activities (Linda and Thabrani 2021). In the case of agro-industrial products with a limited shelf life, efficient supply chain management is essential to maintain the quality and quantity of products until they reach consumers. One of the stakeholders that is crucial for maintaining a competitive edge, achieving customer satisfaction, and enhancing overall business performance is retailers. Retailers, as key stakeholders, play an essential role in supporting the sustainability and success of the supply chain.

Despite its importance, many companies in the F&B sector overlook the performance of their retailers, missing opportunities for improvement, including CV. LMN. CV. LMN is an apple cider drink in Indonesia that distributes its products through 36 retailers. However, it faces several challenges, including discrepancies between order plans and actual orders received, late payments, and defective products leading to consumer complaints. These persistent issues highlight the urgent need for a systematic evaluation of retailer performance, which the company has previously overlooked. Therefore, this study seeks to address this gap by assessing the efficiency of CV. LMN's retailers offer valuable insights into performance optimization and strategic improvement opportunities.

Several methods can be employed to measure retailer performance, including the Balanced Scorecard (BSC), performance prism, and Data Envelopment Analysis (DEA) (Shafiee et al. 2014, Saleheen et al. 2018). This study utilizes DEA due to its capability to accommodate diverse inputs and outputs quantitatively without requiring predefined assumptions about their functional relationships (Ebrahimi and Hajizadeh 2021). DEA measures efficiency by comparing the relative efficiency of a Decision-Making Unit (DMU) with other DMUs, providing a comprehensive evaluation (Wen et al. 2014). Additionally, DEA can manage a wide range of inputs and outputs that may be expressed in different units, enhancing its applicability in varied contexts (Nasution et al. 2019). This flexibility makes DEA particularly suitable for complex environments like supply chains, where multiple performance indicators must be analyzed simultaneously (Charnes et al. 1978). By leveraging DEA, this study aims to offer a nuanced understanding of retailer performance, guiding strategic decisions and operational improvements.

A comprehensive perspective is required in determining inputs and outputs for performance measurements. The Supply Chain Operations Reference (SCOR) model is particularly effective for this purpose. SCOR, a widely recognized Supply Chain Management (SCM) performance measurement model, divides the supply chain process into five key stages: plan, source, make, deliver, and return. It evaluates these stages across five performance attributes: reliability, responsiveness, flexibility, costs, and assets (Putri et al. 2019). This model provides a holistic framework that encompasses both internal and external elements of the supply chain, ensuring that all relevant metrics are considered in the performance evaluation.

The integration of SCOR and Data Envelopment Analysis (DEA) enhances the depth and accuracy of performance assessments. SCOR offers a structured approach to categorize and measure supply chain activities, facilitating the identification of relevant inputs (e.g., resources, costs) and outputs (e.g., delivery performance, customer satisfaction) for DEA (Wibowo & Nur, 2016). By mapping SCOR processes to DEA, organizations can capture a more nuanced picture of efficiency across different stages of the supply chain. This integration also promotes effective communication and collaboration among supply chain participants, as SCOR's standardized language and metrics ensure that all stakeholders are aligned in their understanding and. The detailed performance metrics provided by SCOR enable DEA to perform more precise efficiency analyses, identifying performance gaps and areas for improvement with greater accuracy. Studies have shown that combining SCOR with DEA not only improves the granularity of performance evaluations but also supports the development of targeted strategies for enhancing overall supply chain efficiency (Shafiee et al. 2014, Bire 2021).

Given the critical role of retailer performance in the supply chain, particularly in the competitive food and beverage sector, there is a pressing need for comprehensive evaluation methods. The SCOR model provides a robust framework for understanding and measuring supply chain activities, while Data Envelopment Analysis (DEA) offers a quantitative approach to assess efficiency. Integrating these methodologies allows for a detailed and accurate performance evaluation. Therefore, this research aims to examine the performance of CV. LMN's retailers using DEA from the SCOR perspective. This approach will provide valuable insights into performance optimization and identify strategic improvements necessary for enhancing overall supply chain efficiency.

METHODS

Supply Chain Operation Reference (SCOR) method

This study employed SCOR as perspectives to determine the input and output of the performance measurement. SCOR is a method that can be used to measure and improve the company's supply chain performance. Basically, SCOR consists of 3 main pillars, namely process modeling, performance measurement, and the application of best practices. SCOR performance measurement measures the company from upstream to downstream, allowing it to tackle supply chain problems within the company (Kusumawati et al., 2023). SCOR includes all relationships between suppliers, companies, distributors, retailers, consumers, raw material purchases, process costs, demand forecasting, deliveries, and other factors affecting supply chain performance. It also includes the physical movement of raw materials, in-process goods, finished goods, and the return of finished products (Lemghari et al. 2018). The inputs and outputs of retailer performance measurement are displayed in Table 1.

Table 1 Operational definition of input and output variables

Processes	Attributes	Variables	Definition of Operational	Description
Plan	Reliability	Ordering plan	The percentage that corresponds to the anticipated monthly order volume (%)	input
	Assets	Cash-to-cash cycle time	Payment terms to supplier and payment receipt period (days)	output
Source	Responsive ness	Source lead time	The amount of time, in days, it takes to order a product from the time of placement of the order to when it is delivered	input
	Flexibility	Minimum order quantity	Minimum quantity of orders (in units)	input
	Reliability	Order received damaged free	Product defect-free rate as a percentage (%)	output
Delivery	Responsive ness	Delivery lead time	The delivery time starts from the CV. LMN make the delivery until the product is received by the retailer (days)	input
	Reliability	Delivery quantity	Product delivery capacity (units)	input
		Fill rate	Number of items available when requested by customer (%)	output
Return	Reliability	Return rate to supplier	Return on the number of defective products (%)	input
		Customer complaint	The number of consumer complaints received by the company (complaints)	output

References: (Hasibuan and Dzikrillah 2018, Kusrini et al. 2019, Permana et al. 2020, Nugraha et al. 2022, Ernawati et al. 2022)

Table 2 Input and Output Variable Data

DMU	Ordering Plan	Cash-to-cash Cycle Time	Source Lead Time	Minimum Order Quantity	Order Received Damaged Free	Delivery Lead Time	Delivery Quantity	Fill Rate	Return Rate to Retailer	Customer Complaint
1	1	1	0.833	0.888	0.950	1	1	1	0.960	0.500
2	0.800	1	0.833	0.888	0.983	1	0.750	0.983	0.985	0
3	0.625	0.666	0.666	0.666	0.988	0	0.800	0.988	0.993	0.500
4	1	1	0.833	0.888	0.995	1	1	0.995	0.990	0
5	1	1	0	0.888	0.990	1	1	0.990	0.995	1
6	0.500	1	0.833	1	0.980	1	1	1	0.975	1
7	1	1	0.833	0.666	0.985	1	0.667	0.975	0.990	1
8	1	1	0	0	0.988	1	0.800	0.988	0.993	0.500
9	1	0.666	0.666	0	0.994	0	0.800	0.994	0.987	0.500
10	1	0.666	0.666	1	0.990	1	1	1	0.933	0.500
11	0.600	0.666	0.666	0.888	0.975	1	0.667	0.975	0.991	0
12	1	1	0	0.666	0.995	1	1	1	0.990	1
13	1	1	0.833	0.888	0.990	1	0.909	0.990	0.960	0.500
14	0.600	1	0.833	0.888	0.993	1	1	0.993	0.980	1
15	1	0.833	0.833	0.888	0.990	1	1	0.990	0.940	0
16	0.500	0.666	0	1	0.980	1	1	1	0.990	0.500
17	1	0.833	0.833	1	1	1	1	1	0.980	1
18	0.750	0.833	0.833	0.888	0.985	0	0.667	0.985	0.975	1
19	1	0.666	0.666	0.666	1	0	1	1	0.970	0
20	1	0	0	0.666	0.990	0	1	1	0.993	1
21	1	0.666	0.666	0.666	0.990	0	1	0.990	0.993	1
22	1	0	0	1	1	1	1	1	0.960	0.500
23	1	1	1	0.888	0.980	1	0.667	0.950	0.993	1
24	0.500	0.666	0.666	0.666	1	0	1	1	0.995	1
25	0.833	0.833	0.833	0.444	0.988	1	0.800	0.975	0.993	0.500
26	1	0.666	0.666	0.666	0.990	1	1	1	0.970	0
27	1	0.666	0.666	0.666	0.990	1	0.667	1	0.993	1
28	0.500	0	0	0.666	0.980	1	1	0.980	0.985	0
29	1	0	0	0.666	0.975	1	1	0.975	0.995	1
30	0.667	0.666	0.666	0.888	1	0	1	1	0.980	0.500
31	0.750	0.666	0.666	0.888	1	1	0.667	0.950	0.993	1
32	1	0.833	0.833	0.666	0.990	1	1	0.975	0.990	0.500
33	1	0.666	0.666	0.666	0.990	1	1	0.983	0.995	1
34	0.600	0	0	0.444	0.983	0	1	0.983	0.990	0.500
35	1	0.833	0.833	0.666	1	1	1	1	0.995	1
36	0.750	0.833	0.833	0.888	1	1	1	1	0.980	0

Data Envelopment Analysis (DEA) method

Data Envelopment Analysis is a method that can be used to evaluate and improve a manufacturer's or service's performance. DEA methods are widely used in performance evaluation and benchmarking in various institutions such as schools, hospitals, banks, and production plans (Fukuyama and Weber 2002, Weng et al. 2009, Amirteimoori and Kordrostami 2011, Lin and Chiu 2013). The unit used for measuring efficiency in DEA is called DMU (Anouze and Bou-Hamad 2019). This method is used to determine how efficient a DMU is in using and utilizing existing inputs to produce maximum output (Koesdijati and Wasesa 2021).

The DEA model was developed by Charnes et al. 1978. This model is also called the Constant Return to Scale (CRS) model. In the CRS model DEA, it is assumed that input and output have a linear relationship. That is, every increase in input will result in a constant increase in output. Another assumption used in this model is that the company is already operating at an optimal scale (Hanif et al. 2020). The approach used here is output oriented. The CRS output-oriented model is a DEA technique that assumes that the available inputs will optimize the outputs (Chen and Wang 2021). The following equations (1) – (4) are the similarities of the Output-oriented CRS model (Huguenin, 2012):

$$Maximize\,\Phi_k \quad (1)$$

$$Subject\ to$$

$$\Phi_k\, y_{rk} - \sum_{j=1}^{n} \lambda_j y_{rj} \leq 0 \quad r = 1, \dots, s \quad (2)$$

$$x_{ik} - \sum_{j=1}^{n} \lambda_j x_{ij} \geq 0 \quad i = 1, \dots, m \quad (3)$$

$$\lambda j \ \geq 0 \quad j = 1, \dots, n \quad (4)$$

Where:

Φ_k = efficiency value for observed DMUs

y_{rk} = total of output r generated by DMU k

x_{ik} = total of input I used by DMU k

J = DMU
r = output
i = input
k = DMU under study
n = number of DMUs to be evaluated
m = total inputs
s total output

RESULT AND DISCUSSION

Decision-Making Unit (DMU)

The Decision-Making Unit (DMU) is the result of the conversion from input to output, which is then evaluated. Several criteria can influence DMU selection, including the requirement that the DMU must be a homogeneous unit. Additionally, the DEA assumes that all DMUs are comparable and uniform, using the same inputs to produce the same outputs (Tatlari et al. 2023). In this study, the DMUs used were retailers who collaborated with CV. LMN.

Table 3 Each DMU's Efficiency Value

DMU	Technical efficiency (%)	Cash-to-cash Cycle Time (day)		Order Received Damaged Free (%)		Fill rate (%)		Customer Complaint		Description
		Actual Value	Target Value	Actual Value	Target Value	Actual Value	Target Value	Actual Value	Target Value	
1	100	1	1	95	95	100	100	2	2	Efficient
2	100	1	1	98	98	98	98	3	3	Efficient
3	100	3	3	99	99	99	99	2	2	Efficient
4	97.7	1	0	100	100	100	100	3	2	Marginally Efficient
5	100	1	1	99	99	99	99	1	1	Efficient
6	100	1	1	98	98	100	100	1	1	Efficient
7	100	1	1	99	99	98	98	1	1	Efficient
8	100	1	1	99	99	99	99	2	2	Efficient
9	100	3	3	99	99	99	99	2	2	Efficient
10	100	3	3	99	99	100	100	2	2	Efficient
11	100	3	3	98	98	98	98	3	3	Efficient
12	100	1	1	100	100	100	100	1	1	Efficient
13	100	1	1	99	99	99	99	2	2	Efficient
14	100	1	1	99	99	98	98	1	1	Efficient
15	100	2	2	99	99	99	99	3	3	Efficient
16	100	3	3	98	98	100	100	2	2	Efficient
17	100	2	2	100	100	100	100	1	1	Efficient
18	100	2	2	99	99	99	99	1	1	Efficient
19	100	3	3	100	100	100	100	3	3	Efficient
20	100	7	7	99	99	100	100	1	1	Efficient
21	100	3	3	99	99	99	99	1	1	Efficient
22	100	7	7	100	100	100	100	2	2	Efficient
23	100	1	1	98	98	95	95	1	1	Efficient
24	100	3	3	100	100	100	100	1	1	Efficient
25	99	2	2	99	99	98	99	2	1	Marginally Efficient
26	98.5	3	3	99	100	100	100	3	2	Marginally Efficient
27	100	3	3	99	99	100	100	1	1	Efficient
28	100	7	7	98	98	98	98	3	3	Efficient
29	100	7	7	98	98	98	98	1	1	Efficient
30	100	3	3	100	100	100	100	2	2	Efficient
31	100	3	3	100	100	95	95	1	1	Efficient
32	96.9	2	2	99	100	98	100	2	2	Marginally Efficient
33	99.7	3	1	99	100	98	100	1	0	Marginally Efficient
34	100	7	7	98	98	98	98	2	2	Efficient
35	100	2	2	100	100	100	100	1	1	Efficient

36	99.3	2	2	100	100	100	100	3	1	Marginally Efficient

The total number of DMUs used was 36, with 52.8% being small business units and 47.2% being micro business units. Micro businesses are productive enterprises owned by individuals with 1 to 4 employees, whereas small businesses are productive economic enterprises operated independently by individuals with 5 to 19 employees (Indonesian Statistics, 2020). The retailers involved have collaborated with CV. LMN since their establishment, with operating time spans between 2012 and 2021. The duration of the retailers' collaboration with CV. LMN impacts supply chain performance. The longer the relationship between the retailer and the company, the better or more efficient the supply chain performance (Afriliyani et al., 2019)

Input Variable Data and Output Variable

The DEA method for measuring efficiency involves determining input variables and output variables. Output data have to be increased or decreased. Therefore, data modification is required to adjust the output in one model (Ji and Lee 2010). Several methods can be implemented to modify the data in the DEA model, such as multiplicative inverse, additive inverse, and the addition of the most significant positive value of β (TRβ). Data modification was done with TRβ because this method is widely used in other studies and can maintain a positive value from unwanted outputs (Hua et al. 2007). The inverse data was then normalized before being processed using DEAP 2.1 software. The input and output variable data used are displayed in Table 2.

Efficiency of CV. Apple Cider Retailer LMN

Out of the 36 DMUs, 30 have achieved 100% efficiency, while six DMUs have been identified as inefficient. The inefficient DMUs are classified as "marginally efficient," with a score range between 90% and 99.9%. Table 3 shows the efficiency value for each DMU. DMUs 4, 32, and 36 scored slightly below 98% efficiency, while DMUs 25, 26, and 33 achieved efficiency ratings between 98.5% and 99.7%.

Inefficient DMUs need to be modified in order to achieve efficient conditions. Improvement is achieved by maximizing the value of the output variable while keeping the current input value unchanged. Output variables that must be improved are order received, damaged-free, and fill rate variables. Furthermore, output variables such as cash-to-cash cycle time and customer complaints must be reduced.

In DMU 4, to achieve efficiency, the cash-to-cash cycle time was reduced from 1 day to 0 days, and customer complaints were decreased from 3 to 2. In DMU 25, to achieve efficiency, the fill rate increased from 98% to 99%, and customer complaints were reduced from 2 to 1. In DMU 26, to achieve efficiency, the order received damaged-free rate was increased from 99% to 100%, and customer complaints were reduced from 3 to 2. In DMU 32, to achieve efficiency, the order received damaged-free rate was increased from 99% to 100%, and the fill rate was increased from 98% to 100%. In DMU 33, to achieve efficiency, the cash-to-cash cycle time was reduced from 3 days to 1 day, the order received damaged-free rate increased from 99% to 100%, the fill rate increased from 98% to 100%, and customer complaints were eliminated. Additionally, in DMU 36, to achieve efficiency, customer complaints were reduced from 3 to 1.

Managerial Implications

Based on the results of the study, there are 6 DMUs that need to be improved in some areas for retailer performance to reach 100% efficiency. The factors that need improvement are as follows:

Cash-to-cash cycle time

Cash-to-cash cycle time is a variable that represents the "Plan" process in the SCOR method. Based on the data processing using DEAP 2.1 software, DMU 4's initial cash-to-cash cycle time value of 1 day must be reduced to 0 days, and DMU 33's initial cash-to-cash cycle time value of 3 days must be reduced to 1 day. The inefficient DMU has partnered for a long time with CV. LMN. DMU 4 has been working together for 10 years, and DMU 33 has been working together for 7 years. LMN prioritizes optimizing cash flow by aligning payment terms with select apple cider distributors. This partnership approach fosters long-term collaboration and benefits both parties. While the supply chain involves various relationships, LMN focuses on these strategic partnerships built on mutual needs and growth (Zahrah et al. n.d.). To accelerate the conversion of inventory into cash, a two-fold strategy is used.

Retailers can minimize their inventory, and distributors can work with retailers to negotiate faster payment terms.

Order Received Damaged Free

Order received damaged-free is a variable representing the SCOR method's “Source” process. Based on the results, DMUs 26, 32, and 33, initially 99% elevated to 100%, should have their free values enhanced. The cause of the defective apple cider drink product for DMU 26 is the transfer of the product from the distribution car to the storage area by throwing a relay to quicken the product transfer. This can dent the cardboard, causing apple cider items in the cardboard to be damaged and potentially leak. In order to reduce the risk of damage and leakage, it is recommended that a systematic storage system for apple cider be implemented, with the avoidance of excessive stacking. It is recommended that storage piles be limited to a maximum of five in order to prevent damage to the lower products caused by the weight of the upper products (Tiaraningtyas and Nyoman 2022). In DMU 32 and 33, the causes of defective apple cider beverage products are defects on the road when the product is sent to the retailers. To minimize damage during shipping, ensure products are packed efficiently, leaving minimal gaps. This prevents items from shifting and colliding during product shock, which can cause breakage (Oktaviani et al. 2018).

Fill Rate

The fill rate is a variable that represents the “Delivery” process in the SCOR method. Based on the results, DMUs whose fill rate value must be increased to achieve an efficient condition are DMU 25, whose initial value of 98% needs to be increased to 99%, and DMU 32 and 33 whose initial value of 98% needs to be increased to 100%. The poor fill rate for DMU 25 is caused by a lack of inventory of apple cider drink items, which means that orders are not fulfilled 100% if there are sudden larger orders. The strategy that can be done to overcome these problems is to make a safety stock that serves as a safety item and anticipate problems or inhibitions during the product purchase process so that there is adequate stock (Amirjabbari and Bhuiyan 2014).

The low fill rate observed in DMUs 32 and 33 can be attributed to the storage location's inadequate hygiene and humidity levels, which have resulted in the deterioration of the cardboard packaging. Cardboard has become wet, leading to a reduction in its lifespan and, consequently, a decline in the overall fill rate. It is important to consider the temperature of the storage location, as it can affect the rate of deterioration of the product. Apple cider drinks must be stored in a cold, dry place at room temperature regulated and maintained at 20°C-25°C (El-Ishaq and Obirinakem 2015). It is essential to maintain optimal hygiene and sanitation standards in the product storage area to prevent deterioration in quality. The storage space must not be exposed to direct sunlight. There are several types of loss in food products during storage, such as weight, quality, and nutritional value losses. Weight loss frequently occurs because insects eat the product in storage due to open or damaged packaging. Quality loss is a change in taste and smell that should not occur. Because of inappropriate storage, a product's nutritional and vitamin content may be lost, resulting in a loss of nutritional value (Karanth et al. 2023).

Customer Complaint

In the SCOR method, customer complaints are variables that reflect the “Return” process. According to the results of this study, several DMUs must lower the value of their customer complaints to establish effective operating circumstances. The number of consumer complaints in DMU 4 and DMU 26, which were initially 3 complaints, must be reduced to 2 complaints. The number of consumer complaints in DMU 25, which was initially 2, must be decreased to 1. The number of consumer complaints in DMU 33, which was initially 1 complaint, must be reduced to 0 complaints. The number of consumer complaints in DMU 36, which was initially 3, must be decreased to 1. The primary cause of consumer complaints is that dented packaging cardboard leads to damaged and leaking products. The implementation of pre-delivery inspections, in conjunction with the maintenance of a hygienic and well-ordered storage area for apple cider, can serve to significantly reduce instances of damage and enhance customer experience. Neat condition means that the cardboard is packed in such a way that the height of the pile is considered so that the product at the bottom does not become dented or leak. Cleanliness in the storage area must also be considered so that insects do not contaminate the apple cider drinks (Santoso 2018).

CONCLUSION

Six from the 36 DMUs are marginally efficient, which are DMU 4, DMU 25, DMU 26, DMU 32, DMU 33, and DMU 36, with efficiencies of 97.7%, 99%, 98.5%, 96.9%, 99.7%, and 99.3% respectively. To enhance the performance of retailers, it is recommended to implement the following strategies: reduce inventory levels, negotiate payment with distributors, stack apple cider no more than five high, prepared products for shipping in a well-organized until there are no gaps between products, maintain safety stock as a safety item, maintain optimal conditions for storage, and perform quality control checks prior to sending the product to customers. It is recommended that future research should consider the importance of giving weight to each variable. In addition, the research should consider the sustainability perspective that considers the environment and society so that the supply chain performance assessment is more comprehensive. Future studies should explore the development of a methodology for assigning weights to the variables considered in the performance evaluation of retailers. By assigning appropriate weights to each factor (such as inventory levels, payment negotiations, and storage conditions), researchers can more accurately reflect their relative importance to overall efficiency and make the assessment process more nuanced and aligned with real-world business priorities.

ACKNOWLEDGMENT

The authors express their gratitude for the support provided by the "Hibah Doktor Non Lektor Kepala 2023" grant presented by the Institute of Research and Community Services at Brawijaya University (DRPM UB). The grant number is 3508.6/UN10.F10/PT.01.03/2023

REFERENCES

Afriliyani, U., Bambang, S.,, and Retno Widuri. 2019. The Impact of Long Term Relationship, Process Integration, Cooperation On Supply Chain Management Performance And Competitive Advantage. Journal of Research in Management 2:1–6.

Agung, W., M., and M. Nur Sholeh. 2016. Application Of Supply Chain Performance Measurement In SCOR Model At Building Project. The 2nd International Conference on Civil Engineering Research. 60-64

Amirjabbari, B., and N. Bhuiyan. 2014. Determining supply chain safety stock level and location. Journal of Industrial Engineering and Management 7:42–71.

Amirteimoori, A., and S. Kordrostami. 2011. Production planning: A DEA-based approach. International Journal of Advanced Manufacturing Technology 56:369–376.

Anouze, A. L. M., and I. Bou-Hamad. 2019. Data envelopment analysis and data mining to efficiency estimation and evaluation. International Journal of Islamic and Middle Eastern Finance and Management 12:169–190.

Ayu Tiaraningtyas, D., and I. Nyoman Purnaya. 2022. The Effect of the Application of Class Based Storage Method on Increasing the Utility in The Warehouse at CV. Bachtiar Jaya Plastic. Page Jurnal Logistik Indonesia.

Bire, R. B. 2021. Applicability of SCOR-Based DEA Performance Measurement In Small Med-Size Enterprises. Jurnal Ilmiah Bisnis dan Ekonomi Asia 15:12–29.

Charnes, A., W. Cooper, and E. Rhodes. 1978. Measuring the efficiency of decision making units. Page Company European Journal of Operational Research.

Chen, L., and Y. M. Wang. 2021. Limitation and optimization of inputs and outputs in the inverse data envelopment analysis under variable returns to scale. Expert Systems with Applications 183.

Ebrahimi, B., and E. Hajizadeh. 2021. A novel DEA model for solving performance measurement problems with flexible measures: An application to Tehran Stock Exchange. Measurement: Journal of the International Measurement Confederation 179.

El-Ishaq, A., and S. Obirinakem. 2015. Effect of Temperature and Storage on Vitamin C Content in Fruits Juice. Page International Journal of Chemical and Biomolecular Science.

Ernawati, D., S. Dewi, and N. K. Sari. 2022. Supply Chain Performance Measurement in a Refractory Brick Industry. Pages 170–176 3rd International Conference Eco-Innovation in Science, Engineering, and Technology. Galaxy Science.

Fukuyama, H., and W. L. Weber. 2002. Evaluating public school district performance via DEA gain functions. Journal of the Operational Research Society 53:992–1003.

Hanif, Z., P. Kristy, M. W. D. Utami, Yuniaristanto, and W. Sutopo. 2020. Supply Chain Performance Analysis with Data Envelopment Analysis in TBBM PT. Pertamina Boyolali. Page IOP Conference Series: Materials Science and Engineering. IOP Publishing Ltd.

Hasibuan, S., and N. Dzikrillah. 2018. Supply Chain Performance Measurement and Improvement for Indonesia Chemical Industry Using SCOR and DMAIC Method. Saudi Journal of Engineering and Technology.

Hua, Z., Y. Bian, and L. Liang. 2007. Eco-efficiency analysis of paper mills along the Huai River: An extended DEA approach. Omega 35:578–587.

Huguenin, J.-M. 2012. Data Envelopment Analysis (DEA) a pedagogical guide for decision makers in the public sector. IDHEAP, Lausanne

Indonesian Statistics. (2020) Industri Mikro dan Kecil. Available at: https://www.bps.go.id/subject/170/industri-mikro-dan-kecil.html#:~:text=Industri%20Kecil%20adalah%20perusahaan%20industri,kerjanya%20antara%201%2D4%20orang. Accessed on 17 July 2023 [In Indonesian]

Ji, Y.-B., and C. Lee. 2010. Data envelopment analysis. Page The Stata Journal. 10:267-280

Karanth, S., S. Feng, D. Patra, and A. K. Pradhan. 2023. Linking microbial contamination to food spoilage and food waste: the role of smart packaging, spoilage risk assessments, and date labeling. Frontiers Media SA.

Koesdijati, T., and A. J. A. Wasesa. 2021. Efficiency Distribution Analysis with Data Envelopment Analysis (DEA) Approach Fertilizer. Tibuana 4:91–98.

Kusrini, E., V. N. Helia, and M. P. Maharani. 2019. Supply Chain Performance Measurement Using Supply Chain Operation Reference (SCOR) in Sugar Company in Indonesia. Page IOP Conference Series: Materials Science and Engineering. IOP Publishing Ltd.

Kusumawati, A., Wahyudi, and Halia. 2023. Supply Chain Measuring Performance With Scor Model Business Process Mapping. Injurity: Iterdiciplinary Journal and Humidity 2:319-331

Lemghari, R., C. Okar, and D. Sarsri. 2018. Supply chain performance measurement: A case study about applicability of SCOR model in automotive industry firm. Page MATEC Web of Conferences. EDP Sciences. 200:1-8

Lin, T. Y., and S. H. Chiu. 2013. Using independent component analysis and network DEA to improve bank performance evaluation. Economic Modelling 32:608–616.

Linda, M. R., and G. Thabrani. 2021. Supply Chain Management Practices on Competitive Advantage with Supply Chain Performance as Moderating Variable. Proceeding of the Serventh Padang International Conference on Economics Education, Economics Business and Management, Acounting and Entrepreneurship (PICEEBA 2021) 192:469-480

Nasution, N. H., S. Efendi, and Tulus. 2019. Sensitivity Analysis in Data Envelopment Analysis for Interval Data. Pages 1–4 Journal of Physics: Conference Series. Institute of Physics Publishing. 1-4

Nugraha, E., R. M. Sari, and A. Yunan. 2022. Development Strategies Analysis Using the SCOR Method Approach: A Case Study from Medical Device Company. Jurnal Manajemen Teori dan Terapan | Journal of Theory and Applied Management 15:91–106.

Oktaviani, N., Z. Arin Yadia, and N. Nasution. 2018. How To Reduce Cargo Damage?. Atlantis Press, Beijing.

Permana, D. M. P., Rimawan Erry, and Sawarni. 2020. Supply Chain Performance Analysis With Supply Chain Operation Reference (SCOR) and Analytic Hierarchy Process (AHP) Methods (Case Study In The European Steel Industry). Journal of Critical Reviews 7:1041–1047.

Putri, Y. D., L. N. Huda, and S. Sinulingga. 2019. The concept of supply chain management performance measurement with the supply chain operation reference model (Journal review). Page IOP Conference Series:

Materials Science and Engineering. Institute of Physics Publishing. 1-6

Saleheen, F., M. Mamun Habib, and Z. Hanafi. 2018. Supply Chain Performance Measurement Model: A Literature Review. Page Int. J Sup. Chain. Mgt. 7:70-78

Santoso, V. A. 2018. Best Raw Material Storage Method For Keeping Quality Of Food Production. International Journal of Transportation and Infrastructure. 57-62

Shafiee, M., F. Hosseinzadeh Lotfi, and H. Saleh. 2014. Supply chain performance evaluation with data envelopment analysis and balanced scorecard approach. Applied Mathematical Modelling 38:5092–5112.

Tatlari, A. A., S. J. Sajjadi, and R. Soltani. 2023. Optimization of the dynamic network data envelopment analysis (DNDEA) model based on the game theory in the capital market. Int. J. Nonlinear Anal. Appl 14:2008–6822.

Wen, M., L. Guo, R. Kang, and Y. Yang. 2014. Data Envelopment Analysis with Uncertain Inputs and Outputs. Journal of Applied Mathematics 2014.

Weng, S. J., T. Wu, J. Blackhurst, and G. Mackulak. 2009. An extended DEA model for hospital performance evaluation and improvement. Health Services and Outcomes Research Methodology 9:39–53.

Zahrah, H., A. Rahayu, and P. D. Dirgantari. (n.d.). The Effect of Partnership Strategy on Business Success (Case Study on Hospitality in West Java). 3: 236-244