Opsi
Vol. 17, No. 1, June 2024
p-ISSN 1693-2102
e-ISSN 2686-2352

Performance measurement of organic tea supply chain with supply chain operation references (Case study of active Tegal Subur Farmer Group, Kulon Progo)

Ferdiansyah Aji Pratama[1], Irwan Soejanto[1]*, Eko Nursubiyantoro[1]
[1]Faculty of Industrial Engineering, Department of Industrial Engineering, Universitas Pembangunan Nasional "Veteran" Yogyakarta, Yogyakarta, Indonesia

*Corresponding Author: irwansoejanto@upnyk.ac.id

Article history:
Received: 24 October 2023
Revised: 17 November 2023
Accepted: 15 May 2024
Published: 30 June 2024

Keywords:
Organic tea
Supply chain
Supply Chain Operation References
Analysis Hierarchy Process (AHP)

ABSTRACT
Tegal Subur Aktif Farmer Group is one of the organic tea producers located in Menoreh Hills, precisely in Nglinggo, Pagerharjo, Samigaluh, Kulon Progo. The efforts made by this farmer group include the procurement of tea ingredients, the provision of production facilities, the cultivation and maintenance of tea plants, the processing of agricultural products, and trade in general. Processed products from organic tea produced are green tea, black tea, yellow tea, and roasted tea. Farmer groups have uncertain orders. It deals with actual production planning caused by an erratic supply of raw materials. The Tegal Subur Aktif Farmer Group has never measured the performance of the organic tea supply chain. The purpose of this study is to measure the performance of the organic tea supply chain and find out the indicators that need to be improved. To measure the performance of the organic tea supply chain by applying the Supply Chain Operation References (SCOR) and Analysis Hierarchy Process (AHP) methods. From the results of the study, the measurement of the performance of the organic tea supply chain was 54.667. Indicators for improvement are the availability of direct labour, the ability to fulfill uncertain orders, the level of product exhaustion, and the accuracy of product packing.

DOI:
https://doi.org/10.31315/opsi.v17i1.11036

1. INTRODUCTION

Industrial development continues to grow significantly, giving rise to the need for more innovative and efficient competitive strategies. In the face of increasing competition, Supply Chain Management (SCM) has become the key to ensuring high-quality products and services [1–3]. The key to successful SCM lies in optimizing the performance of the supply chain which encompasses various entities and operational processes, from conception to use of the product or service [4]. An efficient supply chain is the foundation for business continuity and prosperity and enables companies to effectively control the flow of information, products, and financial resources [5]. In this context, good integration in all stages of the supply chain is of key importance. This includes smooth information flow, long-term relationships with suppliers, and strong collaboration with all supply chain stakeholders [6, 7]. Thus, SCM is not just about organizing logistics and distribution, but also about building an interconnected and mutually supportive business ecosystem.

In an era where collaboration is increasingly valued, the door is open to the recognition that cooperation across the supply chain can be the key to success for companies. More than just organizing the flow of goods from point A to point B, SCM has become a battleground where efficiency meets innovation. From inventory management to strategic site selection, every step is organized in such a way as to ensure that companies can respond to the market quickly and effectively [8–10]. However, implementing SCM is not a walk in the park. It requires a structured and sequential approach, flowing from a macro vision down to concrete micro steps. In this process, the alignment between the company's goals and the practical steps taken is a key determinant of success [11]. From tackling challenges at the macro level to solving problems at the micro level, SCM becomes a demanding, but also highly satisfying landscape when it successfully achieves harmony between vision and action [12].

Taticchi et al. [13] highlighted the importance of performance management and continuous improvement efforts in the context of supply chain management. The effectiveness of performance management in supply chains can be improved through the implementation of a holistic measurement system, capable of evaluating performance from multiple perspectives. Performance measurement systems are generally designed with multiple levels, which take into account diverse aspects. In addition, the components that are often included in a performance measurement system include [14]:

1. Metrics for performance evaluation of planned order procedures.
2. Supply chain partnership and related metrics.
3. Measuring customer service and satisfaction.
4. Production level measures and metrics.
5. Performance evaluation of delivery link.
6. Supply chain finance and logistics costs.

These diverse approaches not only provide insight into current performance but also serve as a driver for targeted improvement initiatives. With a smooth transition from the discussion of performance measurement components, the Supply Chain Operations Reference (SCOR) model emerged as a guide that steers companies toward operational excellence. SCOR, a leading framework carefully designed to evaluate and improve supply chain performance across multiple operational dimensions, provides a holistic perspective on supply chain operations. By integrating the metrics and dimensions highlighted by Baghwat & Sharma [14] into a structured SCOR framework, organizations can effectively assess their performance, identify areas for improvement, and propel themselves toward unparalleled levels of efficiency and competitiveness. The Supply Chain Council (SCC) emphasizes that the SCOR model provides a variety of techniques, diagnostics, and benchmarking tools that facilitate significant and rapid improvements in supply chain processes. However, it should be noted that the SCOR model does not include sales and marketing activities associated with demand creation, product development, and research and development. To address this, the American Production and Inventory Control Society (APICS) provides an additional framework that extensively addresses these specific areas. The integration of six core management processes in the SCOR model includes [15]:

1. Plan, assess resources, collect and prioritize demand requirements, plan supply for distribution, production, and material requirements, and plan rough capacity for all products and all channels.
2. Source, i.e., obtain, receive, inspect, withhold, issue, and authorize payment for purchased raw materials and finished goods.
3. Manufacture, request and receive raw materials, manufacture and test products, packaging, containment, and release of products.
4. Deliver, i.e., running order management processes, configuring products, creating and maintaining customer databases, maintaining product or price databases, and managing accounts receivable, credit, collection, and invoices. Running warehouse processes includes selecting, packing, configuring, shipping products, managing transportation and export-import processes, and verifying performance.
5. Return processes defective, warranty, and excess product returns, including authorization, scheduling, inspection, transfer, administrative warranty, acceptance and verification of defective products, disposition, and replacement.

By adopting the SCOR model and utilising additional frameworks from APICS, companies can formulate a holistic and targeted strategy to improve their supply chain performance.

In developed countries, achieving optimal performance in SCM is strongly influenced by factors such as cost efficiency, product quality, and adherence to sustainable practices, often represented by GreenScor metrics [16]. However, in developing countries, such as Indonesia, farmer groups face diverse challenges in their efforts to achieve operational excellence [17]. Take, for example, the Tegal Subur Active Farmers Group, a group of organic tea producers located at the foot of the beautiful Menoreh Hills, in Nglinggo village, Pagerharjo, Samigaluh, Kulon Progo. Despite the beautiful surroundings, these farmers face various hurdles ranging from limited access to technology and market information to logistical constraints and financial issues. As they face these challenges, customized strategies and support systems are needed to empower this group of farmers and unlock their full potential. By tackling these issues head-on and encouraging collaboration between stakeholders, we can pave the way for sustainable growth and prosperity in agricultural supply chains in developing regions like Indonesia.

These farmer groups endeavour to involve themselves in various aspects of the organic tea supply chain, from raw material procurement to finished product distribution. They ensure the availability of tea raw materials, provide production facilities, conduct plant cultivation and maintenance, and process agricultural products into various processed products such as green tea, black tea, yellow tea, and roasted tea. These products are not only sold to visiting tourists, but also in retail outlets. The group consists of 37 members, each of whom is responsible for picking 5-6 kg of wet tea leaves at a time. With a production capacity of up to 25kg of wet tea leaves per session, they can fulfil market demand quite well. In addition, Tegal Subur Active Farmer Group has partnerships with local distributors or shops that regularly order their organic tea products every month. This ensures a more structured and sustainable supply and marketing of their products in the local market.

A major challenge faced by farmer groups is the unpredictability in monthly orders. This variability affects their ability to meet unexpected demand as product stocks are often insufficient. Although the number of unfulfilled orders is relatively small, this can have an impact on consumer satisfaction and the smooth flow of the upstream to downstream supply chain. The data shows that 95.39% of uncertain orders were fulfilled during the period August 2021 to March 2022. This high percentage illustrates the challenges faced in planning production according to actual demand, mainly due to the uncertainty of irregular raw material supply. Deviations between production planning and actual production can result in cost losses, both in the form of lost revenue and decreased production efficiency. In addition, the uncertainty of monthly orders also makes production planning difficult, making it difficult for farmer groups to organize production schedules and resource allocation efficiently. A more structured and sustainable strategy is needed to address these challenges and improve overall supply chain performance.

Therefore, this study aims to investigate the supply chain performance of organic tea using the SCOR approach. Previously, there have been a number of studies using SCOR to measure supply chain performance in various industrial contexts. For example, there have been studies on evaluating supply chain performance in the batik industry [18, 19], applying the SCOR model in the aircraft spare parts industry [20, 21], and implementing SCOR in the sugar and leather industries [22]. However, this study has a different focus as it explores measuring and improving supply chain performance specifically in the context of organic tea production. By understanding the specific dynamics involved in the organic tea supply chain, it is expected that this research can provide valuable insights for practitioners and researchers in an effort to improve the efficiency and sustainability of the organic product supply chain.

2. MATERIALS AND METHODS

2.1. Material

The ingredients used for this study were organic tea in Tegal Subur Akitf, Nglingo, Pagerharjo, Samigaluh, and Kulon Progo. Processed products from organic tea produced are green tea, black tea, yellow tea, and roasted tea.

2.2. Method

The method used to measure supply chain performance in this study is SCOR. The SCOR model is known as an effective diagnostic tool in analyzing SCM, which allows users to gain a deep understanding of the various processes that occur within the company's organization. The selection of SCOR as a performance measurement method is based on the consideration that the Key Performance Indicators (KPIs) that currently exist are not fully in accordance with the company's supply chain strategy, so a more structured and holistic approach is needed [23]. This method is not only a reference framework for supply chain operations, but also provides methodologies and measurement tools that can help companies identify and correct weaknesses quickly [24]. For example, Gonzales-Pascual et al. [25] assert that even small businesses can use SCOR to identify their shortcomings by utilizing easy-to-understand yet relevant measures. The SCOR model also includes the application of Analytical Hierarchy Process (AHP) and Fuzzy AHP methodologies in risk management, specifically focused on the five main components in the supply chain: planning, procurement, delivery, production, and returns [26]. By utilizing SCOR as the main framework, this study aims to provide deeper insights into the performance of the organic tea supply chain and provide a solid foundation for the development of continuous improvement strategies.

2.2.1. Data processing of the AHP method

Steps of AHP data processing:

1. Define the problem and define the desired solution.
2. Create a hierarchical structure that begins with a general purpose, criteria, sub-criteria, and alternative options.
3. Create a paired comparison matrix that describes each element's relative contribution or influence to a goal or criterion level above.
4. Defines pairwise comparisons so that a total number of raters is obtained as many as n x [(n-1)/2] pieces, where n is the number of elements compared.
5. Calculates eigenvalues and tests their consistency. If it is inconsistent, then the data retrieval is repeated.
6. Repeat steps 3, 4, and 5 for all hierarchy levels.
7. Calculates the eigenvalue of each paired comparison matrix, which is the weight of each element for prioritization of elements at the lowest hierarchical level until reaching the goal.

2.2.2. Data processing method of SCOR

The steps of SCOR method are as follows:

1. Identifying the company's supply chain by observing the company's supply chain and then carrying out the SCOR model approach; the observations are compiled into the company's supply chain framework.
2. Determine the indicators of the level-1 matrix, level-2 matrix, level-3 matrix. The level-1 matrix is the processes in SCOR, namely plan, source, make, deliver, and return. The level-2 matrix is a dimension for supply chain performance measurement. The dimensions used include Reliability, Responsiveness, Agility, Cost, and Asset. The level-3 matrix contains indicators that affect each process and dimension of supply chain management performance measurement, so they are referred to as KPIs.
3. Develop a hierarchical structure of the company's supply chain indicators. The three levels of the matrix are then made a hierarchy of supply chain performance indicators in the company based on interviews and filling out indicator questionnaires by parties involved in the research.
4. Calculating the normalization of KPIs with the normalization of Snorm De Boer The weights of the indicators are converted into a conversion of a specific value that is between 0 and 100.
5. Weighting the importance of Performance Attributes with the AHP method. This weighting is done to determine the importance of each level and KPIs.
6. Calculate the final value of supply chain performance. Multiplies the KPIs score by the previously calculated KPI weight.
7. Calculates the final value of a dimension. Multiplies the score of each dimension by the weight of the previously calculated dimension.
8. Calculates the total value of supply chain performance. Multiplies the normalized score value of each matrix by the matrix weight value obtained from the weighting results using AHP.

2.2.3. AHP and SCOR data processing

Steps in data processing integration of AHP and SCOR:

1. Identifying the company's supply chain by observing the company's supply chain and then carrying out the SCOR model approach, the observations are compiled into the company's supply chain framework.

2. Determine the indicators of the level-1 matrix, level-2 matrix, and level-3 matrix. The level-1 matrix is the processes in SCOR, namely plan, source, make, deliver, and return. The level-2 matrix is a dimension for supply chain performance measurement. The dimensions used include Reliability, Responsiveness, Agility, Cost, and Asset. The level-3 matrix contains indicators that affect each process and dimension of supply chain management performance measurement, so they are referred to as KPI.
3. Develop a hierarchical structure of the company's supply chain indicators. The three levels of the matrix are then made a hierarchy of supply chain performance indicators in the company based on interviews and filling out indicator questionnaires by parties involved in the research.
4. Calculating the normalization of KPIs with the normalization of Snorm De Boer. The weights of the indicators are converted into a conversion of a specific value between 0 and 100.
5. Weighting the importance of Performance Attributes with the AHP method. This weighting is done to determine the importance of each level and KPIs.
6. Create a hierarchical structure that is initialized with the main purpose.
7. Create a paired comparison matrix that describes each element's relative contribution or influence to a goal or criterion level above.
8. Defines pairwise comparisons so that a total number of raters is obtained as many as n x [(n-1)/2] pieces, where n is the number of elements compared.
9. Calculates eigenvalues and tests their consistency. If it is inconsistent, then the data retrieval is repeated.
10. Repeat steps 3, 4, and 5 for all hierarchy levels.
11. Calculates the eigenvector of each paired comparison matrix that weights each element to prioritize elements at the lowest hierarchical level until they reach the goal.
12. Calculate the final value of supply chain performance. Multiplies the KPI score by the previously calculated KPI weight.
13. Calculates the final value of a dimension. Multiplies the score of each dimension by the weight of the previously calculated dimension.
14. Calculates the total value of supply chain performance. Multiplies the normalized score value of each matrix by the matrix weight value obtained from the weighting results using AHP.

The AHP is a decision-support method developed by Saaty [27]. Decision support models describe complex multi-factor or multi-standard problems as hierarchical structures. According to Saaty [27], this decision support model would hierarchically break down complex multi-factor or multi-criteria problems.

According to Kumar & Pant [28], the preparation of AHP consists of several steps, namely:

1. The initial phase of AHP involves converting the multi-criteria decision-making challenge into a hierarchical framework.
2. Subsequently, determining the relative significance of each criterion is essential.
3. Finally, performing several computations is necessary to assess the priority vector (weights) and ensure judgment consistency.

In evaluating company performance, various methods have been applied [18]. One important step in this process is the normalization of the performance indicators used, which allows for a more objective assessment of the level of achievement. Each indicator has a different weight according to its unique measurement scale, making the use of parametric equations crucial. Normalization, or the process of standardization, plays a key role in achieving accurate measurement results. In this context, the normalization process uses the Snorm De Boer normalization equation [18], which has a central role in adjusting the data so that it can be compared and analyzed more effectively. Thus, proper normalization measures provide a solid foundation for more detailed and relevant performance evaluations in an increasingly competitive business environment.

$$\text{Larger is better: } Snorm = ((Si - Smin)/(Smax - Smin))\ x\ 100 \tag{1}$$

$$\text{Lower is better: } Snorm = ((Smax - Si)/(Smax - Smin))\ x\ 100 \tag{2}$$

where,

Si : The attained value of the indicator in question

Smin : The performance indicator's value represents the poorest level of performance attainment.

Smax : The best performance achievement value of the performance indicator

The performance indicator monitoring system is presented in Table 1.

Table 1 Work indicator monitoring system

Monitoring System	Performance Indicators
< 40	*Poor*
40 – 50	*Marginal*
50 – 70	*Average*
70 – 90	*Good*
> 90	*Excellent*

Source: Trienekens & Hvolby [29]

3. RESULTS

3.1. SCOR management process of Tegal Subur Active Farmer Group

Three streams, namely material flows and information and financial flows, occur in the Active Tegal Subur Farmer Group. The material flow flows only one way from upstream to downstream. The process starts with the raw materials used in finished products to be distributed to consumers. Information and financial flows are two-way, from upstream to downstream and downstream to upstream.

The Active Tegal Subur Farmer Group process is Plan, Source, Make, and Deliver. In the Return process, there is no Active Tegal Subur Farmer Group. The Tegal Subur Aktif Farmer Group has never received a return on the quality of products received by distributors.

3.2. Research data of the Active Tegal Subur Farmer Group

Other data obtained from the Tegal Subur Active Farmer Group for research can be seen in Table 2.

Table 2 Data of the Active Tegal Subur Farmer Group

Material fulfillment								
Month	Ags	Sept	Oct	Nov	Des	Jan	Feb	March
Planning	150	150	160	160	160	160	160	160
Production								
Month	Ags	Sept	Oct	Nov	Des	Jan	Feb	March
Production	69.6	68.1	73.5	73.5	75.5	76	75.5	76.4
Product Inventory								
Month	Ags	Sept	Oct	Nov	Des	Jan	Feb	March
Total product	67.6	66.1	71.5	71.5	73.5	75	74.5	75.4
Demand								
Month	Ags	Sept	Oct	Nov	Des	Jan	Feb	March
Demand	60	61	62	63	64	65	66	67
Unexpected orders								
Month	Ags	Sept	Oct	Nov	Des	Jan	Feb	March
Unexpected orders	8	9	7	12	10	9	12	13
Fulfilled	7.6	5.1	7.0	11.0	9.5	9.0	9.4	8.4
Products sold								
Month	Ags	Sept	Oct	Nov	Des	Jan	Feb	March
Sent	67.6	66.1	69.0	74	73.5	74.0	75.4	75.4

3.3. Key Performance Indicator

There are 18 KPIs selected in the Active Tegal Subur Farmer Group. Key performance indicators from the Active Tegal Subur Farmer Group and their data can be seen in Table 3.

Table 3 Critical performance indicator data of Tegal Subur Active Farmer Group

No	Key Performance Indicator	Unit	Smax	Smin	Si
1	Meeting with suppliers	day	5	1	4
2	Material requirements planning	kg	160	150	158
3	Material fulfillment	%	98.125	93.333	95.849
4	Material quality	%	99.363	99.286	99.337
5	Material lead time	day	5	2	5
6	Supplier availability	person	24	10	22
7	Cost of material procurement	Rp/kg	4,000	1,000	3,500
8	Machine production capacity	Kg	100	50	70
9	Product packing accuracy	%	98.692	97.064	97.768
10	Product manufacturing time	day	6	2	4
11	The ability to fulfill orders is uncertain.	%	100.000	84.400	95.392
12	Availability of direct labour	person	20	8	14
13	Production cost	Rp/kg	20,000	10,000	14,000
14	Duration of use of production equipment	hour	6	3	4
15	Orders delivered	Kg	77	66	72
16	Product delivery cycle time	day	5	3	4
17	Product exhaustion rate	%	100.000	96.503	99.083
18	Product shipping costs	Rp	450,000	200,000	315,000

3.4. Overall Weight Calculation

Global weighting determines which criteria, attributes, and sub criteria are most important. This can be seen from how much weight is for the process, dimensions, or the indicator itself. The greater the weight, the greater the importance of the process, dimensions, or indicators. Global weights are calculated by multiplying process weights by dimension and indicator weights. The results of the overall value weighting calculation can be seen in Table 4.

Table 4 Value weighting

No	Process (Level 1)	Weight	Dimensions (Level 2)	Weight	KPI (Level 3)	Weight	Global Weights
1	Plan	0.332	Reliability	0.538	PR	1.000	0.179
			Responsiveness	0.462	PRs	1.000	0.153
2	Source	0.324	Reliability	0.483	SR-1	0.631	0.099
					SR-2	0.206	0.032
					SR-3	0.164	0.026
			Agility	0.312	Sag	1.000	0.101
			Cost	0.205	SC	1.000	0.066
3	Make	0.245	Reliability	0.320	MR-1	0.787	0.062
					MR-2	0.213	0.017
			Responsiveness	0.139	MRs-1	0.575	0.020
					MRs-2	0.198	0.007
					MRs-3	0.227	0.008
			Cost	0.312	MC	1.000	0.076
			Asset	0.228	MA	1.000	0.056
4	Delivery	0.099	Reliability	0.634	DR	1.000	0.063
			Responsiveness	0.184	DRs-1	0.657	0.012
					DRs-2	0.343	0.006
			Cost	0.182	DC	1.000	0.018

3.5. Determination of the category of work indicators

The evaluation process can be facilitated by determining the category before an actual performance evaluation, especially if using Snorm De Boer. The category is generally divided into 2: Larger is Better, and Lower is Better. Larger is Better indicates that the higher or greater the value of a performance indicator, the better it is considered. At the same time, the lower is better category describes that the lower or smaller the value of the performance indicator, the better. The determination of categories for 18 KPI performance indicators from the Active Tegal Subur Farmer Group can be seen in Table 5.

Table 5 Key Performance Indicator Category

No	Key Performance Indicator (Level 3)	Category
1	Meeting with suppliers	Lower is better
2	Material requirements planning	Larger is better
3	Material fulfillment	Larger is better
4	Material quality	Larger is better
5	Material lead time	Lower is better
6	Supplier availability	Larger is better
7	Cost of material procurement	Lower is better
8	Machine production capacity	Larger is better
9	Product packing accuracy	Larger is better
10	Product manufacturing time	Lower is better
11	The ability to fulfill orders is uncertain	Larger is better
12	Availability of direct labour	Larger is better
13	Production cost	Lower is better
14	Duration of use of production equipment	Larger is better
15	Orders delivered	Larger is better
16	Product delivery cycle time	Lower is better
17	Product exhaustion rate	Larger is better
18	Product shipping costs	Lower is better

3.6. Supply Chain Performance Assessment

Each indicator has a different size scale, and there needs to be a process of equalizing parameters. The process of equalizing the parameters used is the normalization process with the Snorm De Boer normalization formula in equations 1 and 2. The result value for the critical performance indicator meeting with suppliers is 50. The resulting value for the key performance indicator of material fulfillment is 65.925. The results of all normalization indicators can be seen in Table 6.

Table 6 Normalization of Key Performance Indicators

No	Key Performance Indicator	Smax	Smin	Si	Unit	Score
1	Meeting with suppliers	5	1	3	day	50.000
2	Material requirements planning	160	150	157,5	kg	75.000
3	Material fulfillment	98.125	93.333	95.849	%	52.500
4	Material quality	99.363	99.286	99.337	%	65.925
5	Material lead time	4	1	2	day	66.667
6	Supplier availability	20	9	12	person	27.273
7	Cost of material procurement	50,000	20,000	40,000	Rp	33.333
8	Machine production capacity	25	20	24	kg	80.000
9	Product packing accuracy	98.692	97.064	97.768	%	43.283
10	Product manufacturing time	6	2	4	day	50.000
11	The ability to fulfill orders is uncertain	100	56.778	85.142	%	65.624
12	Availability of direct labour	30	15	21	person	40.000
13	Production cost	174,000	144,000	154,000	Rp/kg	66.667

Table 6 Normalization of Key Performance Indicators (Continued)

No	Key Performance Indicator	Smax	Smin	Si	Unit	Score
14	Duration of use of production equipment	6	3	4	hour	33.333
15	Orders delivered	75.44	66.11	71.875	kg	61.790
16	Product delivery cycle time	5	3	3,75	day	62.500
17	Product exhaustion rate	100.000	96.503	99.404	%	82.969

3.7. KPI Final Value Calculation

Each indicator has a different size scale, and there needs to be an equalization process. The calculation of the final value of KPIs can be seen in Table 7.

Table 7 Calculation of KPI final value

No	Process (Level 1)	Weight	Dimensions (Level 2)	Weight	Key Performance Indicator (Level 3)	Weight	Global Weights	Score	Performance Appraisal
1	Plan	0.332	Reliability	0.538	PR	1.000	0.179	50	8.927
			Responsiveness	0.462	PRs	1.000	0.153	75	11.487
2	Source	0.324	Reliability	0.483	SR-1	0.631	0.099	52.500	5.189
					SR-2	0.206	0.032	65.925	2.125
					SR-3	0.164	0.026	66.667	1.708
			Agility	0.312	Sag	1.000	0.101	27.273	2.759
			Cost	0.205	SC	1.000	0.066	33.333	2.213
3	Make	0.245	Reliability	0.320	MR-1	0.787	0.062	80	4.937
					MR-2	0.213	0.017	43.283	0.725
			Responsiveness	0.139	MRs-1	0.575	0.020	50	0.978
					MRs-2	0.198	0.007	65.624	0.442
					MRs-3	0.227	0.008	40	0.309
			Cost	0.312	MC	1.000	0.076	66.667	5.099
			Assets	0.228	MA	1.000	0.056	33.333	1.865
4	Delivery	0.099	Reliability	0.634	DR	1.000	0.063	61.790	3.886
			Responsiveness	0.184	DRs-1	0.657	0.012	62.500	0.748
					DRs-2	0.343	0.006	82.969	0.519
			Cost	0.182	DC	1.000	0.018	41.667	0.751
						Total Performance Appraisal			54.667 (Average)

Indicators are selected based on the value of weights multiplied by values in the company's supply chain. The higher the weight, the more critical this indicator is for the company. A lower performance value indicates that the supply chain is worse at fixing problems. Therefore, the top 4 results will be prioritized for improvement. Here are Table 8, priority fixes of the weight calculation result:

Table 8 Priority fixes

Key Performance Indicator (Level 3)	Weight	Global Weights	Score	Performance Appraisal
MRs-3	0.227	0.008	40.000	0.309
MRs-2	0.198	0.007	65.624	0.442
DRs-2	0.343	0.006	82.969	0.519
MR-2	0.213	0.017	43.283	0.725
DRs-1	0.657	0.012	62.500	0.748
DC	1.000	0.018	41.667	0.751

Table 8 Priority fixes (Continued)

Key Performance Indicator (Level 3)	Weight	Global Weights	Score	Performance Appraisal
MRs-1	0.575	0.020	50.000	0.978
SR-3	0.164	0.026	66.667	1.708
MA	1.000	0.056	33.333	1.865
SR-2	0.206	0.032	65.925	2.125
SC	1.000	0.066	33.333	2.213
Sag	1.000	0.101	27.273	2.759
DR.	1.000	0.063	61.790	3.886
MR-1	0.787	0.062	80.000	4.937
MC	1.000	0.076	66.667	5.099
SR-1	0.631	0.099	52.500	5.189
PR	1.000	0.179	50.000	8.927
Prs	1.000	0.153	75.000	11.487

Table 9 Identify strategies in KPIs

Key Performance Indicator (KPI)		Strategy Proposal
MRs-3	Availability of direct labour	Appoint or determine a member of a farmer group to be a coordinator in production, make a definite schedule for work, and make binding rules for work.
MRs-2	The ability to fulfill orders is uncertain	Increase production so that stocks are met by scheduling the supply of raw materials and providing incentives or fixed wages to workers who produce.
DRs-2	Product exhaustion rate	Forming a promotion team for the improvement of long-stored product promotion. The promotion team can create promos by utilizing all existing media.
MR-2	Accuracy of product packaging	Packing using digital scale tools, making the right dosing container, and doing it in a fit state.

4. DISCUSSION

The normalization process involves utilizing Snorm De Boer to change the unit of measure for each KPI Once a normalized score is obtained, the importance at each level is weighed using the AHP. According to calculations, it has been determined that the planning process has the greatest weight in level one, particularly with a weight of 0.332. Furthermore, the second priority is the planning process, with a value of 0.324. The next focus relates to the manufacturing and delivery process. After adding up all existing performance assessments, the results of the performance value of the organic tea supply chain can be known in the Active Tegal Subur Farmer Group. The total value of supply chain performance is 54.667, which is included in the "Average" category.

Based on the supply chain performance evaluation, it can be concluded that the output is of medium quality but not perfect. Therefore, to improve the company's supply chain performance, it is very important to implement innovation to add value.

Indicators are selected based on the value of weights × values in the enterprise's supply chain. The higher the importance, the more important this indicator is for the company. A lower performance value indicates that the supply chain is worse at fixing problems. Therefore, the top 4 results will be prioritized for ranking. The priority improvement proposals are:

1. MRs-3 is the availability of direct labour by appointing or appointing a member of a farmer group to be a coordinator in production, making a definite schedule in work, and making binding rules in work.
2. MRs-2 is the ability to fulfill uncertain orders and increase production so that stocks are met by scheduling the supply of raw materials and providing incentives or fixed wages to workers who produce.

3. DRs-2 is the product exhaustion rate by forming a promotional team to increase the promotion of products that have been stored for a long time. The promotion team can create promos by utilizing all existing media sources.
4. MR-2 is the accuracy of product packing using digital scale tools, making the right dosing container, and doing it in a fit state.

These four indicators are the performance of the Tegal Subur Active Farmer Group. This implies that there is a requirement for internal upgrades to increase the value of supply chain performance.

5. CONCLUSION

Based on performance measurement and supply chain performance estimation analysis, it was concluded that the value of organic tea supply chain performance in the Tegal Subur Active Farmer Group was 54.667. The indicators that are priorities for improvement are: 1. Availability of direct labour by appointing or appointing a farmer group member to be a production coordinator, making a definite schedule for work, and making binding rules for work; 2. The ability to fulfill orders is uncertain; increase production so that stocks are met by scheduling the supply of raw materials and providing incentives or fixed wages to the labour that does the production; 3. Product exhaustion rate by forming a promotional team for increased promotion of long-stored products. The promotion team can create promos by utilizing all existing media sources; 4. The accuracy of product packing by packing using digital scale tools, making the right dosing container, and doing it in a fit state. These four indicators are the performance of the Tegal Subur Active Farmer Group. This implies that there is a requirement for internal upgrades to increase the value of supply chain performance.

REFERENCES

[1] M. Kanan, "Investigating the relationship between information quality, system quality, service quality, and supply chain performance in the manufacturing sector of Saudi Arabia: An empirical study," *Uncertain Supply Chain Manag.*, vol. 11, no. 4, pp. 1589–1598, 2023, doi: 10.5267/j.uscm.2023.7.010.

[2] H. A. Salhab, M. Allahham, I. A. Abu-Alsondos, R. H. Frangieh, A. F. Alkhwaldi, and B. J. A. Ali, "Inventory competition, artificial intelligence, and quality improvement decisions in supply chains with digital marketing," *Uncertain Supply Chain Manag.*, vol. 11, no. 4, pp. 1915–1924, 2023, doi: 10.5267/j.uscm.2023.8.009.

[3] R. A. C. Leuveano, M. N. Ab Rahman, W. M. F. W. Mahmood, and C. Saleh, "Integrated vendor-buyer lot-sizing model with transportation and quality improvement consideration under just-in-time problem," *Mathematics*, vol. 7, no. 10, 2019, doi: 10.3390/math7100944.

[4] H. Fatorachian and H. Kazemi, "Impact of Industry 4.0 on supply chain performance," *Prod. Plan. Control*, vol. 32, no. 1, pp. 63–81, 2021, doi: 10.1080/09537287.2020.1712487.

[5] V. Charles, A. Emrouznejad, and T. Gherman, "A critical analysis of the integration of blockchain and artificial intelligence for supply chain," *Ann. Oper. Res.*, vol. 327, no. 1, pp. 7–47, 2023, doi: 10.1007/s10479-023-05169-w.

[6] R. A. C. Leuveano, F. A. Bin Jafar, C. Saleh, M. R. Bin Muhamad, and M. N. A. Rahman, "Incorporating Transportation Cost into Joint Economic Lot Size For Single Vendor-Buyer," *J. Softw.*, vol. 9, no. 5, pp. 1313–1323, 2014, doi: 10.4304/jsw.9.5.1313-1323.

[7] R. A. C. Leuveano, H. M. Asih, M. I. Ridho, and D. A. Darmawan, "Balancing Inventory Management: Genetic Algorithm Optimization for A Novel Dynamic Lot Sizing Model in Perishable Product Manufacturing," *J. Robot. Control*, vol. 4, no. 6, pp. 878–895, 2023, doi: 10.18196/jrc.v4i6.20667.

[8] Z. Alizadeh Afrouzy, M. M. Paydar, S. H. Nasseri, and I. Mahdavi, "A meta-heuristic approach supported by NSGA-II for the design and plan of supply chain networks considering new product development," *J. Ind. Eng. Int.*, vol. 14, no. 1, pp. 95–109, 2018, doi: 10.1007/s40092-017-0209-7.

[9] Y. Wang, S. W. Wallace, B. Shen, and T.-M. Choi, "Service supply chain management: A review of operational models," *Eur. J. Oper. Res.*, vol. 247, no. 3, pp. 685–698, 2015, doi: http://dx.doi.org/10.1016/j.ejor.2015.05.053.

[10] M. N. A. Rahman *et al.*, "Incorporating logistic costs into a single vendor-buyer JELS model," *Appl. Math. Model.*, vol. 40, no. 23–24, pp. 1339–1351, 2016, doi: 10.1016/j.apm.2016.07.021.

[11] P. Fernández Campos, L. Huaccho Huatuco, and P. Trucco, "Framing the interplay mechanisms between structural and dynamic complexity in supply chains," *Prod. Plan. Control*, vol. 35, no. 6, pp.

599–617, 2024, doi: 10.1080/09537287.2022.2114959.

[12] A. Azadegan and K. Dooley, "A Typology of Supply Network Resilience Strategies: Complex Collaborations in a Complex World," *J. Supply Chain Manag.*, vol. 57, no. 1, pp. 17–26, 2021, doi: 10.1111/jscm.12256.

[13] P. Taticchi, P. Garengo, S. S. Nudurupati, F. Tonelli, and R. Pasqualino, "A review of decision-support tools and performance measurement and sustainable supply chain management," *Int. J. Prod. Res.*, vol. 7543, no. July 2015, pp. 1–22, 2014, doi: 10.1080/00207543.2014.939239.

[14] R. Bhagwat and M. K. Sharma, "Performance measurement of supply chain management: A balanced scorecard approach," *Comput. Ind. Eng.*, vol. 53, no. 1, pp. 43–62, 2007, doi: https://doi.org/10.1016/j.cie.2007.04.001.

[15] APICS, *Supply Chain Operations Reference Model*. 2017.

[16] V. Jain, S. Kumar, A. Mostofi, and M. Arab Momeni, "Sustainability performance evaluation of the E-waste closed-loop supply chain with the SCOR model," *Waste Manag.*, vol. 147, pp. 36–47, 2022, doi: 10.1016/j.wasman.2022.05.010.

[17] D. Sinoimeri and J. Teta, "Supply Chain Management Performance Measurement. Case Studies from Developing Countries," *Int. J. Membr. Sci. Technol.*, vol. 10, no. 2, pp. 1323–1331, 2023, doi: 10.15379/ijmst.v10i2.1380.

[18] Kasmari, Basukiyanto, and K. Indriyaningrum, "Application of the Supply Chain Operation Reference (SCOR) Method: Batik SMEs in Indonesia," *Int. J Sup. Chain. Mgt*, vol. 9, no. 5, pp. 1014–1020, 2020, [Online]. Available: http://excelingtech.co.uk/

[19] H. Munawir, P. R. Mabrukah, M. Djunaidi, and Suranto, "Analysis of green supply chain management performance with green supply chain operation reference at the batik enterprise," *Econ. Ann.*, vol. 187, no. 1–2, pp. 139–145, 2021, doi: 10.21003/EA.V187-14.

[20] P. Liu, S. H. Huang, A. Mokasdar, H. Zhou, and L. Hou, "The impact of additive manufacturing in the aircraft spare parts supply chain: Supply chain operation reference (scor) model based analysis," *Prod. Plan. Control*, vol. 25, no. July, pp. 1169–1181, 2014, doi: 10.1080/09537287.2013.808835.

[21] D. Milambo and J. Phiri, "Aircraft Spares Supply Chain Management for the Aviation Industry in Zambia Based on the Supply Chain Operations Reference (SCOR) Model," *Open J. Bus. Manag.*, vol. 07, no. 03, pp. 1183–1195, 2019, doi: 10.4236/ojbm.2019.73083.

[22] A. Caroline, M. nu, and S. ah, "Performance Measurement of Palm Sugar Business using the Integration of Supply Chain Operation Reference (SCOR) and Objective Matrix (OMAX)," *Int. J. Sci. Manag. Stud.*, no. February, pp. 75–84, 2021, doi: 10.51386/25815946/ijsms-v4i1p107.

[23] A. Handayani and C. Y. Setyatama, "Analysis of Supply Chain Management Performance using SCOR and AHP Methods In Green Avenue Apartments of East Bekasi," *J. Appl. Sci. Eng. Technol. Educ.*, vol. 1, no. 2, pp. 141–148, 2019, doi: 10.35877/454ri.asci1241.

[24] N. Sooksaksun, K. Wavnum, J. Thepklang, and S. Seehaworg, "The application of Supply Chain Operations Reference (SCOR) model: Herb supply chain in Dong Bang Village, Thailand," *Eng. Appl. Sci. Res.*, vol. 50, no. 3, pp. 244–250, 2023, doi: 10.14456/easr.2023.27.

[25] E. Gonzalez-Pascual, J. Nosedal-Sanchez, and J. Garcia-Gutierrez, "Performance evaluation of a road freight transportation company through SCOR metrics," *Case Stud. Transp. Policy*, vol. 9, no. 4, pp. 1431–1439, 2021, doi: 10.1016/j.cstp.2021.07.001.

[26] S. Butdee and P. Phuangsalee, "Uncertain risk assessment modelling for bus body manufacturing supply chain using AHP and fuzzy AHP," *Procedia Manuf.*, vol. 30, pp. 663–670, 2019, doi: 10.1016/j.promfg.2019.02.094.

[27] T. L. Saaty, *The analytic hierarchy process: decision making in complex environments*. 1984.

[28] A. Kumar and S. Pant, "Analytical hierarchy process for sustainable agriculture: An overview," *MethodsX*, vol. 10, no. December 2022, p. 101954, 2023, doi: 10.1016/j.mex.2022.101954.

[29] J. H. Trienekens and H. H. Hvolby, "Performance measurement and improvement in supply chains," in *Proceedings of the third CINET Conference; CI 2000 From improvement to innovation : CINET Conference: CI 2000 From Improvement to innovation, Aalborg, September 18-19, 2000*, 2000, pp. 399–409.