Institutional model of sustainable development for controlling clove pest management

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Abstract. Institutional clove farmers are still very weak, both in terms of marketing and in a pest control system. The number of damaged plants affected decreases production and productivity. Hence, the farmers’ revenue was lowering and they lost their income. This study aims to analyze the existing institutions in clove production centers and to formulate strategies to strengthen institutional pest control of clove. The survey was conducted in April-October in Sumedang and Sukabumi Regencies in West Java. The results show that there were three institutional models, namely Temu Urip at Sumedang, Maju Bersama, and Tanjaya groups at Sukabumi. All models had only focused on cooperation activities such as land clearing, plant cultivation process, weeding, harvesting, and savings-loans. The model that was specific to the pest control had not been developed. To establish and strengthen their position, farmers should innovate the concept of the Clove Institutional Model. They should take a partnership with other related elements, such as cooperatives, distributors of pesticides, financial institutions, government, universities, and research institutes. In this model, farmers’ association plays an important role as an institution that controls clove pests mainly at the district level and coordinating down to the village level.

Keywords: Institutional model, clove farmers, pest control system, cloves

1. Introduction
Clove is a commodity that has a strategic role with its significant contribution in absorbing labor, sourcing foreign exchange, supplying industrial raw materials, increasing farmer's income, environmental conservation, as well as being important in equitable regional development [1][2]. Smallholder farmers manage the clove production in about 95% plantations and other actors cultivate the rest [3]. From the national clove production, the cigarettes industry is the main consumer of clove because it absorbs around 95% of the national clove production used as the main raw material in producing clove cigarettes. The development of cigarette production has increased, especially the production of Hand Clove Cigarettes (HCC) and Machine Clove Cigarettes (MCC), and this will cause increased clove demand [4]. In line with the increasing demand for cloves especially from the clove cigarette industry, to meet domestic demand, Indonesia imports cloves from Zanzibar and Madagascar [5]. Due to this condition, Indonesia is the largest clove producer and importer in the world [6]. Most of
the clove is used as raw material for the manufacture of the cigarette industry and the rest is to meet the needs of the food and medicine industry. This shows that the role of cloves in the national economy is quite large, especially in the form of cigarette customs excise. Receipts in 2009 amounted to Rp50.5 trillion, and in 2010 it reached Rp58 trillion [7].

In terms of the performance of the commodity system, the condition of national cloves trading is characterized by fluctuated prices. This has a correlation with the fluctuations in production due to plant genetic characteristics and climate conditions, which cause clove plants to have the unique characteristics intermittent of grand harvests followed by small harvests in the following year and harvests in certain periods. During the grand harvest, the price tends to fall below the break event point and those results in farmers losing money and then they would not maintain their crops. Meanwhile, the conditions in the field shows that many clove plants are old and damaged infested with pests, no good cultivation, and no use of superior seeds. Therefore, these result in poor planting and low productivity [6][8].

The total clove area in 2014 was 495,404 ha and total production was 101,670 tons with productivity of 330 kg dry / ha. The total of the land area of clove was 495,404 hectares, and 83,214 ha was the damaged plants caused by pests and diseases. If Indonesia's clove productivity is 330 kg dry/ha/year, it means that Indonesia has lost 27.461 kg per year. If the price of dry cloves is IDR 130,000 / kg (at the farm level), then Indonesia was losing a yield of IDR 3,569,930,000. This loss is not small, moreover, the clove cultivation business was involving farmers around 1,064,110 households at the on-farm level with 20,932 workers [9][10].

For this reason, in order to maintain a long-term balance of clove supply and demand, we need efforts to improve crop productivity and quality. One of the strategies is to control clove pests through the institutional approach. Recommended possible policy is to establishing and strengthening the Clove Pest Control Institutional Model [11]. The research aims to identify the clove institution and identifies the recent state of the main pest management institutional model in West Java, especially Sumedang and Sukabumi regencies. With appropriate pest control, we hope it can minimize the attack of pest clove so that the production and productivity of cloves could increase then eventually would increase farmers' income and welfare.

2. Literature review

Clove Pest Institutional model is a synergy of some institutions working together organically in the field controlling and eradicating clove pests and diseases associated with the type of clove pests that exist in the research location. Clove Pest institutional approach consists of at least farmers’ groups, extension workers, cooperatives, funding institutions for distributors of pesticides, universities, and government agencies that issue policies or regulations on controlling clove pests.

2.1. Farmer, a group of the farmer, and cooperation

A farmer is someone who is engaged in agriculture by carrying out land management with the aim of growing and maintaining crops in the hope of obtaining the results of these plants for their own use or selling them to others. They can also provide raw materials as raw materials for various industries, both beverage, food, medicine, cosmetics, and other industries. While the combination of several farmers’ groups is called a group of farmers’ group [12]. According to the Ministry of Agriculture regulation number: 273 /Kpts./ OT.160 / 4/2007, farmer groups are groups of farmers/breeders/ planters formed on the basis of shared interests, common environmental conditions (social, economic, resources) and familiarity to improve and develop member businesses. There are a number of things that characterize farmer/breeder groups or institutions [13]:

- Get to know each other, get close and trust each other among members
- Have the same views and interests in farming
- Have similarities in tradition or settlement, expanse, type of business, economic or social status, language, education, and ecology
- There is a division of tasks and responsibilities among members based on mutual agreement.
Joint farmer groups (Gapoktan) is a collection of several farmer groups who join and work together to increase economies of scale and business efficiency. An association is a collection of farmer-fishermen who have commercialized one or a combination of several agricultural commodities commercially [14]. Indonesian farmers, in general, are indeed poor due to several factors, including poverty passed on by parents, low income, limited capital, narrow land, a system for the inheritance that fragments land and others [15]. Source of income of farmers and all their needs come from farm products that are very dependent on price. Farmers' gate prices are sometimes unfair and they are only price takers, which have limited capital and low income. Those finally cause weak farmers' bargaining power, or even powerless. They do not have enough power to determine a particular price [12]. Meanwhile, they need cash to fill their needs, whether agree or disagree they must sell their produce at prices usually determined by the trader. Therefore, the market usually causes price inequity for farmers.

For the price issue, both the price of production inputs or selling prices, one of the institutions that can help farmers is in the form of cooperatives. Cooperatives can accommodate farmers' needs, for example, about the capital that borrowed from cooperatives, buying daily necessities, farming equipment and production inputs including pest control in the form of insecticide pesticides, herbicides and others at prices below market prices. Farmers' cooperatives are cooperatives intended for farmers, the members of which are farmers. The types of cooperatives established for farmers are usually savings and credit cooperatives and sales cooperatives. The cooperative collects farmers and sells their products collectively at prices agreed by the buyer with the cooperative acting here to represent the farmers [16]. The existence of cooperatives could minimize the problem of price and capital, which can help and ease the burden of farmers in an effort to increase farmers' income and welfare [17].

2.2. Extension
Agricultural extension is part of the agricultural development system, which is a non-formal education system for farmers, farm families and other community members involved in agricultural development. The propose of agricultural extension is to create a conducive state to help farmers and farm families in order to develop to be more dynamic and be able to improve their life and livelihood with their own strength [18]. Agricultural extension is an effort to empower farmers, their families, and the community of agribusiness practitioners through non-formal educational activities in agriculture, in order to be able to help themselves both in the economic, social and political fields, to increase their income and welfare. Extension, in the general term, is a social science that studies the systems and processes of change in individuals and society [19]. The extension is able to assume as a form of education for adults [20]. Agricultural extension is the involvement of a person to communicate information consciously with the aim of helping each other provide opinions so they can make the right decision [21]. Furthermore, agricultural extension is a non-formal educational activity for farmers and their families as a form of government guarantee for farmers' right to education.

2.3. Farmer’s institution
Farmer institutions greatly contribute to increasing the independence and welfare of farmers because institutions have a very strong bond with the farmers' techno-social conditions [22][23]. Farmer institutional development is very important for several reasons. First, many agricultural problems can be solved by farmer institutions [24]. Second, it is essential for providing continuity in the effort to disseminate technology or technical knowledge to farmers. Third, it is able to prepare farmers to be able to compete in a more open economic structure; and Fourth, the existence of farmer cooperation can encourage the use of farmer resources more efficiently [25][26]. However, the condition of farmer institutions is still weak, especially on the aspect of controlling pests. So many plants were damaged or died due to pests become decreasing in production and low productivity.

3. Methodology
The study was conducted in Sumedang and Sukabumi regencies, West Java from January to December 2016. The data collected included secondary data and primary data. Secondary data collection through
literature studies was conducted to identify problems in the clove commodity system and system identification. Primary data collection was gained from in-depth interviews and Focus Group Discussion by involving experts from groups of farmers, seed breeders, traders, cooperatives, local governments, agencies, and other relevant institutions while the respondents were selected based on the snowball sampling method in the determined proposed location. Total respondents were 105 farmer’s households, consisting of 55 persons from Sukabumi and 50 persons from Sumedang regency. Data analysis was carried out in a descriptive way to analyze the existing institutions in the clove production center in West Java and to formulate a strategy to strengthen the clove pest institutions with the following recommendations for improvement.

4. Results and discussions
The formation of a farmer group was certainly based on the existence of the same desire to cooperate with each other in the same place, to increase business, business scale, business efficiency. Besides, they try to get an easier way to get guidance, assistance, supporting facilities from the local government and related institutions in order to improve the welfare of farmers.

4.1. Cimanggu village, Pelabuhan Ratu District, Sukabumi Regency
Cimanggu Village is an area of clove production centers in Pelabuhan Ratu District. In this village, there are two clove farmers’ groups, each group consisting of 25-30 households with an area of clove land ownership ranging from 1000 m² - 3 hectares per household. Their cultivation was still carried out on a simple method. The agricultural practices were merely generally in the form of weeding. Fertilization was almost not available, except integrated pest management (IPM) practice. The clove pests that often attack their plants in this location were namely stem borer and leaf spot diseases. Farmers used pesticides such as Furadan and Corakron. The farmers’ group institutions found in this area are Maju Bersama and Tani Jaya farmer group.

4.2. Ganjarresik Village, Wado District, Sumedang.
Farmers have an average of acreage of clove’s plantation range from 0.5 - 3.5 hectares with the various number of clove trees of each farmer between 10 to 250 trees per farmer. They have a varied age of plantation. Some farmers has had the trees for more than 40 years. Others have been cultivating their trees for 3, 5, or 12 years. Their spacing is 8x8 m and 7x7m. In terms of pests, the main clove pests found at the study site are termites, leaf spot diseases, aphids, and stem borer. These pests are prone to attack, especially in young plants, aged 1-5 years with mortality rates ranging from 0.08 - 5%. For old plants, stem borer was infested between 0.20 - 0.80%. Aphids attack young plants (under 5 years), while stem borer commonly attack older plants. Farmers carry out pest controlling by using Furadan and Decis. They have a treatment of how to give spraying to the young plants and moistening cotton with Decis fluid, then the cotton was inserted into a hole in the clove plant tree that is attacked. Whereas the farmers’ organization in this research location is Temu Hurit farmer group but not specifically for cloves, it is general for all agricultural activities.

4.3. Institutional model development
Institutional farmers in an area are formed by the willingness or determination to cooperate with each other based on the similarity of types of businesses and places, in an effort to increase business scale, business efficiency, and get guidance and facilities to improve farmers’ welfare. The survey results in Sumedang and Sukabumi Regencies, found three institutional models, namely Maju Bersama, Tani Jaya, and Temu Hurit. These three institutional models, in terms of functions, have almost similar activities (table 1).
One of the similarities of the three clove institutional models is that they collaborate in carrying out land preparations and new opening land together. Implementation of preparation is carried out in rotation in the farmer group members. All members have played a role in collaborating on opening new land, and the work process out together. While the source of funds to afford group operations was from the contributions of each member. Members are burdened with compulsory and principal savings and voluntary savings, the amount of which has been determined in accordance with mutual agreement and is used for mutual interest through a financing scheme for members as capital in the management and maintenance of their clove gardens.

4.4. Strengthening of the Clove Pest Control Institutional Model at the study site
To strengthen the position of farmers in controlling clove pests, the Clove Pest Institutional Model must be developed, in which there is a partnership between farmer organizations, farmers’ groups, group of farmers’ groups, farmers’ associations with several related elements, such as cooperatives, distributors of controlling pesticide and IPM, research institutions, financial institutions, extension agencies, universities, government, and related agencies [27][28]. In this model, farmer groups play an important role as clove pest control in their respective regions.

![Figure 1. Clove pest’s detection and handling flowchart.](image-url)
Based on the results of the field survey, in terms of the flow of clove pest detection and handling, the institutional flow is divided into two, namely detection flow and handling flow. The detection flow is intended as a flow chart of rapid response to the presence of Clove OPT attacks encountered in the field. So that when a clove OPT attack occurs or symptoms are found in the field, there must be a work step in dealing with it quickly and clearly. The handling flow describes various systematic efforts from various parties who have a joint responsibility to deal with clove attacks. Although in practice, farmers as the main actors in handling clove pests, but handling clove pests requires participation from all parties, especially in the field it is found that farmers’ knowledge of pests and handling of cloves is relatively low and better understanding is needed. It can be seen in figure 1: the flow chart of clove pest detection and handling. The handling of pest clove attacks requires the participation of all parties. The role of research institutions and universities gives research results through innovative research that is produced to strengthen farmers’ knowledge through the enrichment of extension workers so that pest management can be quickly dealt with together [29].

5. Conclusion, suggestions, and implication
Institutional farmers play an essential role in providing agricultural production facilities, capital, approaching farming to the upstream and downstream sectors, increasing productivity and quality by implementing recommended technologies to increase farmers’ income and welfare. For the government, the existence of farmer institutions facilitates farmers’ development which could run programs to increase production, quality, and income of clove farmers. The existing institutional model in the field is not an optimum state and does not deliver its role as expected. It is necessary to formulate the Clove OPT institutional model with institutional actors such as farmer groups, extension workers related technical agencies, distributors of agricultural pesticides as well as research institutes and universities which are all interrelated. With the existence of an institutional model for clove pest control, it can be detected quickly and precisely all existing clove pests, as well as the solution to overcome them, so that the level of loss of clove yields of farmers due to the main pests can be suppressed and controlled. The initiation related to a micro-insurance policy in agriculture would cover farmers’ losses due to clove disease that is very detrimental to farmers.

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