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A Cost-Driven Method for Determining the Optimum Selling Price in Tofu Production on the Household-Scale Tofu Agroindustry: A Case Study in Mataram, Indonesia

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ABSTRACT

The determination of the cost of production is a necessity for every entrepreneur to establish the cost of the goods sold. The methods commonly used are the Cost Structure method, the Activity-Based Costing method, and the Volume Cost Profit method. The solution proposed in this article is a cost-driven method which is considered simpler in determining the optimal selling price for the tofu agroindustry on a household scale. This study aims to analyze the correlational relationship between raw material costs, firewood costs and labor wages with production, and to find a cost-driven formulation by modifying the Volume Cost Profit method. The research was conducted in the tofu agro-industry center in Kekalik Jaya Urban Village, Sekarbela District and in Abiantubuh Baru Village, Sandubaya District with the number of respondents 40 units of tofu agro-industry selected by the accidental proportional sampling method consisting of 27 agro-industry units in Kekalik Jaya sub-district and 13 agro-industry units in Abiantubuh Baru Urban Village. Collecting data using triangulation methods, namely the method of sending questionnaires to respondents, survey methods with direct interviews with tofu agro-industry business actors, and observation methods at the production process site. The results showed that there was a positive correlation between the cost of raw material for soybean seeds and production and was the largest component of production costs so that it could be used as a cost determinant in the processing of soybeans into tofu, the cost driven method could be used as strategic planning in determining the selling price.

1. INTRODUCTION

Soybeans are a staple food for people in Asia, especially in the form of tofu or soy milk [1]. Tofu is one of the processed soy foods that contain high-quality vegetable protein and issue table for people who want to reduce the consumption of animal products [2].

Tofu was one of the processed foods for the household agroindustry that was favored by the people of Indonesia, but lately the tofu agroindustry has been facing pressure from two sides. First, in terms of raw materials, prices have increased [3]. Second, from the demand side, it has been faced with declining purchasing power [4] and declining purchase volume [5-7].

The double pressure as mentioned above had an impact on the increasing production costs per unit and/or decreasing contribution margins. In difficult situations, entrepreneurs have to be more specific in determining a cost determinant factor through a consideration of a careful analysis of each component of the production costs [8, 9]. Knowledge of cost-driven analysis could be used as an alternative in choosing a strategy to maintain business continuity (life business) so that entrepreneurs and workers could continue to earn an income that could meet the needs of a decent life, while consumers could obtain products at an affordable price [10].

Tofu agroindustry business actors in developing countries are on average educated at the basic education level and secondary education level [11], meaning that it is not easy to carry out a cost-driven analysis. An understanding of cost-driven analysis requires expertise in operating computer programs [12] and/or having the ability to use available applications on ready-to-use programs using Microsoft SQL [13]. Operating the available applications was constrained by hardware and software, making it difficult for craftsmen to reach. In overcoming the problem of operating an application using Microsoft SQL, we initiated the use of a calculator application on a mobile phone, as a solution for obtaining information that could be used in determining cost components as cost-driven and calculating the cost of production and at the same time determining the optimum selling price.

Based on the results of research conducted by Maryati et al. [14], the raw material cost component was the largest cost component in addition to the labor cost component. Therefore, the raw material for tofu was soybean seeds, while the price of soybean seeds fluctuated and experienced continuous increases. Soybean prices increased from December 2020 to February 2021. The normal price of soybeans was between IDR 700,000 to IDR 750,000 per quintal. In February 2021, the price of soybeans soared to IDR 1,010,000 per quintal [3] which caused tofu entrepreneurs to go on strike [15] because it was difficult to determine the selling price of tofu that was suitable for the continuity of their tofu business.

Knowledge of cost-driven or cost determinants has changed

the economic actions of business actors, especially in manufacturing companies or production activities [16-18]. Among the analytical tools used as cost determinants was the cost structure [19] through displaying the largest relative cost component, but recently the use of the cost structure has been replaced with Activity-Based Costing (ABC).

The ABC method was used so that the company was able to determine the cost of production accurately and was able to compete with other companies [20, 21], as well as help management reduce calculation errors in determining the cost of goods sold, because the company calculated all the resources used in its activities focused on the actual product produced [22].

The ABC method has been widely applied to large companies with economies of scale, because large companies had complete data and resource availability [23]. The weakness of the ABC method was that it was not suitable for applying to household-scale companies that produced tofu, because the business activities of tofu producers do not require expertise [24].

Because the object of this research was a household-scale company, the ABC method was adapted to the limitations of data and limited resources. An alternative method of determining costs that was likely to be applied by soybean processing companies making tofu was the Volume Cost Profit (VCP) method, because the VCP method of determining the cost of goods sold was based on activities and the concept of a given fixed cost and variable costs based on activity and variables price of raw materials [25]. The average fixed cost decreased according to the volume of raw materials, but the VCP method still had a weakness because it had to add up all variable costs each time in the production process [26], especially difficult to determine fixed costs, making it impractical for household scale businesses. Therefore, an alternative method of calculating the cost of production that is more simple, practical and applicable is needed, namely the cost driven method. The cost driven method has advantages when compared to the ABC and VCP methods, because it can be used as a strategy in determining the contribution margin to be obtained by the company, and does not bother calculating fixed costs [27, 28].

The innovation in this cost-driven analysis was to apply a dynamic equation based on changes or increases in volume use and changes in raw material prices with the hope that the calculation of cost of goods sold was accurate with minimal errors. This study aims to analyze the correlational relationship between the cost of raw materials, the cost of firewood and labor wages with production, as well as found a cost-driven formulation by modifying the Volume Cost Profit method and applying a cost-driven formulation in calculating sales prices using a calculator application on a cellphone.

2. LITERATURE REVIEW

Cost-driven is a cost efficiency strategy from a producer side view [29]. As a strategy is an alternative choice of input sources with lower costs [30], or through the use of input substitution which saves more on production costs. The strategic choice is a streamlined cost structure, and uses low prices as a proportion of the price offered to customers [31, 32].

The scheme built from cost driven produces predictions that are comparable or better when compared to certain fixed a priori, after going through the refinement of predictors resulting in better observations in octre [16]. Green Kaizen by using cost-driven in pharmaceutical production creates positive involvement for environmental improvement by reusing wasted plastic [17].

A cost-based predictive maintenance policy ensures the safety of the aircraft while minimizing maintenance costs and resulting in significant cost savings [18], while Handayani [19] suggests using cost-driven as a method of determining rail fares in Indonesia.

3. MATERIALS AND METHODS

The study was conducted on 40 units (12 percent of 334 units) of household-scale tofu agro-industry companies (3 people to 5 workers) determined by the quota sampling method. The research location is in Kekalik Jaya Village, Sekarbela District and in Abiantubuh Baru Village, Sandubaya District, Mataram City. Data collection was carried out from June to September 2021.

The unit of analysis was a tofu agroindustry business which was actively operating in 2021, and owned and used mobile phones as a tool of communication. From a population of 334 tofu agroindustry businesses, 227 units in the Kekalik Jaya Urban Village and 107 units in the Abiantubuh Baru Village, the number of sample units was determined by the quota sampling method to be as many as 40 units in two urban villages and the determination of the number of units in each urban villages using the proportional sampling method was found to be 27 in Kekalik Jaya Urban Village and 13 in Abiantubuh Baru Urban Village, while the determination of the units to be sampled was done by accidental sampling.

The respondents were the owners and or managers of tofu agroindustry businesses at the research location. The owner was an individual or household who acted as an investor in a tofu agroindustry business unit. The manager was an individual who was given the task and authority by the owner to carry out the business operations of a tofu agroindustry company.

Data collection was done by combining three methods as follows:

1. Sending questionnaires to respondents in Google Form format;
2. In-depth interviews are guided by structured questionnaires while still applying health protocols;
3. Direct observation at the location of the production process to observe and discuss production processes and technology, the use of raw materials, auxiliary materials, labor, buildings and equipment owned, as well as cooperation partners in procuring inputs and selling products.

The collected data and information are processed and analyzed using descriptive statistics which include:

1. Correlational analysis of raw material costs, firewood costs, and labor wages with production.
2. Finding a cost-driven formulation by modifying the Volume Cost Profit method.
3. Apply cost-driven formulation in calculating sales price.

Implement the use of cost-driven formulations via cell phones.

4. RESULTS AND DISCUSSION

4.1 Tracing the process of cost determination (Cost-Driven)

Production costs consist of fixed costs and variable costs. The amount of fixed costs did not change even though production changes [33], so it is not possible to use as a cost determination (not as cost-driven). Cost-driven characteristics were costs that were linear with production or performance. Therefore, the tracing option continued on the variable cost component. Variable costs were costs that vary in proportion to the volume of production [33].

Cost determination (cost-driven) tracking steps:

a. Arranging variable costs by activity.
b. Tracing the percentage of the largest cost component by sorting in descending order from the percentage of the largest cost component to the smallest cost component (Table 1 and Table 2).
c. The three largest variable cost components (Table 1 and Table 2) were selected.
d. Correlation analysis was conducted between the value of costs and the volume of production successively based on ranking (Table 3).
e. Two components of variable costs with the strongest correlational relationship were selected as the cost determination (cost-driven).
f. Among the two components of variable costs, the one with the strongest and most consistent correlational nature was selected as cost-driven.

4.2 The process of determining cost determination (cost-driven)

4.2.1 Cost-Driven tracing steps

From the tracing steps, the following results were obtained:

1. The largest variable cost values based on successive activities were the cost of raw materials, labor wages, and the cost of firewood as shown in Table 1.

Table 1. Ranking of tofu processing variable costs in AbdiantubuhBaru Urban Village

No.	Component	Volume	Unit Price	Cost	%
1	Raw material	84.62	10,873.00	920,073.26	81.98
2	Labor	1.05	85,000.00	88,901.90	7.92
3	Firewood	7.92	10,000.00	79,200.00	7.06
4	Fuel oil	1.87	7,850.00	14,679.50	1.31
5	Water	0.55	25,000.00	13,750.00	1.23
6	Salt water	3.92	1,000.00	3,920.00	0.35
7	Electricity	0.92	980.00	901.60	0.08
8	Soda	0.92	960.00	883.20	0.08
	Total			1,122,309.46	100.00

It was common knowledge that the tofu production process had costs. The biggest cost was the raw material of soybean seeds. Soybean seeds were the main component in the production of tofu, so they had to be available in sufficient quantities at affordable prices. Among the variable cost components, the cost of raw material of soybean seeds took up a large portion of the variable cost structure, which was above 80%, while the other variable costs are less than 20% Table 1 and Table 2). The results of this research are in sync with the research results of Sri Maryati et al. [14], in that the largest component of production costs was the cost of raw materials.

The consequence of such a cost structure was that the most operational capital allocation was in the supply of raw materials [34], followed by firewood, while labor was paid after the employees worked. The three largest cost components account for 96.20% of the total variable costs. This finding was relevant to the results of research by Ida Widaningrum [35] that the largest cost component in the tofu agroindustry was the cost of raw materials, fuel and labor. Therefore, the cost determination was taken from the three components of the most variable costs.

The largest component of tofu processing variable costs in Kekalik Jaya and Abiantubuh Baru Urban Village was the raw material for soybean seeds, because the price of soybeans has already exceeded the psychological price above IDR 10,000/kg [36]. Not only were local soybeans expensive, but so were the price of imported soybeans [5].

The three largest types of variable cost components in tofu processing in Kekalik Jaya Urban Village were the same as the three largest variable cost components in tofu processing in Abiantubuh Urban Village, namely the raw materials of soybean seeds, firewood and labor wages. The difference was that the second rank was occupied by the cost of firewood. Labor wages fell to third place. The cause of the decline in the position of labor wages was the smaller absorption of labor, and the lower wages per person per working day when compared to the area of Abiantubuh Baru Urban Village. In Table 2. We can examine the ranking of the variable costs of tofu processing in Kekalik Jaya Urban Village.

Table 2. Ranking of tofu processing variable costs in Kekalik Jaya Urban Village

No.	Component	Volume	Unit Price	Cost	%
1	Raw material	55.33	11,905.00	658,703.65	86.70
2	Firewood	4.19	10,000.00	41,900.00	5.51
3	Labor	0.53	70,000.00	37,383.33	4.92
4	Water	0.42	25,000.00	10,500.00	1.38
5	Fuel oil	1.17	7,850.00	9,184.50	1.21
6	Salt water	1.44	1,000.00	1,440.00	0.19
7	Electricity	0.69	980.00	679.14	0.09
8	Soda	-	-		-
	Total			759,790.62	100.00

The three components of the largest variable costs, namely the raw materials of soybean seeds, firewood, and labor account for 97.13%, and other components account for 2.87%. Based on the portion of the cost, it was reasonable to suspect that the three cost components were the cost determination, while the smaller cost components were water, fuel oil (pertalite), and saltwater. The use of saltwater was a characteristic of Mataram tofu, which was different from Sumedang tofu, which used vinegar as a coagulant [37, 38]. The smaller costs were the electricity costs for driving the milling machine dynamo and lighting lamps. The least was the cost of the soda. This soda is not formalin, but a developer material [39]. In addition to the variable costs as stated above, there were still semi-fixed costs, namely the filter cloth used to filter soybean juice. This filter cloth could be replaced using a rotated drum [40] so it was not included as a fixed cost.

2. Analysis of the correlation between the value of raw materials cost, firewood cost, and labor wages with the production volume

The correlation coefficient values of raw material cost, firewood cost, and labor wages with the production volume are presented in Table 3. The cost of raw materials is positively correlated with production volume with a relatively strong

correlation coefficient, according to Haider's opinion [41] that the larger the production volume is followed by the greater the cost of raw materials.

Table 3. The partial correlation value between production volume with variable cost components

No.	Variable Cost Components	Urban Village		Aggregate
		Abiantubuh Baru	Kekalik Jaya	
1	Raw material cost	0.9981	0.9841	0.9925
2	Firewood cost	0.8813	-0.0988	0.6182
3	Labor wages	0.6628	0.6228	0.6847

The variable cost components consisted of the cost of raw material of soybean seeds, the cost of firewood, and the cost of labor wages. It was seen that the most strongly correlated was the cost of raw material of soybean seeds, while the components of the cost of firewood and cost of labor wages were moderate. Therefore, it could be concluded that the cost of the raw material of soybean seeds was a cost determinant (cost-driven). This was reinforced by the research results of Sri Maryati et al. [14], who found that raw materials were the largest cost component when compared to other cost components Tirta [42] argues that cost driven has a big impact on production costs.

Among the three components of variable costs that consistently had a positive and strong relationship with production volume were the cost of raw materials and labor wages, while the cost of firewood was inconsistent, especially for tofu processors in Kekalik Jaya Urban Village. The weak correlation between the production value and the cost of firewood was due to the fact that tofu entrepreneurs in Kekalik Jaya area used more agricultural waste materials such as rice husks, peanut shells, soybean shells, and corn gimbals. Tirta [42] argued that variable costs were cost-driven.

3. From the results of the correlation analysis, the two components of variable costs with the strongest correlation with production volume were selected, then used as a cost determination (cost-driven).

By considering the results of the correlation analysis above, what should be considered as a cost determination was the cost of raw materials and labor wages, and it could be concluded that as the cost determination was the cost of raw material of soybean seeds.

4.2.2 Determination of value-driven price using the cost-driven formulation

1. Process of tracing the tofu selling price determination method (Value-Driven)

Those who knew best how to determine the selling price were the experienced tofu processing entrepreneurs. Tofu processing entrepreneurs were the actors in determining the selling price. Because it was the entrepreneurs who were believed to know best the method or formula for setting the selling price, it was they who should be asked for their knowledge of the method of determining the selling price of tofu.

The steps in the tracing for the method of determining the selling price are as follows:

a. Asking how many kilograms of soybean seed raw materials are used each time in the production process.

Armed with experience as a consultant in assisting agricultural agroindustry in Bima Regency in 1995, information has been obtained that as the basis of price determination was the cost of raw materials. The formula used at that time was the selling price of soybeans calculated by a formula of two times the cost of raw materials of soybean seeds. However, during the COVID-19 pandemic situation that occurred during 2020 to 2021, the price of soybean seeds experienced significant fluctuations. Soybean seed price fluctuations meant that IDR 8,000/kg jumped to IDR 13,000. The soybeans seeds price fluctuation as a raw material of tofu made it difficult for tofu processing entrepreneurs to set selling prices [3]. If they still stuck to a formula of two times the cost of raw materials, it was feared that the tofu would not sell well in the market, and consumers would switch to substitute food ingredients such as marine fish or freshwater fish. The preferred solution was to reduce the size. Each printer was usually filled with 2 kilograms per board, which has to be reduced in order to cover production costs.

b. Asking the purchasing price per kilogram of raw material of soybean seeds received at the business location.

The strategy applied was to reduce production according to orders. This strategy was more effective when compared to the first strategy, because without reducing the size, customers still needed tofu, so they did not disappoint consumers even though they were sold at a higher price. Each printed board was measured between 2 kg to 2.5 kg at a higher price. Each printed board containing 8 x 8 = 64 pcs was sold at a price of IDR 30,000 to IDR 60,000. The selling price of tofu varied between tofu processing entrepreneurs. Most of them sold for IDR 56,000/board.

c. Calculating the total cost of raw materials of soybean seeds in one production process by multiplying the total cost of raw materials of soybean seeds by the price per kilogram of soybeans seeds.

The total cost of raw materials of soybean seeds was IDR 920,073.26/process in Abiantubuh Baru Urban Village and IDR 658,703.65/process in Kekalik Jaya Urban Village, with the amount of raw materials being 84.62kg and 55.33kg, respectively.

d. Asking the total of tofu production that was produced from the total use of soybean seed raw materials.

The average production of tofu was 42.31 boards per production process in Abiantubuh Baru Urban Village and 26.67 boards per production process in Kekalik Jaya Urban Village (Table 4).

e. Asking the selling price of tofu products per board sold to intermediary traders or customers.

By using the weighted average method, the average price of tofu per board obtained was IDR 46,068.18 in Abiantubuh Baru Urban Village and IDR 52,420.14 in Kekalik Jaya Urban Village, while the average price of tofu in Mataram City was IDR 49,669.40/board (Table 4).

f. Calculating the production value by multiplying the number of tofu product boards produced by the selling price per tofu product board (Table 4).

The results of the calculation of the production value are presented in Table 4.

Tofu production was obtained from the screening process of soybean juice that has been coagulated using a coagulation agent. The coagulation agent used was saltwater. The ratio between the amount of production (board) with the amount of raw materials was called the yield.

The yield of soybean processing into tofu was 65.39% in Abiantubuh Baru Urban Village and 63.03% in Kekalik Jaya Urban Village. The average overall yield was 63.80%. This yield was considered high because it was more than 50%. The

high yield was due to the high water content and produced high added value [28, 33].

Table 4. Average production, price, and value of tofu production

No.	Description	Urban Village		Aggregate
		Abiantubuh Baru	Kekalik Jaya	
1	Production (board)	42.31	26.67	31.75
2	Price (IDR/board)	46,068.18	52,420.14	49,669.40
3	Production Value (IDR)	1,949,144.70	1,398,045.13	1,577,152.49

Indirect tofu production yields could be used as calculation data in determining the selling price. Instead, the ratio used was the Ratio of Production Value to Raw Material Costs.

Table 5. Average production value, production cost, and profit

No.	Description	Urban Village		Aggregate
		Abiantubuh Baru	Kekalik Jaya	
1	Production Value (IDR)	1,949,144.70	1,398,045.13	1,577,152.49
2	Production Cost (IDR)	1,718,613.95	1,224,064.85	1,384,793.31
3	Profit (IDR)	230,530.75	173,980.28	192,359.18
4	R/C Ratio (%)	11.83	12.44	12.20

The production value obtained from the result of tofu selling has been able to cover all the costs sacrificed, meaning that the tofu processing company could earn a profit above normal profit, namely the profit after deducting the manager's salary and management fee to cover factory overhead costs.

g. Divide the tofu production value by the raw materials cost

The ratio of production value (PV) to the raw materials cost (RMC) is a ratio that can be used as a determinant of the selling price. An PV/RMC ratio of more than 2x the price of raw materials indicates that the soybean seeds processing company has earned above-normal profits as reported in Table 6.

Table 6. Ratio of production value to raw material cost

No.	Description	Urban Village (IDR)		Aggregate (IDR)
		Abiantubuh Baru	Kekalik Jaya	
1	Production Value	1,949,144.70	1,398,045.13	1,577,152.49
2	Raw Material Cost	920,073.26	658,703.65	743,648.77
3	PV/RMC Ratio	2.1185	2.1224	2.1211

The average ratio of Production Value (PV) to the cost of raw materials (RMC) is 2.1211. This means that the production value is 212.11% of the cost of raw materials. With the acquisition of Production Value more than double the cost of raw materials, it is certain that the tofu agroindustry entrepreneur has earned above-normal profits (Table 5). If the PV/RCM ratio is used as a constant (k), then the maximum value of k is 2.1211.

Therefore, even in the COVID-19 pandemic situation and the price of soybeans seeds soaring by 50% above the price at the end of 2019 of IDR 8,000/kg, the business of tofu still existed, because still needed by consumers and willing to pay a price above normal profit. For tofu processing entrepreneurs, the COVID-19 pandemic was a blessing, because it could boost profit achievement above normal profit. For tofu processing entrepreneurs, the COVID-19 pandemic is a blessing, because it can boost the achievement of profits above normal profits. The profit gain of tofu agroindustry entrepreneurs also occurred in Lampung Province in Indonesia with the acquisition of Revenue Cost Ratio of 1.66, meaning that they obtained a profit of 66% of production costs [43].

The cost of raw materials was linearly correlated with the increase in the price of raw materials, the more expensive the price of raw materials, the cost of raw materials would increase proportionally, because the price was a constant of the raw materials cost above variable costs.

h. Divide the cost of tofu production by the raw materials cost

The ratio of production costs (PC) to raw material costs (RMC) was obtained by dividing production costs by raw material costs. The PC/RMC ratio is a constant that is used as the prediction of the cost of production. The cost of production of tofu was obtained by multiplying the ratio of PC/RMC by its constant value. The results of the PC/RMC ratio analysis are shown in Table 7.

Table 7. Ratio of production cost to raw material cost

No.	Description	Urban Village (IDR)		Aggregate (IDR)
		Abiantubuh Baru	Kekalik Jaya	
1	Production Cost	1,718,613.95	1,224,064.85	1,384,793.31
2	Raw Material Cost	920,073.26	658,703.65	743,648.77
3	PC/RMC ratio	1.878	1.868	1.862

The average ratio of production costs (PC) to raw material costs (RMC) is 1.862. This means that the cost of production can be determined from 1,862 times the cost of raw materials. The total cost of raw materials, other material costs, labor wages and overhead is equivalent to 182.6% of production costs. If the cost of raw materials is identical to 100%, then the other costs are 82.6% of the production cost. If PC/RMC is constant, it is formulated that PC/RMC = k minimum.

2. Determine the value of the selling price forecasting

Forecasting the selling price of tofu at the level of tofu processing entrepreneurs was determined by choosing the squared root of the least deviation mean. The squared root of the least deviation mean was achieved at the ratio of the production value to the raw materials cost of 2.068. The selling price (SP) per year per board is:

$$SP\ per\ board = k * \frac{RMC}{Q}$$

$$SP\ per\ board = 1.9915 * \frac{RMC}{Q}$$

Description
SP = selling price (IDR/board)
RMC = raw material cost (IDR/process)
Q = production (board/process)
$1.862 < k <= 2.121$
k- optimum = 2.068

One board is cut into 64 pcs, then the production is equal to the number of boards x 64 pcs, then

$$SP\ per\ pcs = \frac{1.9915 * RMC}{64 * Q}$$

4.2.3 Implementation of a cost-driven formulation on a mobile phone

A cost-driven method could be used to forecast the selling price of tofu products per pcs to intermediary traders using the formulation that has been formulated above, namely SP = k*RMC/64Q or the selling price of tofu products per board with the formula SP = k*RMC/Q.

5. CONCLUSIONS

Soybean seed raw material has a strong positive relationship with production costs and raw material costs contribute the most to the formation of production costs, so they are designated as cost driven. The cost driven method can be used to plan the selling price of tofu products with a formulation of 1.9915 times the cost of raw materials divided by the amount of production per process. Tofu agro-industry entrepreneurs are advised to use a cost driven formulation as a plan to determine the selling price of tofu products, if the price of soybean seed raw materials increases than usual, they can set the selling price of tofu between 187% to 199% of the cost of raw materials, on the contrary if the price of raw material for beans Soybean decreased from the previous, the selling price is set between 199% to 212% of the cost of raw materials divided by the amount of production per process. It is recommended for researchers to conduct research on the effect of using various types of fuel on the quantity and quality of tofu products.

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