Development and potential analysis of cassava-based agroindustry in North Sumatera

A A Simanjuntak, T Supriana*, S N Lubis and R Ginting
Magister of Agribusiness, Faculty of Agriculture, Universitas Sumatera Utara, Medan, Indonesia.

E-mail: *tavi@usu.ac.id

Abstract. This study aimed to analyse the influencing factors of the cassava-based agroindustry development in North Sumatera and the strategies needed for the development of cassava-based agroindustry. This research used internal and external analysis and strategy measurement was conducted with Interpretive Structural Modelling (ISM). The research results were in the cell position I. ISM (Interpretive Structural Modelling) method could formulate the development strategies, namely: 1) The role of the government had to be further enhanced in agro-industrial development; 2) Dissemination of technological innovations led to efficient production processes; 3) Optimizing agro-industrial clusters; 4) Improving business management of the actors on cassava-based agroindustry and 5) Growing the partnerships in marketing.

1. Introduction
North Sumatera Province is the largest producer of cassava in Indonesia from 1993 to 2015 with an average production of 18 tonnes/ha/year [1]. Cassava has the potential as a food material and also as a raw material for non-food industries. In addition, the results of processed cassava can be exported to generate foreign exchange. This gives a very positive and big contribution to the welfare of the community, especially in North Sumatera, with a total production of up to 532,873 tons, more than total production of rice.

The emergence of the tapioca industry in the cassava centre villages made farmers unable to meet their economic needs. Tapioca industry is growing rapidly on its own with its business orientation, absorbing labour and fulfilling the needs of raw material for producers by purchasing cassava from farmers at a very cheap price [2].

Various kinds of obstacles in the development of the cassava-based agroindustry above also occur in the province of North Sumatera. These constraints have caused the development of cassava-based agroindustry in North Sumatera to experience an increase, decrease or fluctuate. In fact, the cassava-based agroindustry has the potential to be developed. With the support by a land area of 16.904 ha, the number of farmers in cassava farming is quite a lot, reaching 90 percent of the sample location population, the amount of production is abundant, and the plants are easy to grow with the potential for quite a lot of idle land [3]. Based on above explanation, the objectives of this study were: 1) To analyse the factors influencing the development of cassava-based agroindustry; 2) To analyse the strategies needed for the development of cassava-based agroindustry in North Sumatera.
2. Methods

2.1. Data collection

Data collection was carried out at the research site, namely Serdang Bedagai district, North Sumatera. Where Sergai district is the largest cassava producer in North Sumatra Province, reaching 500 tons/year. Primary data was obtained through direct observation with respondents to determine the external and internal environmental strategic factors and other information related to the object of research. Observations were carried out either through questionnaires or direct interviews with experts and stakeholders related to the research topic.

2.2. Data analysis method

The identification of the agro-industrial system structure was conducted by using the IE matrix through evaluating internal and external factors. Internal factors are more described from within in the form of strengths and weaknesses, while external factors are described from outside the entity where these factors are not directly involved in the research. These external factors are opportunities and threats. The purpose of internal and external evaluation was to measure the extent to which the strengths and weaknesses are owned [4]. The identification stage of internal factors is by registering all the strengths and weaknesses of the company. Presentation of data with positive factors (strengths) is written before negative factors (weaknesses). Likewise, with the identification stage of the company's external factors. Determination of the weight in the internal and external analysis of the company is done by asking questions to respondents using the paired comparison method (paired comparison). Rating describes how effective the company's current strategy is in responding to existing strategic factors. Depicted from a scale of 1 to 4, the value 1 describes a poor ability to achieve the specified indicators, while the value 4 describes a very good ability to achieve the specified indicators.

The method of measuring strategy used was ISM (Interpretive Structural Model). The use of ISM was divided into two parts, namely hierarchical arrangement and sub-component classification. The hierarchy arrangement was done by dividing the structure into components and each component will be broken down into a number of sub-components. Restructuring was carried out by direct interviews in the field to obtain the main obstacle components, namely actor constraints in the form of policies from government elements, chairperson of the Farmer Group and academics of the main constraint components will be determined the most decisive sub-components in the development of the agro-industry. Determination of the contextual relationship between the sub-components containing a direction in subordinate terminology led to pairwise comparisons (by experts). If the number of experts was more than one, then it would be levelled. The contextual relationship was presented in the form of a Structural Self-Interaction Matrix (SSIM) using the VAXO symbol, which was then transformed into a binary matrix form (numbers '0' and '1'). After SSIM was formed, then the Reachability Matrix (RM) table was created by replacing V, A, X, and O into numbers 1 and 0. Conversion rules; 1)If the relation (i, j) is denoted as V then input (i, j) in RM becomes 1 and (j, i) to 0, ; 2)If the relation (i, j) is denoted as A then input (i, j) in RM becomes 0 and (j, i) to 1, ; 3)If the relation (i, j) is denoted as X then input (i, j) in RM becomes 1 and (j, i) to 1, ; 4)If the relation (i, j) is denoted as O then input (i, j) in RM becomes 0 and (j, i) to 0. Furthermore, the Transitivity rule was calculated by making a collection towards SSIM to form a closed matrix, which was then processed further. From the Reachability matrix final table, the value of the driver power could be seen by adding the value of the sub-components horizontally, in which the value of the sequence was determined based on the value of the driver power sorted from largest to smallest, while the value of dependence was obtained from the sum of the values of the sub components vertically and the level value was determined based on the value of the dependence sorted from largest to smallest [5].
3. Results and discussion

3.1. Analysis of internal and external factors
The results of the internal factors analysis of cassava-based agroindustry in North Sumatera are presented in Table 1. The results of the external factors analysis of cassava-based agroindustry in North Sumatera are presented in Table 2.

**Table 1. Internal factors analysis of cassava-based agroindustry in North Sumatera.**

| No | Internal Factor                          | The Weight | Rating | Score |
|----|------------------------------------------|------------|--------|-------|
|    | **Strengths**                            |            |        |       |
| 1  | Raw Materials Availability               | 0.27       | 4.00   | 1.07  |
| 2  | Labour Availability                      | 0.07       | 2.57   | 0.17  |
| 3  | Easy Processing                          | 0.20       | 2.80   | 0.56  |
| 4  | Profitable Venture                       | 0.33       | 3.00   | 1.00  |
| 5  | Continuous Production                    | 0.13       | 2.43   | 0.32  |
|    | **The Total of Strengths**               | **1.00**   | **3.12**|       |
|    | **Weaknesses**                           |            |        |       |
| 1  | Passive/Limited Marketing                | 0.07       | 2.43   | 0.16  |
| 2  | Not Applying Product Innovation Yet      | 0.27       | 2.80   | 0.75  |
| 3  | Unavailability of Product Quality Standard| 0.20       | 2.10   | 0.42  |
| 4  | Traditional Processing                   | 0.13       | 2.63   | 0.35  |
| 5  | Small Production Scale                   | 0.33       | 2.57   | 0.86  |
|    | **The Total of Weaknesses**              | **1.00**   | **2.54**|       |
|    | **S – W**                                | 0.59       |        |       |

**Table 2. External factors analysis of cassava-based agroindustry in North Sumatera.**

| No | External Factors                                      | The Weight | Rating | Score |
|----|-------------------------------------------------------|------------|--------|-------|
|    | **Opportunities**                                     |            |        |       |
| 1  | The Increasing of Revenue                             | 0.27       | 3.00   | 0.80  |
| 2  | Demand from Modern Market and Open Export             | 0.33       | 2.90   | 0.97  |
| 3  | Reachable Sales Location                              | 0.20       | 3.00   | 0.60  |
| 4  | Good Road Access                                      | 0.13       | 2.00   | 0.27  |
| 5  | The Availability of Employment                        | 0.07       | 2.60   | 0.17  |
|    | **The Total of Opportunities**                        | **1.00**   | **2.81**|       |
|    | **Threats**                                           |            |        |       |
| 1  | Continuously Lower Production                         | 0.27       | 2.60   | 0.69  |
| 2  | Move to Another Business                              | 0.20       | 2.13   | 0.43  |
| 3  | Fluctuation of Raw Materials’ Price                   | 0.33       | 3.00   | 1.00  |
| 4  | The Wholesale Is Very Far                             | 0.13       | 3.00   | 0.40  |
| 5  | No Good Bookkeeping yet from the Business Owners      | 0.07       | 2.07   | 0.14  |
|    | **The Total of Threats**                              | **1.00**   | **2.66**|       |
|    | **O – T**                                             |            |        | **0.15**|
From Table 1, cassava-based agroindustry was able to take advantage of its strengths (3.12) to reduce its weaknesses (2.54). The greatest strength of this agroindustry was the availability of raw materials with the largest score of 1.07 and the smallest strength was the availability of labour with a score of 0.17. The main weakness of this agroindustry was passive/limited marketing with a score of 0.16.

From Table 2, the cassava-based agroindustry was able to take advantage of opportunities (2.81) to face threats (2.66). The biggest opportunity was the demand from modern market/open export with a score of 0.97 and the smallest opportunity was the availability of employment with a score of 0.17. The biggest threat to this agroindustry was the fluctuation of raw materials’ price with a score of 1.00 and the smallest threat was the absence of good bookkeeping from business owners with a score of 0.14.

3.2. ISM (Interpretive Structural Model) analysis
The results of the ISM (Interpretive Structural Model) analysis of the cassava-based agroindustry in North Sumatera are presented in Table 3.

| R1  | R2  | R3  | R4  | R5  |  DP  | RANK |
|-----|-----|-----|-----|-----|------|------|
| R1  | 1   | 1   | 1   | 1   | 0    | 4    | 1    |
| R2  | 0   | 1   | 1   | 1   | 0    | 3    | 2    |
| R3  | 0   | 0   | 1   | 1   | 0    | 2    | 3    |
| R4  | 1   | 1   | 0   | 1   | 0    | 3    | 2    |
| R5  | 1   | 0   | 1   | 0   | 1    | 3    | 2    |
| DEP | 3   | 3   | 4   | 4   | 1    |      |      |
| RANK| 2   | 2   | 1   | 1   | 3    |      |      |

From Table 3, R1 was the Head of Agriculture Service in Serdang Bedagai, R2 was the Agriculture Section Chief of Serdang Bedagai, R3 was the Agricultural Extension, R4 was the Chairperson of the Farmer Group, R5 was an academician. The largest Drive Power value was R1 (Head of Department) and the smallest was R3 (agricultural extension).

The results of ISM (Interpretive Structural Model) analysis based on the component classification are presented in Figure 1.

![Figure 1. Classification of components.](image-url)
From Figure 1, it can be seen that the key element in the cassava-based agroindustry in North Sumatera was R1 (Head of the Agriculture Service) as a strategic decision maker, who could determine favourable policies for agroindustry business actors.

4. Conclusions
Based on the analysis of internal factors, the cassava-based agroindustry was able to take advantage of its strengths to reduce its weaknesses. Based on the analysis of external factors, the cassava-based agroindustry could take advantage of the existing opportunities to face the threats. Based on ISM (Interpretive Structural Model) analysis, the key element was the government as a policy maker, who could decide policies that were beneficial for cassava-based agroindustry business actors in North Sumatera.

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