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ANALYSIS OF SUPPLY CHAIN PERFORMANCE AND ADDED VALUE OF TEMPEH IN MATARAM CITY

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ABSTRACT

Supply chain performance measurement presents a valuable opportunity to enhance and advance supply chain management practices across various industries, including the tempeh agroindustry. The research was aimed at analyzing the structure and performance of the supply chain, as well as the added value of the tempeh agroindustry in Mataram city. The study utilized a descriptive method that involved interviewing several respondents. Collected data was analyzed using the Supply Chain Operation Reference (SCOR) method version 9, and Hayami Model Added Value Analysis. The results indicated that the stakeholders involved in the agroindustry supply chain in Mataram city were soybean importers in Java, local soybean supply agents, tempeh agroindustry entrepreneurs, and tempeh retailers. The study found that the tempeh agroindustry supply chain performance attained superior performance in the Reliability, Flexibility, Responsiveness, and Asset attributes. On the other hand, the Total Supply Chain Cost attribute recorded poor performance. Processing one kilogram of soybeans into tempeh yielded an added value of IDR. 9,280.82, with an added value ratio of 43.56%, and is categorized as moderate.

Keywords: Agroindustry, Supply, Tempeh.

INTRODUCTION

Soybean is classified as a very important food crop for Indonesian people. Soybeans can be processed into various food products such as tempeh and tofu. Indonesian people consume tempeh and tofu relatively high due to their relatively high nutritional content and relatively cheap prices. The nutritional value of tempeh protein is higher than the original material as a result of the release of amino acids during the fermentation process (Salim, 2012). Based on a SUSENAS survey by the Central Bureau of Statistics every six years, soybean consumption in the form of seeds and processed products continues to increase. Tofu and tempeh are soy products dominant consumed by residents of

villages and cities. The average consumption of tofu and tempehh among urban residents is higher than that of rural residents (Widyatami and Wiguna, 2017). The average per capita consumption of tempeh and tofu in Indonesia is estimated at 20.3 grams per day (Amirullah, 2015).

Increased public awareness of nutritious and affordable food sources will lead to a surge in demand for tempeh, thereby opening up a wide market potential. However, despite the high level of consumption, it's ironic that the raw materials for tempeh are imported products. Data from the Ministry of Agriculture reveals that about 86.4% of the domestic demand for soybeans is met through imports. This high volume of imports indicates the significant need for soybeans to meet the population's demands through various processed products (Zakiah, 2012). In 2013-2017, the import dependency ratio (IDR) for Indonesian soybeans was 88.60%, which shows that Indonesia's dependence on imported soybeans is very high, almost 90%. The value of IDR is consistent with the Self-Sufficiency Ratio (SSR) value of 11.82%. The SSR implies that Indonesia can only meet 11.82% of the total soybean demand from domestic production (Budiharjo, et al., 2020). Budiharjo, et al (2020) further explained that until 2020, Indonesia imported 2.48 million tons of soybeans or the equivalent of US$ 1 billion. The high dependence on imported raw materials can lead to unstable prices of tempeh and tofu, as imported goods are vulnerable to exchange rate fluctuations. Several artisans anticipate the high cost of raw materials by raising the prices or reducing the volume of tempeh and tofu they produce (Yudhistira, 2018). The existence of these imports has various adverse effects on Indonesia, such as a significant loss of foreign exchange and long-term dependence, which will affect the soybean supply system and national food security.

Tempeh and tofu are the most widely produced processed products made from soybean raw materials in Mataram City. These agro-industries have production centers in Sekarbela and Sandubaya Districts. The soybean-based agro-industry in Mataram City involves various decision-making units in the flow of raw materials and processed products. All these units are designed in a supply chain system, and measuring supply chain performance can provide a great opportunity to improve industry standards and supply chain management. Measuring supply chain performance is important because most of the raw materials for processed soybean products are imported commodities. Poor supply chain management can be minimized by monitoring the supply chain's performance. Amirullah (2015) states that companies use value chain to identify cost processes and understand ways to implement business-level strategies. This value chain shows the activities of how a soybean product moves from the raw material stage to the final customer. The activities in the value chain are interdependent, ranging from raw material supply to after-sales handling. Value chain approach helps to explain how much added value is generated from the processing of soybean into tempeh, to whom the profits are distributed, and what institutions are involved in the value chain flow.

This research aims to analyze performance of the supply chain and the added value of tempeh in Mataram City.

METHODS

Research methods and techniques

The method used in this research is the descriptive method. Descriptive research is a method that is intended to describe phenomena that exist either currently or in the past (Nazir, 2014). Data collection was carried out using a survey technique, by conducting interviews with respondents

Determination of Research Locations and Samples

The research was conducted in in the districts of Sekarbela and Sandubaya, in Mataram City. This decision was made because processed soybean products are

mostly produced in these districts. The study focuses on tempeh entrepreneurs, and 30 respondents were sampled. Additionally, one soybean trader and five tempeh traders was also selected as respondents for this research.

Data analysis.

The collected data was analyzed using the Supply Chain Operation References (SCOR) version 9.0. The SCOR method is an analytical method that helps to analyze and explain a supply chain framework by defining and classifying the processes that build supply chain indicators (Inggitana and Surjasa, 2018). According to Pujawan and Mahendrawathi, the attributes used in measuring SCOR performance include reliability, responsiveness, flexibility, cost, and assets. According to Bolstorff and Rosenbaum (2007), the complete attributes and performance measurements of the supply chain are as follows).

Table 1. Attributes and Performance Indicators of the Supply Chain Management (SCM) Model.

SCM Attributes	Performance Indicator	Benchmarking		
		Parity	Advantage	Superior
Reliability	Delivery Performance (%)	85.00 –89.00	90.00 – 94.00	≥ 95.00
	Order fulfillment (%)	96.00 – 97.00	94.00 – 95.00	≥ 98.00
	Suitability of Standard	80.00-84.00	85.00-89.00	≥ 90.00
Flexibility	Flexibility (days)	42.00-27.00	26.00-11.00	≤ 10.00
Responsiveness	Order fulfillment cycle (days)	8.00-7.00	6.00-5.00	≤ 4.00
	Order fulfillment lead time (days)	7.00-6.00	5.00-4.00	≤ 3.00
	Daily inventory (days)	27.00-14.00	13.00-0.01	= 0.00
Assets	Cash to cash cycle time (days)	45.00-34.00	33.00-21.00	≤ 20.00
Cost	Total of Supply Chain Cost (TSCM) (%)	13.00-9.00	8.00-4.00	≤ 3.00

Source: Bolstorff and Rosenbaum (2007).

The performance of the tempeh agroindustry supply chain can be measured by calculating the average actual value of each performance indicator (metric) and comparing it with the SCOR Model Benchmarking value. Furthermore, to determine the amount of added value of processed soybean products, the Hayami value-added analysis model is used. Hayami's value-added analysis model can be seen in Table 2 (Hayami, et al. 1987)

RESULTS AND DISCUSSION

This sub-section begins with the stakeholders involved in the tempeh agroindustry supply chain, followed by a discussion of the supply chain performance. The next section discusses the performance of the added value generated from converting soybeans into tempeh.

Involved Stakeholders in the Tempeh Supply Chain

Supply chain management is the management of a physical network that involves various institutions so that the supply chain can run well. By choosing the right supplier, the company will avoid vacancies or damage to goods (Indrajit and Djokopranoto 2002). The results of the study show that the parties involved in tempeh supply chain in the city of Mataram can be seen in Figure 1.

Table 2. Value-Added Analysis of Hayami Model.

NO.	VARIABLE	FORMULA
I.	Output, Input, and Price	
1	Output (kg)	A
2	Raw materials (kg)	B
3	Labor (man days)	C
4	Conversion factor	D = A/B
5	Labor coefficient	E = C/B
6	Average Product Price (IDR /Kg)	F
7	Average Labor Wage (IDR /man days)	G
II.	Revenue and Profit	
8	Raw materials price (IDR /Kg)	H
9	Contribution of Other Inputs (Rp/Kg)	I
10	Product Values (IDR /Kg)	J = D x F
11	a. Added value (IDR /Kg)	K = J - H – I
	b. Added Value Ratio (%)	L = (K/J) x 100%
12	a. Labor Benefits (IDR /kg)	M = E x G
	b. Labor Share (%)	N = (M/K) x 100%
13	a. Profit (IDR)	O = K – M
	b. Profit level (%)	P = (O/K) x 100%
III.	Profit (reward) of Owners of Factors of Production	
14	Margin (IDR /Kg)	Q = J – H
	a. Labor Income (%)	R = (M/Q) x 100%
	b. Other Input Contributions (%)	S = (I/Q) x 100%
	c. Entrepreneur Profit (%)	T = (O/Q) x 100%

Source: Hayami, et al. (1987).

Figure 1. Path of Tempeh Supply Chain

Table 3. Stakeholders involved and their role in the Tempeh Supply Chain.

Stakeholder	Address	The role
Soybean Importer (PT FKS Multi Agro)	Banyuwangi, East Java	Soybean importers and suppliers in Indonesia
Local suppliers/traders of soybean	Ampenan, Lombok	Meet the needs and distribute soybeans to tempeh entrepreneurs in Mataram City
Tempeh Entrepreneurs	Mataram	Producing tempeh and meeting the needs of retailers and consumers of tempe
Tempeh Traders	Markets in Mataram City	Fulfilling the needs of end consumers of tempeh

Based on the Figure 1, it is known that the tempeh supply chain path starts from the procurement of raw materials to the final product to the consumer. This route involves various business actors, namely soybean importers, local suppliers (agents), tempeh entrepreneurs and retailers. For more details on the roles/functions of parties/institutions involved in the soybean agro-industry supply chain, it can be seen in the following table:

Analysis of the performance of the supply chain in Tempeh's agro-industry.

The supply chain is the journey that a product takes from its raw material procurement to its final delivery to the consumer. It involves multiple stages of activity, such as production, distribution, and the contribution of various actors, including suppliers, producers, traders, and consumers. Evaluating the performance of a supply chain is a complex task due to its transversal nature. One way to measure its performance is by using the Supply Chain Operations Reference (SCOR) model developed by the Supply Chain Council (SCC). The SCOR model consists of three main elements: business process reengineering, benchmarking, and process measurement (Bolstorff and Rosenbaum, 2007; Hwang et al., 2008). Business process reengineering captures the current processes and defines expected future processes. Benchmarking involves comparing performance data with other companies in the same field to improve supply chain performance. Finally, process measurement is useful for measuring achievements and improving ineffective supply chain processes (Pujawan and Mahendrawanthi, 2017).

Based on the results of the above analysis, the performance of the tempeh agroindustry supply chain in Mataram city using the Supply Chain Operations Reference (SCOR) model can be explained as follows.

Table 4. Analysis of Tempeh Supply Chain Performance in Mataram City in 2022.

Attribute of SCM	Performance Indicators	Benchmarking			
		Parity	Advantage	Superior	Average value
	Delivery performance (%)	85.00–89.00	90.00-94.00	≥ 95.00	100
Reliability	Order fulfillment (%)	94.00-95.00	96.00-97.00	≥ 98.00	100
	Suitability of Standard (%)	80.00 – 84.00	85.00-89.00	≥ 90.00	98.2
Flexibility	Flexibility (days)	42.00-27.00	26.00-11.00	≤ 10.00	1.50
	Order fulfillment cycle	8.00-7.00	6.00-5.00	≤ 4.00	1.25
Responsiveness	(days)				
	Order fulfillment lead time (days))	7.00-6.00	5.00-4.00	≤ 3.00	1.40
	Daily inventory (days)	27.00 – 14.00	13.00-0.01	= 0.00	0
Asset	Cash to Cash Cycle Time (days)	45.00 – 34.00	33.00-21.00	≤ 20.00	1
Costs	Total of Supply Chain Cost (TSCM) (%)	13.00-9.00	8.00-4.00	≤ 3.00	79

Reliability Performance

Delivery performance is an attribute that shows the reliability of the company in fulfilling consumer requests on time according to the date and time limit desired by consumers. Table 4 shows that the average value of the delivery performance of tempeh entrepreneurs in Mataram City is 100% or occupies the best performance position in carrying out supply chain activities. According to Yolandika et al, (2016), a score that is getting closer to 100% means that the achievement of reliability performance is getting better, and when it reaches 100% it means that the achievement of delivery performance is in a position of perfection. Thus, it can be said that tempeh entrepreneurs have been able to fulfill retail partner requests promptly. The results showed that the product manufacturing process is carried out every day with product delivery starting at 6 a.m. and arriving at the intended location, not until 8.30. According to Apriyanti et al. (2018), timeliness in delivery will affect the reliability of the company. Market share and sales can be increased through product innovation strategies and disciplined delivery times because these two actions reflect the strong characteristics of responsiveness, flexibility, and reliability of a company so that they can affect the increase in ownership of company assets.

Order fulfillment. The company's ability to fulfill customer requests without having to wait is one measure of reliability assessment. The greater the average value of supply chain order fulfillment, the better the achievement of supply chain performance. The result of the analysis of the order fulfillment indicator is 100% and is in the superior category. This means that tempeh entrepreneurs can fulfill all requests very well, where tempeh entrepreneurs distribute to each trader according to the number of requests on time (without having to wait). The ability to fulfill demand will be disrupted if there is a delay in the procurement of raw materials, where delays in the procurement of raw materials sometimes occur if there are problems in soybean imports. However, the results show that during the past few months, the procurement of raw materials has been relatively smooth despite the increase in the price of soybean.

Suitability of Standard. Providing satisfaction to customers is the ultimate goal for every company. One indicator of customer satisfaction is the conformity of the product to the standards desired by consumers. The results showed that the standard conformity value was 98.2% in a superior position. This means that tempeh entrepreneurs in meeting the standards of consumer desires are in the excellent category (superior). This condition also implies that the entrepreneur's ability to make quality tempeh is very good. This is because entrepreneurs produce tempeh with good quality raw materials, and in the manufacturing process entrepreneurs always maintain cleanliness so that the tempeh produced is of good quality.

Flexibility is the company's capacity to adapt to changes in the market. In this study, flexibility refers to the average time it takes the company to respond to changes in orders, such as increasing or decreasing quantities. Based on Table 4, the company has a flexibility score of only 1.5 days, which puts it in a superior position. This indicates that the entrepreneur is very quick to respond to unexpected requests. As previously mentioned, the process of distributing tempeh to customers is carried out every day. If there is a change in demand at that time, the entrepreneur can fulfill it very well. This is possible due to the availability of raw material stocks that are always in the warehouse and the entrepreneur's skills in making tempeh, which are also exceptional.

Responsiveness

Order Fulfillment Cycle. The order fulfillment cycle is the time required by

the company to fulfill the demand in one order. Order Fulfillment Cycle = time for planning + sorting time + packaging time + delivery time and is expressed in days. Based on the table above, it is known that the order fulfillment performance indicator has a value of 1.25 days and is in a superior position. This means that the entrepreneur's performance in fulfilling orders is very good. The order fulfillment cycle depends on the availability of raw materials and the time required in the tempeh-making process. The results of observations in the field show that the stock of raw materials is always available, if there is stock in normal conditions, then the order for raw materials only takes a few hours because tempeh producers already have a regular supplier subscription. In addition, the process of making tempeh requires simple technology and the manufacturing process is also fast, which is only about 2 days.

Order Fulfillment Lead Time. The order fulfillment lead time refers to the company's ability to fulfill customer orders quickly. It is the waiting time required by the company to fulfill orders. According to the calculation results displayed in Table 2, entrepreneurs require only 2 days to fulfill customer orders, which is considered superior. This shows that the entrepreneur has a fast reaction in responding to orders from customers, which is only one and a half days, which is the same as the time required for making tempeh itself. The fast lead time also shows that the supply chain management has a good performance.

Assets

Inventory days of supply. Daily inventory is the time of availability of products that can meet consumer needs if there is no continuous supply of products, expressed in units of days. The analysis results show that the performance of the daily inventory indicator has a score of 0 days and is in the superior category. Tempeh entrepreneurs never plan inventory or stock tempeh, but entrepreneurs always fulfill products ordered by consumers every day. This is done by entrepreneurs so as not to overstock considering that tempeh is a perishable product.

Cash to Cash Cycle. Time refers to the duration of time that it takes for money to turn over between supply chain actors. In other words, it is the period between when a supply chain actor pays their supplier and when they receive payment from their customer, expressed in days. This is an important performance attribute that measures how quickly a supply chain converts goods into money. The faster this conversion happens, the better the performance of the supply chain, as stated by Pujawan and Mahendrawathi (2017). Based on Table 2, it is evident that the cash turnover time among the supply chain actors in the tempeh agro-industry is excellent, with a value of only 1 day. This means that the supply chain is efficient in converting inventory into money. Transactions within the supply chain, including payments made by tempeh entrepreneurs to raw material suppliers, from producers to retailers, and from consumers to retailers, are carried out at the time of the transaction, and there has never been any delay in payment.

Total Supply Chain Cost Management (TSCM)

Total Supply Chain Cost Management (TSCM) is a measure that compares the overall costs incurred by tempeh entrepreneurs from procuring raw materials to delivering the final product (tempeh) to the customer with the value of sales received by tempeh producers, expressed in percentage. A smaller TSCM value indicates better performance of cost management in the tempeh agro-industry supply chain, according to Yolanda et al. (2016). Table 2 shows that the TSCM value is 79% greater than the parity value (13%), which means that the level of fund management efficiency is still very low. This inefficiency is due to the expensive

price of soybeans, which are used as raw materials for tempeh. All agro-industry entrepreneurs use imported soybeans to make tempeh, and the prices tend to increase every year. In 2021 and mid-2022, there was an increase in soybean prices from IDR 9,000 to IDR 10,000 and in mid-2022 to IDR 11,000, respectively. However, this increase in soybean prices did not increase tempeh prices. Entrepreneurs only dared to slightly reduce the size of tempeh. On the other hand, tempeh entrepreneurs are not willing to use local soybeans, even though they are relatively cheaper, because the quality of local soybeans is not good enough to produce tempeh with good quality. The high TSCM value also suggests that the profit earned by tempeh entrepreneurs is not significant. However, according to respondents, the tempeh business can run smoothly, and the sales are always sold out in the market. Additionally, the process of making tempeh is quite easy, and the production costs required are not expensive.

Value-Added Analysis of Tempeh Agroindustry in Mataram City. A value-added analysis is useful for analysing the production process according to the contribution of each production factor. The basis for calculating the added value analysis of the Hayami method is a calculation based on one kilogram of soybean raw material in one production process. In this study, the value added is the amount of value obtained from processing soybeans into tempeh. The results of the analysis of the added value of soybeans as raw material for tempeh in Mataram City can be seen in Table 5.

Based on the results of the analysis of the added value of tempeh agroindustry in Mataram City, it is known that in one production process, an output of 125 kg of tempeh is produced with the use of 88 Kg of soybean raw materials. The price of soybean raw materials per kilogram is IDR 11,000 per Kg while the price of tempeh is IDR 15,000 per Kg. The comparison of the amount of output and input will result in a conversion factor value of 1.42, which means that processing one kilogram of soybeans produces 1.42 Kg of tempeh.

In the production process of tempeh, labor is used both within and outside the family. On average, it takes 1.96 man-days of labor to process tempeh in a single production cycle. When comparing the amount of labor used to the amount of soybeans used, a coefficient of 0.023 is obtained. This means that 0.023 man-days of labor are required to process one kilogram of soybeans. The value-added from processing one kilogram of soybeans into tempeh is IDR 9280.82, which is calculated by subtracting the cost of raw materials and other inputs from the reduced product value. The value-added ratio is 43.56%, indicating that each processing of soybeans into tempeh provides an added value of 43.56% of the product value. This value-added is considered moderate, as it falls within the range of 15-45%. According to Azmita et al. (2019), there are three indicators of added value ratio: 1) a value-added ratio of less than 15% is classified as low, 2) a value-added ratio between 15-40% is classified as medium, and 3) a value-added ratio of over 45% is classified as high. The high added value obtained in this case is due to the high price of imported soybean raw materials, which cost IDR 11,000.

A study conducted by Andani et al. (2015) and Lestari et al (2016) revealed that the value added by the agro-industry is the gross value added, as it does not take into account labor rewards. The labor rewards can be calculated by multiplying the value of the labor coefficient with the labor wage. The research found that the value of the labor coefficient is 0.023 man-days, while the average wage of labor is IDR 86,548/man-day, which results in a labor reward value of IDR 1,937.49/Kg. To determine the labor share ratio, we divide the labor reward by the

added value. Using this formula, we get a labor share ratio of 20.88%. This means that in the added value produced by the tempeh agro-industry, there is a labor share of 20.88%. The net profit of this tempeh agro-industry is IDR 7,343.32, which is obtained by subtracting the labor rewards from the value added.

Table 5. Value-Added Analysis of Tempeh Agro-Industry in Mataram City.

No.	Variable	Unit	Value
I.	Output, Input and Price		
1	Output (Kg)	A	125.00
2	Raw materials (Kg)	B	88.00
3	Labor (man days)	C	1.97
4	Conversion factor	D = A/B	1.42
5	Labor coefficient	E = C/B	0.022
6	Average Product Price (IDR /Kg)	F	15 000.00
7	Average Labor Wage (IDR / man days)	G	86 548.00
II.	Revenue and Profit		
8	Raw materials price (IDR /Kg)	H	11 000.00
9	Contribution of Other Inputs (IDR/Kg)	I	1 026.00
10	Product Values (IDR Kg)	J = D x F	21 306,82
11	a. Added value (IDR /Kg)	K = J - H – I	9 280.82
	b. Added Value Ratio (%)	L = (K/J) x 100%	43.56
12	a. Labor Benefits (IDR /Kg)	M = E x G	1 937.49
	b. Labor Share (%)	N = (M/K) x 100%	20.88
13	a. Profit (IDR)	O = K – M	7 343.32
	b. Profit level (%)	P = (O/K) x 100%	79.12
III.	Profit (reward) of Owners of Factors of Production		
14	Margin (IDR /Kg)	Q = J – H	10 306.82
	a. Labor Income (%)	R = (M/Q) x 100%	18.80
	b. Other Input Contributions (%)	S = (I/Q) x 100%	9.95
	c. Entrepreneur Profit (%)	T = (O/Q) x 100%	71.25

In agroindustry activities, the profit of the factor of production owner can be divided into three categories, namely labor income, other input contributions, and entrepreneurial profits. From Table 3 above, we can see that the profit margin of the tempeh business is IDR 10,306.82. This value is obtained by subtracting the cost of soybean raw materials from the output value. Based on the profit margin, it is clear that the share of labor income is 18.80%, the share of other inputs is 9.95%, and the largest share of profit goes to the entrepreneur in the form of service fees, which is 71.25%. This implies that out of the profit margin of IDR 10,306.82 per kg, entrepreneurs earn a profit of IDR 7,343.61.

CONCLUSIONS

Based on the findings of the research, it can be concluded the followings: (1) Stakeholders involved in the agroindustry supply chain in Mataram City include soybean importers in Java, local soybean supply agents, tempeh agroindustry entrepreneurs, and tempeh retailers. (2) The performance of the tempeh agroindustry supply chain in Mataram City on Reliability, Flexibility, Responsiveness, and Asset attributes has achieved superior performance or the best performance. While the performance of the Total Supply Chain Cost attribute or supply chain costs has a poor performance (inefficient). (3) The added value obtained

from processing one kilogram of soybeans into tempeh is IDR 9,280.82, with an added ratio value of 43.56%, and is in the medium category of added value. To improve cost performance and increase the value-added ratio, it is recommended that tempeh agroindustry entrepreneurs should be more efficient in the use of production costs, especially the cost of procuring raw materials, by replacing expensive imported soybeans with cheap local soybeans. For this reason, government facilitation is expected in producing high quality local soybeans, or providing subsidies for purchasing expensive imported soybeans.

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