The shallot agro-industrial cluster based on regional characteristic with soft system methodology approach: A conceptual design

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Abstract Un-structured problems of shallots are a result of asymmetric information along the supply chain. In recent years, shallot is strategic horticultural commodities with high price fluctuation and contributes to instability of the regional economic development. This study was conducted in Brebes District of Central Java, the biggest production centre for shallot in Indonesia. This study was used an agro-industry cluster development initiated by Bank Indonesia (BI). The main objective of this study was to describe the unstructured or ill-structure problematic situation, then formulate a strategic assumption in the development of agro-industrial cluster of shallot often involving behavioural variable and, should not addressed by hard methodologies. We proposed a solution in order solve the problems above and as a reference through the inductive process with the application of a methodological approach called Soft System Methodology (SSM). The result of the SSM is capabilities to organize consensus among the stakeholders in the scope of agro-industrial cluster of shallot by SSM as qualitative method which was combined with Interpretative Structural Modelling (ISM) also produce design functional improvement of farmers’ institution.

Keywords: agro-industrial cluster, farmer’s institutions, shallot, soft system methodology

1. Introduction
In recent years, shallots are one of strategic commodities for domestic market which thus contributing to the inflation for Indonesian economic development. Un-structure problems of shallots are due to asymmetric information along the supply chain caused un-balanced between supply and demand. As a consequence, it adversely affects farmer’s income. This study focused on the producer side or farmers interest which help to increase farmer’s welfares. Bank of Indonesia (BI) is a key institution responsible for managing inflation through developing cluster system in the production area, such as cluster system developed in Brebes District of Central Java. This needs supports from many stakeholders, including farmer group, regional government, BI in Tegal Region, and Indonesian Shallot Association.
Unstructured or ill-structure problematic situation in the supply chain of shallot can be solved by cluster approach through integration of value chain from upstream to downstream. The concept of cluster system indicated an efficient instrument for achieving value chain effectiveness and competitive advantages along the supply chain. The cluster consists of a set of companies in one area that manages the same product by involving functions in marketing, development and research, suppliers and customers and collaborates with governments and private institutions to provide services to members and resulting in cost savings in production and fostering innovation- in the development of knowledge [1]. A cluster is the interconnected companies and associated institutions in particular field in one geographical area which linked by commodities and complementarities [2]. Cluster is also defined as a geographic concentration of industries that create ‘value networks’ that aggregate vertical relationships along value chains with horizontal relationships among producers [3]. Unbalances supply demand that caused a huge impact during the supply chain especially in the farmer’s level. They get unfair profit distribution which incurred disproportionate risks including low price, unsold product, and even wasted. The shallot’s farmers must sell their product by themselves. The middle man came and bought their product directly to the field before harvesting and took it with a low price to the farmers. Until now the relevant institutions could not support farmer’s business.

The institutional component of the supply chain consists of actors, the mechanisms, patterns of interaction between actors and their impact on improving the prosperity of actors [4]. In Brebes District, the farmer’s institution is still weak causing imbalances of control and information transparency between actors in shallot supply chain. This institution is based on farmer groups gathered according to cultivation site, not yet as institutional business. The main objective of this study was to describe unstructured or ill-structure problematic situation and then formulate a strategic assumption in the development of agro-industrial cluster of shallot often involving behavioural variable and, thus cannot be addressed by the hard methodologies. This study would also analyze how the application of SSM to organization that requires consensus among the stakeholders in the scope of agro-industrial cluster of shallot. Improvement of functional of farmer’s institution has remained attractive to discover since integration between supply chain and value chain could support effectiveness and efficiency of supply chain. Meanwhile, SSM could assist structuring the thinking of both the analysts and actors in the situation while also providing a rich picture and conceptual model.

We employ soft system methodology [5] which is described as seven stage processes. In this present work, we draw a rich picture based on situational condition of Brebes region of shallot’s production, researcher’s point of view, and expert opinions. The institutional aspect is a point of view in unstructured problem investigated to give the figure for the policy. Therefore it needs further investigation from each point of view of stakeholders in shallot agro-industrial cluster.

The remaining six sections of the paper are organized as follows. Section 2 provides literature review of the cluster, agro-industrial cluster, shallot agro-industrial cluster, institutional, Soft System Methodology (SSM), and Interpretative Structural Modelling (ISM). Section 3 proposes the SSM and ISM to build the conceptual design. After describing the methodologies in Section 3, this paper proceeds to give result of this study by a review the comparison of conceptual model and reality in Section 4. After this, section 5 describes findings related to the managerial implication. Finally, some conclusion is presented at the last section of the paper.

2. Literature review

2.1. Cluster
Cluster refers to a geographic concentration of industries that create ‘value networks’ that aggregate vertical relationships along value chains with horizontal relationships among producers [3]. Clusters are a natural manifestation of the specialized knowledge, skills, infrastructure and supporting industries in enhancing productivity as the key determinant of sustaining high levels of prosperity in a location [6]. Clusters define networks of firms, research institutes and public actors, which are located within relatively close geographic proximity and where cross-sectorial linkages are intended to spur
technological spill overs and local competitiveness via economies of scale and scope, ultimately spurring new entrepreneurial activities [7]. The cluster consists of 2 dimension. First, geographic dimension acts as the drivers of urban and regional development and main criterion for classifying clusters; second dimension is functional referring to the interconnection among cluster members [8]. The cluster concept is to increase the added value of the upstream activities to the latest activities and encourage specialization (core competencies) to be competitive. Developing industry clusters has become a key goal for regional economic development as cluster to strengthen competitiveness by increasing productivity, stimulating innovative, new partnership, even among competitors, and presenting opportunities for entrepreneurial activity [9]. Observation linkages among existing economic activities in a region is one of conceptual limitation to region-specific approaches to define cluster [10,11]. In regional cluster as prescribed by Porter’s [2], firms might operate more efficiently and reform faster due to sharing common technologies, knowledge and skill, inputs and responding to demanding local customers [7].

2.2. Agricultural cluster
In this part, discussion about cluster theories and agro-industrial shallot in Brebes Region is presented. The concept of cluster system indicated an efficient instrument to achieve value chain effectiveness and competitive advantages along the supply chain. An important factor in the process of cluster development, especially in agricultural complex, is the development and implementation of public policies to support cluster development [12]. A cluster approach in agro-industrial development management is realized in the form of the cluster policy [13]. The support for development of regional agro-industrial clusters is the priority direction of the state cluster policy [14].

Agro-industrial cluster based on regional characteristic is one important element of policy on the development of potentials in any region, increasing the competitiveness of regional enterprises and influencing the other region surrounding the agro-industrial cluster. Regional authorities, association, business and scientific community and the other interested parties play a significant role in increasing the competitiveness of regional cluster [15]. The basic requirement of agro-industry cluster development is described as follows: the establishment of legal and regulatory frameworks: private sector development; the construction of close relationships among participants of cluster; development of technologies in every value chain such as production, processing, storage, marketing and so on; an extensive financial support and investment promotion for the related industry development by constructing a banking system, and necessary infrastructure [16].

2.3. Shallot agro-industrial cluster at Brebes Region
The big production centre of shallots is in Java Island, but demand is thoroughly spread from Sabang to Merauke. The largest production center of shallot in Java Island is Brebes, Central Java Province, scattered in 9 districts of 11 districts in this region. Two biggest production area located in Wanasari and Bulakamba. For spices, shallot variety from Brebes is very popular and possesses a specific characteristic. The shallot could be harvested three times a year, reaching up to 8–10 tons per hectare. About 70% of the shallot production from Brebes are sold in Jakarta.

Bank of Indonesia (BI) has initiated to develop cluster in this region. In Brebes, 9 districts have been noted as the center for shallot cultivation, but they are not integrated into cluster system in shallot supply chain. Un-structure problems of shallots occur due to asymmetric information along the supply chain; and this is a major reason why BI developed cluster system in Brebes.

2.4. Institutional aspect
The institutional aspect can be a backbone for community in managing relationship and interaction between people to achieve goals. This aspect is inevitable since people may not reach achieve the goals individually [17]. Many factors influenced the sustainability of the institution, including external and internal factors [18]. One of the goals of institutional establishment was to fulfill the basic human needs
or economic purpose. This collaborative action plays an essential role in connecting the parts of the business environment and fostering efficient collective actions for the provision of public goods [19]. The benefits of clusters related to improvement of productivity and farmer’s income, while it also generates employment in farm sector [20]. Economic institutions are connected to economic functions by using institutional economic theory and methods [21]. The farmer’s institution in cluster system requires innovation that become an economic institution. This institutional can withstand the various influences and pressures of external activities and complexity of the problems in cluster system. Therefore, institutional changes are made by mapping and analyzing linkages through identification of actors, institutional mechanisms, opportunities and challenges [22]; [23]. Institutional analysis requires a framework that identify elements and general relationships among these elements and analyzed by the theory to integrate the relevant variables and parameters with the goal, then developing the assumption from the strong elements with limited variables and parameters to construct appropriate institutional model. An institutional framework should identify the major types of structural variables that have some extent in institutional arrangement but whose values still differ from one type of institutional arrangement to another. Logic, mathematics, game-theory models, agent-based models, interpretative structural model, experimentation and simulation, and other means are used to explore systematically the consequences of these assumptions on a limited set of outcomes [24]. As domain decision makers, the platform, the agents of change are nested in dense interaction among them and will give the mutual learning effect and effective decision-making about institutional reforms that benefit not only to the smallholders, but also to the longer-term interest of the countries concerned [22].

2.5. Soft System Methodology (SSM)
In this study, we used Soft System Methodology (SSM) that acts as soft system approach. SSM refers to an approach capable of accomplishing process based on issues oriented where users are learning to know the circumstances and the improvement is taking place [5]. SSM adopts a participative approach to solve the problem which encompasses discussion structure between stakeholders as system model [25]. Furthermore, it is employed as soft system approach consisting of human activity since it involves a lot of stakeholders and each of them has different point of view, interest and belief [26].

SSM has been widely applied by practitioners and academics because of its ability to explain the problems in two perspectives namely, system thinking and real-world point of view. SSM recommends the solution based on the real world situations and also it is practical to apply at the real world [27]. Furthermore, in practical issue SSM framework enables to illustrate problem on real world and conceptual system, understand unstructured issues to provide recommended actions for real-world improvement. SSM is the real world complexity as experienced by stakeholders, and revealed by constructive endeavor from researchers. SSM provides a useful tool to a) map programmed complexity, b) develop and refine stakeholders programmed theories [28]. In systems engineering, soft system methodology is now towards development of a better understanding of complex situations through participant’s learning [25].

Soft system methodology was developed by Checkland and Scholes (1990). Iterative approach with different combination of CATWOE can be configured and provided in depth understanding from a variety of perspective including expert input. SSM supports inclusion of stakeholders considered and has expert input and the engagement of stakeholder is important in both SSM and realist approaches [28].

SSM approaches proposed 7 steps to find a compatible solution for complex, unstructured and ill-defined problems, as exhibited in figure 1.
2.6. Interpretive structural model

The complexity of the problem situation as representation of current conditions was described in a rich picture and based on transformation process explained by the root definition. We developed conceptual model for institutional part at producer level as one of defined elements of this study. The alternative solution was analyzed by Interpretive Structural Model (ISM). Interpretive structural modelling is defined as a process that transforms unclear and poorly articulated structure models of systems into seen clearly and well-defined models which useful for many purposes [30]. ISM is a process that transforms a model that might not be revealed and weakly explained into defined clearly and useful model [21]. The basic principle of ISM is to extract the constituent elements of the problem through a variety of creative techniques, with applying a directed graph, matrix and other tools and computer technology, to process information of elements and their relationship, explicit the problem level and the overall structure, to make an explanation, and improve problem mapping and the level of understanding.

The decision-making method was based on an interactive review process to produce a model structure in the complex system that describes specific relationships between variables and has output in the form of graphical models presented as quadrants and variables. ISM analyses and models can help decision-makers to visualize issues through a systems approach and then identify factors possessing highly influential effect and therefore requiring high prioritization and substantial effort to resolve [31]. ISM is used to develop and analyze interaction issues on supply chain based on Just in Time [32]. Determining the variables in supply chain management was to improve the supply chain performance using the ISM [33]. Characteristic of ISM is interpretive as the judgment of the group decision whether and how the different elements are related. It is structural on the basis of mutual relationship; an overall structure is extracted from the complex set of elements. It is a modelling technique, as the specific relationships and overall structure are portrayed in a digraph model [34]. The ISM is typically implemented in tactical management of decision making who forces managers to review perceived priorities and improve their understanding of the linkages among key factors.
3. Methodology

Research framework in this study was constructed using Soft System Methodology (SSM) approach, since it is flexible and provides a framework which explicitly shows a variety of stakeholder perspectives separately and understands their implications [25]. The first consideration of SSM method is reviewed related to unstructured or ill-structure problems in the development of agro-industrial clusters of the shallot. SSM method was operated by logical thinking process through discussion, interview, debates and dialogue with the experts concerning problematic situation in line with development cluster system of shallot agro-industry. Two perspectives need to explain, namely system thinking view and real world view.

This study used combined methods able to support the system models. SSM will be usefully completed with quantitative system method and based on numeric data. The combination of SSM and other methods to solve complex problems had been previously formulated by [27] combining SSM with FCM, and [35], [4] collaborating SSM with Interpretative Structural Modelling (ISM).

Perspective and point of view for complex problem in shallot agro-industrial cluster based on regional characteristic was applied by SSM framework and provide a comprehensive recommendation for the policy makers and other stakeholders in shallot supply chain. Figure 2 described the research framework and this part we apply soft system methodology in shallot agro-industrial cluster by using seven stages from SSM.

![Figure 2. Research framework.](image)

3.1. Research stages

3.1.1. Soft System Methodology

a. Situation considered problematic (un-structured problem)

This step collects information and data about situation problem in supply chain of shallot the cluster system based on regional characteristic. Generally, there are more than one problem to be solved, so the identification is needed one by one. Primary information was collected from interview and discussion
with the experts and stakeholders, while secondary information was obtained from literature references from scientific research and statistical data.

b. **Problem situation expressed**
All information and assumption collected in previous stage is described in this stage. Problem situation expressed is a transition stage to describe the complexity of the problems to be more easily understood based on real world view. The problem description is described in a rich picture which has unique symbols to tell the problems consistently. The rich picture provides a representation of how we can look at and think about system and does not describe the model of the system in any precise way. We have to take a note on differences between rich picture and formal models.

c. **Root Definition (RD) of relevant system**
Next step is to establish problem definition related to problem situation. RD explains the transformation process analyzed by using mnemonic CATWOE to identify the stakeholders, transformation, the way of thinking and environment which are used to build the definition of activity system needed to solve the problem. Root definition is formulated through rich picture as a basic idea and described in a strong statement based on system thinking view [27]. CATWOE elements is defined in table 1.

d. **Conceptual Model**
In this stage, modelling system of conceptual system for each system is given. The conceptual model was built to achieve the ideal goal based on the root definition that has been constructed for each defined element. This model identified human activity system and representation all the activity which was resulted from problem situation expressed in rich picture.

e. **Comparison the conceptual model with the real world**
The fifth stage expressed comparison the conceptual model with the real world and new ideas for possible changes. The result of this stage was formulated by determining the alternative strategic assumptions for appropriate action. This stage did not only apply model and fix the problems, but also to take action to fix the problem; therefore, the stage produces recommendation of transformation to be implemented at the system.

| Element   | Description                                                                 |
|-----------|----------------------------------------------------------------------------|
| **Customer** | The recipient of the transformations output, the victims or gain benefits or both |
| **Actors** | Whose do the activity in conceptual model if implemented in the real world   |
| **Transformation** | Basic and key activity and its relation which is necessary to convert input to output |
| **World - view** | A world view statement to understand the transformation process comprehensively also describe root definition statement clearly |
| **Owner** | A system’s decision maker who have full authority and concern to the systems performance |
| **Environment** | External features of the system which may be obstacles for the system |

### 3.1.2. Interpretative Structural Modelling (ISM)
The various steps for adopting ISM methodology is extracted from [4] [30] [36], [34], [37] and its logical flow is shown in figure 3.
Based on above description, the development of ISM model to design institution at producer level in cluster system of agro-industrial shallot is discussed below.

a. **Structural self-interaction matrix (SSIM)**

This step presents development of contextual relationship among the identified elements based on identification of key factors of elements relevant to issues, expert opinion based on management technique such as brainstorming, and nominal group discussion technique. For expressing the relationship between different critical key factors of element for developing of cluster system of shallot agro-industrial, four symbols have been used to denote the direction of relationship between the sub-element i and j (here i, j) as given below:

- **V**: Factor i will lead to factor j.
- **A**: Factor j will lead to factor i.
- **X**: Factor i and j will lead to each other.
- **O**: Factors i and j are unrelated.

On the basis of contextual relationship among the identified elements between challenging issues, SSIM has been developed. Final SSIM are given in table 2. The assessment is carried out by six experts on the contextual relationship and value obtained is an aggregation of each expert. There is no consensus amongst researchers on the adequacy of the number of experts to be assessed. The group of experts was selected from professors, researchers and practitioners, with total of 42 experts [38].
Table 2. Structural Self Interaction Matrix (SSIM).

| No. | Challenging issues                                                                 | 1  | 2    | 3    | 4    | 5    | 6    |
|-----|------------------------------------------------------------------------------------|----|------|------|------|------|------|
| 1   | Strengthening management of farmer business entities to increase the income of its members | V  |      |      |      |      |      |
| 2   | Issuing the farmer business entities regulation as implementation of Law No. 19, 2013 | V  |      |      |      |      |      |
| 3   | Strengthening the role and function of farmer groups                               | V  |      |      |      |      |      |
| 4   | Strengthening the bargain position of farmers for the quality and quantity of product at Collection Center | V  |      |      |      |      |      |
| 5   | Improving the farmer capitals through the Agricultural Financial Institution         | V  |      |      |      |      |      |
| 6   | Producing product comparativeness through the Rural Post Harvest Enterprises          | V  |      |      |      |      |      |

b. Initial reachability matrix
The initial reachability matrix by substituting V, A, X and O by 1 and 0 as per the case was converted to binary matrix using following rules as given in table 3.

Table 3. Rules of conversion.

| If the (i, j) entry in the SSIM is | Entry in the initial reachability matrix |
|-----------------------------------|------------------------------------------|
| V                                 | 1                                        |
| A                                 | 0                                        |
| X                                 | 1                                        |
| O                                 | 0                                        |

Following above rules, initial reachability matrix is shown in table 4.

c. Final reachability matrix
The final reachability matrix is acquired from incorporating the transitivity as enumerated in the ISM methodology. In this table, we find out the driver power and dependence of each element. The driving power of particular factor is total number of factors including itself which may help to give major contribution to achieve goals, while the dependence is the total number of factors, which may help achieving the goals. The final reachability matrix is developed in table 5.

Table 4. Initial reachability matrix.

| No. | Challenging issues                                                                 | 1  | 2  | 3  | 4  | 5  | 6  |
|-----|------------------------------------------------------------------------------------|----|----|----|----|----|----|
| 1   | Strengthening management of farmer business entities to increase the income of its members | 1  | 0  | 1  | 1  | 1  | 1  |
| 2   | Issuing the farmer business entities regulation as implementation of Law No. 19, 2013 | 1  | 1  | 1  | 1  | 1  | 1  |
| 3   | Strengthening the role and function of farmer groups                               | 0  | 0  | 1  | 0  | 0  | 1  |
| 4   | Strengthening the bargain position of farmers for the quality and quantity of product at Collection Center | 0  | 0  | 1  | 0  | 0  | 1  |
| 5   | Improving the farmer capitals through the Agricultural Financial Institution         | 0  | 0  | 1  | 1  | 1  | 1  |
| 6   | Producing product comparativeness through the Rural Post Harvest Enterprises          | 0  | 0  | 1  | 0  | 1  | 1  |
Table 5. Final reachability matrix.

| No. | Challenging issues                                                                 | 1 | 2 | 3 | 4 | 5 | 6 | DP |
|-----|-----------------------------------------------------------------------------------|---|---|---|---|---|---|----|
| 1   | Strengthening management of farmer business entities to increase the income of its members | 1 | 0 | 1 | 1 | 1 | 1 | 5  |
| 2   | Issuing the farmer business entities regulation as implementation of Law No. 19, 2013 | 1 | 1 | 1 | 1 | 1 | 1 | 6  |
| 3   | Strengthening the role and function of farmer groups                               | 0 | 0 | 1 | 1 | 0 | 1 | 3  |
| 4   | Strengthening the bargain position of farmers for the quality and quantity of product at Collection Center | 0 | 0 | 1 | 1 | 0 | 1 | 3  |
| 5   | Improving the farmer capitals through the Agricultural Financial Institution         | 0 | 0 | 1 | 1 | 1 | 1 | 4  |
| 6   | Producing product comparativeness through the Rural Post Harvest Enterprises         | 0 | 0 | 1 | 1 | 0 | 1 | 3  |

d. Level partition

Final reachability matrix partitioned the reachability set and antecedent set of issues. A level partitioning is carried out to the placement of element of issues level wise. The reachability set consists itself and other issues influenced. Meanwhile, the antecedent set consists itself and other issues which may help to achieve it. All issues and levels of different issues are determined from the intersection of the reachability and antecedent set.

e. Classification of factors

Level identified and relation in the final reachability matrix was used to depict ISM-based model and MICMAC analysis. MICMAC refers to Matrice d’Impacts Croisés Multiplication Appliquées à un Classement [39]. The critical success factors were plotted on a graph in to four quadrants based on their driving power and dependence.

f. Formation of ISM-based model.

From the final reachability matrix and MICMAC analysis, the elements were classified in four quadrants, replacing the element nodes with statement. Meanwhile, it is necessary to check for conceptual inconsistency. If the result is “No” decided the hierarchical actions to be taken to solve problems or issues under consideration. The hierarchical action was connected between coordination elements i and j which is shown by an arrow which points from i to j. The structural model was generated from the hierarchical action by means of vertices or nodes and lines of edges. The coordination between elements was called a digraph. Finally, after removing the transitivity the diagraph converted into ISM.

4. Result and discussion

4.1. Unstructured problem

The probabilistic and dynamic situation along shallot supply chain influenced Indonesian economic development. During stabilization of price, demand contributes to economic inflation in recent years; thus, there is a need for an integrated solution through synergy form all components in the supply chain. The collaborative actions could be built by a system approach. It constitutes one of alternative problem solving methods that begin with identification of a number of needs which resulted in the effective operational system [40]. Price fluctuation was caused by inequality of supply and demand for shallot. Farmers is an actor that often receives unfair profit distribution in shallot supply chain. The identification of shallot agro-industrial cluster issues from various perspective is derived from in depth interview with stakeholder and literature review. Some various issues and problems of shallot supply chain agroindustry are high cost of seed and other input in cultivation, high losses in the field due to inappropriate postharvest handling, lack of value-addition, many middlemen determining unfair price, less optimum facilities, and
no price protection. In addition, the problem was also due to absence of systematic and efficient distribution mechanism, while farmer’s institution is still powerless, which in turn causing imbalances in control and information transparency between actors in shallot supply chain. Besides, regulation and policy from central and regional government are still partially enforced.

4.2. Problem situation expressed and rich picture

All information and assumption collected from previous stage is described in this stage. A model thinking about system and to help the analyst to gain an appreciation of the problem situation is a rich picture. The rich picture provides a representation of how we can look at and think about system and does not describe the model of the system in any precise way. We have to take a note on differences between rich picture and formal models. There are several influential factors in supply chain of shallot agro-industrial cluster at Brebes Region which make the unfair profit distribution between stakeholders. This farmer institutional group has been based on cultivation site, not yet as institutional business. Farmers depend on the middleman to sell their product to the market because they could give them fresh cash money. Industry could not get raw material directly from farmers, leading to in-continuous supply. Supporting external stakeholder is low such as capital assistance, introducing technology and consoling, transparency information of price or other supports, market access and mechanism of distribution. Problem situation expressed is a transition stage to describe the complexity of the problem to be more easily understood based on real world view. The problem description is described in a rich picture which has unique symbols to tell the problems consistently. Furthermore the problem description which was delivered above depicted in figure 4.

4.3. Root definition and CATWOE elements

In this study, we define CATWOE elements and root definition in a system thinking role designed to tackle problems based on unstructured problems and rich picture above. We develop two root definitions on this study as follows:

- Farmer’s institution should be upgraded to economic functional institution containing business entity within the cluster system through balanced control mechanisms and information transparency in order to secure farm-gate prices, maintain shallot quality, minimize the uncertainty supply demand, and build a strong relationship with other stakeholders
- Increasing the farmer’s welfares by creating platform to connect supply and demand, improve the agro-logistic based on digital technology from rural area to urban area and business development of diversification product to meet the industry and consumer needs. Analyzing CATWOE elements described in table 6.

Table 6. CATWOE and its elements.

| Element   | Description                                                                 |
|-----------|-----------------------------------------------------------------------------|
| Customer  | Farmer, Farmer Groups, Industry, Government                                  |
| Actors    | Farmer’s enterprises                                                        |
| Transformation | Improving functionality of farmer’s institution                           |
| World-view| The farmer’s institution needs to contain a business entity capable of       |
|           | providing a strong bargaining position to the farmers.                     |
| Owner     | Farmers group, industry, community and government                           |
| Environment| Intervention of other institutions or other stakeholders not comfortable    |
|           | with this situation                                                         |

4.4. Conceptual model

The corrective actions were taken from current situation through the iterative process. In this study was used two processes as iterative process, namely deductive and inductive process. SSM framework resulted from inductive process and final procedure is Purposeful Activity Model (PAM) as conceptual
model. The research explored feedbacks from in-depth interview given by practitioners and experts of shallot agro-industrial in cluster system. Those knowledge acquisition used the deductive process that was analyzed using Interpretative Structural Modelling (ISM) to back up process in designing conceptual model.

In this study, one of the conceptual models was designed for improving farmer institution. The conceptual model was developed from inductive (SSM framework) and deductive (ISM model) process. The convergence of these two processes resulted in the appropriate policy recommendation for upgrading functionality of farmer institution. In this paper, establishment of the farmer business entity regulation was discussed as one improvement of farmer’s institution.

4.4.1. Deductive process by ISM. In this stage, we developed conceptual model from deductive process by ISM model. The ISM method was applied to design institution at producer level in development of shallot agro-industrial cluster system. This method is also one of structuring tools in descriptive modelling which generates models of structural relations of the elements. The structures illustrated the arrangements of elements and relationship between elements which contribute to develop institution at producer level in shallot cluster systems.

Indicator was used in ISM model consisting of six key elements which result in identification of problem in the field and expert opinion through brainstorming. These six key elements included the purpose of the program, program requirements, main obstacles and possible changes, activities to plan action and other institutions involved in the program implementation.

In program purpose, there were six sub elements and based on data processing using ISM with consistency value of 94.6%. We found that sub elements of issuing the farmer business entities regulation as implementation of Law No. 19, 2013 was in the lowest rank indicating that this sub elements was the key sub elements in the purpose of programs. The graph is shown in figure 5. Next, program needs had consistency value of 97.5% with regulation and its subsequent to implement Law No.19, 2013 as the key sub elements, while the sub elements of restricted regulation to support its growth and development of BUMP, lack of skill of human resources in management and operational institution and lack of information and market access as keys of elements in the main obstacles of program showed consistency value of 98.4%.

The possible changes had consistency value of 92.2%, with key sub elements including skilled labors able to manage BUMP and digitalized information access for business development. The activities towards plan action demonstrated consistency value of 93.7% and its key sub elements were the good coordination among farmers institution members, performance of BUMP management effectively and compilation of the operational regulation of BUMP. In addition, institutions involved in the program implementation showed consistency value of 100%, with key element as follows: research and development institution, as well as central and regional government.

The analysis results for the six elements tested by using ISM showed that the regulation is substantial matter to protect and facilitate farmers with providing their institutional functions to become a business entity. The central and regional government played as influential institution that demonstrates function as regulator to issuing the farmer business entities regulation as implementation of Law No. 19, 2013. Research and development institution is another institution which also influence to deliver the innovation of technology and managerial generating study or research activities. It can provide inputs for the regulator to issue farmer’s economic institutional regulation.
Figure 4. Rich picture.
4.4.2. Inductive process (PAM). Inductive process resulted in Purposeful Activity Model (PAM) as conceptual model in SSM framework. In this part, a conceptual model was designed for improving the functionality of farmer institution. Regarding to convergence between inductive and deductive process, we designed PAM as conceptual model for the substantial matter of regulation, as depicted in figure 6.

![Figure 6. Purposeful activity model (PAM).](image_url)

4.5. Comparison conceptual model with the real world
Based on rich picture and conceptual model above, there are several activities required in achieving the shallot agro-industrial cluster development through improvement functional farmer’s institution. The comparison model with real world was described at table 7.
Table 7. The comparison between conceptual model and reality.

| Activity | Real condition | Recommendation |
|----------|----------------|----------------|
| Farmers business entities (BUMP) Regulation | The legal entities was just on top level or in Law level | Optimization coordination and synchronization of regulation between central and regional governments |
|          | Restricted regulation to support BUMP growth and development | Initiated policies formula to subsequent of regulation to implement Law No.19, 2013 |
|          | Restriction on the entity of institution | Strengthening and developing the farmer cooperation |
|          | Uncertainty legal to existing farmer institution | Providing legal guarantees for existing regulation of farmer institution |
|          | A large gap between farmer, farmer group and government by triggered by the dependence of farmers to the state | Encouraging the independence of farmers to develop their businesses |
|          |                                           | Corporatism of state to the farmers |
|          |                                           | Initiating the operational regulation of BUMP |

5. Managerial implication

The finding of this study was very useful to improve the functionality of farmer institution in shallot agro-industrial in cluster system. Issuing the regulation to upgrade function of farmer institution to be business entities as a substantial matter and as driving power to the other elements such as agricultural financial institution, collection centre and rural post-harvest business. The proposed policy to initiate policies formula for subsequent regulation from Law No.19, 2013 to all stakeholders could encourage the agricultural financial institution to assist farmers to satisfy their need for working capital and social capital. The farmers had bargain position to determine the price in the producer level in which they get fair profit in their farm business. The collection centre can assist farmer to produce a quality product through the good post-harvest handling in order to fulfill market demand and developing processing businesses through the diversification of product which can further increase added value of product in order to increase the farmer income.

6. Conclusion and recommendation

Soft system methodology (SSM) has been revealed able to provide the effective solution framework to develop shallot agro-industrial cluster based on regional characteristic. The problem situation was expressed in rich picture that provides solutions required to be translated into root definition and conceptual model. Improving functionality of farmer’s institution and performance of stakeholder was performed by strengthening the regulation to make balanced control mechanisms and information transparency in order to build a strong relationship with the other stakeholder. Improvement was made to build the platform which can connect the supply and demand, improve the agro-logistic based on digital technology from rural area to urban area and business development of diversification product to meet the industry and consumer needs.

The proposed institutional design can facilitate to describe the functionality of centre and regional government as regulator to issue regulation, which subsequently generates research and development institution to create innovation for development of farmer business entities in the future.

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