Optimizing Efficiency and Value Added in Tofu Production: A Food Industry Perspective

.

ABSTRACT

This research is conducted at industry know that has address at Jl. Happy Market I-A, Village Trade-III, District Bandar, Simalungun District. The study was conducted for two months, starting in May 2024 until June 2024. Determination of the sample in this study was conducted with the type of Non Probability Sampling. This study uses time series data (time series) or also called annual data for the year 2019-2023. Data analysis method is done descriptively.

The results showed that the industry knew technically, the price (allocative) and economically was not efficient in the research area, where the technical efficiency is greater than I, the efficiency of the price is smaller than I and the economic efficiency is less that I. The availability of inputs on the tofu industry in ward Trade III, Bandar Sub district is classified as less available. The average value added of soybean processing to know in one year is Rp. 672,613,580.00 or Rp. 9,158.26 / board. From this result shows that soybean processing business to know has positive added value (NT> 1) means that added value can build and improve the performance of the tofu industry. The presence of tofu industry provides low value-added rewards to consumer needs, selling prices, capital and labor. The industry's revenue level is Rp. 47,296,020.56/month < Rp. 2,400,000, so it can be said that Tahuna industry opinion is high. The R/C ratio is greater than I that is 1.49. Therefore R/C ratio is greater than one so that the industry knows feasible to cultivate.

Keywords: Feasibility Analysis, Tofu Industry, Income, Added Value, Inputs.

1. INTRODUCTION

A farmer has cultivated his soybeans to obtain production, so that after the farmer obtains production, it will automatically be sold to the industry. So that the industry will process the soybeans into tofu. Through the processing of soybeans can produce added value contained in the output (production) produced.

Of course, in managing to make tofu, the industry will require the availability of inputs (raw materials, supporting materials, labor, fuel, equipment and machinery). So that the tofu product is sold to consumers, it obtains revenue by means of total tofu production multiplied by the selling price. Revenue is expressed in the form

(Rp). In the processing of making tofu must take into account the costs incurred so as to determine the selling price of the tofu product.

This industry earns revenue which is an illustration of the success or failure of the industry in business. Income is obtained by subtracting from business revenue to the total cost of production, If obtained income in the tofu industry, then a business feasibility can be calculated. Income is expressed in rupiah (Rp).

To assess whether or not the industry is feasible to develop, there are several components to look at, namely production costs, revenue, and profits as well as financial analysis.

The industry in the research area is feasible or not to be cultivated and developed in the region can be seen through technical, price (allocative) and economic efficiency. In addition to the efficiency, it is also necessary to know the financial feasibility by calculating the ratio of revenue to total costs, called the Retrun cost Ratio (R/C) and Break Even Point (BEP).

Hypothesis

1. The tofu industry is technically, price (allocative) and economically efficient in the study area.

2. Availability of inputs (raw materials, supporting materials, labor, fuel, equipment, machinery) is high in the study area.

3. The added value (consumer demand, selling price, return on capital and return on labor) of the tofu industry in the study area is high.

2. MATERIALS AND METHODS

To see the technical, price (allocative) and economic efficiency from 2019-2023.

To see the technical efficiency using the following formula: $\frac{NPMx}{Py}$

NPMx =Px or

PM. Py + Px Px

The maximum efficiency level (i.e. maximum PR) is reached when : PM = PR

PR = Y/X

So to find out the level of technical efficiency is tested with : $\frac{NPM}{Px} = \frac{PR_i \, Py}{Px}$

(Sunarjono, 2000)

Description:

PR= Average production (Board)

Px= Production Price x (Rp)
X= Means of Production y (Rp)
Y= Output (Tofu) (Board) NPM = Marginal product value

Test criteria:

- If NPM/Px > 1, it means that the availability of input X is not efficient and needs to be increased.
- If NPM/Px = 1, the availability of input X is efficient.
- If NPM/Px < 1, it means that the availability of input X is not efficient and needs to be reduced.

To determine the level of price analysis (allocative) the following formula is used: bi.Y.Py/x= Px Or bi.Y.Py/ *X.Px*

Description:

Px = Price of factor of production
Py = Output price
Y = Output/Production
bi = Regression coefficient
X = Factor of Production

With Criteria:

- If $\frac{biYPy}{X.Px} > \mathbf{1}$ This means that the availability of input x is not efficient. To achieve efficiency, input x must be increased.
- If $\frac{biYPy}{X.Px} = \mathbf{1}$ This means that the availability of input X is efficient.
- If $\frac{biYPy}{X.Px} < \mathbf{1}$ It means that the availability of input x is not (more) efficient. To achieve efficiency, input x must be reduced.

Analysis for economic efficiency used the following formula:
EE = ET x EA
Description:
EE = Economic Efficiency
ET = Technical Efficiency
EA = Allocative Efficiency (price)
With criteria:

- If ET x EA < 1, then input availability is not efficient and needs to be increased.
- If ET x EA = 1, then input availability is efficient.
- If ET x EA >, then the availability of inputs is not efficient so it is necessary to reduce the use of production factors (Taman, 2008).

Break Even Point (BEP) is the point of return where total revenue equals total cost (TR = TC).

BEP The Production Volume = $\frac{\textbf{\textit{The Total Production Cost}}}{\textbf{\textit{The Farmer's Price}}}$

BEP Production Price = $\frac{\textbf{\textit{The Total Production Cost}}}{\text{The Total of Production}}$

Test criteria: the break-even point is exceeded if the value of each variable is higher than the result of the BEP (Break Even Point) calculation.

To answer hypothesis 2, a descriptive analysis was used where researchers directly observed the availability of inputs (raw materials, supporting materials, labor, fuel, equipment, machinery). To see the exact size of input availability in the research area, the Gutman scale scoring method was used with a questionnaire system. The assessment and scoring guidelines are as follows:

1. Number of options = 1 (available and not available)
2. Number of questions = 6
3. Lowest scoring = 0 (Insufficient answer options)
4. Highest scoring = 1 (sufficient answer options)
5. Lowest total score = lowest scoring x number of questions (0 x 6 = 0 (0%)
6. Highest total score= highest scoring x number of Questions (1 x 6 = 6(100%)

Formula: I (Interval) =$\frac{Range\ (R)}{\text{Kategori(K)}}$

Where:

Range (R) = Highest score - lowest score (100-0 = 100%) Category (K)
= 2 is the number of criteria arranged in the variable
Questions are available and not available.

Interval = R/K = 100/2 = 50

Scoring criteria = highest score - interval = 10050=50%

Then - available = if score > 50%
- Not available = if score < 50%

To answer Hypothesis 3 to calculate the added value, it was tested with :
Calculating added value

Gross value added (NTb)

NTb = Na - BA
= Na - (Bb + Bp)

Description:

NTb = Gross value added (Rp)

NA = Value of final tofu product (Rp)
Ba = Intermediate cost (Rp)
Bb = Cost of tofu raw materials (Rp)
Bp = Cost of supporting materials
(Rp) Net Added Value (NTn)

$$NTn = NTb - NP$$

$$NP = \frac{Initial\ Value - NilaiSisa}{Economic\ Life}$$

Description:
NTn = Net value added (IDR)
NTb = Gross value added (Rp)
NP = Depreciation Value (Rp)

3. RESULTS AND DISCUSSION

The efficiency of input use of each production factor (input) to production (output) can be known by comparing the value of marginal production with each production factor.

Table.1 Calculation of Technical Efficiency The use of fuel and supporting materials in the research area

No.	Variables	NPM/Px	Criteria
1	Soybeans	252444,7	Not yet efficient
2	Salt	1716624	Not yet efficient
3	Vinegar	29095,32	Not yet efficient
4	Firewood	134,1	Not yet efficient
5	Solar	295.969,7	Not yet efficient

Source: Data processed, 2024

The data presented in Table 1 outlines the calculation of technical efficiency in the use of fuel and supporting materials within the research area. The analysis evaluates the efficiency of inputs based on the NPM/Px criteria, which determines whether each resource is efficiently utilized. Below is a detailed explanation of the findings:

1. Inefficiency of Soybeans (NPM/Px: 252,444.7)

   The calculated value for soybeans indicates inefficiency in its utilization. A high NPM/Px ratio suggests that the marginal product of soybeans is not proportionate to its price, implying that adjustments in input levels are necessary. This inefficiency could stem from overuse or under-optimization in production processes, potentially leading to wastage or diminished returns.

2. Salt's Inefficiency (NPM/Px: 1,716,624)

   Salt exhibits the highest NPM/Px ratio among the inputs. This significant imbalance signifies severe inefficiency, where the marginal product vastly exceeds the cost, indicating that salt is not being utilized optimally. The production process should assess the current quantities to ensure proportional application that aligns with economic efficiency.

3. Vinegar (NPM/Px: 29,095.32)

   Vinegar’s utilization also demonstrates inefficiency, albeit to a lesser extent than salt. This inefficiency points to possible imbalances in the production formula, where excessive amounts of vinegar are being used without yielding proportional increases in production output. Revising the input-to-output ratio could improve overall efficiency.

4. Fuel Sources: Firewood (NPM/Px: 134.1) and Solar Energy (NPM/Px: 295,969.7)

   Both firewood and solar energy display inefficiency in their use. The inefficiency in firewood is less severe compared to other inputs, but still indicates room for improvement. Solar energy, with a notably high NPM/Px value, highlights a critical inefficiency, suggesting the need for better utilization strategies or alternative energy sources to enhance productivity.

The overall inefficiency across all inputs implies a systematic issue in resource allocation and utilization within the production process. Immediate actions, such as recalibrating the input ratios, adopting best practices, and incorporating technological advancements, are necessary to improve efficiency. Effective monitoring and periodic evaluations can help sustain improvements and ensure alignment with production goals. This analysis underscores the importance of optimizing resource use not only for cost reduction but also for enhancing productivity and sustainability in the research area's processes.

Table.2 Calculation of Price Efficiency (Allocative) Use of raw materials and supporting materials in the research area.

No.	Variables	Bi. Y. Py/X.Px	Criteria
1	Soybeans	0,62	Not yet efficient
2	Salt	1453,64	Not yet efficient
3	Vinegar	-110,17	Not yet efficient
4	Firewood	-0,57	Not yet efficient
5	Solar	67,27	Not yet efficient

Source: Data processed, 2024

The calculation of allocative (price) efficiency in Table 2 highlights the effectiveness of using raw materials and supporting materials in the study area. The findings indicate the following trends:

1. Efficiency Analysis of Soybeans

   The calculated value for soybeans is 0.62, falling significantly below the efficiency threshold of 1. This suggests that soybeans are not yet utilized optimally within the production process. Factors such as procurement costs, distribution inefficiencies, or improper usage could contribute to this inefficiency. Addressing these issues by optimizing supply chains and usage protocols could enhance their economic viability.

2. Salt Efficiency

   Salt displays an extraordinarily high value of 1453.64, which also falls into the inefficient category. Such an anomaly suggests overpricing or excessive allocation relative to its contribution to output. A potential corrective measure would be to reassess the quantity and price balance, ensuring alignment with production needs while minimizing waste.

3. Negative Allocative Efficiency in Vinegar and Firewood

   Vinegar and firewood exhibit negative efficiency values, -110.17 and -0.57, respectively. These figures indicate severe inefficiency, with possible wastage or mismanagement during use. Negative values often reflect improper cost management or misalignment between input costs and their actual contribution to output. These materials may require a thorough review of usage policies, pricing, and procurement strategies to prevent economic losses.

4. Solar Fuel Analysis

   Solar, used as a supporting material, yields a value of 67.27, denoting suboptimal use. While the inefficiency is less drastic than vinegar or firewood, the value still emphasizes the need for strategic interventions. Adjustments in operational planning, such as better maintenance of solar-powered systems or leveraging alternative resources, could improve efficiency.

The overall inefficiency of raw materials and supporting materials demonstrates a critical gap in resource management within the study area. None of the materials met the allocative efficiency benchmark, signifying potential cost overruns and wastage. Efforts to bridge these gaps should include: Enhanced Resource Allocation: Implementing accurate demand forecasting to prevent underutilization or overallocation. Cost-Benefit Analysis: Regular assessments to ensure the pricing of materials aligns with their productive contributions. Training and Awareness: Educating workers and managers on the optimal use of inputs to reduce inefficiencies. By addressing these factors, the region can achieve significant economic and operational improvements in the use of raw materials and supporting inputs.

Table.3 Calculation of Economic Efficiencies The use of raw materials and supporting materials in the study area.

No.	Variables	Bi. Y. Py/X.Px		Economical Efficiency	Criteria
1	Soybeans	252444,7	0,62	157754,473	Not yet efficient
2	Salt	1716624	1453,64	2495352479	Not yet efficient
3	Vinegar	29095,32	-110,17	-3205337,2	Not yet efficient
4	Firewood	134,1	-0,57	-769,04917	Not yet efficient
5	Solar	295.969,7	67,27	19910734,9	Not yet efficient

Source: Data processed, 2024

Based on the provided data regarding economic efficiency in the use of raw materials and supporting materials in the study area, the findings indicate inefficiencies across all variables analyzed. Below is a comprehensive analysis of the results:

1. **Soybeans**
   The economic efficiency calculation for soybeans shows a result of Bi×Y×PyPx=157,754.473Bi \times Y \times \frac{P_y}{P_x} = 157,754.473Bi×Y×PxPy=157,754.473, which is below the efficiency threshold. This indicates that the current utilization of soybeans in production processes is not yielding optimal outcomes. Factors such as waste during processing or misalignment between input quality and output requirements may contribute to this inefficiency. A revision of sourcing strategies or processing methods could improve efficiency levels.
2. **Salt**
   Salt exhibits a significantly higher value (2,495,352,4792,495,352,4792,495,352,479) compared to other materials. Despite its high contribution to the production process, it is still deemed inefficient. The excessive cost of salt relative to its output value might be due to overuse or the availability of cheaper alternatives that have not been

explored. Further analysis is necessary to determine how the procurement or utilization of salt can be optimized.

3. **Vinegar**
   Vinegar demonstrates a negative efficiency value (−3,205,337.2-3,205,337.2−3,205,337.2), reflecting a substantial inefficiency. This could be due to incorrect measurements in its application, high costs compared to its contribution to the final product, or compatibility issues within the production system. Investigating alternative suppliers or adjusting usage levels may address this problem.
4. **Firewood**
   Similar to vinegar, firewood presents a negative efficiency (−769.04917-769.04917−769.04917), suggesting minimal to no economic benefit in its use. The negative result highlights inefficiency not only in financial terms but also in environmental impact, as firewood usage often has sustainability concerns. Transitioning to modern, energy-efficient fuel sources might resolve these inefficiencies.
5. **Solar Energy**
   Solar energy shows the most promising efficiency figure among the materials (19,910,734.919,910,734.919,910,734.9), yet it remains categorized as inefficient. This could imply underutilization or high setup and maintenance costs relative to its benefits. Streamlining the operational use of solar energy and increasing its integration in production processes may help improve its efficiency.

Conclusion

The research highlights critical inefficiencies in the tofu industry's production processes in the study area. Both technical and allocative efficiencies are below optimal, with inputs such as soybeans, salt, vinegar, firewood, and solar energy being underutilized or misaligned with production needs. Economic efficiency is similarly suboptimal, with a low R/C ratio (1.49) indicating marginal profitability, underscoring the need for strategic process improvements and better resource management. Despite these challenges, the tofu industry demonstrates positive value-added potential, generating an annual value of Rp. 672,613,580.00 or Rp. 9,158.26 per board. However, its socioeconomic impact remains limited due to low labor rewards and minimal job creation. Addressing these limitations through optimized input usage, enhanced technological adoption, and better labor engagement could significantly improve outcomes. While the tofu industry has value-adding potential, inefficiencies in production and resource allocation must be resolved to ensure sustainability and enhance its economic and social contributions. Strategic improvements in process optimization and community involvement are essential for the industry's long-term viability. The capital used by tofu entrepreneurs ranges from 100 to 300 million, which is still relatively low, where annual revenue can reach 500 million per year. The existence of larger capital loans to banks can still be covered by the amount of income received each year. The results show that the industry provides low rewards for labor, because it only uses a workforce of 5 to 19 people. The presence of the tofu industry does not have a major impact on the creation of jobs in the community.

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