

## DETERMINING FACTORS OF AGRIBUSINESS SYSTEM DEVELOPMENT RED CHILLIES IN NORTH SUMATRA PROVINCE

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### Abstract:

This study aims to identify the main determinants and determine priority activities in the context of developing the red chili agribusiness system in North Sumatra Province. This research was conducted in North Sumatra Province which is the 3rd largest red chili producing centre in Indonesia. The data used are primary data derived from in-depth interviews with experts, local governments, academics, and practitioners related to the red chili agribusiness system in North Sumatra. Data analysis method using Interpretative Structural Modelling (ISM). The analytical method used : (a) analysis of net income is the difference between gross incomes minus total production costs. (b) Multivariate linear regression analysis to explain the effect of variable costs of seeds, fertilizers, pesticides, labour, mulch, to net income. Then the red chili development strategy in the region of North Sumatra Province is in quadrant 1 where it supports an aggressive strategy that describes a very good situation because it has opportunities and strengths, so it can be take advantage of existing opportunities, the strategies that must be implemented support the policy aggressive growth. In support of an aggressive growth policy, priority strategy that can be applied in agribusiness development efforts for chili farming in Indonesia attacking agropolitan districts is to implement the five strategies of agriculture, planting, using superior seeds and utilizing soil fertility and optimizing resources humans so that the production of limited resources and the attack of plant disease organisms can overcome. The results showed that there are 6 determining factors that have a strong driving force in the development of the red chili agribusiness system including production, increasing the capacity of extension workers, employment, price stability, land leases, as well as marketing agencies. Based on this, priority activities that have a strong driving force in the development of the red chili agribusiness system are increasing production, increasing productivity and quality of red chili commodities, increasing product down streaming, implementing Good Agricultural Practice (GAP) and increasing agricultural human resource capacity.

**Keywords:** Determinants, Red Chili, Agribusiness System, ISM.

### INTRODUCTION

Development is a process of planned change, continuous and gradual development towards a better and growing level of activity. To achieve this goal, development must be carried out in stages and planned in an integrated and comprehensive manner. One of the keys to successful development is agricultural development which is the main sector in the economy (Isbah & Iyan, 2016).

Agribusiness is a system consisting of several sub-systems which are incorporated in a series of systems, starting from the provision of production factors, marketing, down streaming, and supporting institutions. The agribusiness system is able to bring the performance of the agricultural sector to continue to grow optimally and sustainably. One of the agricultural commodities that have an important role in the economy is red chili. Red chili needs to get

attention because it has an important position in determining inflation. In addition, red chilies play an important role in society, especially for household needs and also play a role in anticipating consumer nutrition, in addition, red chilies if developed for business value can easily enter the market.(Lubis, Harisudin, & Fajarningsih, 2019).

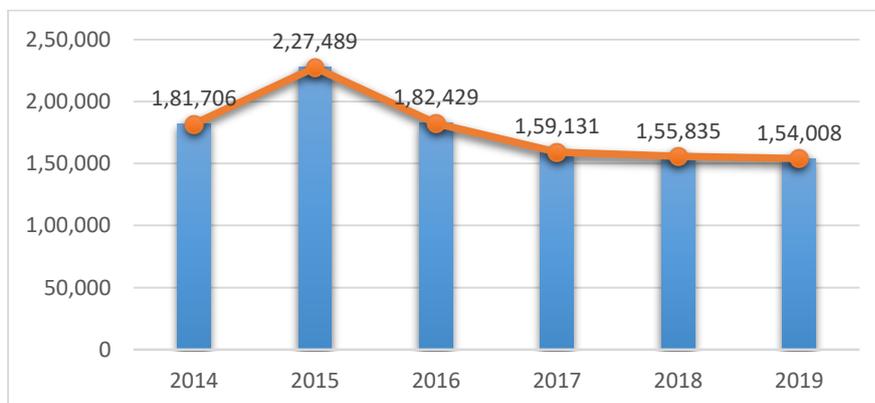
North Sumatra is the 3rd largest red chili producing province in Indonesia in 2019. Red chili production in North Sumatra in 2019 reached 154,008 tons. This value decreased by 1,827 tons compared to the previous year which reached production of 155.835 tons.

**Table 1: Development of Red Chili Production by Province, 2018-2019**

province	Production (Tons)		
	2018	2019	2018-2019 Absolute (%)
West Java	274,037	263.949	-3.68
Central Java	171,796	164.906	-4.01
North Sumatra	155.835	154,008	-1.17
West Sumatra	106.061	139.9994	31.99
East Java	91,965	104.677	13.82
<b>Total</b>	<b>799,694</b>	<b>827,534</b>	<b>36.95</b>

Source: Ministry of Agriculture Republic of Indonesia, 2020

On the other hand, the development of red chili production in North Sumatra Province during the period 2014-2019 tends to decrease every year. The average decline that occurs is -2.13% per year.



**Figure 1: Development of Red Chili Production in North Sumatra Province.**

In general, red chili commodities have not reached optimal levels and tend to have a high risk. This is due to several things, such as drought, pest and disease attacks, heavy rainfall during harvest, and the low level of downstream technology used, which causes selling prices to drop at harvest time. In addition, long marketing channels affect the income received by farmers. In general, among the marketing actors of red chili, the position of farmers is the weakest due to

limited capital and information received by farmers so that farmers face uncertainty in selling prices.(Fitriani, 2015).

Various problems that occur in red chili commodities indicate that the development of red chili commodities has not been optimal with a more holistic approach. Development with a more holistic approach is defined as a form of solving problems that occur by looking at all related matters. This is what is called the development of an agribusiness approach.

Commodity development, especially red chili with an agribusiness approach, is directed at development in the context of achieving sustainable development, which means that the development of this commodity does not rely on the production aspect alone, but on other aspects that are viewed with an environmentally sound agribusiness perspective. With this, it is hoped that the development of red chili commodities with an agribusiness and regional approach will be able to improve and optimize welfare and quality of life.

This shows that the opportunity for agribusiness development is still very potential. In the context of developing red chili agribusiness in North Sumatra Province, the involvement of all parties is needed because the interrelationships between these sub-systems are very close and the success of agribusiness depends on the progress that can be achieved in each sub-system.(Hariance, Febriamansyah, & Tanjung, 2016).

The purpose of this study is to identify the main determinants in the development of the red chili agribusiness system, determine the relevant institutions that play a role in the development of the red chili agribusiness system, and determine priority activities as a policy agenda for the development of the red chili agribusiness system.

## **METHODOLOGY**

This research was carried out in June 2021. The location of this research was determined with the consideration that North Sumatra Province is the 3rd largest red chili producing center in Indonesia so it has the potential for further development.

Respondents in this study are key informants in the form of parties/subjects who are very understanding, long enough, and have intensively had activities, have information and are involved in developing red chili agribusiness in North Sumatra Province. The technique of determining the sample is the snowball sampling technique. In this study, the number of respondents was 20 people. The data used in this study are primary and secondary data taken through in-depth interviews with key informants. Secondary data comes from publications from the Central Statistics Agency, related agencies, journals and other related publications.

The data analysis in this research is the analysis of Interpretative Structural Modeling (ISM). The ISM method is a method used in analyzing the keys involved to solve complex problems. ISM is a useful aid to individuals and small groups in developing complex understandings and helps to impose order and direction on complex relationships between elements of a system (Chaudhuri A. et al. 2016). ISM is a modeling technique that is able to synchronize the opinions of experts into a concrete Figure in a hierarchical structure of sub-elements of each system

element, and in finding key sub-elements in each sub-elements (Saxena et al., 2006; Sushil, 2013). ).

The following are the steps for implementing ISM:

- a. Take elements/variables and short lists related to the problem being researched.
- b. Expert opinion should be used to build contextual relationships among various elements or variables.
- c. The development of a Structural Self Interaction Matrix (SSIM) for variables, shows a one-to-one relationship between the variables being studied.
- d. Transforming Structural Self Interaction Matrix into Reachability with Matrix n replacing VAXO with binary numbers.
- e. Transitivity is tested for each combination of variables and requires changes to develop a final range matrix.
- f. ISM development through conversion of affordability matrix into a diagram.
- g. The model should be checked for any conceptual errors and necessary changes should be made if necessary.
- h. With the use of driving power and their respective dependencies
- i. to get a driver dependency map for a better analysis of the interrelationships between variables (Behl.A, et al. 2016).

This is in line with research Purwandani, Rahayu & Setyowati (2016) in KulonProgo Regency, which states that development of the Pranaji Gisik Auction Market in Panjatan District can be done by market expansion by utilizing online media (internet) or information technology to attract Trader Alternative strategy that has value the lowest is strategy 01 with a weight value of priority 0.059.

## RESULTS AND DISCUSSION

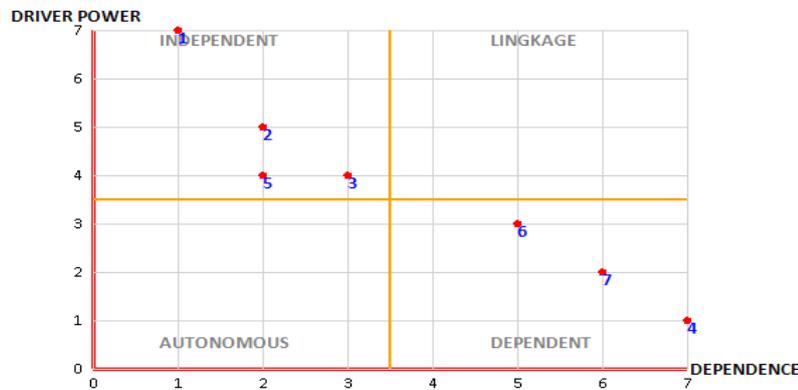
### Determinants of the Red Chili Agribusiness System in North Sumatra Province

#### 1. Elements of Natural Resources and Environment

This first determining factor has 7 sub-elements in the development of the red chili agribusiness system including production, productivity, land suitability, crop rotation, certified seeds, irrigation systems and risk management. The results of the ISM analysis based on Driver Power (DP) Dependence (D) show four sub elements included in the Independent (IV) sector, namely (1) Production (quality and quantity), (2) Productivity, (3) Land suitability, and (5 ) Certified seeds. This means that the sub-element has a strong driving force (DP) and weak dependence (D). Where the four sub-elements of natural resources and the environment have a large impact on other sub-elements, but are not easily affected by other sub-elements of the system.

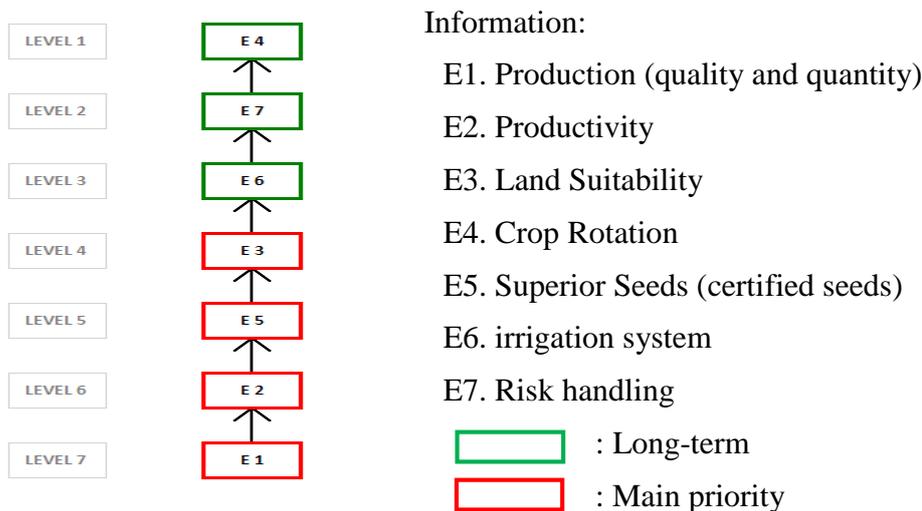
In addition, there are 3 sub-elements of natural resources and the environment in the Dependent sector, the first determining factors for the development of red chili agribusiness systems, namely (4) crop rotation, (6) irrigation systems and (7) risk management. This shows that these

sub-elements have a weak driving force (DP) for the development of the red chili agribusiness system and strong linkages (D) with other sub-elements.



**Figure 2: DP-D Matrix Elements of Natural Resources and Environment**

The structuring of the first determining factor sub-elements shows the driving force of the first determining factor element on the natural resources and other environmental sub-elements (Figure 3). The structure of natural resources and the environment are arranged according to priority objectives. The structure is shaped in a hierarchy from the lowest priority (Level 1) and the highest (Level 3). Production, productivity, superior seeds and land suitability from Level 7 to Level 4 respectively are the first determinants that become the basic conditions for achieving the first determinants. Furthermore, the irrigation system and risk management are also at Level 3 and Level 2, respectively. And then the sub-element that is at the lowest level (level 1) in the first determining factor of the red chili agribusiness system is crop rotation.



**Figure 3: Hierarchical Structure Elements of Natural Resources and Environment**

In farming activities, management is needed in its implementation. Supported by previous research Firman., et al (2016) it is said that if farming is not optimal in doing farming management, then production the output will not be optimal. For that, according to the results of the study that has been done, it is found that the farmers of Karang Anyar Village, Beringin District, Deli Serdang Regency has implemented management in carrying out red chili farming. It can be seen from already implementation of management functions such as: Planning (Planning), Organizing, Actuating and Monitoring (Controlling) in the implementation of red chili farming.

## 2. Elements of Human Resources

The determining factor of the second element in the development of the red chili agribusiness system is human resources which consists of 5 sub elements as described in table 2.

**Table 2: Human Resources Sub-Elements**

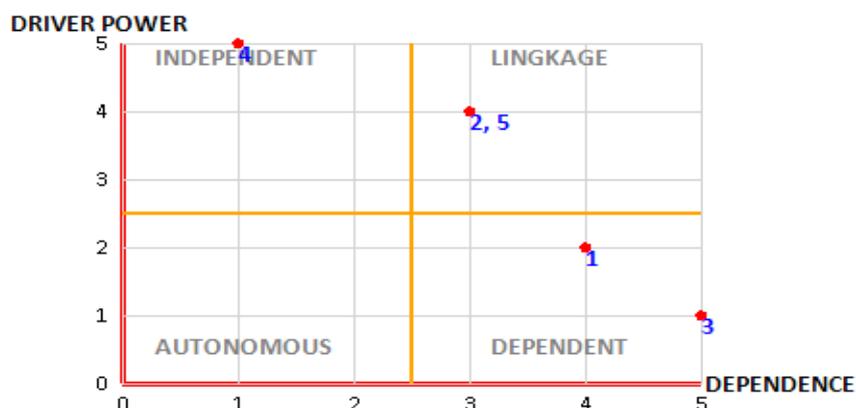
No	Sub-Element
1	Farmer education
2	Farmer skills/Farmers capacity
3	Number of farmers
4	Capacity building for extension workers
5	Farmer regeneration

Source: Primary Data (Processed 2021)

Based on the ISM analysis, it shows that there is 1 sub-element that is included in the Independent sector (IV): (4) Extension of Extension Capacity. This means that these sub-elements have a strong driving force (DP) and weak dependence (D) in the determinants of the two red chili agribusiness systems, namely human resources.

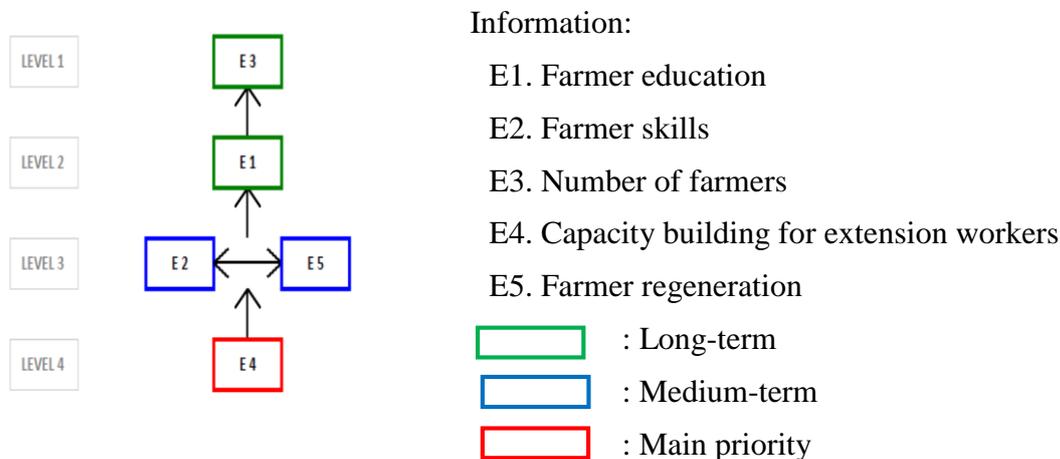
In addition, the results of the ISM analysis in the Linkage sector show that the second determining factor in the development of the red chili agribusiness system has two sub-elements, namely: (2) Farmer skills/farmer capacity and (5) Farmer regeneration. This shows that the two sub-elements have a strong driving force (DP) and a large dependence (D) on the development of the red chili agribusiness system.

And finally, the results of the ISM analysis in the Dependent sector show that there are two sub-elements of the determinants of the second element in the development of the red chili agribusiness system, namely (1) Farmer education and (3) Number of farmers. This shows that the two sub-elements have a weak driving force (DP) towards the development of the red chili agribusiness system and their relationship (D) with other sub-elements is strong.



**Figure 4: DD Matrix Elements of Human Resources**

The second determining factor is the increase in the capacity of the extension workers who are at the highest level (level 4) which is the basic condition for achieving the other second determinants. In the agribusiness system, increasing the capacity of extension workers has a great driving force to encourage the achievement of human resources. Meanwhile, the sub-elements at level 3 are farmer skills/farmer capacity and farmer regeneration. The achievement of HR sub-elements at levels 4 and 3 will have a major impact on efforts to achieve human resources at levels 2 and 1, namely farmer education and the number of farmers.

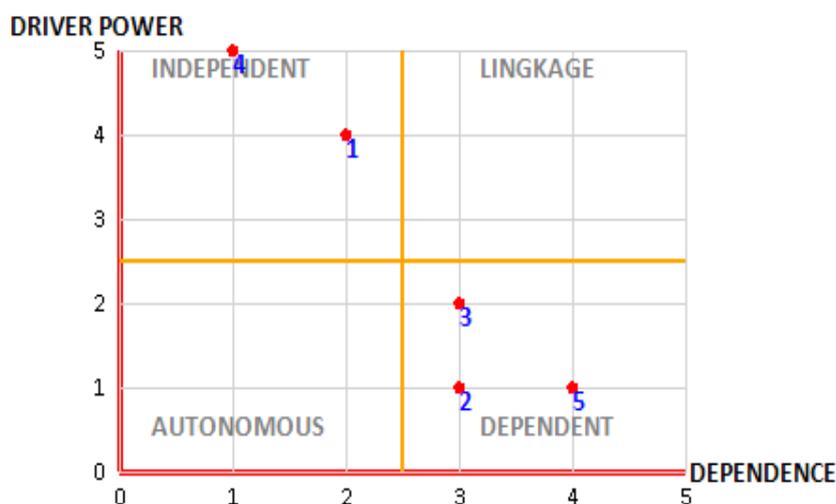


**Figure 5: Hierarchical Structure Elements of Human Resources**

Research result Nugrahapsari and Arsanti (2018) show that the import restriction policy causes the supply of chili to become more stable. However, there are still seasonal price variations. so it needs to be followed by guarantee efforts chili preparations throughout the season.

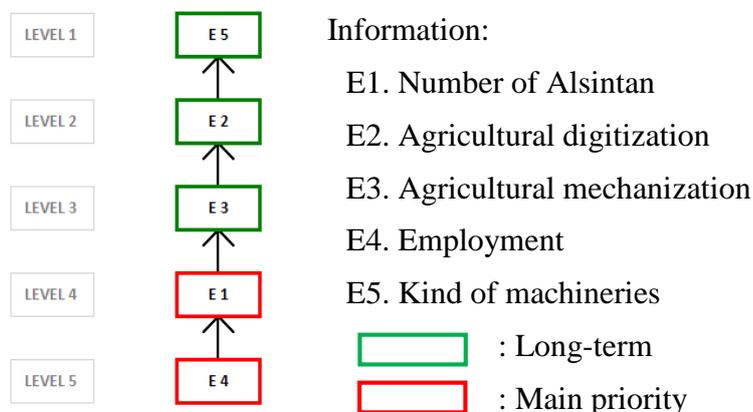
### 3. Elements of Science and Technology

The sub-elements included in science and technology includes the number of agricultural machine tools (1), agricultural digitization (2), agricultural mechanization (3), employment (4), and types of agricultural machine tools (5). Of the 5 sub-elements, it shows that there are 2 sub-elements in the Independent sector in determining the development of the red chili agribusiness system, namely (4) employment and (1) the number of agricultural machinery. This shows that these 3 sub-elements are the main drivers of other elements. Meanwhile, the Dependent sector shows that there are 3 sub-elements, namely (3) agricultural mechanization, (2) agricultural digitalization and (5) types of machinery and equipment which are sub-elements with weak driving force.



**Figure 6: DP-D Matrix Elements of Natural Science and Technology**

The labor absorption sub-element is the sub-element that is at the highest level (level 5) as the determining factor for the main element. This sub-element is the determining factor. For experts, the absorption of the working population is caused by the demand for labor in the agricultural sector. The characteristics of the technology used in the development of agribusiness that are accommodative to the diversity of the quality of the workforce. In more detail, the priority structure for the elements of science and technology can be seen in Figure 7.



**Figure 7: Hierarchical Structure Elements of Science and Technology**

Quality seeds will produce optimal plant growth, so that productivity is high (Taghfir et al. 2018). Constraints faced in chili seeding are the limited number of farmers who use high quality and undeveloped seeds seed industry (Swastika et al. 2017). This matter causes a mismatch between the target areas with seed availability. Therefore, the development of a commodity must be able to answer the question what variety cultivated, how to stock up, and seed quality for the targeted area (Sudjindro 2009).

#### 4. Market Element

The fourth determining factor element consists of 5 sub-elements as shown in table 3.

**Table 3: Red Chili Agribusiness System Market Sub-Elements**

No	Sub-Element
1	Price stability
2	Marketing channel
3	Marketers
4	Market information/marketing access
5	Trade between regions (export/import)

Source: Primary Data (Processed 2021)

The results of the ISM analysis based on Driver Power (DP) - Dependence (D) as shown in Figure 8 show that there are 2 sub-elements namely (1) price stability and (4) Market information has a major influence on other sub elements but both are not easily influenced by other sub elements.

Meanwhile, the marketing channel sub-elements are linkage variables. This sub element needs to be handled carefully because it is unstable. This instability is because the marketing channel is a sub-element with high driving force but is also easily influenced by changes in other sub-elements.

Furthermore, there are two market sub-elements in the Dependent sector, the determining factors in the market element include (3) Marketing actors and (5) Inter-regional trade

(exports/imports) with weak driving force (DP) on the development of the red chili agribusiness system and its linkages (D ) with other strong sub-elements.

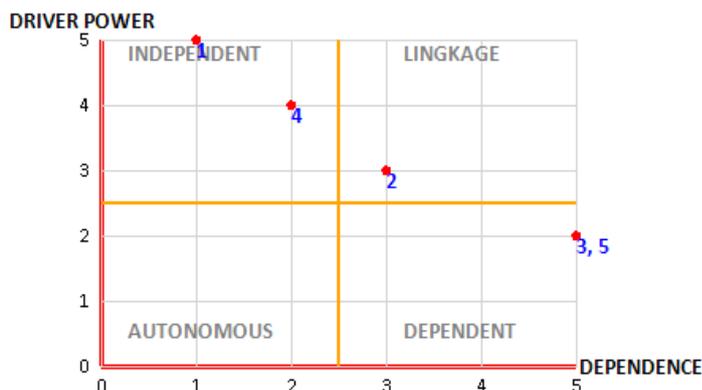


Figure 8: DP-D Matrix Market Element

The structuring of the sub-elements of the determinants of the market elements shows that the sub-elements of price stabilization are the sub-elements that are at the highest level (level 4) as the determining factor in the red chili agribusiness system. Where one of the issues in government policy is the policy of stabilizing the price of red chili and minimizing its impact on inflation. Furthermore, the sub-elements at Level 3 are market information/marketing access. The sub-elements at level 2 are marketing channels. And the sub-elements that are at the lowest level (Level 1) in the fourth determining factor in the red chili agribusiness system are marketing and trade actors between export/import regions.

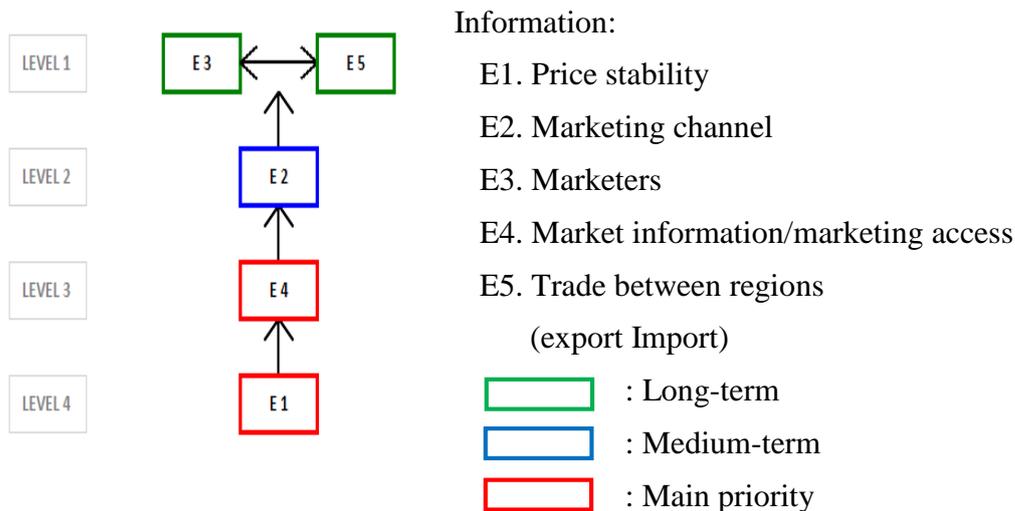


Figure 9: Hierarchical Structure Market Element

Rinaldi et al. (2017) argues that fertilizer subsidy policy has had a positive impact in red chili farming. Other research more focused on anticipating price fluctuations, among others, by Anwarudinsyah et al (2015) which emphasizes the need for regulation planting area and chili production in the dry season.

### 5. Financial Element

This fifth determinant element has 5 sub-elements in the development of the red chili agribusiness system which are described in Table 4.

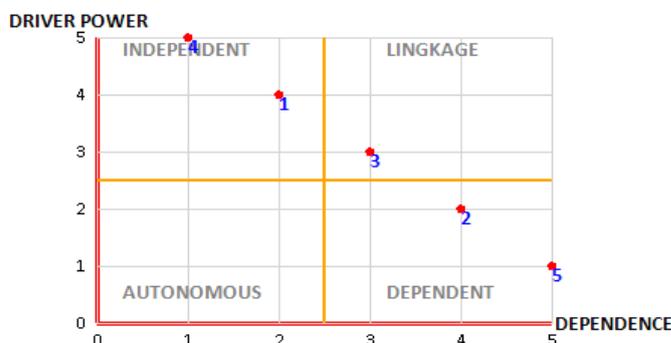
**Table 4: Sub-Elements of Finance/Working Capital**

No	Sub-Element
1	Fertilizer cost
2	Cost of seeds/seeds
3	Labor wages
4	Land lease
5	Tool shrinkage

Source: Primary Data (Processed 2021)

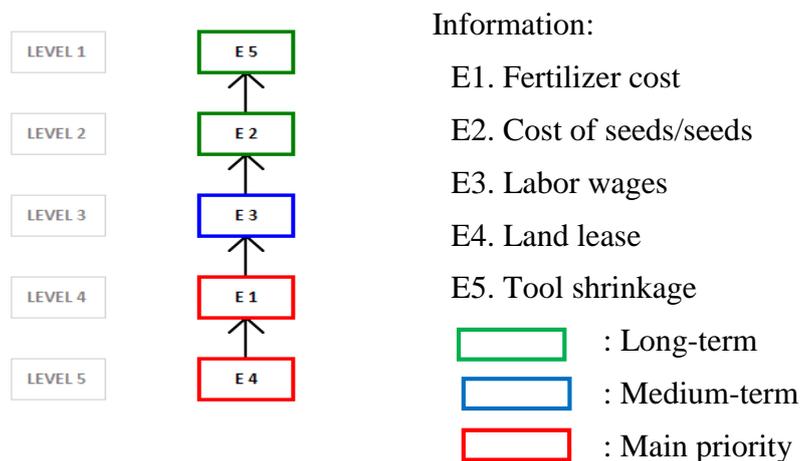
The results of the ISM analysis show that the sub-elements (4) land rent and (1) fertilizer costs are independent sub-elements. This means that the sub-elements are the main drivers in the red chili agribusiness system which is seen from the aspect of financial elements. Sub-elements of Finance/Working capital in the linkage sector, namely (3) labor wages. This means that this sub-element has a strong driving power and has a large impact between the sub-elements and has a large driving value and dependence on the development of the red chili agribusiness system.

Furthermore, there are two sub-elements of Finance/working capital in the dependent sector, the determinants of the development of the red chili agribusiness system, namely (2) the cost of seeds/seeds and (5) depreciation of equipment. This shows that the two sub-elements have a weak driving force (DP) towards the development of the red chili agribusiness system and their relationship (D) with other sub-elements is strong.



**Figure 10: DP-D Matrix Financial Elements/Working Capital**

The structuring of financial/working capital elements reflects the priority level of the objectives. Priority factors from the financial element are land rent and fertilizer costs. The next medium-term priority is labor wages. And then the sub-elements that are at level 2 and 1 respectively are the cost of seeds/seeds and equipment depreciation.



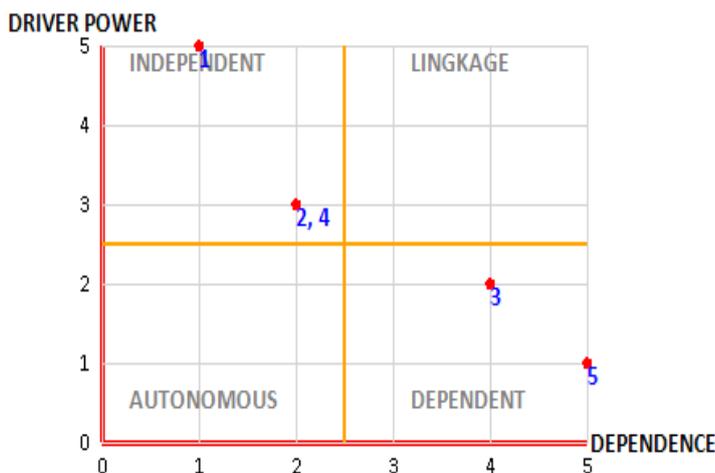
**Figure 11: Hierarchical Structure Financial Elements/Working Capital**

This is in line with the results of Reardon's research et al. (2007) which states that income non-farm enterprises can overcome obstacles capital faced by farmers. Income Non-farm businesses are also capital for farmers to select superior seeds and use

Fertilizers more intensively (Diirro 2013). Farmer who have non-farming income will invest their income to adopt agricultural technology (Dhraief et al. 2018).

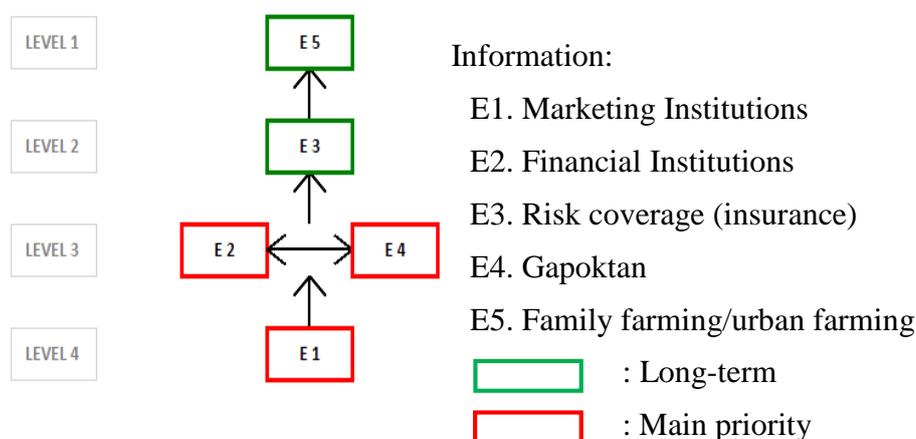
## 6. Organizations/Institutions

Organizational/institutional elements are divided into 5 sub-elements including marketing institutions, financial institutions, risk-taking (insurance), farmer groups / farmer group associations, and urban farming / family farming. The result is that there are 3 sub-elements that are included in the Independent (IV) sector, namely: (1) marketing institutions, (2) financial institutions and (4) gapoktan. This means that these sub-elements have a strong Driver Power in the determining factor. Meanwhile, there are two sub-elements in the Dependent sector, namely (3) Risk coverage (insurance) and (5) Family farming/urban farming. This shows that these sub-elements have a weak driving power towards the development of the red chili agribusiness system and their relationship with other sub-elements is strong.



**Figure 12: DP-D Matrix Organizational/Institutional Element**

The structuring of organizational/institutional elements states that the sub-elements of marketing institutions, financial institutions, and farmer group development are sub-elements that must be prioritized in the development of red chili agribusiness in North Sumatra.



**Figure 13: Hierarchical Structure Organizational/Institutional Element**

In line with the results of this study, Kuntariningsih and Mariyono (2013) explain that the agricultural technology introduced to the young farming community and have access to more credit allow it to be adopted by the farming community. In other words, the dissemination of the chili seedling method with high-yielding varieties should be carried out not only focus on the method itself, but the ability of financial resources farmers to access the technology. Need ensure that the farmers are financially able purchase or access technology components introduced nursery, starting from input procurement, seeding, to results seedlings ready to use.

### Priority Activities as Policy Agenda for Red Chili Agribusiness System Development

Activities and policies in the development of the red chili agribusiness system in North Sumatra Province are divided into 10 activity sub-elements (Table 5).

**Table 5: Elements of Priority Activities Defined as Policy Agendas in the Development of Red Chili Agribusiness Systems in North Sumatra Province**

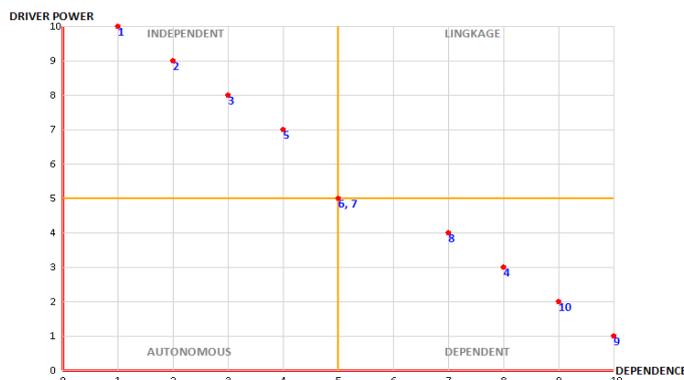
No	Sub-Element
1	Increased production, productivity and quality
2	Product downstream improvement
3	Good Agricultural Practice (GAP)
4	Good Handling Practice (GHP)
5	HR capacity building
6	Supply chain optimization
7	Institutional strengthening
8	Agricultural digitization
9	Optimization of agricultural education
10	Accessibility of financing

Source: Primary Data (Processed 2021)

As presented in (Figure 14) the grouping of the four sectors. Autonomous, Dependent, Linkage, and Independent were carried out to see the position of the interests of each activity that was set as the policy agenda for the development of the red chili agribusiness system. The results of the grouping show that of the 10 priority activities, four activities are in the Independent position which are priority activities, namely (1) Increased production, productivity and quality of results, (2) Increased down streaming of products, (3) Good Agricultural Practice (GAP) and (5) Capacity building of human resources. These four sub-elements have high driving force and have an impact on other sub-elements.

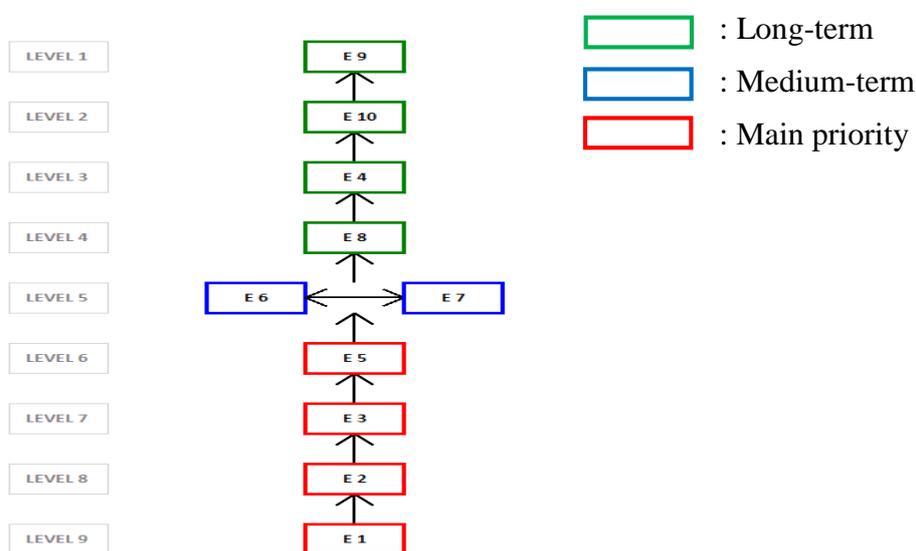
Furthermore, in the linkage sector there are 2 activities namely: (6) Supply chain optimization and (7) Institutional strengthening is a sub-element that shows it has a high driving value and dependence on the development of the red chili agribusiness system in North Sumatra.

Meanwhile, the focus of other activities is in the Dependent sector, which means that the four activity agendas have a weak driving force for the red chili agribusiness system development policy, but their relationship with other agendas is strong. The four agendas of these activities are: (8) Digitization of agriculture, (4) Good Handling Practice (GHP), (10) Accessibility of financing and (9) Optimizing agricultural education.



**Figure 14: DP-D Matrix Elements of activities that are set as a policy agenda in the development of the red chili agribusiness system in North Sumatra Province**

The structuring of priority activities as a policy agenda for developing red chili agribusiness systems in North Sumatra Province, shows that the main priorities that must be considered are increasing production, productivity, and quality of red chili products, increasing down streaming, implementing GAP, and increasing human resource capacity. More detail is shown in Figure 15 below.



**Figure 15: Hierarchical Structure Elements of activities set as policy agenda in the development of red chili agribusiness system in North Sumatra Province**

Information:

- E1. Increased production, productivity and quality of horticultural crops.
- E2. Product downstream improvement
- E3. Good Agricultural Practice (GAP)
- E4. Good Handling Practice (GHP)
- E5. HR capacity building
- E6. Supply chain optimization
- E7. Institutional strengthening
- E8. Agricultural digitization
- E9. Optimizing agricultural education for the horticulture sub-sector
- E10. Accessibility of financing

## CONCLUSIONS

Based on the results of the study, it can be concluded that the main determinants of each element have a strong driving force in the development of the red chili agribusiness system in North Sumatra, namely production, productivity, and quality (elements of natural resources and the environment). Capacity building for extension workers (human resources element), labor absorption (science and technology elements), price stability (market elements), land rent (financial elements/working capital), and marketing institutions (institutional elements).

Through these six main determinants, it is hoped that policy makers will jointly plan development activities that are integrative and comprehensive. The priority activities and policies in the context of developing the red chili agribusiness system in North Sumatra Province are: (1) Increasing production, productivity and quality of results, (2) Increasing product down streaming, (3) Good Agricultural Practice (GAP) and (4) Human resource capacity building.

## POLICY IMPLICATION

1. Strengthening the institutional forum both in building structure organizations at the provincial and district levels, formulate tasks the main points and functions of each part in detail, the importance of commitment support from the central, provincial, and local governments in funding and other facilitation.
2. Institutional forum will be able to run if the main tasks can be done well executed and obeyed by all members. The initial activity very important thing to do is collect data on production maps, maps, trade, and demand maps with reliable data support and accurate.
3. Integration of forum program and the Agropolitan program within the framework of development of vegetable agribusiness in the Agropolitan area, by placing roles and functions

of local community institutions (farmer groups), institutions market-economy (traders/entrepreneurs), and political-government institutions through a harmonious coordination system through mutually beneficial partnerships require, amplify, and profitably produce products competitive vegetables.

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