



Article

The Value-Added Analysis Of The Soybean Supply Chain To Produce Tempeh

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Abstract: The Soybean was the raw material of tempeh. Soybean tempeh was well known in Indonesia. The objectives of the research were to analyze the value-added of soybeans and the network structure of the soybean supply chain to produce tempeh. This research object was the four-tempeh industry in Gresik Regency. Data processing and analysis were carried out using the qualitative method for analysis of supply chain structure and the Hayami method to obtain value-added. The number of samples was four industries which were the owners of the tempeh industry. The results showed that the network structure in the soybean supply chain into tempeh of three tempeh industries have 4 tiers and only one tempeh industry has three tiers. The supply chain structure of 4 tiers is supplier, tempeh industry, retailers, and consumers. The supply chain structure of 3 tiers is supplier, tempeh industry, and consumers. The highest value-added ratio is owned by the Hikmah tempeh industry at 60.057% or 18,498.00 IDR/ kg with a soybean price of 11,500.00 IDR / kg and a selling price of tempeh of 22,000.00 / kg. All of tempeh industry have value-added ratio is in high category because more than 50%. The tempeh industry can be continued as an enterprise because profitable and have value-added. The novelty of the research is the supply chain structure of the research and know value-added of tempeh industry. Suggestions for further research could be to examine the appropriate business model of tempeh industry..

Keywords: Soybean, Supply Chain, Tempeh, Value-Added

Citation: Banun Probowati. The Value-Added Analysis Of The Soybean Supply Chain To Produce Tempeh American Journal of Economics and Business Management 2024, 7(7), 153-159..

Received: 10th Apr 2024

Revised: 21th Mei 2024

Accepted: 24th Jun 2024

Published: 27th Jul 2024



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1. Introduction

Soybean is the most important strategic major food crop after rice and corn [1]. Indonesia is the largest soybean market in Asia importing 67.28% or 1.96 million tonnes of domestic soybean needs, while the remaining 32.72% is produced through domestic soybean production. Domestic soybean production is the unfulfillment demand of soybeans from producers of tempeh, tofu and other processed soybean products [2], [3]. Soybean production in Indonesia in 2018 amounted to 982,598 tonnes. One of the soybean producers in Indonesia is the Gresik Regency.

One of the most popular processed soybean products is tempeh. Tempeh is an Indonesian food made from fermented soybeans using yeast [4]. This yeast comes from several types of Rhizopus molds, such as Rhizopus oligosporus, Rhizopus oryzae, Rhizopus stolonifera, or Rhizopus arrhizus. Tempeh obtained from this fermentation becomes a product that has value-added because it provides nutritional value to the community, especially the high protein content. The change of soybean into tempeh shows the value-added process [5], [6]. Value-Added is a change in value that occurs due to the treatment of input in a process. Increasing the value added of agricultural commodities

occurs in every link of the supply chain [7] from upstream to downstream starting from farmers and ending at the end consumer. The value-added of agricultural commodities can be achieved by providing raw materials quality, and sustainability [8], and involving actors in the supply chain.

The supply chain of soybean into tempeh in the tempeh industry shows a flow of soybean supplied in the industry and processed into tempeh which is then distributed to the end consumer. The role of the tempeh agro-industry supply chain includes the procurement of raw materials from the producer, processing them into tempeh, and distributing them to the end consumers [7], [9]. Tempeh's industry can still develop and has considerable opportunities [2], [3]. The development of the tempeh industry is expected to be sustainable so that agricultural products in the form of soybeans from farmers will become products that have value-added [5], [6]. Therefore, research related to value-added analysis is needed to analyze a supply chain [10]. This research has its attractiveness of analyses the value-added of soybeans that are processed into tempeh and analyses the network structure in the soybean supply chain into tempeh, thus motivating business actors who want to develop their business. The objectives of this study are (1) to analyze the network structure in the soybean supply chain into tempeh and (2) to analyze the soybean's value-added that is processed into tempeh.

2. Materials and Methods

This research was conducted in October 2022 - March 2023. This research object was the four-tempeh industry in Gresik Regency. They are the Pak Dikin tempeh industry, the Aderina tempeh industry, the Hikmah tempeh industry, and the Makmur tempeh industry. Data collection for this research that was observed was the price of soybeans, yeast additives, plastic, firewood, electricity, kerosene, and labor wages which was carried out by interviewing and also observation of the research location. Data processing and analysis were carried out using the qualitative method for analysis of supply chain structure and the Hayami method to obtain value-added in Table 1.

The advantages of value-added analysis using the Hayami method are to determine the value-added, output value, and productivity. Also can determine the amount of compensation for owners of production factors. The principle of value-added according to Hayami can be applied to other sub-systems outside processing, for example for marketing activities. This value-added calculation can generate important information: (1) Estimated value added (2) The value-added ratio to the value of the finished product (3) Labor reward (3) Labor percentage (4) Profit received by the industry (5) Profit rate of the industry. Table 1 shows how to calculate the value-added using the Hayami method.

Table 1. Hayami Method

Number.	Variable	Notation	Calculate
Output, input, and price			
1.	Soybean tempeh production output	A	
2.	Raw material (kg/production Process)	B	
3.	Labor (working day/ Production Process)	C	
4.	Conversion factor	D	=A/B
5.	Labor coefisien	E	=C/B
6.	Price of product (IDR/kg)	F	
7.	Average wage (IDR/working day)	G	
Revenue and Profit			
8.	Price of raw material (IDR/kg)	H	
9.	Other input contribution (IDR/kg)	I	
10.	Value of product (IDR/kg)	J	=DXF
11a.	Value-added (IDR/kg)	K	=J-I-H
11b.	Value-added ratio (%)	L	=(K/J) X 100%

12a.	Labor income (IDR)	M	=EXG
12b.	Labor income percentage (%)	N	=(M/K) X 100%
13a.	Profit (IDR/kg)	O	=K-M
13b.	Profit rate (%)	P	= O/K X100%

3. Results and Discussion

3.1 . Supply Chain Structure

The soybean tempeh supply chain consists of several levels that are different. Suppliers are in the first tier supplying raw materials, the tempeh industry is in the second tier manufacturing, and the retailers and consumers as the third tier. The consumers are also becoming the fourth tier.

Pak Dikin's Tempeh Industry was established in 2013 and produces soybean tempeh of various sizes. Production capacity is 210 kg in one production process. Pak Dikin's tempeh industry only has one supplier, in the city of Surabaya. Soybean delivery is once for 2 weeks as much as 2.1 tonnes. Soybeans from suppliers are processed into tempeh and then to be distributed to direct consumers or retailers in the traditional market.

Pak Dikin tempeh industry has 2 kinds of supply chain structures:

1. Supplier → Tempeh Industry → Retailer → consumer
2. Supplier → Tempe industry → consumer

Pak Dikin tempe industry has a supplier who supplies soybeans and ingredients from Surabaya. Soybean delivery is once in 2 weeks as much as 2.1 tonnes. The price of soybeans is 12,000.00 IDR / kg. Pak Dikin tempe industry can produce 210 kg tempeh from 150 kg soybean every day. It uses 2 workers with a salary is 70,000.00 IDR/day. Retailers distributed tempe to direct consumers or through traditional markets.

The structure of the Pak Dikin tempeh industry is very simple so becomes easy to handle. Retailers are responsible for distributing tempeh to consumers. The tempeh price to retailers is IDR 2,000.00 per piece. The retailer delivered that traditional market and its price is IDR 3,000.00/pcs.

The Aderina tempeh industry was established in 1993 and produces soybean tempeh of various sizes. Aderina tempeh industry has one supplier from Surabaya and it has been a long-time customer. The price of soybeans at this supplier is stable compared to another supplier. The location is near that making it easy to deliver. The Aderina tempeh industry is delivered 5.6 tonnes of soybean stock once a week. The capacity of soybean tempeh produced is 560 kg in one production. Soybeans from suppliers are processed into tempeh and will be distributed to direct consumers or through retailers in the traditional market.

The Aderina tempeh industry also has 2 kinds of supply chain structures like the Pak Dikin tempe industry. The chain structures are :

1. Supplier → Tempeh Industry → Retailer → consumer
2. Supplier → Tempe industry → consumer

The first tier is the supplier which supplies soybeans to the Aderina tempe industry once a week about 5.6 tonnes. The price of soybean is 11,750.00 IDR/kg. The second tier is the Aderina tempe industry which produces 560 kg tempeh from 400 kg of soybean. It uses 2 workers with a salary is 70,000.00 IDR/day. The third tier is retailers or end customers. The retailers distributed tempeh to consumers in the traditional market. Retailers distributed tempe to direct consumers or through traditional markets. The price of the tempeh is 2,000.00 IDR/pcs and resold by the seller in the traditional market at 3,000.00 IDR/pcs.

The Hikmah tempeh industry was established in 2014. It has two kinds of supply chain structures. The structures are simple like Pak Dikin and Aderina tempeh industry. The structures are :

1. Supplier → Tempeh Industry → Retailer → consumer
2. Supplier → Tempe industry → consumer

The first tier is soybean supplier which is Koperasi Giri Gresik. The Hikmah tempeh industry chose this supplier because the price of soybean is cheaper than the others. The price of soybeans is 11,500 IDR/kg. The delivery of soybeans to the Hikmah tempeh industry is once in 2 weeks as much as 2.8 tonnes. The second tier is the Hikmah tempe industry which produces tempeh 560 kg of 200kg of soybean. The same with the Pak Dikin and Aderina tempe industry, the third tier is retailers or end customers. The retailers distributed tempeh to consumers in the traditional market. Retailers distributed tempe to direct consumers or through traditional markets. The price of the tempeh is 2,000.00 IDR/pcs and resold by the seller in the traditional market at 3,000.00 IDR/pcs.

The Makmur tempeh industry was established in 2019. It has a supply chain structure and there are three tiers, that are supplier, tempeh industry, and consumers. The first tier is the supplier which supplies soybeans as raw material to produce tempeh. It is an agent of soybean in Surabaya. Soybean is delivered to the Makmur tempeh industry once in 1 month as much as 1.5 tonnes. The second tier is the Makmur tempeh industry which produces tempe from soybeans. It produces 70 kg tempeh from 50 kg soybean every day. The third tier is consumers, that buy tempeh to directly consume. The chain structure is :

Suppliers → Tempe Industry → Consumers

3.2. Value-added Analysis

The value-added of the tempeh industry can be seen based on the calculation results with the Hayami method as in Table 1. This table explains sequentially starting from the explanation related to the input needs of the tempeh production process, the price of tempeh, and how to calculate value-added. Table 2 shows the value-added of soybean in tempeh in each tempeh industry.

Value-added is provided by each network in the chain involved in the distribution of tempeh. Value-added measurement is conducted to determine the value of the raw material [6], namely soybeans that have been processed into tempeh. However, the distribution of soybeans from one tier to another is also valuable. The value-added showed that the change form will increase the value in a distribution. The industry can consider the quality and price [11]of soybeans to produce tempeh. The output or product produced is tempeh with a shape that is adjusted by each industry's wishes and based on consumer or market needs[12].

The tempeh products sold by the tempeh industry are relatively the same size. The unit is converted into the price of tempeh kilogram per day. Value-added analysis was conducted on four tempeh industries that became the object of research. Analysis of the value-added of soybean into tempeh can be seen in Table 2.

Table 2. The value-added analysis of soybean into tempeh

Number	Component	Pak Dikin Tempeh Industry	Aderina Tempeh Industry	Hikmah Tempeh Industry	Makmur Tempeh Industry
1.	Soybean Price (IDR)	12.000	11.750	11.500	12.000
2.	Tempeh Price (IDR)	22.000	22.000	22.000	22.000
3.	Value-added (IDR)	17.889	18.476	18.498	17.775
4.	Value-added Ratio (%)	58.118	59.986	60.057	57.713
5.	Profit (IDR)	16,965	16,976	16,748	17,275
6.	Profit rate (%)	55.082	55.116	54.376	56.089
7.	Profit Margin (IDR)	18,800	19,050	19,300	18,800

Pak Dikin tempeh industry shows that 150 kg of soybean can produce 210 kg of tempeh or 2,310 packs. They use 2 laborers and give 70,000.00 IDR/day for their salary. The labor required to process 150 kilograms of soybeans is 0.013 work per day. The price of the tempeh is 22,000.00 IDR. Conversion for 1 kilogram of soybean tempeh will produce 11 packs of tempeh or 90,909 grams/pack. The price of raw materials is 12,000.00 IDR/kg and the contribution of other inputs is 901.345 IDR/kg. The value-added of Pak Dikin Tempeh Industry is IDR 17,899.00 or 58.113% per process. Labor income for each process is IDR 933,333 or 5.215%. The profit of tempeh production is IDR 16,965.00. The profit rate of the production process is 55.082%. The margin of profit is IDR 18,800.00.

Aderina tempeh industry shows that 400 kg of soybean can produce 560 kg of tempeh or 6,160 packs. They use 6 laborers and give 100,000.00 IDR/day for their salary. The labor required to process 150 kilograms of soybeans is 0.015 work per day. The price of the tempeh is 22,000.00 IDR. Conversion for 1 kilogram of soybean tempeh will produce 11 packs of tempeh or 90,909 grams/pack. The price of raw materials is 11,750.00 IDR/kg and the contribution of other inputs is 574.345 IDR/kg. The value-added of the Pak Dikin Tempeh Industry is IDR 18,476.00 or 59.986% per process. Labor income for each process is IDR 1,500.00 or 8.119%. The profit of tempeh production is IDR 16,976.00. The profit rate of the production process is 55.116%. The margin of profit is IDR 19,050.00. The Hikmah tempeh industry shows that 200 kg of soybean can produce 280 kg of tempeh or 3,080 packs. They use 5 laborers and give 70,000.00 IDR/day for their salary. The labor required to process 150 kilograms of soybeans is 0.025 work per day. The price of the tempeh is 22,000.00 IDR. Conversion for 1 kilogram of soybean tempeh will produce 11 packs of tempeh or 90,909 grams/pack. The price of raw materials is 11,500.00 IDR/kg and the contribution of other inputs is 802.345 IDR/kg. The value-added of Pak Dikin Tempeh Industry is IDR 18,498.00 or 60.057% per process. Labor income for each process is IDR 1,750.00 or 9.461%. The profit of tempeh production is IDR 16,976.00. The profit rate of the production process is 55.116%. The margin of profit is IDR 19,300.00.

The Makmur tempeh industry shows that 50 kg of soybean can produce 70 kg of tempeh or 770 packs. They use 1 labor and give 25,000 IDR/day for their salary. The labor required to process 50 kilograms of soybeans is 0.02 work per day. The price of tempeh is 22,000.00 IDR. Conversion for 1 kilogram of soybean tempeh will produce 11 packs of tempeh or 90,909 grams/pack. The price of raw materials is 12,000.00 IDR/kg and the contribution of other inputs is 1,025.00 IDR/kg. The value-added of the Pak Dikin Tempeh Industry is IDR 25,475.00 or 66.170% per process. Labor income for each process is IDR 1,750.00 or 9.461%. The profit of tempeh production is IDR 16,976.00. The profit rate of the production process is 55.116%. The margin of profit is IDR 18,000.00.

Based on Table 2, the highest value-added ratio is owned by the Hikmah tempeh industry at 60.057% or 18,498.00 IDR/ kg with a soybean price of 11,500.00 IDR / kg and a selling price of tempeh of 22,000.00 / kg. This value-added ratio is in high category because more than 50%. The highest profit rate is the Makmur tempeh industry at IDR 17,275.00 or 56.089%, but the highest profit margin Hikmah tempeh industry at IDR19,300.00. It means the lowest price of raw materials can support the highest profit margin if the value-added and profit margin [4] are the highest. So the lower raw material price can reduce production costs[13] so that if the product is sold at the same price as another company, the profits obtained will be different. Price is one of the important factors considered by consumers too[11], [14], [15]

Soybean have a highest value addition of 60,057% after the production process becomes tempeh. Soybean have value addition due transportation, storage

and processing. Soybeans that go through the supply chain structure [16] to become tempeh consumed by consumers have a value-added of 60.057% compared to soybeans that are stored and not distributed. A supply chain structure [16], [17] with at least 3 tiers can provide value-added. A value-added of tempeh is saleable that has been enhanced with additional qualities [18] that make it worth a higher than soybean the raw materials that used [19], [20].

4. Conclusion

As for the research results of the value-added analysis of tempeh, it can be concluded: (1) The network structure in the soybean supply chain into tempeh of three tempeh industries have 4 tiers and only one tempeh industry has three tiers. The supply chain structure of 4 tiers is supplier, tempeh industry, retailers, and consumers. The supply chain structure of 3 tiers is supplier, tempeh industry, and consumers. (2) The highest value-added ratio is owned by the Hikmah tempeh industry at 60.057% or 18,498.00 IDR/ kg with a soybean price of 11,500.00 IDR / kg and a selling price of tempeh of 22,000.00 / kg. All of tempeh industry have value-added ratio is in high category because more than 50%. The tempeh industry can be continued as an enterprise because profitable and have value-added. The novelty of the research is we can find the supply chain structure of the research and know value-added of tempeh industry. Suggestions for further research could be to examine the appropriate business model of tempeh industry

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