Analysis of Agro-Industry Supply Chain Performance on Organic Rice in Jember Regency

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Received: August-20-2024; Accepted: December-11-2024; Published: December-31-2024

Abstract
Organic rice is one of the potential food commodity innovations, organic rice has increased interest and demand from the market but is not matched with organic rice productivity. Based on this, analyzing the supply chain to determine performance and recommend improvement strategies is necessary. The purpose of this research is to determine the current organic rice supply chain system, analyze supply chain performance, and develop strategies to improve the performance of the organic rice agroindustry supply chain in Jember Regency. The method used in this research is supply chain performance analysis using supply chain operation reference (SCOR) and strategy formulation using analytical network process and benefit opportunity cost risk (ANP-BOCR). These methods were chosen because they synergize with each other and have been widely used in previous studies to analyze similar problems. The results showed that the performance of the organic rice agroindustry supply chain in Jember Regency received a score of 66.01 or classified into the average range. Hence, there is a need for improvement in the supply chain that is carried out through strategy. The results show that the sub-criteria benefit (0.198205), opportunity (0.164375), and economic (0.109545) get the highest value. Based on the results of pairwise comparisons, it is also found that the most appropriate strategy is to improve all KPIs.
Keywords: *agroindustry; ANP-BOCR; organic rice; SCOR; supply chain*

1. INTRODUCTION

Organic food products are one of the innovations in the food sector. Organic food products are produced naturally because they are cultivated without involving chemicals, antibiotics, or genetic organism modification. (Vigar et al., 2020). In the beginning, organic food products were only consumed by physically active, highly educated, and health-focused people. However, over time consumers of organic food products have increased significantly due to the increasing awareness of the public. (Shenoy et al., 2024). In terms of health, organic food products have advantages in terms of content that is beneficial for health. According to Pawar et al. (2022), Organic food products have higher macronutrient and micronutrient content than non-organic food products. One of the organic food products that many consumers are interested in is organic rice. (Syamsiyah et al., 2023). According Sujianto et al. (2020), increased interest in organic rice is motivated by health.

The increase in demand for organic food, especially organic rice, is unfortunately not matched by the productivity of organic rice. Based on the data presented by David & Alkausar (2023), It is known that the productivity of organic rice in Indonesia is still fluctuating and tends to decrease. In 2020, organic rice production was 44,477.7 tons, while in 2021 it decreased to 35,420.1 tons and in 2022 it slightly increased to 40,376.5 tons. This is also in line with what is experienced in Jember Regency. Organic rice productivity in Jember Regency has not been able to meet consumer demand. Based on interviews conducted with the heads of organic farmer groups in Jember, it is known that organic rice farmers in Jember are only able to produce 50 tons/month, while consumer demand is 150 tons/month. This is reinforced by data from David & Alkausar (2023) Which states that organic rice is a keyword that is searched quite often on Google by the people of East Java, one of which is Jember. This shows a high interest in organic rice products. On the other hand, a survey conducted shows that 28.82% of organic rice consumers consume when the product is available. This means that organic rice products are still quite difficult to find, but have a high demand. In addition,

ISSN 225-6137 (print), ISSN 2302-3848 (online), doi: 10.22146/aij.v11i2.99299

according to Agustina (2011), the people of Jember Regency make health indicators, which shows the interest of the people of Jember Regency in organic rice. This is thought to be due to the chain structure and market structure of organic rice products that are still not well established. Supply chain structure has a significant influence on motivation and performance in a business (Sutia et al., 2020). Therefore, it is necessary to identify supply chain performance and new strategies for organic rice products in the Jember Regency.

The identification of supply chain performance needs to be done to analyze the course of the organic rice agro-industry supply chain from the beginning to the end of the process. In addition, the identification of supply chain performance can also determine the factors that affect the performance of the rice agro-industry supply chain. In the research conducted, the identification of supply chain performance is carried out using the supply chain operations reference (SCOR) method, while strategy development is carried out using the analytical network process-benefit opportunity cost ratio (ANP BOCR). SCOR is one of the methods that can assess the performance of a supply chain as well as identify processes that require improvement (Chopra et al., 2022). In several previous studies, SCOR has been used to test the performance of vegetables, corn, and horticulture (Hamdani et al., 2021; Naafilah et al., 2024; Sibuea et al., 2023). While ANP BOCR is a problem-solving method by utilizes the opinions of experts by considering the network structure of benefits, opportunities, costs, and ratios to facilitate decision-making for strategy (Sari & Suprayitno, 2020). ANP BOCR has also been used in several previous studies such as for the selection of suppliers of pharmaceutical products, the selection of waste management alternatives, to the preparation of agricultural cooperative development strategies (Astuti et al., 2011; Fatikhah et al., 2020). This research aims to identify supply chain performance and develop strategies to improve the performance of the organic rice agro-industry supply chain in Jember Regency.

2. MATERIAL AND METHODS

This research was conducted in Jember Regency from September 2021 to December 2021. This research was conducted in Jember Regency from September 2021 to December 2021. This research was conducted in Jember Regency from September 2021 to December 2021. Jember Regency was chosen as the research site because this area has organic farms managed by the people. Thus, organic rice farming in Jember Regency has experienced good development. According to the interview with the head of the organic farmer community Jember Regency, there are 82 organic farmer groups in the Jember Regency. The research stages carried out in this study are presented in Figure 1.

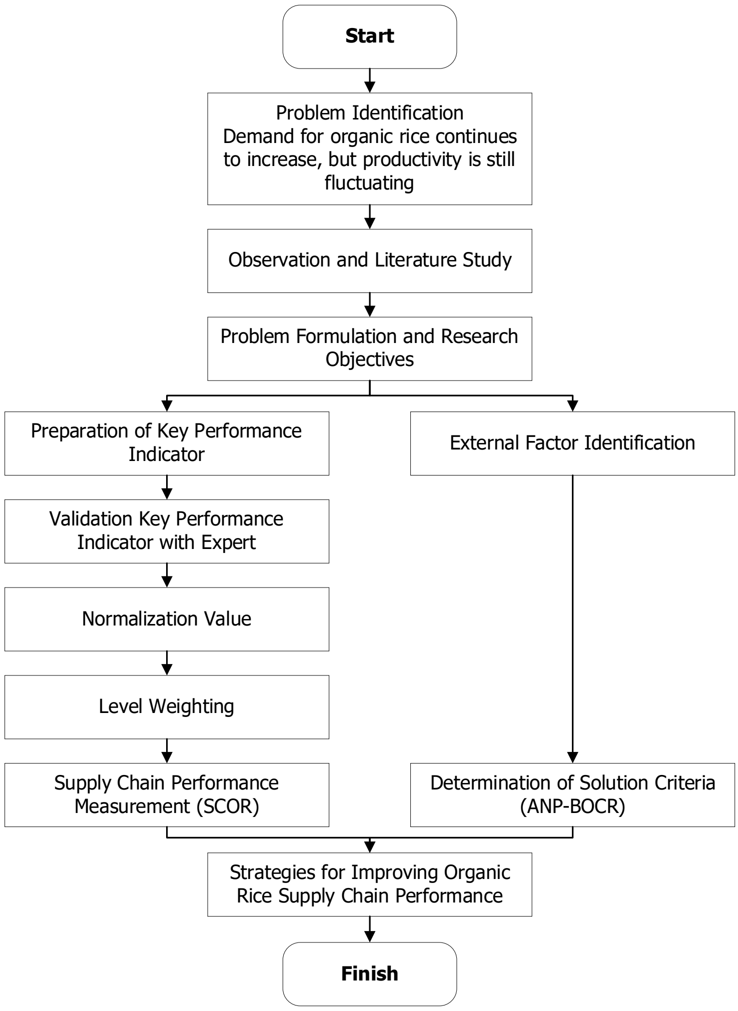

Figure 1. Research Stage

The tools used in this research are a laptop used to express research findings and analyze data obtained through the software Microsoft Excel and Super Decision. Mobile phones were used for brief note-taking and used to contact the interviewees. The camera was used for taking pictures and documenting the research conducted. Finally, the questionnaire was used to collect the primary data needed in this study. Meanwhile, the materials used in this research are primary data and secondary data.

2.1 Preparation and Validation of Key Performance Indicators

The development of key performance indicators was conducted by mapping the organic rice agroindustry process, which was divided into five processes: plan, source, make, deliver, and return. Mapping is conducted from the point of origin to the point of consumption for each supply chain actor, including farmers, grain collectors, and rice retailers. The key performance indicators were developed through structured interviews with two experts, namely an academic expert in the field of agro-industry and an expert practitioner in the domain of organic rice. The two experts were selected from the academic and practitioner communities because their diverse perspectives facilitate the generation of reliable data during fieldwork. After the consolidation of primary performance indicators, data collection will be conducted at each stage of the chain, commencing with farmers, progressing to grain collectors, and concluding with interviews within the organic rice agro-industry in the Jember Regency. Data collection was conducted through a questionnaire accompanied by researchers to ensure the accuracy and completeness of the data. Key performance indicators are presented in Table 1 to Table 3.

Table 1. Key performance indicators farmers

Main Process	Attribute	Metric	Unit
Plan	Reliability	Match of actual harvest to predicted harvest	%
	Reliability	Grain order fulfillment	%
Source	Reliability	Fertilizer needs	kg/litre
	Reliability	Subsidized fertilizer received	kg/litre
	Reliability	Pest and weed medications required	g/ml
	Flexibility	Supplier availability	People
	Cost	Total cost of farm inputs	Rp
	Asset	Serviceable support machine	Machine
Make	Reliability	Match of actual harvest to predicted harvest	%
	Reliability	Labor reliability farmer	%
	Responsiveness	Harvest cycle time	Day
	Cost	Production cost farmers	Rp

Table 2. Key performance indicators grain collectors

Main Process	Attribute	Metric	Unit
Plan	Reliability	Accuracy of grain raw material inventory	%
	Flexibility	Unexpected alternatives	%
Source	Reliability	Percentage of grain defects	%
	Reliability	Percentage of damaged packaging materials	%
	Reliability	Percentage of orders fulfilled	%
	Flexibility	Supplier availability	People
	Cost	Ordering cost to the farmer	Rp
Make	Reliability	Percentage decrease in rice yield	%
	Reliability	Labor reliability collector	%
	Responsiveness	Product process time	Day
	Cost	Production cost collector	Rp
Delivery	Reliability	Request fulfilled by collector	%

Table 3. Key performance indicators rice retailers

Main Process	Attribute	Metric	Unit
Plan	Reliability	Accuracy of raw material and grain inventory	%
Source	Reliability	Percentage of rice defects	%
	Flexibility	Supplier availability	People
	Cost	Ordering cost to the collector	Rp
Make	Reliability	Percentage of defective rice products	%
	Reliability	Packaging accuracy	%
	Cost	Production and maintenance cost	Rp
Delivery	Reliability	The request was fulfilled by the distributor	%

2.2 Weighting Key Performance Indicators

The performance indicators that have been determined and validated will then be given a weighting based on their level of importance by experts who have been determined using a pairwise comparison questionnaire. The selected experts include farmers, procurement in the grain collection industry, and organic rice retailers. Weighting is carried out using the Analytical Hierarchy Process (AHP) concept and processed using Expert Choice software.

2.3 Supply Chain Performance Measurement

Supply chain performance assessment is carried out by comparing the actual value with the target contained in each supply chain actor. The assessment begins with normalization using the Snorm de Boer formula so that there is uniformity of value. After normalizing the value, an assessment is then carried out through interviews with farmers, grain collectors, and rice retailers to get actual and expected data. The results of the next value will be multiplied by the weight that has been determined on each indicator so that the value of supply chain performance will be obtained. The details of the supply chain performance score category that refers to Saragih et al. (2021) Are presented in Table 4.

Table 4. Supply chain performance score category

Performance Score	Category
95-100	Excellent
90-94	Above Average
80-89	Average
70-79	Below Average
60-69	Poor
<60	Unacceptable

Source: Rakhman et al. (2018)

2.4 Strategy Design Using ANP & BOCR

Strategy formulation is carried out using the ANP & BOCR method in the hope of improving supply chain performance. Strategy formulation begins with determining criteria and sub-criteria based on the results of previous tests and discussions with farmers, grain collectors, and organic rice retailers. The results of determining the criteria and sub-criteria are then compiled in the form of networks and questionnaires using pairwise comparison for data collection which will be carried out on experts in this case the head of the agriculture office, supply chain academics, heads of farming businesses, and representatives of organic rice companies.

3. RESULTS AND DISCUSSION

3.1 Supply Chain Management Organic Rice Agroindustry

The supply chain of organic rice in Jember Regency involves three main actors: farmers, rice collectors, and organic rice retailers. To study the organic rice supply chain that occurs, the researchers conducted interviews with organic rice farmers and the food crops, horticulture, and plantations office. The agro-industrial supply chain of organic rice begins with the planting of organic rice seeds. During the planting period, measurements are taken of the fertilizers used (KPI 6), the subsidized fertilizers provided (KPI 7), the pesticides used (KPI 8), unexpected alternatives (KPI 5), the input costs incurred by the farmers (KPI 16), the production costs incurred (KPI 28), the reliability of the labor (KPI 22), the harvest cycle time (KPI 26), product process time (KPI 27), farmer availability (KPI 14), accuracy grain inventory (KPI 3), and the fulfillment of the collectors demand (KPI 2, 11). The results of interviews conducted with farmers indicate that the requisite quantity of organic rice seeds for one hectare of land is 7.5 kilograms, with the cultivation process requiring 100-110 days. The harvesting process yielded a wet paddy weighing 5.8 tons. In this process, the accuracy of the quantity of rice produced (KPI 1), the precision of order fulfillment, and the amount of defective grain produced will be quantified (KPI 9). Subsequently, the harvested wet paddy is transferred to the rice collector, where it undergoes a drying process to reduce the moisture content until it reaches the desired level of dry paddy. The result of the drying process is 4.5 tons of dry paddy. The subsequent phase is milling, which serves to separate the husk from the organic rice. The milling process yields a weight of 2.92 tons. At this juncture, the percentage decrease in rice yield (KPI 21), the accuracy of rice order fulfillment and prediction (KPI 20, 31), the accuracy of raw material inventory (KPI 4), the percentage of defective rice produced (KPI 12), the cost of ordering from farmers (KPI 17), the use of supporting machines (KPI 19), the reliability of collecting labor (KPI 23), the production cost of collectors (KPI 29), maintenance cost (KPI 30), collector availability (KPI 15) and the accuracy of packaging will be evaluated (KPI 10, 25). The organic rice that has been obtained is then packaged and distributed to organic rice retailers. At this retail stage, measurements related to the percentage of defective rice (KPI 24) ordering costs for collectors (KPI 18), store availability (KPI 13), and meeting needs will be conducted (KPI 32).

Based on the flow of goods, the distribution of organic rice is currently carried out with a bottom-up scheme, namely through ordering. This is due to the high demand for organic rice, but on the other hand, organic rice productivity has not been met. Another thing that causes an imbalance between demand and production is the absence of regional policies that support organic rice production in the Jember Regency. Based on the financial flow created, it is known that consumers have the choice if they want to buy organic rice products, they can go through retail or collectors. So that finances will end up in farmers by the agreed profit sharing. Meanwhile, based on the flow of information, it occurs in two directions in various lines to determine the quantity and quality of organic rice products. The supply chain management pattern that occurs in organic rice products is visually presented in Figure 2.

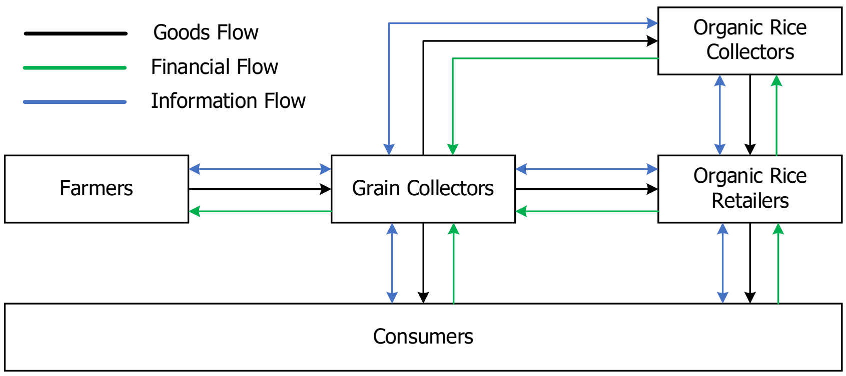

Figure 2. Supply Chain Management of Organic Rice Agroindustry

3.2 Valid Key Performance Indicator

The supply chain key performance indicators used were validated by experts and then arranged in the form of a hierarchy. Validation has a function to get the right indicators to measure supply chain performance. The description of the key performance indicators used and the hierarchical structure used is presented in Table 5 and Figure 3.

Table 5. Key performance indicators details

Process (Lv 1)	Dimensions (Lv 2)	Code	Matrix (Lv 3)	Unit
Plan	Reliability	KPI 1	Match of actual harvest to predicted harvest	%
		KPI 2	Grain order fulfillment	%
		KPI 3	Accuracy of grain raw material inventory	%
		KPI 4	Accuracy of raw material and grain inventory	%
	Flexibility	KPI 5	Unexpected alternatives	%
Source	Reliability	KPI 6	Fertilizer needs	Kg/litre
		KPI 7	Subsidized fertilizer received	Kg/litre
		KPI 8	Pest weed medications required	g/ml
		KPI 9	Percentage of grain defects	%
		KPI 10	Percentage of damaged packaging materials	%
		KPI 11	Percentage of orders fulfilled	%
		KPI 12	Percentage of rice defects	%
	Flexibility	KPI 13	Supplier store availability	People
		KPI 14	Supplier farmers availability	People
		KPI 15	Supplier collectors availability	People
	Cost	KPI 16	Total cost of farm inputs	Rp
		KPI 17	Ordering cost to farmers	Rp
		KPI 18	Ordering cost to the collector	Rp
	Asset	KPI 19	Serviceable support machine	Machine
Make	Reliability	KPI 20	Match of actual harvest to predicted harvest	%
		KPI 21	Percentage decrease in rice yield	%
		KPI 22	Labor reliability farmer	%
		KPI 23	Labor reliability collector	%
		KPI 24	Percentage of defective rice	%
		KPI 25	Packaging accuracy	%
	Responsiveness	KPI 26	Harvest cycle time	Day
		KPI 27	Product process time	Day
	Cost	KPI 28	Production cost farmer	Rp
		KPI 29	Production cost collector	Rp
		KPI 30	Production & maintenance cost	Rp
Delivery	Reliability	KPI 31	Request fulfilled by collector	%
		KPI 32	The request was fulfilled by the distributor.	%

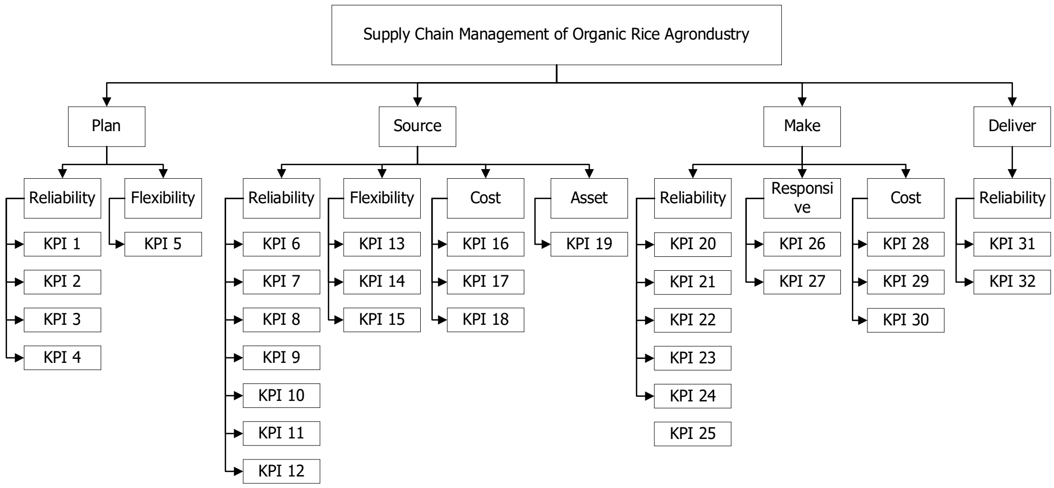

Figure 3. Hierarchical Structure of Key Performance Indicators

Based on the hierarchy presented above, several key performance indicators are key in solving the problem of the gap between demand and production. Some of the key performance indicators that are considered crucial are the percentage of fulfilled demand (KPI 11), availability of supplier farmers (KPI 14), availability of collectors (KPI 15), total input costs (KPI 16), fulfillment of collectors' requests (KPI 31), and fulfillment of distributor requests (KPI 32). These key performance indicators are considered to be the focus because they are closely related to the problems faced today, namely the inability to fulfill demand for organic rice products. One of the factors to focus on is the cost of inputs used because farmers consider the cost of organic rice cultivation inputs such as organic fertilizers and organic pesticides to be more expensive than the cost of inputs for non-organic rice cultivation. This is in line with the research of Nurhidayati et al. (2021), which states that the input costs of organic rice cultivation are more expensive than the input costs of non-organic rice cultivation. This has an impact on the availability of supplier farmers and the availability of collectors which is minimal, which has an impact on the minimum supply produced. In more detail, several KPIs that are the focus will be measured in the next section.

3.3 Calculation of Normalisation Value Key Performance Indicators

The normalization calculation is performed to uniform the performance values obtained using the Snorm de Boer formula. The Snorm de Boer formula normalizes by considering the actual value, the best performance value, and the worst performance value. These values will be filled in by the interviewed experts, namely farmers, procurement in the grain collection industry, and organic rice retailers. The results of value normalization are presented in Table 6.

Table 6. Result normalization value key performance indicators

Process (Lv 1)	Dimensions (Lv 2)	Matrix (Lv 3)	Score
Plan	Reliability	KPI 1	86.67
		KPI 2	92.00
		KPI 3	66.67
		KPI 4	66.67
	Flexibility	KPI 5	70.00
Source	Reliability	KPI 6	64.29
		KPI 7	25.00
		KPI 8	80.00
		KPI 9	75.00
		KPI 10	75.00
		KPI 11	61.90
		KPI 12	87.50
	Flexibility	KPI 13	100.00
		KPI 14	50.00
		KPI 15	50.00
	Cost	KPI 16	25.00
		KPI 17	50.00
		KPI 18	40.00
	Asset	KPI 19	71.43
Make	Reliability	KPI 20	77.78
		KPI 21	80.00
		KPI 22	92.31
		KPI 23	83.33
		KPI 24	75.00
		KPI 25	85.00
	Responsiveness	KPI 26	25.00
		KPI 27	75.00
	Cost	KPI 28	70.00
		KPI 29	76.67
		KPI 30	84.21
Delivery	Reliability	KPI 31	66.67
		KPI 32	60.00

Based on the data that has been obtained, it is known that KPI 13 gets the highest score of 100 and the lowest score is obtained by KPI 7, 16, and 26 with a score of 25. KPI 13 gets the highest score because the available rice supply can always be fulfilled. Meanwhile, KPI 7 gets the lowest score because the subsidized fertilizer received is still lacking, even though the subsidized fertilizer is considered very helpful for organic rice farmers. On the other hand, KPI 16 also received the lowest score because the cost of agricultural inputs is arguably quite high due to the uncontrolled price of raw materials. KPI 26 also received the lowest score, which is about the timing of the harvest cycle which is increasingly difficult to predict due to climate change. This is in line with Ansari et al. (2021), who stated that climate change has a significant impact on the timing of rice planting, necessitating several adjustments to be made to the climate.

3.4 Weighting Result Key Performance Indicators

The weighting of key performance indicators was carried out using an analytical hierarchy process using expert choice software through a pairwise comparison questionnaire on each of the performance labels. The weighting is carried out by experts who have been selected in this study, namely farmers, procurement in the grain collection industry, and organic rice retailers. The weighting results at each level are presented in Table 7.

Table 7. Weighting result each level

Process (Lv 1)	Weight	Dimensions (Lv 2)	Weight	Matrix (Lv 3)	Weight
Plan	0.183	Reliability	0.757	KPI 1	0.190
				KPI 2	0.414
				KPI 3	0.186
				KPI 4	0.211
		Flexibility	0.243	KPI 5	1.000
Source	0.408	Reliability	0.288	KPI 6	0.206
				KPI 7	0.067
				KPI 8	0.062
				KPI 9	0.096
				KPI 10	0.043
				KPI 11	0.371
				KPI 12	0.489
		Flexibility	0.084	KPI 13	0.403
				KPI 14	0.292
				KPI 15	0.305
		Cost	0.474	KPI 16	0.567
				KPI 17	0.216
				KPI 18	0.216
		Asset	0.155	KPI 19	1.000
Make	0.141	Reliability	0.194	KPI 20	0.276
				KPI 21	0.034
				KPI 22	0.328
				KPI 23	0.034
				KPI 24	0.245
				KPI 25	0.083
		Responsiveness	0.207	KPI 26	0.645
				KPI 27	0.355
		Cost	0.599	KPI 28	0.471
				KPI 29	0.275
				KPI 30	0.254
Delivery	0.268	Reliability	1.000	KPI 31	0.558
				KPI 32	0.442

Based on the results obtained, it can be seen that the source process is the process with the greatest weight. This means that the sourcing process, namely raw materials, is a top priority for organic rice agro-industry actors. This is because quality organic rice raw materials will produce quality organic rice. (Purwandoko et al., 2019). The next priority lies in the delivery, planning, and making processes.

3.5 Supply Chain Performance Measurement

The calculation of the performance of the organic rice agro-industry supply chain is done by multiplying the score by the weight that has been determined at each level starting from level 3 to level 1. The supply chain performance at level 3 is presented in Table 8.

Table 8. Supply chain performance level 3

Process (Lv 1)	Dimensions (Lv 2)	Matrix (Lv 3)	Score	Weight	Final	Total
Plan	Reliability	KPI 1	86.67	0.190	16.47	81.02
		KPI 2	92.00	0.414	38.09	
		KPI 3	66.67	0.186	12.40	
		KPI 4	66.67	0.211	14.07	
	Flexibility	KPI 5	70.00	1.000	70.00	70.00
Source	Reliability	KPI 6	64.29	0.206	13.24	96.06
		KPI 7	25.00	0.067	1.68	
		KPI 8	80.00	0.062	4.96	
		KPI 9	75.00	0.096	7.20	
		KPI 10	75.00	0.043	3.23	
		KPI 11	61.90	0.371	22.96	
		KPI 12	87.50	0.489	42.79	
	Flexibility	KPI 13	100.00	0.403	40.30	70.15
		KPI 14	50.00	0.292	14.60	
		KPI 15	50.00	0.305	15.25	
	Cost	KPI 16	25.00	0.567	14.18	33.62
		KPI 17	50.00	0.216	10.80	
		KPI 18	40.00	0.216	8.64	
	Asset	KPI 19	71.43	1.000	71.43	71.43
Make	Reliability	KPI 20	77.78	0.276	21.47	82.73
		KPI 21	80.00	0.034	2.72	
		KPI 22	92.31	0.328	30.28	
		KPI 23	83.33	0.034	2.83	
		KPI 24	75.00	0.245	18.38	
		KPI 25	85.00	0.083	7.06	
	Responsiveness	KPI 26	25.00	0.645	16.13	42.75
		KPI 27	75.00	0.355	26.63	
	Cost	KPI 28	70.00	0.471	32.97	75.44
		KPI 29	76.67	0.275	21.08	
		KPI 30	84.21	0.254	21.39	
Delivery	Reliability	KPI 31	66.67	0.558	37.20	63.72
		KPI 32	60.00	0.442	26.52	

Based on the results that have been obtained, it is known that the source process in the reliability dimension has the highest value compared to other dimensions with a value of 96.06. This is in line with the previous explanation that the quality and resilience of organic rice raw materials are the main focus for organic rice agro-industry actors. Quality and resilient raw materials will make quality product results in terms of nutritional content. The lowest value is obtained by the source process in the cost dimension with a value of 33.62. This is because the input costs generated are fluctuating and uncontrollable, which affects the price of the final product. Mardalisa et al. (2023) Stated that price fluctuations are a major risk faced by farmers, especially in organic rice products. Furthermore, the supply chain performance at level 2 is presented in Table 9.

Table 9. Supply chain performance level 2

Process (Lv 1)	Dimensions (Lv 2)	Score	Weight	Final	Total
Plan	Reliability	81.02	0.757	61.33	78.34
	Flexibility	70.00	0.243	17.01	
Source	Reliability	96.06	0.288	27.67	60.57
	Flexibility	70.15	0.084	5.89	
	Cost	33.62	0.474	15.94	
	Asset	71.43	0.155	11.07	
Make	Reliability	82.73	0.194	16.05	70.09
	Responsiveness	42.75	0.207	8.85	
	Cost	75.44	0.599	45.19	
Delivery	Reliability	63.72	1.000	63.72	63.72

Based on the results above, it can be seen that the planning process at this level has the highest value compared to other core processes with a value of 78.34. This is because the planning process includes the fulfillment of grain orders, which is a crucial process that is the focus of organic rice agro-industry business actors. The source core process at this level has the lowest value compared to other core processes with a value of 60.57. This shows that there needs to be improvements in the core source process, especially in the cost dimension. Furthermore, the supply chain performance at level 1 is presented in Table 10.

Table 10. Supply chain performance level 1

Process (Lv 1)	Score	Weight	Total
Plan	78.34	0.183	14.34
Source	60.57	0.408	24.71
Make	70.09	0.141	9.88
Delivery	63.72	0.268	17.08
Total			66.01

Based on the test of supply chain performance at the final level, the highest to lowest value is obtained, namely the core process of source with 24.71, the core process of deliver with a value of 17.08, the core process of plan with a value of 14.34, and the core process of make with a value of 9.88. In total, the score is 66.01 or classified as average because it is in the range of 50-70. This shows that there is a need for improvement in the organic rice agro-industry supply chain in Jember.

3.6 Strategy Design Using ANP & BOCR

The development of strategies to improve the supply chain of organic rice agro-industry was carried out using analytical network processes and benefit opportunity cost risk. The application of the analytical network process is carried out using three main steps, namely extracting problems through interviews with experts, developing an analytical network process, and determining alternative solutions and policy strategies. This analytical network process will be combined with benefit opportunity cost risk consisting of internal factors (economic, social, environmental, legal and political, transport), benefit opportunity cost risk, and alternative strategies. The detailed data of criteria, sub-criteria, and alternative strategies are presented in Table 11, and the relationship diagram is presented in Figure 4.

Table 11. Criteria, sub-criteria, and alternative strategies

Code	Criteria	No	Sub-Criteria
A	Internal Factor	1	Economy
		2	Social
		3	Ecology
		4	Politic and Law
		5	Transportation
B	BOCR	6	Benefit
		7	Opportunities
		8	Cost
		9	Risk
C	Alternative	10	Improve all KPI
		11	Improve some KPI
		12	No improvement

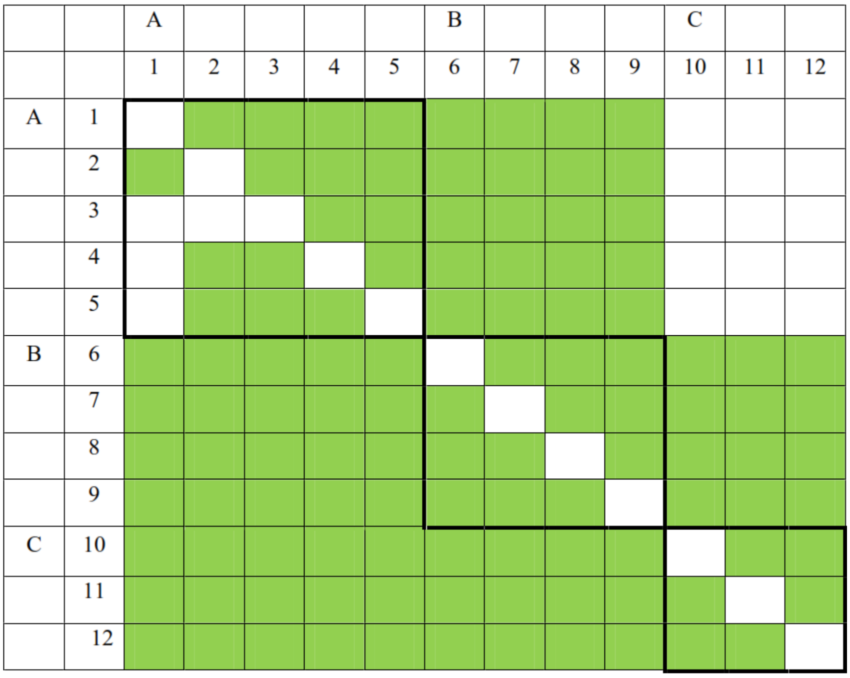

Figure 4. Relationship Diagram

The graph above illustrates the interrelationship in research by showing the correlation between one set of elements with another set of elements either in the same cluster called inner dependence or showing the relationship between one set of elements with another set of elements but in a different cluster called outer dependence. In its application, several things need to be considered related to the clusters used in this study, including internal factors, BOCR, and alternatives. Internal clusters are factors that come from factors that can be controlled and come from within the industry, while BOCR is a cluster that explains the desired things in the form of benefits, and unwanted things in the form of costs, and can also be things that have the potential to occur in the future, which are presented in the form of opportunities and risks. The last cluster is an alternative strategy that is implemented, in this case, the alternative strategy is divided into three things, namely the need for improvement on all KPIs, the need for improvement on some KPIs, or there is no need for improvement on KPIs. The ANP BOCR structure is presented in Figure 5.

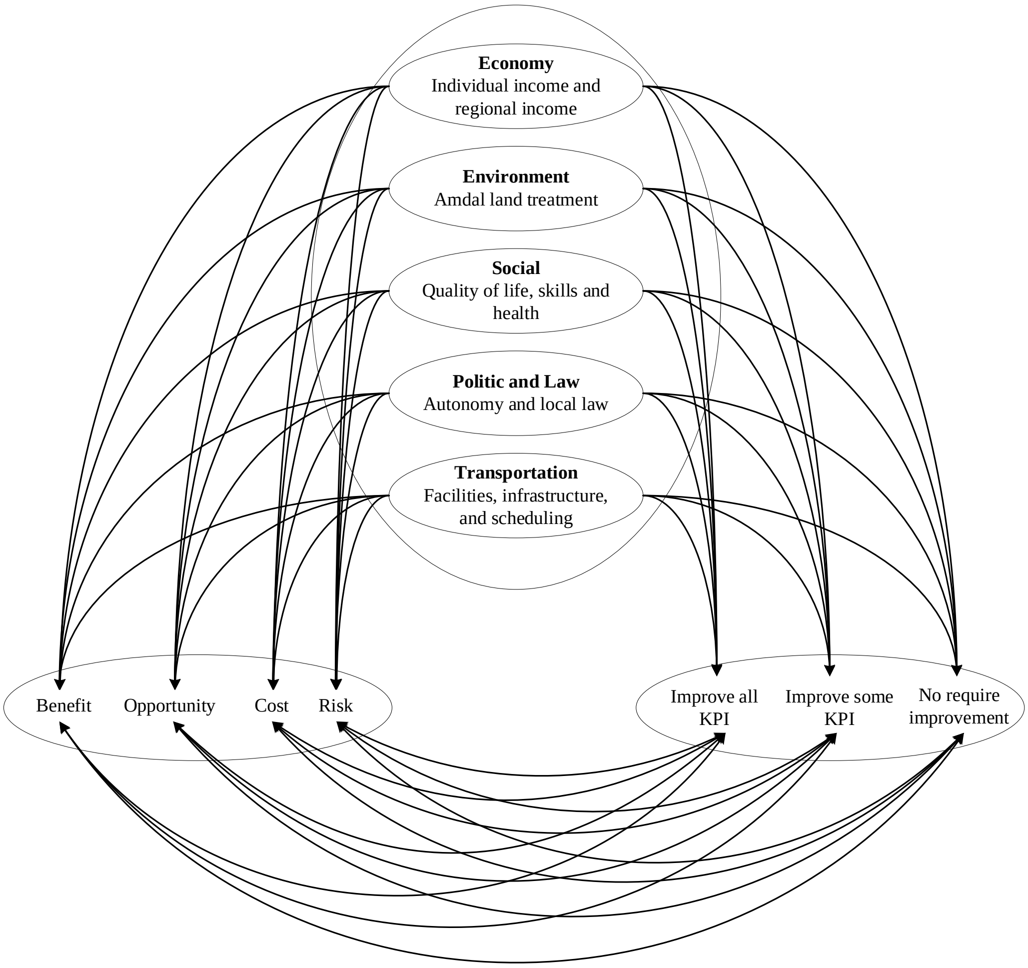

Figure 5. Hierarchy Structure ANP BOCR

The process of determining alternative strategies for developing organic rice agro-industry is carried out by reviewing alternatives based on benefits, costs, opportunities, and risks to predetermined aspects, namely economic, social, environmental, legal & political, and transportation. Later conclusions will be drawn in the form of three alternatives, namely improving all KPIs, improving some KPIs, or making no improvements. The elements used in detail are presented in Table 12.

Table 12. Elements ANP BOCR

Cluster	Criteria	Benefit	Opportunity	Cost	Risk
Economy	Individual Income Regional Income	Contribution to economic improvement at the community level	Economic opportunities created by the increase in the selling value of organic rice	Costs incurred due to repairs	The risk of economic instability will trigger input, land, and technology prices.
Social	Quality of Life Skill Possesd Public Health	Improving community welfare	Opportunities for job creation	Social costs arising from squatter settlements	Risk of social divide from those who favor conventional agriculture
Environment	Amdal Treat	Creation of integrated and environmentally friendly neighborhoods	An organic management system creates good environmental sanitation	Cost of managing impacts due to changes in conventional agriculture	Soil changes due to change from conventional to organic
Politic and Law	Autonomy Local Law	Improved security and absence of conflict	Increased legal and political awareness of the community	Costs incurred due to permit processing	Politics mass mobilization due to the system change
Transportation	Facilities, Infrastructure, & Scheduling	Creating accessible transport access	Better transport links created	Technology investment cost/technology failure	Maintenance of transport facilities

Priority analysis and synthesis are carried out through interviews with experts to get priority weights. The sub-criteria priority weights are presented in Table 13.

Table 13. Weight priority sub criteria

Code	Sub criteria	Normalized by Cluster	Limiting
A	1. Economy	0.39414	0.109545
	2. Social	0.23524	0.065381
	3. Ecology	0.14451	0.040165
	4. Politics and Law	0.15428	0.042879
	5. Transportation	0.07182	0.019961
B	6. Benefit	0.35889	0.198205
	7. Opportunities	0.29764	0.164375
	8. Cost	0.19247	0.106294
	9. Risk	0.15100	0.083395
C	10. Improve all KPI	0.42088	0.071465
	11. Improve some KPI	0.41239	0.070023
	12. No improvement	0.16674	0.028312

Based on the results of the calculations that have been carried out, it is found that the benefit sub criteria is the sub criteria that gets the highest weight with 0.198205, followed by the opportunity sub criteria with 0.164375, and the economic sub criteria with 0.109545. The highest weight value indicates a priority that supports the successful implementation of alternative organic rice agro-industry business development strategies. The results of the data processing obtained will be useful in decision-making so that it can be better. Furthermore, prioritization of the three alternatives obtained and the largest value states the best choice. The ranking of alternative strategies for developing organic rice agro-industry is presented in Table 14.

Table 14. Ranking of alternative strategies for organic rice agroindustry development

Alternative	Raw	Normal	Ideal	Ranking
Improve all KPI	0.071465	0.42088	1.000	1
Improve some KPI	0.070023	0.41239	0.979	2
No improvement	0.028312	0.16674	0.396	3

Based on the data processing results using the super decision software, the highest result is the improvement of all KPIs with a value of 0.42088, followed by the improvement of some KPIs with a value of 0.41239, and no need for improvement with a value of 0.16674. From the obtained results, it can be concluded that there is a need for improvement in the specified KPIs to enhance the performance of the organic rice agro-industrial supply chain. Some practical steps that can be taken to improve the performance of the supply chain include providing in-depth education to farmers on how to properly practice organic farming to produce high-quality and marketable organic rice products. Providing an understanding of the various long-term benefits of organic farming also needs to be disseminated to farmers so that a positive multiplier effect can be created. In addition, providing incentives or subsidies to farmers interested in organic farming, especially rice, can indirectly increase organic rice production and meet the demand.

4. CONCLUSIONS

Based on the research that has been conducted the rice agro-industry supply chain has several actors including farmers, kiosks, rice milling manufacturers, distributors, and consumers. The results of testing the performance of the rice agro-industry supply chain in Jember Regency obtained results that were classified as average with a value of 66.01. This shows that there is a need for improvement in the supply chain that has been carried out so that it can be better. Providing intensive education to farmers on how to farm organically properly and correctly to produce high-quality and marketable organic rice, as well as imparting an understanding of the various long-term benefits of organic farming, should also be disseminated to farmers to create a positive multiplier effect. On the other hand, offering incentives or subsidies to farmers interested in organic farming, particularly organic rice, can also be a solution to increase organic rice production and meet demand. The preparation of strategies for improving the organic rice agro-industry was carried out through ANP BOCR. The results show that the sub-criteria benefit (0.198205), opportunity (0.164375), and economic (0.109545) get the highest value. Based on the results of pairwise comparisons, it is also found that the most appropriate strategy is to improve all KPIs.

ACKNOWLEDGEMENT

The researcher would like to thank you for the Agroindustrial Engineering study program, at IPB University for facilitating researchers to learn about supply chain science in depth.

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