Key drivers of organic rice productivity in Sleman and Magelang Regencies

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Abstract. Organic farming system in Indonesia had been growing continuously in the recent years. Organic label could only be put on products which were complied with organic standards and regulations as well as certification requirements. As the world became more global, in addition to organic national certification, Indonesian organic farmers needed to comply with international organic certification so that they could enter the open market. This study attempted to: (1) provide a descriptive analysis of rice organic farmers’ characteristics in two locations of organic farming, (2) understand farmers’ knowledge and motivation on organic farming, and (3) analyse the gaps between farmers’ practice in organic farming and certification standard requirements. Results of the study showed that, basically, all farmers understood the concept of organic farmers. However, the farmers had not fully implemented the procedures as required in the Indonesian National Standard (SNI), let alone international organic certifications (IFOAM and USDA). There were several aspects that need to be improved in order to close the gaps between farmers’ practice in organic farming and certification standard requirements.

1. Introduction

According to data from the Ministry of Agriculture Republic Indonesia, the contribution of the Agriculture, Forestry and Fisheries sectors to Indonesian GDP during the last five years (2014 – 2018) amounted to 13.3% in average with 3.7% growth in the period of 2017 to the second quarter of 2019 [1]. This sector remained as the second largest contributor to Indonesian GDP after the sector of processing industry [1]. Moreover, the sector had the largest number of employments among other sectors in GDP in the period of 2011 to February 2018. It contributed 33.74% to the employment in Indonesia, while the second largest held by the sector of wholesale and retail trade business; car and motorcycle repair and maintenance that contributed 18.51% [1].

Increasing population in Indonesia would certainly increase its food needs. The issue of food security had been a crucial issue since the end of the 20th century. The food crisis occurred globally in all parts of the world. Indonesia as a developing country had the same concerns about the issue of food shortages so that a green revolution emerged. [2] stated that the green revolution had become a form of
success for Indonesia because of Indonesia's favorable climate, adequate land capacity, as well as supportive life and political security. At that time, the green revolution had succeeded in making Indonesia a country with extraordinary production increases. Rice self-sufficiency occurred with a threefold increase in production. Intensification activities were carried out by using large amounts of chemical inputs to boost production. The effects of the use of chemical fertilizers were felt throughout the last 20 years. In the past 15 years, it was known that the rate of productivity tends to be sloping [3].

[4] wrote that in the 1990s a new agricultural concept was introduced, namely the concept of sustainable agriculture. This concept implied that agriculture should: (i) focus on economic conditions by emphasizing economic justice, business continuity and long-term profit, (ii) focus on the environment where agriculture must also consider its impact on land, water, and wildlife, and (iii) consider the welfare of the community by considering the quality of food and toxic chemicals. One way to achieve sustainable agriculture was through organic farming systems [5]. The definition of organic farming according to the International Federation of Organic Agriculture Movements (IFOAM) was “a production system that sustains the health of soils, ecosystems and people” [6], while according to [7] was “an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity”.

The Government of Indonesia had been supporting the development of organic farming since 2001. The program of Go Organic 2010, which could be interpreted as a movement towards a fully organic agriculture by 2010 in Indonesia, was launched in 2001 [8]. However, [9] and [10] stated that the program was not successful in encouraging farmers’ engagement in organic farming. [11] reported that organic agricultural land in Indonesia in the year of 2017 was 208,042 hectares. The area was only 0.4 percent of total agricultural land in Indonesia.

The development of organic rice farming got special attention from the government because rice was a staple crop in Indonesia. Total organic area for cereals (wheat, spelt, barley, oats, grain, maize, rice, rye, Andean grains, triticale) in Indonesia in 2017 was 53,826 hectares that was 0.3% total organic area [11]. [8] argued that the low adoption of organic rice farming was caused by these factors: (i) low-skilled human resources in the agricultural sector, (ii) no specific and established regulation of organic agriculture (such as subsidies, inspections, and certification), (iii) little access to financial services and (iv) the pervasiveness of middlemen that hamper farmers from realizing the benefits of organic agricultural practices.

This study attempted (1) to provide a descriptive analysis of rice organic farmers’ characteristics in two locations of organic farming, (2) to understand farmers’ knowledge and motivation on organic farming, and (3) to analyze the gaps between farmers’ practice in organic farming and certification standard requirements.

2. Methods

2.1. Sampling and data collection

The study was carried out in Pakem, Sleman District of Yogyakarta Province and Sawangan, Magelang District of Central Java Province, Indonesia. Both locations were selected considering that those villages were the centers of organic rice farming of the selected districts. The microclimate condition as well as the availability of adequate water sources throughout the year in Pakem and Sawangan strongly supported rice farming. Moreover, there were rice farmer groups with specialty of organic rice farming in the locations. Samples derived from organic rice farmers in Sleman were all members of Rukun Farmers’ Group. In Magelang District, Sawangan Organic Farmers Association (GATOS) was chosen as a sample among three rice farmer groups that have organic certificates. The selection was because the farmer group had the most extensive land. In total, samples in this study were 42 organic rice farmers. Data were collected by survey method and in-depth interview. The small number of samples was one of the limitations in this study, so that in subsequent studies it was expected that there would be more samples.
The survey was conducted in 2018, using a structured questionnaire completed during face-to-face interviews. The survey questionnaire covered: (a) profile of farmers (e.g., age, gender, experience, education, farm business analysis); (b) knowledge on organic farming; (c) opinion on organic farming (e.g., organic experience, motivation); (d) compliance of national and international organic certification.

2.2. Assumptions

The assumptions in this study were that the decision to adopt organic farming system was voluntary and that the differences in responses at the household level were due to different socio-economics backgrounds of the farmers (e.g., gender, levels of education), different endowments in resources, different constraints, different farming objectives and preferences.

2.3. Method of analysis

Data collected were summarized and analyzed using descriptive analysis, i.e., frequency, percentage, maximum, minimum, mean, mode. Likert scale was analyzed using mode statistic.

3. Results and Discussions

3.1. Profiles of the farmers

The average age of organic rice farmers in Pakem was 51 years old with 20.06 years of farming experience and 5.94 years of organic farming experience (Table 1). Organic rice farmers in Sawangan had slightly different number of farmer’s age and farming experience which were 50.87 years old and 23.52 years. However, Sawangan farmers had more experience in adopting organic farming which was 10.39 years. This average age of organic farmers was not different from those in California which, according to the study of [12], was 50.1 years old.

|                      | Minimum | Maximum | Mean | Std. Deviation |
|----------------------|---------|---------|------|----------------|
|                      | Pakem   | Sawangan| Pakem| Sawangan       |
| Age                  | 36      | 28      | 69   | 82             | 51.21          | 50.87          | 10.54          | 11.56          |
| Gender               | 1       | 1       | 1    | 2              | 1              | 1.22           | 0              | 0.42           |
| Marital status       | 1       | 1       | 2    | 3              | 1.05           | 1.39           | 0.23           | 0.78           |
| Education            | 0       | 2       | 16   | 16             | 8              | 10.57          | 4.41           | 3.04           |
| Farming experience   | 1       | 4       | 55   | 52             | 20.06          | 23.52          | 19.09          | 13.43          |
| Organic experience   | 1       | 3       | 9    | 23             | 5.94           | 10.39          | 2.44           | 5.42           |
| Settlement duration  | 15      | 5       | 54   | 82             | 45.37          | 38.57          | 15.21          | 18.00          |
| Household members    | 1       | 0       | 4    | 4              | 2.37           | 2              | 0.76           | 1.21           |

Source: Primary data, 2018

There were no female farmers in Pakem and only 2 female farmers in Sawangan. This finding was different from the study of [13]. They found that in M’lang, North Cotabato, Philippines, female farmers were more likely to adopt organic farming. Almost all the farmers in both locations were married (78.26%), 17.39% were widower and 4.35% were single. Education of the farmers in average was 9.40 years or high school level. This was below the education level of organic farmers in the Philippines who were mostly high school graduates [13]. The farmers were native to the location,
shown by the average settlement duration of 41.64 years. In Northeastern Thailand, the average size of the organic farm households was medium size or consisted of 4 family members [14]. In Pakem and Sawangan, the size of the households was smaller, consisted only 2 family members in average. Farming experience of organic rice farmers in average was 22 years. The finding was consistent with farming experience of organic farmers in the Philippines and Peshawar, Pakistan [13,15]. [13] added that farmers with more farming experience were more likely to adopt organic farming. In those years of farming experience, farmers possibly witnessed the adverse effects of conventional farming towards the quality of the soil and the level of production in response to the changes in weather. Thus, they tended to be more responsive to the adoption of organic technique in rice production.

Table 2 illustrated farm business analysis of organic rice farming in Pakem and Sawangan. Organic farming in Pakem and Sawangan had approached conventional farming productivity. In Sawangan, the lowest profit was minus. [5] pointed out that, generally, at least in the short-term, organic farming produced lower crop yields, but in the long-term might produce higher yields.

|                          | Pakem       | Sawangan   |
|--------------------------|-------------|------------|
|                          | Highest     | Lowest     | Average | Highest | Lowest | Average |
| Conventional farming productivity (tons/hectares/year) | 6.7 | 3.7 | 5.2 | 5.2 | 3.2 | 4.1 |
| Average organic farming productivity (Rp/hectares) | 5.7 | 2.9 | 4.6 | 4.7 | 2.6 | 3.6 |
| Farmland size (square meter) | 13 | 500 | 2,597 | 18 | 940 | 5,567 |
| Productivity (tons/hectares/year) | 7.5 | 1.5 | 4.2 | 8 | 2.8 | 4.7 |
| Income (Rp/hectare/year) | 156,108,000 | 3,003,000 | 51,682,924 | 78,171,875 | 6,496,278 | 32,953,482 |
| Profit (tons/hectares/year) | 155,458,000 | 872,5 | 47,049,674 | 74,689,456 | -2,117,290 | 26,661,009 |

Source: Primary data, 2018

3.2. Opinions on climate change and organic farming

There was an argument that organic farming system could contribute significantly to sustainable agriculture and better deal with the negative impacts of climate change [5]. Organic farmers in Sawangan were more aware of climate change (95.7%) compared to farmers in Pakem (57.9%). Most of Pakem and Sawangan farmers considered that today's climate was different from 10 years ago, but they agreed that the change was not extreme. More than half farmers adjusted their farming system in respond to the climate change (Table 3).

|                          | Pakem (%) | Sawangan (%) |
|--------------------------|-----------|--------------|
|                          | Yes | No | Yes | No |
| Awareness of climate change | 57.9 | 42.1 | 95.7 | 4.3 |
| Receiving information about climate change | 57.9 | 42.1 | 47.8 | 63.2 |
| Today's climate was different from 10 years ago | 78.9 | 21.1 | 73.9 | 26.1 |
| Extreme climate | 31.6 | 52.6 | 8.7 | 91.3 |
| Adaptation | 63.2 | 15.8 | 69.6 | 30.4 |

Source: Primary data, 2018
Several adaptation methods carried out by the farmers were: using drought-resistant varieties, using pest-resistant varieties, adjusting planting time, adjusting harvest time, adjusting time, type and dosage of pesticides application, changing the dosage of organic material, changing the dosage of inorganic materials, using mulch, using shade net, increasing watering, reducing water use, changing watering and drainage techniques, diversification by planting other plants, using *pranata mangsa* (a Javanese traditional calendar about the rules of the season), increasing or expanding arable land and diversification of income by working outside the agricultural sector.

Adaptation toward climate change, however, were not easy to do. Farmers stated that there were several obstacles in doing the adaptation. Table 4 summarized the obstacles farmers faced to adapt to the climate changes. The top four obstacles were: current land tenure systems; unavailability of cheap and easy credit facilities; high risk of failure of adaptation strategies; and low support from farming institutions, especially from farmer groups and cooperatives.

**Table 4.** Obstacles faced by the farmers in climate change adaptation.

| Obstacle                                                                 | Pakem (%) | Sawangan (%) |
|-------------------------------------------------------------------------|-----------|--------------|
| Unavailability of farming technology that was designed to adapt to climate change | 21        | 63           | 39           | 61           |
| Difficulty of obtaining farming technology that was designed to adapt to climate change | 21        | 79           | 35           | 65           |
| Current land tenure systems, such as leases, that position farmers to move periodically | 5         | 95           | 0            | 100          |
| *Pranata mangsa* (a Javanese traditional calendar about the rules of the season) was no longer effective | 47        | 53           | 22           | 78           |
| Traditional beliefs/practices (conventional) made it difficult for farmers to adopt adaptation strategies | 32        | 68           | 26           | 74           |
| Ineffective agricultural extension | 21        | 79           | 9            | 91           |
| Lack or ease of access of obtaining weather forecasting information | 47        | 53           | 48           | 52           |
| Difficulty in obtaining varieties that had been designed to adapt to climate change | 32        | 68           | 43           | 57           |
| Unavailability of varieties that had been designed to adapt to climate change | 21        | 79           | 48           | 52           |
| Unavailability of cheap and easy credit facilities | 11        | 89           | 0            | 100          |
| High risk of failure of adaptation strategies | 21        | 79           | 0            | 100          |
| Expensive prices of production inputs | 42        | 58           | 13           | 87           |
| Unavailability of production inputs | 47        | 53           | 4            | 96           |
| Low levels of awareness of farmers in general towards climate change | 47        | 53           | 48           | 52           |
| Low support from farming institutions, especially from farmer groups and cooperatives | 26        | 74           | 0            | 100          |
| Weak attention and government policies on the problem of climate change | 32        | 68           | 30           | 70           |
| Lack of supporting fund | 42        | 58           | 52           | 48           |
| Availability of water | 58        | 42           | 26           | 70           |

Source: Primary data, 2018
Organic farming system was one of several ways of climate change adaptation. The main source of information about organic farming for farmers in Pakem was others (independent learning, farmer group), while in Sawangan was Agricultural Extension Agent /AEA (Table 5). [16] stated that the agents served as administrative leaders and coordinators for formulating, developing, implementing and evaluating agricultural extension programs, as well as improving the farmers’ skill in managing resources in the rural areas. Thus, their role to disseminate appropriate information to farmers in Indonesia was very important. In Nepal, [17] also found that local institutions and training played a vital role for conversion to organic production. Table 5 showed the percentage of organic farming information sources in Pakem and Sawangan. [14] found similar findings to Table 5, particularly to farmers in Sawangan. In Norheastern Thailand, 60 percent of organic rice farmers had got information from extension agents, 18 percent from neighboring farmers (friends and relatives) and 14 percent from mass media.

Table 5. Sources of information about organic farming.

| Source                  | Percentage | Pakem  | Sawangan |
|-------------------------|------------|--------|----------|
| Agricultural Extension Agents | 36.84     | 65.22  |
| Friends                 | 21.05      | 21.74  |
| Relatives               | 0.00       | 4.35   |
| Mass media              | 5.26       | 4.35   |
| Religious Leaders       | 0.00       | 0.00   |
| Public figures          | 10.53      | 4.35   |
| Others                  | 42.11      | 8.70   |

Source: Primary data, 2018

Motivation of the transition to organic farming was analyzed to serve as a basis of information for AEA. The questionnaire survey showed that the main motivation of Pakem farmers was organic products had higher price than conventional products. This finding was in line with the motivation of organic farmers in Slovak Republic. The main motivation of farmers surveyed in Slovak Republics (88%) was a financial benefit derived from increased funding from direct payments [18]. Meanwhile, in Sawangan, the main motivation of adopting organic farming was healthier product. Similar motivation was found in Northeastern Thailand, that demand for healthy food, and human and animal health problems (due to use of agrochemicals) were the influencing factors to adopt organic farming system [14]. The subsequent motivation of organic farmers in Pakem, from the highest to lowest rank, was organic farming was considered more profitable than conventional farming, healthier (non-chemical) agricultural products, soil fertility preservation, easier agricultural technique compared to conventional farming, more independent (in term of providing input such as seeds, fertilizer, pesticides), spiritual reasons and only following other farmers who were already converting. In Sawangan, the motivation from the highest to lowest rank was more independent, soil fertility preservation, spiritual reasons, higher price products, easier agricultural technique, and only following other farmers who were already converting (Table 6). [19] found that farmers with experience of more than ten years (i.e. average and highly experienced farmers) were more concerned about the social factors like quality of food, health benefits, environmental benefits and the benefits about collecting farming. The reasons could be that they had received the required support and training from the government and other bodies and had gradually become more aware of the market opportunities.

[20] pointed out that “more independent” motivation was based on certain principles regarding organic system owned by Pakem and Sawangan farmers, which were: (a) freedom in managing their farm, particularly in choosing a variety to be planted, fertilizers to be applied, etc.; (b) empowerment of the farmers from being exploited by global capitalism (e.g., fertilizer and pesticide industries); (c)
farmers could use inputs that they could make by themselves; and (d) farmers could market their products by their own to increase their "bargaining power" and income [20].

Table 6. Motivation of organic farming adoption.

| Source                              | Rank Pakem | Rank Sawangan |
|-------------------------------------|------------|---------------|
| More profitable                     | 2          | 7             |
| Higher price of the products        | 1          | 5             |
| Healthier agricultural products     | 3          | 1             |
| Easier agricultural technique       | 5          | 6             |
| Preserving soil fertility           | 4          | 3             |
| More independent                    | 6          | 2             |
| Spiritual reasons                   | 7          | 4             |
| Following other farmers             | 8          | 8             |

Source: Primary data, 2018

Farmers in Sawangan had started organic farming system since 2010. Farmers' interest in organic farming was initiated by the Integrated Pest Management (IPM) program which was introduced by extension workers when the region became an endemic plant hopper area. The community used large amounts of pesticides to destroy the plant hopper, which resulted in the reduction of natural enemies. GATOS member farmers got several benefits, including getting rice seeds in the form of debt or even free from groups. The origin of seeds was usually the best grain produced organically so that farmers believed that the seeds planted were organic seeds. GATOS not only produced white rice, but also brown rice and black rice. These organic products had been widely marketed throughout Indonesia. The challenge faced by GATOS was the high demand so that the products available were sometimes unable to meet the needs. Rukun farmer group in Pakem started organic farming system since 2001. In its development, this group received intervention from outside, including Joglo Tani, a non-government organization, and the Yogyakarta provincial agriculture office. In 2015, the farmer group applied for organic recertification from the Organic Certification Institute (LSO) Persada. The organic certificate for the second 5 years would expire in 2020.

3.3. Farmers’ knowledge on organic farming system

[21] remarked that general understanding of organic farming in Indonesia was still different between farmers. Some farmers considered that if an agricultural product was no longer produced with synthetic chemicals, including fertilizers or pesticides, then the product could be sold with the label "organic". This understanding was misleading, because if a land had ever been used for conventional agriculture that used chemicals, a conversion period was needed to degrade chemicals that were left in the soil. This conversion period was usually classified as an “organic transition”. After going through a conversion period or a specified period, the products from the land that were produced with an organic farming system could now be labeled as “organic” [21].

The study of [20] found that there were two types of "organic" rice farming in Yogyakarta and its surrounding. The first one was non-pesticides rice farming (but still used fewer chemical fertilizers plus manure/compost). This type was called semi-organic farming. The second one was pure organic rice farming (used only manure/compost and other natural inputs). Table 7 summarized farmer’s knowledge of organic farming system in Pakem and Sawangan. In general, organic rice farmers in Sawangan had better knowledge of organic system. They understood that organic means without chemical pesticides and fertilizers (100%) and without chemical inputs (87%). In addition, 30% of the
farmers stated that organic farming also requires certified organic seeds and having no contaminant in the water source.

**Table 7.** Farmer’s knowledge of organic farming system.

| Component                    | Aspect                              | Percentage (%) | Pakem | Sawangan |
|------------------------------|-------------------------------------|----------------|-------|----------|
| Organic Definition Knowledge | Without chemical pesticides (%)     | 11             | 0     | 0        |
|                              | Without chemical fertilizers (%)    | 11             | 0     |          |
|                              | Without both (%)                    | 78             | 100   |          |
| Agricultural status          | Organic (%)                         | 100            | 18    |          |
|                              | Conversion process (%)              | 0              | 82    |          |
| Chemical input               | Without chemical input (%)          | 68             | 87    |          |
|                              | With chemical input (%)             | 32             | 13    |          |
| Certified organic seeds      | Yes (%)                             | 26             | 30    |          |
|                              | No (%)                              | 58             | 70    |          |
|                              | Unknown (%)                         | 11             | 0     |          |
| Contaminant free water source| Yes (%)                             | 53             | 57    |          |
|                              | No (%)                              | 21             | 35    |          |
|                              | Unknown (%)                         | 21             | 9     |          |
| Farm Recording               | Yes (%)                             | 32             | 4     |          |
|                              | No (%)                              | 68             | 96    |          |

Source: Primary data, 2018

Table 8 summarized differences felt by farmers in implementing organic and conventional farming. Pakem and Sawangan farmers felt that the health benefits of organic farming were far better than conventional farming, so were the economic benefits and nature conservation benefits. They felt that they contributed better to society by converting to organic farming. Application of technology, obtaining input facilities and marketing products were easier in organic farming compared to conventional farming. In term of price, organic seed, organic fertilizer and organic pesticides was considered cheaper. Farming costs that were considered more expensive were labor costs and other costs (certification, marketing, transportation). However, some Pakem farmers considered the costs were cheaper. [20] found that farmers in Pakem and Sawangan were very dependent on government funding assistance. When the government did not provide funding, farmers did not feel the need to extend the organic certificate validity. The institutional independence of the farmer groups currently was not well-formed, so that farmer groups were still very dependent on external funding sources. [10] added that financial aspect was the main problem faced by organic farming operator in processing legal aspect of organic certification. Particularly for individual farmers, certification cost was very high.

Pest attack was less severe in organic farming, so was production decline. However, crop failure was considered higher. Price of organic product was better than conventional. For the good reasons, farmers felt sure/very sure in converting to organic farming. They also felt very sure in information about organic farming, in nature conservation and in conformity to sustainability agriculture. Pakem farmers felt that time used in doing organic farming was not different than conventional farming, but Sawangan farmers felt that organic farming saved more time than conventional. Interestingly, even though the farmers felt that they sacrificed more in organic farming than in conventional, they felt more love and affectionate, happiness and satisfaction. Contrary statement was also found in product price and level of loss. Farmers found that product price was better, but they also felt more loss, more frustrated and more threatened in doing organic farming.
Table 8. Differences felt by farmers on organic vs conventional farming.

| Benefit Area                                               | Pakem        | Sawangan     |
|-----------------------------------------------------------|--------------|--------------|
| Health benefits for humans and their environment          | far better   | far better   |
| Economic benefits of organic farming compared to          | better       | far better   |
| conventional farming                                       |              |              |
| Benefits for nature conservation                          | far better   | better       |
| Contributions to society                                  | better       | far better   |
| Ease of application of technology                          | easy         | very easy    |
| Ease of obtaining input facilities                         | easy         | easy/very easy|
| Ease of marketing products                                | easy         | very easy    |
| Organic seeds were cheaper than conventional seeds         | cheaper      | cheaper      |
| Organic fertilizer was more expensive than chemical       | cheaper      | far cheaper  |
| fertilizer                                                |              |              |
| Organic pesticides were cheaper than conventional         | cheaper      | far cheaper  |
| pesticides                                                |              |              |
| Labor costs were more expensive                           | not different| far more     |
| Other costs, e.g. certification, marketing, transportation,| cheaper/more | more         |
| were cheaper                                              | expensive    | expensive    |
| Severity level of pest attack                             | less severe  | less severe  |
| Level of risk of production decline                        | lower risk   | lower risk   |
| Level of risk of crop failure                             | higher risk  | higher risk  |
| Product price                                             | better       | better       |
| Sureness in converting to organic                         | very sure    | sure/very sure|
| Level of confidence in information about organic farming   | very sure    | very sure    |
| Level of confidence in nature conservation                | very sure    | very sure    |
| Level of confidence in conformity to sustainable agriculture| very sure    | very sure    |
| Time saving level                                          | not different| far better   |
| Level of sacrifice                                        | more         | more sacrifice|
| Level of love and affection                                | more love    | far more love|
| and affection                                             | and affection|              |
| Level of loss                                              | more         | more loss    |
| Level of happiness                                        | happier      | far happier  |
| Level of satisfaction                                     | more         | far more     |
| Satisfied                                                 | satisfied    | satisfied    |
| Level of frustration                                      | more         | far more     |
| frustrated                                                | frustrated   | frustrated   |
| Level of threatened                                       | more         | far more     |
| threatened                                                |              |              |

Source: Primary data, 2018
3.4. Compliance of national and international organic certification

[22] concluded that small farmers tended to have difficulty getting certification. In addition, distribution channels were also one of the problems to deliver products to consumers and the difficulty of achieving consumer satisfaction. Therefore, trust between farmers and buyers must be constructed. Mayrowani (2012) stated that the challenges faced by organic farmers were related to the high cost of the certification process and the low level of partnership between farmers and companies.

Organic farming in Indonesia was regulated in a compilation of Organic Farming Systems in the Indonesian National Standard (SNI) which had been published by the National Standardization Agency (BSN) in 2016. SNI on Organic Agriculture Systems had been updated three times in 2010, 2015 and 2016. Internationally, USDA and IFOAM were two of several organizations that guarantee organic agents by providing certificates. The components of Indonesian organic certification, USDA, and IFOAM as well as the level of application by rice farmers in Indonesia were shown in Table 9.

**Table 9.** Implementation of organic practices based on criteria derived from SNI, USDA and IFOAM.

| No | Criteria derived from SNI, USDA and IFOAM                                                                 | Percentage of Farmers (%) | Pakem | Sawangan |
|----|----------------------------------------------------------------------------------------------------------|---------------------------|-------|----------|
| 1  | Land must have had no prohibited substances applied to it for at least 3 years before the harvest of an organic crop | NA                         | 100   |          |
| 2  | Not using synthetic N fertilizer                                                                         | 53                         | 100   |          |
| 3  | Non-GMO seeds                                                                                             | 47                         | 87    |          |
| 4  | Using natural enemies for the eradication of pests                                                       | 53                         | 78    |          |
| 5  | Separated agricultural equipment from conventional systems                                               | 63                         | 70    |          |
| 6  | Separated drying place from conventional                                                                   | 74                         | 70    |          |
| 7  | Separated warehousing from conventional                                                                    | 74                         | 70    |          |
| 8  | Organic certified seeds                                                                                   | 26                         | 30    |          |
| 9  | Organic label on the product, the certifying agency and the producer                                      | 63                         | 30    |          |
| 10 | Not burning straw                                                                                         | 89                         | 87    |          |
| 11 | No residual substance that was prohibited to exceed 5% of the EPA/Environmental Protection Agency tolerance (the certificate giver might request residual analysis if it was suspected that the plant had been contaminated by substances that were prohibited or produced by GMOs) (USDA & IFOAM) | 0                           | 0     |          |

Source: Primary data, 2018.

Table 10 showed a summary of the criteria for organic farming formulated by organic certification institutions including SNI, USDA and IFOAM. The results of this survey were sorted from the largest distribution of farmers who carried out specific criteria in applying organic farming. At present, all farmers had been cultivating their farms organically for more than three years without using synthetic N fertilizer. Farmers were still allowed to use non-organic seeds provided they were not from GMOs. However, there were still some farmers who used GMO seeds because of ignorance and lack of supervision from the heads of organic farmer groups. The use of GMO seeds in organic farming would basically be detrimental to ethics because this type of seed was responsive to fertilization, especially synthetic, even though the use of this type of fertilizer was not permitted. The use of GMO seeds would also increase the dependence of seed needs from seed companies, for the next planting period. Independence and sustainability of organic farming would be disrupted. Farmers were familiar with
the use of natural enemies in pest control. Farmers planted flowers, refugia plants, to bring natural enemies to their land.

**Table 10.** Percentages of farmers on implementing organic practices based on additional criteria derived from SNI and USDA.

| No  | Additional Criteria derived from SNI and USDA                           | Percentage of Farmers |
|-----|------------------------------------------------------------------------|-----------------------|
|     |                                                                       | Pakem | Sawangan |
| 1   | Not using synthetic phosphate fertilizer (SNI & USDA)                 | 95   | 91       |
| 2   | Not using human waste (SNI & USDA)                                    | 100  | 100      |
| 3   | Not using pig manure (SNI & USDA)                                     | 100  | 100      |
| 4   | Not using ZPT Potassium Nitrate (SNI & USDA)                          | 100  | 100      |
| 5   | Not using chemical pesticides (SNI & USDA)                            | 90   | 95       |
| 6   | Not using pesticides from tobacco nicotine (SNI & USDA)               | 95   | 96       |
| 7   | Returning straw to the land (SNI & USDA)                              | 68   | 91       |
| 8   | Animal manure came from animals that were organically cultivated (SNI & USDA) | 58   | 57       |
| 9   | The source of springs was free of contaminants (SNI & USDA)            | 53   | 57       |
| 10  | Buffer plants were managed organically (SNI & USDA)                    | 16   | 27       |
| 11  | Irrigation channels were separated from conventional (SNI & USDA)      | 5    | 26       |
| 12  | Availability of buffer plants (SNI & USDA)                            | 5    | 9        |
| 13  | Doing farm records (SNI & USDA)                                       | 32   | 4        |
| 14  | Availability of supporting buildings (SNI & USDA)                      | 11   | 0        |

Source: Primary data, 2018.

Natural enemies made it possible to control pest populations naturally without disturbing the balance of the ecosystem. In the process of cultivating organic plants, it might be possible to separate them from conventional agriculture, both the use of tools and their storage. More than half of the organic farmers had carried out this activity but there were still those who had not been able to do it because of the limited cost of accessing individual tools. Tools used in organic farming were also used in conventional agriculture but were ensured to be cleaned properly before application. Few organic farmers used organic certified seeds. This situation was caused by availability limitations of good quality certified organic seeds at affordable prices. Prices that were relatively more expensive were reasonable because of more intensive handling by not using synthetic inputs to maintain seed quality throughout time. Individual farmers did not provide organic labels on agricultural products from their cultivation. However, packaging and labeling were given by the group before being marketed. One of the more important concerns in organic rice farming in Pakem and Sawangan was that there were still many farmers (89% and 87%) who burned the remaining straw because they believed such action would fertilize the soil. However, this activity was contrary to the criteria suggested by SNI, USDA and IFOAM which was not burning harvested straw.

Organic certificates that could only be obtained by farmers when their rice farming business processes were fully organic. Farmers included in the organic process category were farmers who were still working on the “organic conversion”. These farmers treated soil by providing barriers to others, applying a water filter system, and restoring soil nutrients and nutrients through various natural inputs.
Some farmers still used synthetic fertilizer inputs but in minimal doses. Synthetic fertilizers such as urea and NPK were intended as a starter in the early stages of growth. The maximum dose of urea must be five kilograms per 1000 m$^2$. In principle, the Organic Certification Institute (LSO) did not apply SNI organic standards 100% in the assessment of issuing organic certificates. Farmers were still allowed to use synthetic fertilizer inputs at a reasonably low dose. About 26% and 30% of Pakem and Sawangan farmers had used organic certified seed. The use of non-organic seeds was still allowed if those were not GMO seeds.

The absolute requirement must be met by the farmer group, administratively, was the ability of farmers to show records of farming for at least three years in an orderly manner. This record contained all the activities carried out by farmers for three years in applying the principles of organic farming on their respective lands. After getting the first organic certificate, currently, there were only 32% of Pakem farmers and 4% of Sawangan farmers who still did the recording of their farming. Farming records were important to serve as a basis of making decisions and controlling farming activities. In addition, farm record was one administrative requirement to get organic certificates.

Table 1 showed some additional criteria that must be fulfilled in organic rice farming as required by SNI and USDA. All organic rice farmers no longer used synthetic fertilizers and did not use fertilizers from pig and human manure. The pesticides used also no longer in the form of synthetic pesticides or pesticides that were harmful to the ecosystem. Almost all farmers had tried to return straw to the ground, but the unfortunate thing was that there were farmers who had not returned the straw in its full form. Some farmers burned the straw first and then mixed with soil on agricultural land. The use of manure would be an obstacle if it was required that livestock must also be cultivated organically. Evidence in the field showed that farmers still thought of organic agriculture in terms of cultivation only. Inputs such as manure was still from animal manure given feed from several types of sources including concentrates. Buffer plants were needed to provide barrier between organically and conventionally cultivated plants. However, the application of these buffer plants was still very low, or if any, those were not entirely done organically. Water channels had not been completely separated for organic and conventional rice plants, but the channels that entered the previous organic land were collected first to be filtered.

Table 11. Percentages of farmers on implementing organic practices based on additional criteria derived from USDA.

| No | Additional Criteria derived from USDA | Percentage of Farmers (%) | Pakem | Sawangan |
|----|--------------------------------------|---------------------------|-------|----------|
| 1  | The use of ionizing radiation and sewage sludge was prohibited | 100 | 100 |
| 2  | Maintaining or improving soil biological, chemical and physical conditions, minimizing soil erosion, and improving soil conditions through crop rotation | 0 | 0 |

Source: Primary data, 2018.

Table 12 showed additional criteria for implementing organic rice farming from the USDA. There were two additional criterias which in the first criteria all farmers had avoided using residual materials from both liquid and solid industries as fertilizer on organic farming. However, organic farmers in Sawangan were still trying to farm organic rice on the same land in a row throughout the year. Farmers generally did not rotate crops by planting other crops than rice. This situation was caused by the relatively higher economic value of rice and easier maintenance compared to other crops.
The criteria of the SNI organic certification institution had more details than the other two international certifications (Table 12). However, there were still some specific criteria from USDA and IFOAM. The requirements of organic farming had not really been implemented, some were already good and the other were not yet well achieved. Basically, according to farmers in Pakem and Sawangan, planting rice with organic system was considered uncomplicated. The price of livestock manure which tended to be cheaper compared to UREA and TSP became a special attraction for farmers. In addition, the use of pig manure, human waste, and the use of GMO seeds was not commonly done by Pakem and Sawangan farmers. On the contrary, criteria that were considered difficult, were applied by farmers by 0% - 20%. Some obstacles that were thought to be a factor in the difficulty of these criteria were:

a. Limited capital owned by farmers. The need for supporting structures or buffer plants required a lot of capital.

b. The tendency of farmers to use natural enemies. None of the respondents had used vegetable pesticides. To overcome the pest attack, Sawangan farmers tended to use natural traps or enemies, one of which was by utilizing refugia. Examples of plants that was used as refugia are *kenikir* (*Cosmos caudatus*).

c. Contract with external parties. Farmer groups had contractual ties with organic rice consumers. To maintain the continuity of rice production and availability, farmers must continue to plant rice without rotation. In addition, continuous irrigation was available, causing farmers to grow rice throughout the year.

d. The level of awareness of farmers in managerial aspects. Farming records were only carried out by 32% and 4% of Pakem and Sawangan farmers. Farmers considered the activity was not useful enough to increase their productivity and farm income.

### 4. Conclusion

The study described profiles of organic farmers in Pakem and Sawangan, their opinions on climate change and organic farming, farmers’ knowledge on organic farming system and their compliance of national and international organic certification. The thing that can be concluded in this study was that farmers needed assistance on organic farming management. Farmers’ knowledge of organic farming was good, but in practice, economic reasons often become obstacles, especially towards international
organic certification. Farmers had obtained organic certificates that were in accordance with the Indonesian National Standards. However, if the future goal was international certification, there were several aspects that need to be improved.

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