Advisory innovation model on Indonesian farmers corporation’s development

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Abstract. Indonesian agriculture development requires the effort to accelerate adoption of innovation and increase farm productivity. One approach through farmers corporation’s development had been carried out by the Assessment Institute of Agricultural Technology (AIATs). This study aimed to identify the performance of advisory innovation and to formulate alternative models for accelerating the adoption process. The research was conducted from June to December 2019 through e-survey addressed to the implementing team in 33 provinces (64 respondents), and qualitative data collections in four provinces. Data were analyzed using Partial Least Square. The results showed that advisory activities have referred to government regulations by prioritizing locations and commodities. Implementation of advisory activities were still focused on improving cultivation and post-harvest technology, and did not address specifically on institutional innovation to build farmers corporations. Characteristics of advisory activities varied among locations, relating to the budget allocation. There was an increase in adoption and diffusion innovations, and farm productivity. The role of AIATs has not been seen in the development of a broader scale. Fit model (AVE > 0.5 and CR > 0.7) in advisory showed the importance of improved internal management at AIATs, the need for synchronizing programs, and the policy support.

1. Introduction
One of agricultural development policies and strategies in Indonesia is to develop agriculture with a regional approach, which in its management must be integrated, comprehensive and sustainable. Through the regional approach, agricultural development is considered to be more effective [1]. Each development actor must be able to contribute to realize it. Agricultural research institutions contribute to provide innovations including innovations in food crops, horticulture, cash crops, and livestock, to assist as well as to ensure that these innovations reach their users. The evaluation results related to the implementation of the policy for three years (2015-2017) showed that the dissemination of innovation to users (farmers) did not work as expected. The relatively slow adoption of innovations by users is still being a problem currently.

Various research results indicated several factors influencing the process of dissemination and diffusion of innovations in the development of agricultural zones, including physical carrying capacity, characteristics of farmers, facilities and infrastructure, accessibility, institutions, capital ownership, and partnerships [2]-[3]. Meanwhile, [4] dan [5] revealed the accuracy of technology, policy support, the role of agricultural assistants or extension agents in increasing the capacity of farmers also influencing the successful development of agricultural zones. In 2018, the policy to develop agricultural zones related to the guidelines for development of farmers’ corporation-based
agricultural zones was revised through the Minister of Agriculture Decree No. 18/2018. A corporation-based agricultural zones approach will guarantee the fulfillment of the availability of supply of food commodity production while still providing adequate benefits for farmers and producers. Study by [6] and [7] stated that the concept of corporate-based zones can be a solution to the difficulty of achieving economies of scale in order to increase farming efficiency in the area. The role of the Indonesian Agency for Agricultural Research and Development (IAARD) in the development of the agricultural zones is providing innovation and ensuring the introduction of technology to users to support the realization of farming efficiency, through technological advisory by the Assessment Institute for Agricultural Technology (AIATs).

Questions related to this current policy are: whether the innovation advisory has reached the target? What factors influenced its achievement? What the proper strategies in innovation advisory? The study aimed to analyze the performance of innovation advisory in 2018-2019 and to explore the determinant factors as well as to formulate alternative models and strategies for future innovation advisory in the development of farmers’ corporation-based agricultural zones.

2. Methods
2.1. Approach and concept of innovation advisory model
This study was conducted through a quantitative approach and enriched with qualitative data/information. Online research and confirmation at the field level were based on developed theories and concepts. The concepts of advisory model of farmers’ corporation-based agricultural zones were based on system theory explaining that activity is a form of association between various elements or subsystems. These elements of subsystems are organized and they work as a unity to produce certain outputs [8]-[9].

Each of the various subsystems has inputs to carry out an activity (process) in order to produce output. Innovation advisory by AIATs/IAARD was a subsystem within an agricultural area development system framework. The concept of the innovation advisory model was explained in Figure 1.

![Figure 1. Concept of the advisory model of farmers’ corporation-based agricultural zones by AIATs.](image_url)

The model concept explains that input variables consisting of internal inputs (X1) and external inputs (X2) are needed to carry out activities or processes of implementing innovation advisory (Y1) and to produce outputs from advisory activities (Y2) while benefits (outcome variables) of the output produced is Y3. Each variable has indicators that can be measured and observed with notations that characterize the variables they represent.
2.2. Location and time of assessment
Online survey was carried out with respondents dispersed throughout the provinces, while in-depth studies were carried out at selected locations (purposively selected) as a representative of sub-sectors including food crops (in Lebak District, Banten Province), horticulture (Malang District, East Java), cash crops (East Kolaka District, Southeast Sulawesi) and livestock (Subang District, West Java). The study was conducted in June-December 2019.

2.3. Collection data methods and determination of respondents
Primary data was collected using a structured online questionnaire, which was distributed via a google form link in the form of a self-assessment worksheet to the innovation advisory teams in 33 provinces/AIATs with total respondents (n) = 64. Qualitative data collection was carried out through focus group discussions (FGD) in four provinces, which represented the food crop, horticulture, cash crops and livestock sub-sectors. FGD participants were farmers (as many as 5-10 people/location) as members of farmer groups.

2.4. Data analysis
Confirmation of the model concept was analyzed using the Partial Least Square (PLS) with the SMART-PLS software. The advantage of this analysis tool is that it can simultaneously combine three analyzes such as the Structural Equation Model (SEM), namely factor analysis, regression analysis and path analysis. [10] mentioned SEM as an integrated approach between data analysis and concept construction because the structure of the relationship forming or explaining causality among factors. Comparing to SEM, the number of respondents (n) in PLS analysis is relatively smaller (between 30-100) than in SEM (more than 200 respondents).

3. Results and discussion
3.1. Performance of innovation advisory by AIATs
Performance of innovation advisory by AIATs in developing agricultural zones was somewhat not optimal. This activity was carried out in various forms of activities, ranging from mentoring to the preparation of the Masterplan and Actionplan with the local government, technical guidance for team in the field, demonstration plots and other dissemination methods. Advisory activities carried out by AIATs were determined by the budget availability. An overview of the implementation of innovation advisory can be seen in Table 1.

In general (about 75%), AIATs has conducted various activities, in fact almost all AIATs carried out demonstration plots/demfarms. The pilot location was in accordance with the commodity zoning map as stipulated in the Minister of Agriculture Decree No. 472 in 2018. However, there were still 18.75% of locations chosen outside the region, even around 40.63% were considered less strategic. The choice of location was generally determined together with the regional government and the farmers. The pilot location was assumed influencing the intensity of visits/monitoring of extension officers in the regions. According to [11] the pilot model in the form of a demonstration plot was a dissemination method that could increase innovation adoption. The pilot model was also preferred by farmers because it was easy to understand, more affordable and also allowed them to see the introduced technology directly [12].

Most technologies (about 84.38%) generated by IAARD were introduced during the advisory process, including high yielding varieties, planting methods, maintainance, harvesting methods, and the machinery. Moreover, some advisors also combined the technologies from innovation sources other than IAARD. To determine the appropriate technologies to be disseminated, the advisory team considered local site characteristics and agreed with all members of farmer groups.
| No. | Description | Frequency (n=64) | % |
|-----|-------------|-----------------|---|
| 1.  | Advisory Modes | | |
| a.  | Conducting 1-4 activities | 16 | 25.00 |
| b.  | Conducting >4 activities | 48 | 75.00 |
| 2.  | Demplot/demfarm dan basic implementation | | |
| a.  | Based on local government instruction | 25 | 39.06 |
| b.  | Based on the Minister of Agriculture Decree No. 472/2018 and the IAARD scope | 39 | 60.94 |
| 3.  | Demplot/demfarm locations | | |
| a.  | Outside the areas | 12 | 18.75 |
| b.  | Within the specified areas but less strategic | 26 | 40.63 |
| c.  | Within the specified areas and very strategic | 26 | 40.63 |
| 4.  | Source of introduced innovations | | |
| a.  | Innovations from outside IAARD | 2 | 3.12 |
| b.  | Innovations from IAARD | 54 | 84.38 |
| c.  | Combination (a and b) | 8 | 12.50 |
| 5.  | Advisory intensity by local extension officers | | |
| a.  | Never - rarely (once a month) | 16 | 25.00 |
| b.  | Seldom (twice a month) - Often (more than twice a month) | 48 | 75.00 |
| 6.  | Communication intensity with AIATs (in addition to official meetings/trainings) | | |
| a.  | Never - rarely (once a month) | 9 | 14.06 |
| b.  | Seldom (twice a month) - Often (more than twice a month) | 55 | 85.94 |
| 7.  | Coordination between AIATs and the Technical Directorates in the MoA scope | | |
| a.  | Never | 22 | 34.38 |
| b.  | 1 - 2 times of meeting coordination/year | 39 | 60.94 |
| c.  | ≥ 3 times of meeting coordination/year | 3 | 4.69 |

The agreement and commitment with the groups influenced the sustainability of adoption and diffusion of innovation. A farmer group is one of the successful indicators of transfer process and innovation adoption [13]. As an empowerment organisation, a farmer group plays a pivotal role in dissemination of information and innovation as well as contribution towards the achievement of adoption [14].

However, Table 1 showed that the advisory and communication within selected zone was less intensive. Likewise, the coordination between advisory team in AIATs dan other institutions under Ministry of Agriculture was weak. [15] stated that coordination is essential for the clear distribution of jobs description according to pooled mode of coordination. This mode puts any parties involved in the zone development to work as each role and function in order to achieve the main goals of the farmer’s corporation development. On the other hand, experiences from four visited provinces indicated that the communication and coordination between the advisory team in AIATs and local governments as well as other institutions under Ministry of Agriculture (i.e. Technical Directorates) went so well that the technology innovation performed to bring benefits for farmers within zones in each province.

Outputs from the advisory process was measured using several indicators, among others: percentage of adoption and diffusion by farmers, farming cost efficiency, and decreased of yield loss. Meanwhile, the outcomes and initial impacts were identified using these indicators: the increased productivity, the utilisation of innovation by stakeholders broadly, the initial sustainable programme, etc. As mentioned that the zone development was based on farmer’s corporation; therefore, the initial impact of the advisory process could also be measured from the opportunity to form farmer’s economic institutions towards the corporation. [7] mentioned that the development of Corporate
Farming (CF) in Central Java Province created an embryo of CF institution by merging two farmer groups based on field located in the same irrigation channels. Hence, technology innovation as well as institutional innovation could perform in a good way.

The outputs of advisory process in 2019 by AIATs shown in Table 2. Generally, the process showed the good results. In the beginning of technology introduction through demonstration plot/demonstration farm, more than 95% farmers have applied afterwards. This figure was understandable as the technical assistance from AIATs dominantly worked during the process.

| No. | Indicators                                      | Frequency | %   |
|-----|------------------------------------------------|-----------|-----|
| 1.  | Percentage of innovation adoption by farmers   |           |     |
| a.  | Cooperators farmers were decreasing            | 2         | 3.13|
| b.  | Increasing (< 25%) compared to the beginning  | 45        | 70.31|
| c.  | Increasing (> 25%) compared to the beginning  | 17        | 26.56|
| 2.  | Scope of farmers who applied the innovations   |           |     |
| a.  | Cooperators farmers were decreasing            | 1         | 1.56|
| b.  | Increasing by less than 25% compared to the beginning | 38     | 59.38|
| c.  | Increasing by more than 25% compared to the beginning | 14     | 21.88|
| d.  | Diffusing (outside the village)                | 11        | 17.19|
| 3.  | Farming cost efficiency                        |           |     |
| a.  | Remained steady                                | 12        | 18.75|
| b.  | Cost effective (< 10%)                         | 40        | 62.50|
| c.  | Increasing (≥10%)                              | 12        | 18.75|
| 4.  | Decreasing of yield loss                       |           |     |
| a.  | Remained steady                                | 23        | 35.93|
| b.  | Decreasing by less than 10%                    | 26        | 40.63|
| c.  | Decreasing by more than 10%                    | 15        | 23.44|
| 5.  | Attracting farmers from outside the zone of advisory |     |     |
| a.  | Farmers from other groups within the same village | 24   | 37.50|
| b.  | Farmers outside village                        | 29        | 45.31|
| c.  | Farmers outside subdistrict                    | 11        | 17.19|

Opportunity of diffusion was noted relatively well showed by the increasing number of farmers who have applied the introduced technologies. Likewise, farmers gained benefits from cost efficiency and yield loss even though most of them (62.50) benefited less than 10%. Meanwhile, about 64% farmers had decreased their yield loss due to the application of harvesting technology.

3.2. Determinants factors for innovation advisory performance
Analysis showd that internal inputs (budgeting plan and involvement of AIAT’s management) and external inputs (local government and partners provision, accessibility to facilities and infrastructures) significantly influenced the advisoty process in zone development (Figure 2).

In the implementation of advisory process, demplot or demfarm strategies and role of local extension officers had a considerable influence toward outputs of advisory, which were an increased adoption by farmers and an increased cost efficiency. Thus, it would greatly affect on the benefit gained by farmers that was showed by the increased productivity and the utilisation of innovation by other stakeholders.
Figure 2. Determinants factors for innovation advisory performance in the development of agricultural zone based on PLS analysis.

Previous studies regarding determinants factors for farmers’ perception toward innovation advisory and extension related to farmer characteristics particularly education level and farming experience [16] and [17], courage to take a risk, mobility and both, internal dan external collaboration among groups [18]-[19]. Meanwhile, the determinant factors for farmer’s awareness and adoption toward innovation could also be influenced considerably by extension access [20].

The R² value (refers to adoption level and farming cost efficiency) was considered low due to some reasons, including either (1) indicators explored in the questionnaire had not optimally represented those variables or (2) there were other factors out of those in this study. It was assumed that the factors among others: farmers perception on innovation, bio-phiscal factors relating with natural resources (such as water availability, land fertility, and climate), and fluctuated price for agricultural products.

Despite low value of R², the model was judged to be fit and can be used as a guidance for advisory model in the development of agricultural zones with corporation based. The model is assumed to be fit according PLS analysis when value of Average Variance Extracted (AVE) > 0.5 and Composite Reliability (CR) > 0.7. The results of analysis in this study can be seen in Table 3.

| Table 3. Analysis for model fit based on the value of AVE dan CR. |
|---------------------------------------------------------------|
| AVE | Composite Reliability (CR) |
| --- | --------------------------|
| X₁  | 0.689                      | X₁  | 0.815 |
| X₂  | 0.596                      | X₂  | 0.815 |
| Y₁  | 0.576                      | Y₁  | 0.723 |
| Y₂  | 0.574                      | Y₂  | 0.729 |
| Y₃  | 0.665                      | Y₃  | 0.794 |

*valid AVE value >0.5
*valid CR value >0.7

3.3. Alternative model and strategy for innovation advisory in the future
The current innovation advisory by AIATs was mainly in the form of disseminating innovations, in which most of the activities were implemented only with farmers as cooperators instead of involving all members of farmer groups. Likewise, the involvement of local extension officers was considered less optimal. Based on the fit model in Figure 2, the innovation advisory would be optimally applied when it involves a whole farmer group’s activity as well as active participation from local extension agents. The role of extension agents, both government officers and progressive farmers, has a huge influence on the success of innovation advisory [20].
According to the analysis above, this study identified some strategies for future advisory based on subsystem, indicators, and the actors involved during the process, as shown in Table 4.

**Table 4. Strategies for advisory process in farmer’s corporation development in agricultural zones.**

| Indicators                                      | Strategies                                                                 | Actors                                |
|------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------|
| 1. Role of farmer groups and local extension officers | a. Involving farmer groups and local extension officers since need assessment on technology, advisory process, monitoring and evaluation | Local extension offices and Agency for Agric. Extension (BPSDMP) |
|                                                 | b. Increasing the capacity of extension officers working in farmer’s corporation development zones |                                       |
| 2. Budgeting plan                               | a. Adjusting budget with the need of activities in the innovation advisory | Management under IAARD                |
|                                                 | b. Searching local budget provision from local government or other stakeholders |                                       |
| 3. Involvement of AIAT’s management             | Involving AIAT’s’ management since planning, monitoring and evaluation     | AIAT Management                       |
| 4. Local government and partners provision      | a. Involving local government since planning, monitoring and evaluation     | Local government, local team          |
|                                                 | b. Collaborating with businessmen (capital, marketing, etc)                  |                                       |
| 5. Accessibility to farming facilities          | Intervening to get easy access for farmers on facilities, capital, and market | Local team, farmers, collaborators    |
| 6. Provision of infrastructures                 | Intervening to get easy access for farmers on infrastructures, transportations, information, and communication | Local government, other Ministries, private company |
| 7. Demplot/demfarm development                  | a. Replicating demplot/demfarm in the strategical zones                     | Local team, progressive farmers, private company |
|                                                 | b. Replicating participatory demplot/demfarm in field owned by independent extension agents/progressive farmers |                                       |

**4. Conclusions**

The performance of innovation advisory activities among locations (provinces) was still diverse, according to the inter-AIAT budgeting allocation. The most popular activity was demonstration plot (dem-plot/dem-farm). The results of the advisory innovation were demonstrated through an increase in adoption (knowledge, attitudes and skills), as well as the diffusion of cultivation innovations and increased farm productivity. However, the role of AIATs has not been seen in the development of technology on a broader area. AIAT programs also have not yet focused on the farmers’ corporation development.

Modeling analysis that was fit in the innovation advisory indicated the importance of improving the internal management of implementing agents (AIAT), as well as external support, including the role of farmer groups, the need to synchronize programs, and policy between Ministry and regional level. Some strategies for advisory improvement in the future are: improvement in budgeting patterns, local government support especially in improving infrastructure and farmers' accessibility to production facilities, capital, and markets, and also increasing the role of agricultural extension officers.

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