Institutional strengthening of rice seed based on the community in supporting food security

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Abstract. Seedling-system transformation has been gradually shifted the seed authority management from farmer and breeder to multinational companies. This circumstance should be balanced with farmer capability in producing seeds independently to prevent capitalization. Thus, the Ministry of Agriculture has declared the seed self-reliance villages as a community-based program to face those challenges. This study aimed to evaluate the importance of institutional strengthening through the seed self-reliance villages program to improve food security and increase farmer welfare. This research was conducted based on the survey method and Focus Group Discussion (FGD) at five districts (Kendal, Boyolali, Tegal, Klaten, and Sragen) in Central Java. A survey through informal interview involved 30 representative participants from farmer groups of each district, while the FGD was performed through in-depth discussion with 22 participants, including farmers, extension or agricultural officers, and other related stakeholders. The result showed that global agreement obstructs the community-based seedling system, particularly in breeding and certification. A community-based rice seedling institution threatened to quit due to asymmetric interaction between the actors. Moreover, this seedling institution should be strengthened in the technological aspect and property right management. In the end, the government’s role as a facilitator is critical in this community-based seedling institution, especially in capital aspects.

1. Introduction

The seed has a vital position and substantial control in the food system. However, the seedling system had transformed gradually in the first half of the 20th century. The major transformation was about authority management, which initially handled by farmers and breeders become shifted to multinational companies [1,2]. This condition should be balanced with farmer capability in producing seed independently to avoid company capitalism.

Through the Ministry of Agriculture, the Indonesian government has declared a seedling policy designed in several programs to protect farmers. The seed self-reliance villages program is one of the community-based seedling programs implemented since 2015 in 31 provinces of Indonesia, one of these provinces is Central Java. This program is an informal seedling management system that collectively produces and sells qualified seeds to ensure seed availability in agricultural communities or farmer groups.

Unfortunately, the implementation program of seed self-reliance villages has not yet been worked as expected. The problems are incredibly complex, not only in technical but also in economic and socio-
culture aspects [3]. This program is associated with rural development as a whole. Therefore, the institutional aspect is one of the critical aspects that must be handled properly to sustain the program.

This study was determined to evaluate the seed self-reliance villages program's performance in Central Java and the importance of institutional strengthening in supporting food security and farmer welfare. The study's focus was rice seeds considering that rice is the primary staple food in Indonesia, and the provision of rice seeds would support food security.

2. Methods
The community-based seedling concept implemented in this study refers to the Consortium for Unfavorable Rice Environment (CURE) program. However, there was a little modification in the crop selection and certification process. This program arranges the informal seedling system in an agricultural community or farmer group that collectively produced and sold good quality seeds to ensure seed availability at the right time and in the right place. On the other hand, the institutional strengthening method was carried out through the Field School Farmer (FFS) approach, a non-formal learning process to develop farmer skill and knowledge in recognizing the potency, arranging the business plans, identifying and solving problems, making a decision, applying appropriate technology synergistically and environmentally friendly to achieve high productivity and sustainable farming [4].

This study was conducted in 2015-2019 at five Central Java districts, namely Kendal, Tegal, Boyolali, Sragen, and Klaten. Evaluation of the program performance and its institutional strengthening efficiency was determined based on periodic survey method and Focus Group Discussion (FGD). The survey involved about 30 participants, which were farmer groups representative from each district. Detailed information on seed production and distribution, technology application, seedling management, and socio-economics conditions were collected through an informal interview during the survey. Meanwhile, there were 22 participants representatives from each district, including farmers, agricultural service officers, extension agents, village officials, and relevant stakeholders, involved in the FGD. The data observed including institutional performance and institutional role in supporting food security. Secondary information was collected from the concerned agricultural office. Data were analyzed qualitatively.

3. Results and discussion
An attempt of the community-based seedling system in supporting food security could be noticed from three aspects, i.e.: (1) seed production and distribution, (2) institutional strengthening, and (3) the role of seeds in food security. Each aspect is described as follows:

3.1. Seed production and distribution
Seed production and distribution are the main factors in the seedling system concept [5]. In this study, the rice seeds produced were new superior varieties (NSV) from a specific location and had certified. This kind of seed was expected to be contributed to the increasing in yield and profit. Previous research showed that the utilization of certified and specific-location NSV rice seeds increased the yield and the profit [6, 7, 8, 9].

Table 1 represents the production of certified rice seed in the study location from 2015 to 2019. The seeds were produced on the field laboratory (FL) and field school (FS) land. Intensive assistance was provided on the FL land with some stimulus like seeds and other agricultural inputs. Meanwhile, on the FS land, intensive assistance was provided without stimulus.

The number of seeds produced was adjusted to market demand and working capital. Overall, the seed self-reliance village program's performance has not been fully achieved due to the seed demand in its region was not fulfilled adequately (on time, good quality, exact quantity, well price, seed type, and right place). There were some obstacles in seed production: land, capital, seed source, technology understanding, and farmer behavior. The farmer land for the seedling business is quite extensive, but some farmers were not interested in the seedling business and even refused it. In this business, farmers should be waiting for the payment about a month after the seeds are sold. The fact that farmers mostly
need a direct cash payment to fulfill their daily outcome became the main reason for seedling business rejection. Limited capital of nursery caused the seed payment to the farmers were often delayed.

Another constrain of seed production in the study location is seed availability. The seed required is Foundation Seed (FS) because farmers prefer to use certified Stock Seed (SS) than Extension Seed (ES). Based on the regulation of Indonesian Agricultural Ministry No.355/HK.130/C/05/2015, the production system of rice seed is started from Breeder Seed (BS) and then sequentially derivate into Foundation Seed (FS), Stock Seed (SS), and Extension Seed (ES). The BS class is produced by a breeder in the research institution, while the other seeds class is produced by Seed Center, private producer, or individuals.

There is a misconception at the farmer level, who believed that SS class paddy has better quality, higher yield, and high resistance toward pest and disease attack. The whole seed classes have an equal potential genetic due to the same variety. The seed class was distinguished by the number of impurities (dirt and other varieties mixture) and physical characteristics [10,11]. These factors do not affect productivity, agronomic character, and yield components [10]. Agronomic characteristics and yield components are mainly determined by the genetic nature of the varieties themselves.

### Table 1. The production of certified seeds in five districts of Central Java 2015-2019.

| Year | Production in each location (Kg) | Total |
|------|---------------------------------|-------|
|      | Kendal | Boyolali | Tegal | Sragen | Klaten | |
| 2015 | 2,600 (29,850*) | - | - | (36,530*) | 2,400 (82,400*) | 5,000 (148,780*) |
| 2016 | 6,500 (20,050*) | - | - | 5,900 | 8,225 (66,940*) | 20,625 (101,090*) |
| 2017 | 16,900 (9,000*) | 12,900 (3,500)* | 15,500 | 8,800 (11,900)* | 54,100 (24,400*) |
| 2018 | 6,000 (7,000*) | 6,500 | 16,000 | 20,000 (32,000*) | 48,500 (48,20*) |
| 2019 | 2,000 (43,000*) | 1,000 | - | 32,350 (106,165*) | 44,350 (149,165*) |
|      | 34,000 (108,900*) | 29,400 (3,500)* | 31,500 | 67,050 (188,795*) | 172,575 (472,155*) |

Note: *Field School location

Moreover, poor understanding of farmers in seedling technology is another obstacle in the study location that required intensive assistance, especially in the crop selection stage. Crop selection could reduce the yield so that farmers as a breeder were often neglecting an appropriate crop selection procedure. This negligence led to a failure in field inspection, and as a consequence, the produced seeds become improper seeds.

Farmer behavior toward certified seeds should also be considered in the seed production process. There are three typical farmers based on their utilizing certified seeds [12]. First, the farmers who always use certified seeds realize that the certified seeds have excellent benefits such as higher production, plant growth, and higher yield price. Second, farmers who use certified seeds in a particular season, especially in the second or third planting season. This second type utilize certified seeds in the riskiest planting season to minimize crop failure. Third, farmers who use certified seeds after 3-4 times of planting due to limited assets (narrow land and nether income).

The seeds were mainly distributed to the farmer group members, and the remaining seeds were sold to other areas through farm stalls or collaborated with partners (state-owned enterprises or private
sectors). The seeds were sold to other areas since their varieties were inappropriate with farmer preference. The rice cultivated in the study location varies from 7 to 10 rice varieties. On the other hand, partners’ involvement in seed distribution would help accelerate the cash circulation, primarily if the seeds are sold in large capacity.

3.2. The institutional strengthening

The organization’s establishment was an initial step of institutional strengthening in the seed self-reliance village program. The organization was established in the form of a farmer group. However, the implementation of farmer groups as a business unit certainly should deal with some obstacles. Seedling business is a commercial organization managed professionally, requires capital, and has a profit target. Meanwhile, most farmer groups just functioned as facilitators in sharing information or experiences related to agricultural programs or issues [13]. This circumstance rendered a difficulty in farmer group existence as a business unit.

The periodic survey in 2015-2019 showed that the conflict of interest between members of farmer group and business unit administrator was mainly triggered by the obscurity of property rights in seedling business management. There was an inconsistency between investment and working capital. The investment in farmer groups is mostly assisted by local government, which means the groups would handle the property and the profit gained belong to all group members (table 2). Meanwhile, the seedling business’s working capital in five study locations is the head manager's private capital.

| Table 2. Financial support to the village of rice seed self-reliance at Central Java in 2015. |
|-----------------------------------------------|-------------|----------------|----------------|
| Cost items                                    | Unit        | Unit Cost (IDR) | Total Cost (IDR) |
| Infrastructure facilities of production,      | 10 ha       | 2,500,000       | 25,000,000      |
| processing, and certification                |             |                 |                 |
| The seed processing and packaging             | 1 unit      | 45,000,000      | 45,000,000      |
| equipment or machines                        |             |                 |                 |
| Warehouse (min. 40 m²)                        | 1 unit      | 60,000,000      | 60,000,000      |
| Drying floor (min 80 m²)                      | 1 unit      | 40,000,000      | 40,000,000      |
| Total amount (IDR)                            |             |                 | 170,000,000     |

Several issues of seedling business management were also identified in the Focus Group Discussion (FGD): (i) the transparency of property right, (ii) the group has no contribution in working capital share, (iii) complexity in profit calculation due to the free-rider, (iv) mostly members just interested in short-term profit not a long-term investment, and (v) a lack of control in the business management neither from farmer group itself nor from the government.

Institutional strengthening was gradually directed to the seedling management improvement, particularly on the seedling business revitalization. There were several agreements on the revitalization project: (i) the seedling business unit is not a part of the farmer group, and (ii) the seedling business should pay money to the farmer group for using the grant facilities. The local government gives a social grant of seedling facilities through the group to be used by farmers in those areas. This grant could not be transferred to the commercial or individual seedling business juristically. However, the management believed that leasing payment in using the seedling facilities burdensome business.

Interestingly, this conflict did not come to the surface since the seedling business's head manager had a higher socioeconomic status than other farmers in those locations. The group members realized that the seedling business would not operate if no one initiatively managed the business and provided the working capital concurrently. Revitalization implementation is extremely challenging, but the seed self-reliance program threatened unsustainable if the revitalization were unexecuted. This circumstance
proved in 2019, which the seed self-reliance villages only remained 22 active units (34.49%) from 63 units.

3.3. The role of seeds in supporting food security
National production of certified rice seeds in 2019 in the amount of 220,738 tons only meet 20.71% of national demand that reached 276,515 tons [14], and the shortage was obtained from the informal sector. Meanwhile, the certified seed shortage in Central Java is about 20.57% annually [15]. The number of seed producers in Central Java for the last five years (2014-2018) is about 234-313 units (table 3). There are three types of rice seed producers in Central Java: (1) state-owned enterprises (Pertani Ltd., Sang Hyang Seri Ltd.), (2) private sector, and (3) government. Their contribution to rice seed production was dominated by state-owned enterprises (51%) and private sectors (46%) [16]. Farmer, as a breeder in the seed self-reliance program, is categorized as a private producer.

**Table 3. The rice seed producer in Central Java.**

| Description                | 2014   | 2015   | 2016   | 2017   | 2018   |
|----------------------------|--------|--------|--------|--------|--------|
| Total producer (unit)      | 277    | 313    | 259    | 257    | 234    |
| Dealer (unit)              | 97     | 52     | 31     | 28     | 27     |
| Seed production field (ha) | 13,508 | 11,006 | 15,528 | 13,214 | 11,959 |
| Seed production (tons)     | 38,250 | 39,586 | 41,402 | 39,753 | 38,667 |

Source: Supervisory and Certification Office of Central Java (2019) [17]

In the rice seed production system, there is four interacted subsystem: (1) research, breeding, and releasing of varieties; (2) seed production and distribution; (3) quality control and certification; and (4) supporting subsystems, such as government regulation, human resources, and infrastructure facilities [18,19]. Indonesia still not ratification from The International Union for the Protection of New Varieties of Plants (UPOV), but the seed production regulations similar to countries that ratified UPOV. The presence of UPOV in the Regional Comprehensive Economic Partnership (RCEP) would strengthening corporation monopoly in the seed authority and obstruct the farmer right in seed development [20]. Another global agreement associated with seed certification also affected the seed self-reliance villages program [21]. These global agreements emphasized that farmers could only use certified seeds and could not sell uncertified seeds.

In Indonesia, particularly Central Java, rice seed industry development is still limited, and farmer dependency on informal seeds is very high. The combination of utilizing formal and informal seeds in the rural area resulted in complementary and synergic effects. The rice productivity of certified seed had proven high, but the genotype remains unvaried. Meanwhile, the agrobiodiversity of informal seeds could complement that shortcoming. The informal seeds own natural resiliency toward farming environmental change so that this informal seed utilization could become a food security defense strategy for small-scale farmers.

The above overview accentuates that it is crucial to develop a stable community-based seedling system. This system was modified from the system developed by Consortium for Unfavorable Rice Environment (CURE). The seed self-reliance villages program's final purpose is to utilize qualified seeds, both certified and uncertified. This concept is analogous with the previous observation, which reported that the operational policy of the food crop seed production should be directed to (i) juxtapose the location of the seedling industry with the user or production center and avoid the long-distance seed transportation; (ii) develop seedling industries in the rural area (decentralizing seedling industry); (iii) strengthening the seedling industry based on quality management; (iv) revitalization and coordination intensify of inter producers and between the producers with the users; (v) intensifying the role of private sectors and own-state enterprises in the national seedling industries [11]. With the growth of superior
local varieties, the development of seedling industries based on the community would be more effective and efficient if implemented in a specific location.

4. Conclusion
The global agreement could hinder the community-based seedling system, particularly in breeding and certification. The implementation of the community-based seedling system developed by the Consortium for Unfavorable Rice Environment (CURE) should be modified with the ultimate goal of producing qualified seeds, both certified and uncertified. A community-based rice seedling institution threatened to quit due to asymmetric interaction among actors. Therefore, the seedling institution should be strengthening from the technological aspect and the property right management. The government's role as a facilitator is critical in this community-based seedling institution, especially in capital aspects. The program of seed self-reliance villages would support food security through seed provides.

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