

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

ABSTRACT

Tofu production support food security and local economy in the Bandar area of Simalungun Regency. Tofu as an accessible additive for plant-based protein has all the potential to satisfy consumers' demand and promote sustainable foods. The specific objectives of this study include; assessing technical, allocative and economic efficiency of tofu industries in the study area; and estimate the value added created. For the study, we incorporated time series data from the year 2019 to 2023 under descriptive analysis. The findings of the study on degree of technical, allocative and scale efficiencies were technical efficiency greater than one while allocative and scale efficiency were still less than one which implies that resource were not being used efficiently. However, the value added generated is positive with an average of 672,613,580.00 IDRs per year or 9.158.26 per tofu board, therefore should be continued. From the above findings, this study has some important policy implications such as stressing investment on new and more advanced production technology, offering training to labor so as to enhance efficiency level, and offering policies that may support the tofu firms sustainability. We foresee that the protective measures named above will enable the tofu industry to become more competitive, reduce somatic losses, and improve its contribution to the regional economy.

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

1. INTRODUCTION

(Kahar et al., 2023)Tofu as one of the protein based food products has vital strategic importance in global food industry including fulfilling the need for sustainable protein source. (Purwaningrum & Purnomo, n.d.)Tofu is promising as an industrial product to satisfy consumer's demand for quality food that is healthy, cheap and contains essential nutrient components. However, the tofu industry at the local level is associated with technical, price and economic impediments that slow down its competitiveness. Competitiveness. This research is important to determine the factors that affect efficiency and value addition in tofu production in order to enhance profitability, productivity and efficiency and meet the emerging market demands which is expanding. Increased efficiency is expected to enhance the capability and competitiveness of domestic tofu industries on both regional and

global markets. In the tofu industry, the cases of low technical efficiency are observed either due to low quality soybean inputs and small scale techniques of processing. This leads to high costs and minimization of the yields hence renders a lot of resource useless. (Damien Beillouin; et al., 2019) Besides, the added value proportion generally could not cover for the further development of tofu industry in a sustainable way. This problem is made worse by the fact that small and; medium-scale tofu producers have little or no access to technologies, capital, and training. small; and medium-scale tofu producers. As the result, this research is pertinent for the purpose of ascertaining possible areas of enhancing the production effectiveness and realizing more added value. (Grivins et al., 2021) Potential in meeting consumer demand for healthy, inexpensive, and nutrient-rich foods. However, the tofu industry at the local level often faces challenges such as technical, price, and economic inefficiencies that hinder its competitiveness. (Amridha et al., 2020) This study is relevant to understand the factors that influence efficiency and value-added in the tofu production process, with the aim of increasing profitability, reducing waste, and responding to the needs of the growing global market that continues to grow. Improved efficiency is expected to strengthen the competitiveness of the local tofu industry at both national and international levels. In the tofu industry, low technical efficiency In the tofu industry, low technical efficiency is often caused by sub-optimal input use, such as low-quality soybean raw materials and traditional production methods. These inefficiencies result in high production costs, sub-optimal yields and waste of resources. and waste of resources. In addition, the added value generated from tofu production is often inadequate to support sustainable growth of the industry in a sustainable manner. This problem is exacerbated by the lack of access to modern technology, capital, and training for small and medium tofu producers. (Kahar et al., 2023) Medium-sized tofu producers, therefore, this research is important to identify opportunities in improving production efficiency and creating greater added value through technological innovation and better management. through technological innovation and better management. The purpose of this study is to determine the extent of technical, allocative, and economic efficiency of the industry together with assessing the impact of tofu on improving the profitability of the industry in the study area.

(Kahar et al., 2023)The overall efficient performance of the tofu industry in the study area and its contribution to increased product value added. Furthermore, this research will analyze measures that may be taken to minimize inefficiencies and enhance products quality through employment of a: data-driven approach. (Lubis et al., 2021) Therefore, it is envisaged that from the findings of this study, specific suggestion will be made for the local tofu producers on how to use the available resources more efficiently, how to improve on the profitability and how to meet the ever changing markets' requirement. (Snyder, 2019) This research also seeks to grow the existing literature on efficiency of the vegetable protein-based food production. However, there is great potential to develop it into export-oriented product given the increasing demand for vegetable protein throughout the world. Nevertheless, as the local tofu may compete in the international market, it has to set and meet high

standards of quality and innovation in the production process. This research proved that increase of efficiency and generation of new values can play a role in meeting international tofu market standards. However, the use of sustainable techniques also requires much more attention, because they provide significant benefits.

(Handayani et al., 2018) Measures like using production waste to produce animal fodder or bio-fuels will enhance the image perception of tofu products as a friendly food option. Bioenergy can also increase customers' perception of tofu products on the fact that these foods are environmentally friendly foods. (Rizwan et al., 2020; Selvia et al., 2019) This research thus serves to validate the assertion that it is possible to bring efficiency and value added in the tofu industry towards element of strategy in the tofu industry towards sustainability and competitiveness. Some of the recommendations made are as follows; the adoption of modern technology, human resource development, and the improvement of market access. (Rinaldi et al., 2023) For this purpose, collaborations with research institutions and the government necessary for forming the policies that are to help the tofu industry also innovate. By the realization of this strategy, it will be possible for the industry to create a huge impact towards the development of local economy satisfying the demands of the regional market demand tofu and local, global demand for vegetable protein.

(Vinolina & Sidabutar, 2023) 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. (Rizwan et al., 2020) 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. (Matthews, 1992) 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. (Purwaningrum & Purnomo, n.d.) 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. (Handayani et al., 2018) 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 Return 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

([BPS] Badan Pusat Statistik, 2021; Badan Pusat Statistik, 2020; Handayani et al., 2018; Sugiyono, 2017) This research employs a descriptive research method and the data collected is in the form of time series from 2019 to 2023 to estimate technical, allocative and economic efficiency. The data were collected using direct observation and interviews with tofu producers in the research site. The efficiency assessment was conducted with the help of an econometric model that estimates the relationship between the marginal value of the product to the input price. This way, one can understand which production factors have potential for further improvement. However, there was a value-added assessment that was determined by subtracting the cost of the input used in the production by the final value of the tofu products.

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

To see the technical efficiency using the following formula: $NPM_x = \frac{P_y}{P_x} \frac{Y}{X}$

$NPM_x = P_x$ or P_y

$PM = P_y + P_x$

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 : $\frac{NPM}{P_x} = \frac{PR_y P_y}{P_x}$

(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 $NPM/P_x > 1$, it means that the availability of input X is not efficient and needs to be increased.
- If $NPM/P_x = 1$, the availability of input X is efficient.
- If $NPM/P_x < 1$, 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: $b_i \cdot Y \cdot P_y / x = P_x$ Or $b_i \cdot Y \cdot P_y / X \cdot P_x$

Description:

P_x = Price of factor of production
 P_y = Output price
 Y = Output/Production
 b_i = Regression coefficient
 X = Factor of Production

With Criteria:

- If $\frac{b_i Y P_y}{X \cdot P_x} > 1$ This means that the availability of input x is not efficient. To achieve efficiency, input x must be increased.
- If $\frac{b_i Y P_y}{X \cdot P_x} = 1$ This means that the availability of input X is efficient.
- If $\frac{b_i Y P_y}{X \cdot P_x} < 1$ 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:

$EE = ET \times EA$

Description:

EE = Economic Efficiency
 ET = Technical Efficiency
 EA = Allocative Efficiency (price)

With criteria:

- If $ET \times EA < 1$, then input availability is not efficient and needs to be increased.
- If $ET \times EA = 1$, then input availability is efficient.
- If $ET \times EA >$, 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 = $\frac{\text{The Total Production Cost}}{\text{The Farmer's Price}}$

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

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%))

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

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 = 100-50=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

$$\begin{aligned} \text{Gross value added (NTb)} \\ \text{NTb} &= \text{Na} - \text{BA} \\ &= \text{Na} - (\text{Bb} + \text{Bp}) \end{aligned}$$

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)

$$NTn = NTb - NP$$

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

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. $P_y/X.P_x$	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 over-allocation. 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 $B_i \times Y \times P_y / P_x = 157,754.473$, 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 (2,495,352,479) 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.

Disclaimer (Artificial intelligence)

Details of the AI usage are given below:

1. ChatGPT

2. JENNI AI

References

- [BPS] Badan Pusat Statistik. (2021). Statistik Indonesia. *BPS-Statistics Indonesia*.
- Amridha, Y., Heryanto, M. A., Saefudin, B. R., & Awaliyah, F. (2020). the Analysis of the Employee's Job Satisfaction and Performance in Private Agricultural Company. *MAHATANI: Jurnal Agribisnis (Agribusiness and Agricultural Economics Journal)*, 2(2), 122. <https://doi.org/10.52434/mja.v2i2.789>
- Badan Pusat Statistik. (2020). Catalog : 1101001. *Statistik Indonesia 2020, 1101001*, 790. <https://www.bps.go.id/publication/2020/04/29/e9011b3155d45d70823c141f/statistik-indonesia-2020.html>
- Damien Beillouin, Tamara Ben-Ari, & Makowski, D. (2019). global crop diversity Evidence map of crop diversification strategies at the global scale Erratum : Evidence map of crop diversi fication strategies at the global. *Environ. Res. Lett.*, 14 (2019), 1–13.
- Grivins, M., Thorsøe, M. H., & Maye, D. (2021). Financial subjectivities in the agricultural sector: A comparative analysis of relations between farmers and banks in Latvia, Denmark and the UK. *Journal of Rural Studies*, 86(February 2020), 117–126. <https://doi.org/10.1016/j.jrurstud.2021.06.006>
- Handayani, L., Rauf, A., Rahmawaty, & Supriana, T. (2018). The strategy of sustainable soybean development to increase soybean needs in North Sumatera. *IOP Conference Series: Earth and Environmental Science*, 122(1). <https://doi.org/10.1088/1755-1315/122/1/012018>

- Kahar, F. A., Wardhono, A., Wahyudi, E., & Fadah, I. (2023). Determinants of Soybean Production and Imports in Indonesia 1. *Orginal Article*, 2(4), 710–717. <https://doi.org/10.56472/25835238/IRJEMS-V2I4P184>
- Lubis, I., Atmaja, I. S. F., Koesoemaningtyas, T., Ghulamahdi, M., Purnamawati, H., & Shiraiwa, T. (2021). Growth Performance and Productivity of Several Soybean Genotypes (*Glycine max* L. Merr.) Cultivated at High Altitude Areas in Indonesia. *Journal of Tropical Crop Science*, 8(01), 1–7. <https://doi.org/10.29244/jtcs.8.01.1-7>
- Matthews, A. (1992). Principles of Agricultural Economics. In *Agricultural Economics* (Vol. 6, Issue 3). <https://doi.org/10.1111/j.1574-0862.1992.tb00184.x>
- Purwaningrum, P., & Purnomo, A. (n.d.). *Analysis of Raw Material Inventory Control in Tofu Business in Wonomarto Village*. 03(02), 1102–1114.
- Rinaldi, J., Arya, N. N., Mahaputra, I. K., Elisabeth, D. A. A., Resiani, N. M. D., Arsana, I. G. K. D., & Silitonga, T. F. (2023). Production factors, technical, and economic efficiency of soybean (*Glycine max* L. Merr.) farming in Indonesia. *Open Agriculture*, 8(1). <https://doi.org/10.1515/opag-2022-0194>
- Rizwan, M., Rauf, A., Rahmawaty, & Akub, E. N. (2020). Response of Physiology, Growth and Yield of Soybean Varieties on Fertilization Treatment in Agroforestry Systems. *Russian Journal of Agricultural and Socio-Economic Sciences*, 102(6), 145–154. <https://doi.org/10.18551/rjoas.2020-06.17>
- Selvia, I. N., Sahar, A., & Hasanah, Y. (2019). Growth response and N uptake of two soybean varieties on inoculation of *Bradyrhizobium* sp. in Ultisol Binjai, Sumatera Utara. *IOP Conference Series: Earth and Environmental Science*, 260(1). <https://doi.org/10.1088/1755-1315/260/1/012129>
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Sugiyono. (2017). *Qualitative, Quantitative and R&D Research Methods*. Alfabeta, Bandung.
- Vinolina, N. S., & Sidabutar, A. (2023). The effect of biological fertilizer and organic fertilizer in growth and biomass of Pegagan (*Centella asiatica* (L.) Urban) from Simalungun accession. *IOP Conference Series: Earth and Environmental Science*, 1241(1). <https://doi.org/10.1088/1755-1315/1241/1/012005>