

FORMULATION FOR DEVELOPMENT STRATEGY OF GAYO COFFEE AGROINDUSTRY INSTITUTION USING INTERPRETIVE STRUCTURAL MODELING (ISM)

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Abstract

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Institutional aspect is one of strategic aspect for an agroindustry development, including Gayo coffee agroindustry in Province of Aceh, Indonesia. Institution has important role as medium for innovation distribution, certification, and quality management of agroindustry, that the institution conduciveness is very much determining the development of the agroindustry itself. The purpose of the study was to formulate strategy of Gayo coffee agroindustry institution by using interpretive structural modeling (ISM). The study result showed that it was important to formulate strategy of each element in the development system of Gayo coffee agroindustry institution. For the element program goal, strategy that was necessary to be done was improvement in human resources and institutional performance. In element obstacles, the chosen strategy was to build cooperative relationship among agroindustry's actors that need to be optimized. For element activity, the main strategy was to enhance the human resources capacity of agroindustry's actors. In the element indicator of program success, the recommended strategy was the establishment of agroindustry institutional system that is conducive and continues to grow. The last element was actors, with strategy focused on developing farmers and farming group. Result from these strategies formulation became valuable reference for follow-up plan of Gayo coffee agroindustry institution development in Province of Aceh, Indonesia, and also could be a model for development of agroindustry institution of other commodities.

Keywords: agroindustry, interpretive structural modeling, institution, Gayo coffee, strategy, Indonesia

INTRODUCTION

Institution structuring model is one of strategies used in institutional research and analysis. Among methods that are commonly used is the approach that was developed by Saxena (1992) through Interpretive Structural Modeling. This method is a group learning process where the institution structural model is resulted in order to describe complex matter from a particular condition

of institution system through pattern that was designed systematically by using graphics and words (Eriyatno, 2012). ISM method is an interactive learning process where a group of elements is arranged in a comprehensive system model. ISM helps in determining the sequence and the goal on a complex relationship among elements in the system (Pfohl *et al.* 2011; Indrawati, 2013).

According to Kanungo and Bhatnagar (2002), ISM method can be used develop several structure types, includes effect (support or neglect), priority ('more important than' or 'should have been studied before') and idea categorization (e.g. 'included in the same category as'). Structuring of institution development consists of data of development elements, data of sub-elements of institution development structuring and data of contextual relationship. Data of development elements describes the elements contained in the system of agroindustry institution development structuring, while the sub-elements data describes the sub-elements contained in each element. Data of contextual relationship assessment contains contextual relationship among the sub-elements in each element of development structuring. Those data is used as database in sub-model of selection of institution and structuring of institution development.

Result of the model of strategy selection of agroindustry institution development is in the form of main priority of all chosen institution alternatives that the structuring of institution development system will further be done. According to Saxena (1992), program of institution development structuring can be analyzed based on nine elements, which are: goals, needs, main obstacle, indicator of success, involved institutions in the implementation, sectors of affected communities, possible changes, activity needed in action plan, and activity dimensions in order to evaluate result that was achieved by each activity.

However, the researcher usually does not use all elements in doing an analysis. This depends on the needs of the research to be resulted. Usually researcher only analyzes two to five elements, and even not infrequently only one element used in an analysis. Some of institutional researcher that used ISM are Budi *et al.* (2009), Forstater (2001), Jaya *et al.* (2013), Hsu *et al.* (2015), Murtadhlo and Utomo (2014), Panackal and Singh (2015), Pandi *et al.* (2016).

Gayo Coffee Agroindustry

Gayo coffee is an Arabica specialty coffee from Indonesia and has reached geographic index as coffee with the highest selling price in the world (Herdyanti, 2013; SCAA, 2005). Gayo coffee has specific aroma with complex flavor and strong body, which make Gayo coffee as high-quality coffee that is highly in demand by world coffee market (ICCRI, 2008; Putri *et al.*, 2013). This condition makes Gayo coffee agroindustry become a strategic business for the community of Gayo highland in Province of Aceh, a mountain area which include Bener Meriah Regency, Aceh Tengah Regency, and Gayo Lues Regency (Fadhil *et al.*, 2017a). Coffee plants in this area has been grown since 1908 and until now, it has reached 97,796 hectares of coffee plantations that are grown at an altitude of 950–1,450 meters above sea level (Hulupi *et al.*, 2013; Fadhil *et al.*, 2017b).

According to International Coffee Organization report (2011), it is mentioned that Gayo coffee demand to the importing countries is increasing

from year to year, particularly to Europe, America, and Japan markets. However, the increasing demand of Gayo coffee by world communities does not directly give positive effect to the farmers' income (Walker, 2015; Almqvist, 2011). Among the causes is the institution conduciveness aspect that has not been developed optimally, particularly the poor synergy among the actors of Gayo coffee agroindustry itself (Fadhil *et al.*, 2017c; Putri *et al.*, 2013). However, several studies showed that institution aspect is one of the most important elements in developing an agroindustry, including Gayo coffee agroindustry (Walker, 2015; Budi *et al.*, 2009; Silitonga, 2008; Fadhil *et al.*, 2018a). Therefore, it is important to formulate strategy for Gayo coffee agroindustry industry development to provide means for the stakeholders in developing a more competitive and productive coffee industry.

The purpose of this study was to formulate strategy of Gayo coffee agroindustry institution development by using interpretive structure modeling (ISM) approach. Result of this strategy design was expected to become feedback for the policy makers to improve and enhance the development of Gayo coffee agroindustry institution to become better, directed, focused, and sustainable, based on various agenda that were formulated.

MATERIALS AND METHODS

Strategy formulation for agroindustry institution development used Interpretive Structural Modeling (ISM) (Attri *et al.*, 2013; Saxena *et al.*, 1992). ISM is one of modeling technique for strategic policy. Saxena *et al.*, (1992) stated that ISM technique is related to the interpretation of an intact object or system representation through a systematic and iterative graph theory application. ISM is a process of transforming mental model that was unclear and poor of explanation to be a visible mental model that is clearly defined and useful for various purposes. In this study, ISM was used to formulating the hierarchy of strategic elements for the development of Gayo coffee agroindustry institution.

To analyze various alternative for this Gayo coffee, polling from seven experts was performed, consist of Syiah Kuala University lecturer, coffee farmer, collecting trader, local coffee entrepreneur, Department of Agricultural of Aceh Tengah Regency, Agricultural Technology Assessment Center, and coffee community. Data processing was done by using dDSS V.1 PRE-NET (Policy Research Expert Network) Software (PRE-NET, 2010). The stages of using ISM method are as shown on Fig. 1.

Procedures of ISM implementation were as following:

- a) Identifying the elements and sub-elements through deep interview with the experts, field study, and literature review.
- b) Formulate contextual relationship among the elements that were established by using

Structural Self Interaction Matrix (SSIM). This formulation was done with assessment of contextual relationship on pairwise comparison matrix, by using symbol V, A, X and O, which are:

V if $e_{ij} = 1$ and $e_{ji} = 0$

A if $e_{ij} = 0$ and $e_{ji} = 1$

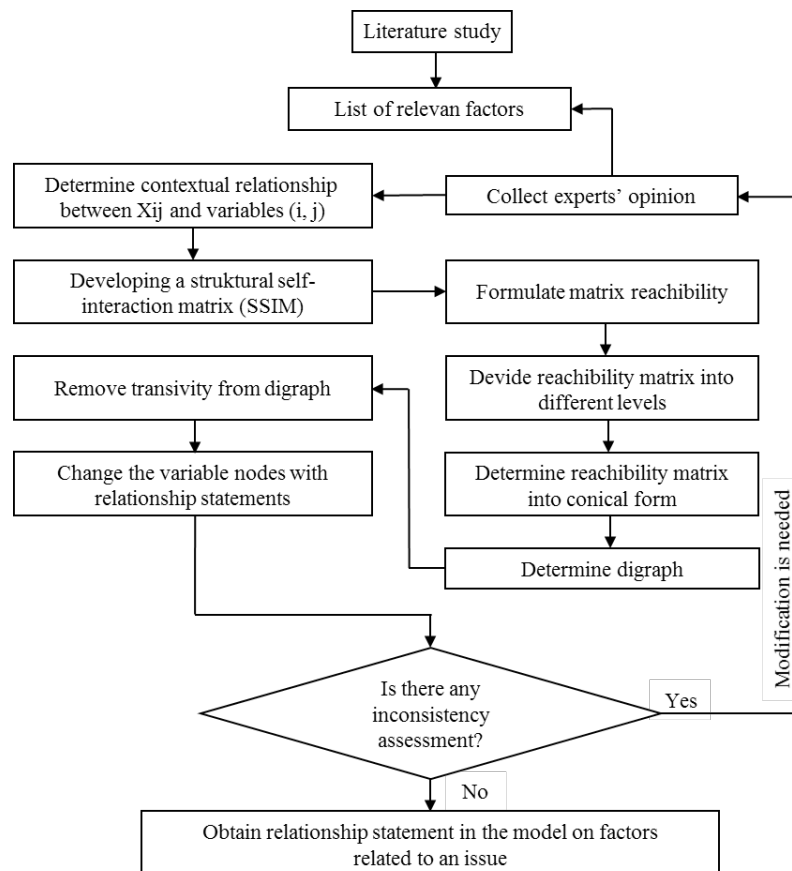
X if $e_{ij} = 1$ and $e_{ji} = 1$

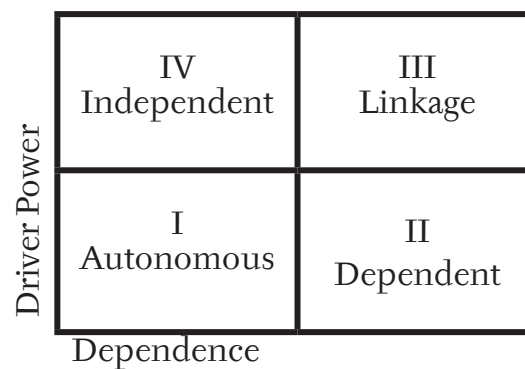
O if $e_{ij} = 0$ and $e_{ji} = 0$

- c) Change SSIM matrix into Reachability Matrix and then into binary matrix. This was a process of interpreting V, A, X, and O into number 1 and 0, and then it was corrected furthermore until it become closed loop matrix that met the transitivity rule, which is a completeness of casual loop, where, for instance, A affect B, and B affect C, so A must affect C. Reachability Matrix was done to obtain driving power and dependence power. Reachability Matrix that has met the Transitivity Rule could proceed by selecting level partition.
- d) Formulate Canonical Matrix, which is a grouping of elements in the same level. Canonical matrix was done by arranging variables based on the level resulted from level partition, in the form of reachability matrix final table.
- e) MICMAC analysis, an analysis that was used to analyze driving power and dependence power from a variable, so that the result of the analysis

could be identified as key variable in the system (Mandal and Deshmukh, 1994). Variables in MICMAC analysis would be classified into 4 sectors (Fig. 2), which are:

- i) Sector 1 is autonomous factors (weak driver – weakly dependent variables). Element included in this sector is element which has weak driving power and weak dependence. This element is not related to the system and possibly has only few relationships, so that the element will be removed from the system.
- ii) Sector 2 is dependent factors (weak driver – strongly dependent variables). Element included in this sector is element which has weak driving power and strong dependence. Element in this sector is dependent element.
- iii) Sector 3 is linkage factors (strong driver – strongly dependent variables). Element included in this sector is element which has strong driving power and strong dependence. Element in this sector is element that need to be studied carefully, because the relationship among the elements is unstable.
- iv) Sector 4 is Independent factors (strong driver – weakly dependent variables).





2: MICMAC analysis

Element included in this sector is element which has strong driving power and weak dependence. Element in this sector is key factor element in model establishment.

- f) Compose Digraph matrix (Directional Graph), a graphic from elements that are directly interconnected to a level of hierarchy.
- g) Structural Model, an ISM model that is resulted from the displacement of all elements' number with actual element description, so that it can give very clear description regarding a system of an element and the relationship flow.

RESULTS AND DISCUSSION

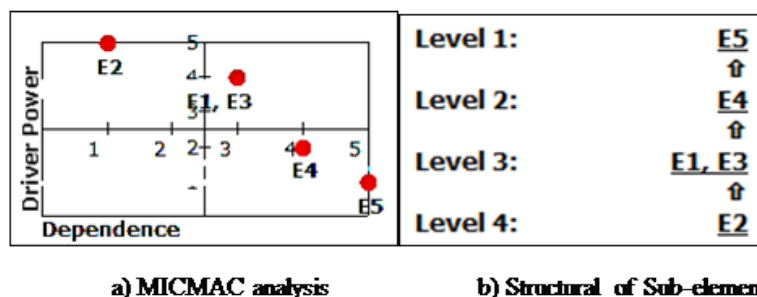
In the initial step, identification of problem to be solved in this strategy formulation of Gayo coffee agroindustry institution development is by determining the list of main elements. Based on the experts' opinion, 5 (five) main elements, whose strategies are considered to be most important to formulate, were selected, they are: 1) the expected goal, 2) obstacles encountered, 3) activity required, 4) indicator of program success, and 5) main actors in the system of Gayo coffee agroindustry institution. The collection of experts' opinion from each element resulted in a number of strategic sub-element for the development of Gayo coffee agroindustry institution. Furthermore, it can be studied from Tab. I.

Structure of Element Program Goal

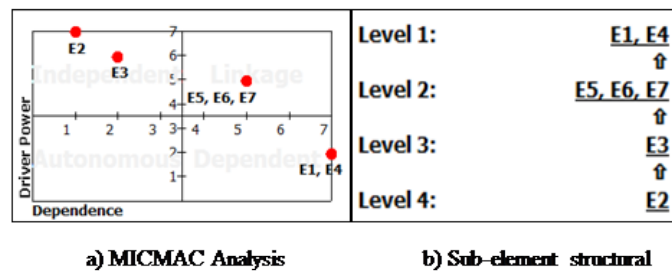
In structuring element program goal, a number of sub-element is obtained, among others were: 1) improvement in agroindustry institution capacity, 2) improvement in human resources quality and institution performance, 3) obtain institution and human resources problem map, 4) establish institution internalization stability, and 5) consolidate the local wisdom base as institution social capital (Tab. I). Then, by MICMAC analysis, it was obtained that E2 was independent factor, E1 and E3 were linkage factors, while E4 and E5 were dependent variable (Fig. 3). It means that variable E2 was the sub-element which owned the strongest driving power and the weakest dependence to other sub-elements, so that this sub-element was the key factor sub-element in establishing model.

Structure of Element Obstacles

For structuring element obstacles encountered, based on the analysis, it obtained seven sub-elements (Tab. I). According to MICMAC analysis, it was obtained that E2 and E3 were independent variable, but the sub-element E2 had the strongest driving power with weakest dependence to other sub-elements (level 4), followed by sub-element E3 (level 3) (Fig. 4). Sub-elements E5, E6, and E7 were linkage variables which had strong driving power and dependence to other sub-elements. Sub-element E1 and E4 were dependent sub-elements, which means they were very dependent to other sub-elements and had weak driving factor.



3: Formulation of key sub-element on each element program goals.



4: Formulation of key sub-element in each element obstacle

I: Elements and Sub-Elements Identification

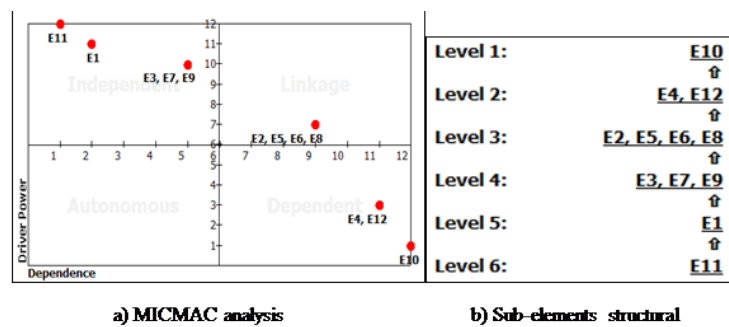
Elements	Sub-Elements
Program Goal	E1. Improvement in agroindustry institution capacity. E2. Improvement in human resources quality and institution performance E3. Obtain institution and human resources problem map E4. Establish institution internalization stability E5. Consolidate local wisdom base as institution social capital
Obstacles	E1. Security and social-politic conflict E2. Cooperative relationship among agroindustry actors is not yet optimal E3. Competencies and expertise is not yet developed E4. Small-scale farming has not complementarily connected yet to the agroindustry system E5. Capital and financial is not evenly distributed E6. Structure is not conducive yet for the development of small entrepreneur and cooperative E7. Capacity expansion is still limited
Activity	E1. Establish agroindustry actors' knowledge base E2. Establish intensive partnership between producer and consumer (among actors) E3. Developing learning culture through organization E4. Support and advocacy from Regional Government to the agroindustry E5. Build cohesiveness in equal and fair social relation in farmer organization E6. Develop local wisdom as social capital base E7. Foster the spirit of public participation in developing themselves E8. Develop group performance coaching through social learning approach E9. Foster the awareness to live in community/group on the basis of need. E10. Enhance the competency of counselor in facilitating the farmers E11. Enhance Human Resources Capacity E12. Financial support from financial institution
Indicator of Program Success	E1. Improvement in the productivity of Gayo coffee agroindustry product E2. Consistent improvement in HR (farmers, collectors, counselors) quality in institution system E3. Escalation in the intensity of institution development program E4. Formation of a conducive and growing agroindustry institution system E5. Improvement in government, NGO, and college roles in the development of Gayo coffee agroindustry
Actors	E1. Farmers E2. Farming group E3. Collecting traders E4. Exporters E5. Financial Institution E6. Regional Government E7. Research and Counselor Institution E8. College E9. Cooperative E10. Entrepreneurs

Annotation: bold words are the chosen key elements and sub-elements

Structure of Element Activity

According to the structuring of element activity, there were twelve sub-elements that needed to be done (Tab. I). Through MICMAC analysis, it was resulting E11, E1, E3, E7, and E9 as independent variables, but the sub-element E11 was key

sub-element that was followed by sub-element E1, whereas sub-elements E3, E7, and E9 had equal levelization (Level 4) (Fig. 5). For independent variables, three sub-elements were obtained, which were: E2, E5, E6, and E8 with equal levelization. Next, on dependent variables, it obtained the equal



5: Formulation of key sub-element in each element activity

sub-elements E4 and E12 (level 2), and the most dependent to other sub-elements was E10 (Level 1).

Structure of Element Indicator of Program Success

In the structuring in element indicator of program success, five sub-elements were obtained (Tab. I). The independent sub-element was E4 (level 3), while linkage sub-element with equal level were E2 and E3, whereas sub-elements E1 and E5 were dependent sub-elements with equal levelization (Fig. VI).

Structure of Element Actors

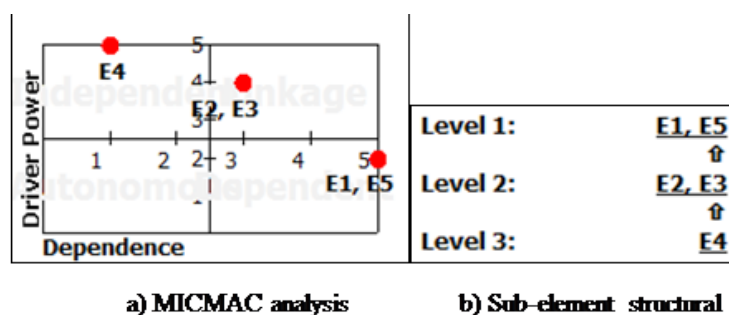
For the structuring of element actors, ten sub-elements were obtained (Tab. I) that consisted of four sub-elements in independent factors, four sub-elements in linkage factors, and two sub-elements in dependent factors. In independent factors, sub-element E1 and sub-element E2 (level 6) were the strongest driving factor with weakest dependence to other sub-elements, and followed by sub-element E6 (level 5) and sub-element E5 (level 4). In linkage factor, the resulted sub-elements were E3, E4, E9, and E10 on equal levelization (level 3), whereas in the dependent factor, there were E7 (level 2) and E8 (level 1) (Fig. 7).

After each element had been analyzed as explained above, the formula of each key sub-element in each element could be summarized as shown on Tab. I (written in bold).

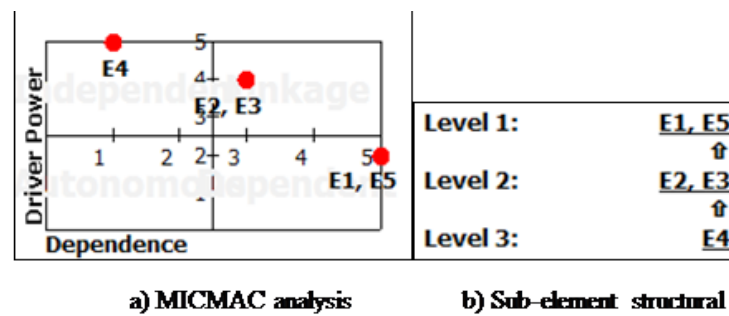
There were two interesting findings from this study, particularly were related to human resources,

they were: key sub-elements in program goal, which was 'improvement in human resources and agroindustry institution performance', and key sub-element in program activity, which was 'the importance of improving human resources capacity'. Both of these issues became interesting to be observed that the study regarding institution development is always much related to the human resources. It means that institution system and human resources is an inseparable entity. Studies about close connection between institution and human resources were also reported by other researchers, such as Budi *et al.* (2009); Jaya *et al.* (2013); Murtadlo and Utomo (2014); Fadhill *et al.* (2017d). Therefore, each study regarding institution needs to always consider its relationship with human resources that are related to the institutional system.

In element obstacles and program indicator, two significant things were also found, they were: key sub-element in element obstacles, which was 'the cooperative relationship among agroindustry actors that has not optimal yet', and key sub-element in element indicator of program success, which was 'the formation of conducive and growing agroindustry institution system'. Between the element obstacles and element indicator of program success of institution development on Gayo coffee agroindustry, it seemed that the harmonization and synergy of the actors still need to be improved. It was exactly like what was stated by Fadhill *et al.* (2018b) that how an institutional system will run well and reach certain level of maturity is very influenced by how the stakeholders do in establishing



6: Formulation of key sub-element in each element indicator of program success



7: Formulation of key sub-element in each element indicator of program success

mutually beneficial partnership system. In the end, the expected goal as the success indicator of a number of Gayo coffee agroindustry institution development programs can certainly be assessed by how conducive the developed institution system is, and how able it is to keep growing.

For element actors, key sub-elements that were resulted were farmers and farming group. This indicated that farmers and farming group owned the most important and strategic roles in Gayo coffee agroindustry institutional system. Farmers and farming group are the most risky actors in the handling of agricultural products, included coffee (Walker, 2015; Jaya *et al.*, 2013; Saputra, 2012;

Almqvist, 2011; Ibrahim and Zailani, 2010). Besides, farmers and farming group are usually the smallest beneficiaries of the institution system that has been developed all this time. This condition needs to be improved by further study, so that the developed agroindustry institution system will not be disadvantageous for one or two actors. Great loss or risk borne by only one stakeholder (one actor) will cause an inequality, which will harm the institution system itself that the stakeholder who suffers losses will take opposite action or refuse the institution system to continue to run.

CONCLUSSION

According to the analysis of agroindustry institution development that was done through this study, it obtained formulation of strategy for each element in the system studied. For element program goal, strategy that needs to be done was improvement in human resources and institution performance. In element obstacles, the chosen strategy was to establish cooperative relationship among agroindustry actors that need to be optimized. For element activity, the main strategy was to enhance the human resources capacity of agroindustry actors. Next, in element indicator of program success, the recommended strategy was to establish a conducive and growing system of agroindustry institution. The last element was actors, with strategy focused on developing farmers and farming group. Result from these strategies formulation became valuable reference for follow-up plan of Gayo coffee agroindustry institution development in Province of Aceh, Indonesia, and also could be a model for development of agroindustry institution of other commodities.

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