THE DEVELOPMENT OF ORGANIC RICE FARMING IN INDONESIA

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ABSTRACT

This study focuses on the discussion about the model in promoting organic farming in Indonesia. Organic farming is urgently needed in Indonesia to achieve better food security, food safety, environmental sustainability and poverty alleviation. There is much evidence that organic farming gives higher productivity than conventional farming. At the same time, factor productivity of conventional farming tends to decrease continuously. This study proposes two stages in developing organic farming; a small scale model in the short run and large scale model in the long run. Learning from experience, this study suggests promoting organic farming with a system of rice intensification to get higher yield harvests.

Keywords: *Organic farming, Factor productivity, Poverty alleviation*

JEL classification: *Q120,*

I. INTRODUCTION

It is widely known that the agriculture sector has a strategic position in Indonesia's economy, particularly in providing for domestic food needs and in providing jobs. According to data from the Badan Pusat Statistik (BPS-Statistics Indonesia), in August 2010 there were around 41.5 million workers engaged in agriculture, forestry, hunting and fisheries; about 38.3% of Indonesia's total workforce. Despite its high contribution to the national economy, development of the agriculture sector, especially paddy farming, is relatively low. Factor productivity of paddy farming tends to decrease continuously. Under such circumstances, promoting organic paddy farming that has good prospects would be a key for improving the productivity of the agriculture sector.

Since 2001, Indonesia has promoted organic agriculture development with the slogan 'Go Organic 2010'. Indonesia has an ambition to become a major player in world organic agriculture markets. The demand for organic agricultural products is expected to increase in the coming years. Moreover, the world's growing organic agriculture market will create opportunities to improve farmers' or peasants' income and welfare in Indonesia's rural areas

as well as maintaining natural resources and environmental sustainability. The Ministry of Agriculture planned and programmed the development of organic agriculture along with the agriculture revitalisation program, where quality improvement, value added, production system efficiency, and environmental sustainability have been the main objectives.

Because the concept and application of modern organic agriculture is relatively new in Indonesia, Fagi and Las (2006) in Las et al. (2006) mention that there are many misconceptions about it. To give a simple definition, organic agriculture is a way or system for plant cultivation using organic or natural inputs. In this system, agrochemical inputs and chemical pesticides are not to be used or their use reduced.

Generally, in Indonesia, there are two schools of thought on organic agriculture; first, there are those who refer to awareness of food security, health, environmental, and farmers' welfare issues. Second, there are those who refer to the physical degradation of paddy field areas and to food security issues as well. Both schools are concerned about the degradation of physical and natural resources in most paddy areas in Indonesia but keep in mind ways of assuring food security. This awareness can be understood because Indonesia now is also experiencing a rapid population growth at a rate of 2% annually while, at the same time, experiencing the effects of the green revolution, which began in the 1970s, in which excessive use of chemical fertilisers and pesticides lead to degradation of the physical environment and to a depletion of natural nutrients of the soil. Based on these two ideas, the development of organic agriculture and the use of organic fertilisers are differentiated (Fagi and Las, 2006).

II. PROMOTING ORGANIC ICE FARMING IN INDONESIA

There are four important justifications for promoting organic farming in Indonesia. First, organic agricultural products have many benefits: they are healthier, safer and more nutritious compared with non-organic agricultural produce. Organically farmed livestock are not given growth hormones and the meat is leaner. Organic farming methods improve the quality of the environment, are less energy demanding and reduce the need for and use of dangerous chemical substances (Purbo, 2007).

Second, organic farming has a high potential to reduce unemployment because it requires more labour than conventional agricultural practices. This characteristic of organic agriculture has the potential in creating economic stability in rural areas by creating new job opportunities and, given that organic products command premium prices, this can lead to income improvement for peasants and farmers. Most rural farmers or peasants in Indonesia live under the poverty line and when the price of imported agricultural inputs (for example, fertilisers and equipment)

rises, then these inputs can become scarce or unaffordable because of stockpiling by speculators. Organic agricultural techniques can be of great help because organic agriculture does not require imported inputs (for example, agrochemical fertilisers, pesticides and herbicides).

Third, organic farming practice is concurrent with the efforts to sustain environment quality. Excessive use of chemical fertilizers has led to a decline soil quality and output productivity (Las et. al, 2006). This causes the so called "soil hungry" in which the soil requires more chemical substances. As result, to sustain crop productivity, farmers have to be dependent on chemical fertilizers. In addition, fertilizer is usually scarce and difficult to obtain by the farmers. Government has provided subsidized fertilizer. The price disparity between subsidized and non-subsidized fertilizers instigates the emergence of fertilizers hoarding. By implementing organic farming practices, farmers are expected to reduce their dependence on chemical fertilizers as well as preserving environmental sustainability.

Fourth, organic farming tends to have high factor productivity (FP). FP values of non-organic wetland paddy for all provinces in Indonesia have tended to decrease in recent years.[1] In the period 2004 to 2007, FP was relatively high. However, all provinces had a decreasing trend in FP values in this period. Three provinces in Kalimantan (Central Kalimantan, East Kalimantan and West Kalimantan), which have high FP in absolute value, encountered a rapid decrease in FP. Their FP decreased by more than five% for the period 2004 to 2007. Meanwhile, FP in most provinces in Java and Sumatra decreased moderately, that is, between 3 and 5%. Entering 2008, there was improvement in the FP value of non-organic paddy farming, which continued until 2010. This improvement was mostly because of a policy of paddy price intervention. In that period, 2008 to 2010, the government increased the price of paddy every year by a significant percentage. The calculation of FP of wetland paddy in all provinces is displayed in Table 1.

There are at least three contributing factors to the decreasing trend of FP values of wetland paddy in all provinces in Indonesia.

First, the agricultural production system has reached a stage of exhaustion from which it is unable to respond to external inputs, especially chemical fertilisers and pesticides. In short, there are diminishing marginal returns to the use of artificial aids to production. In the period 1995 to 2006, the use of fertiliser in the agriculture sector increased by around 23.3%. Meanwhile,

[1] FP value is calculated using the following equation:

$$FP = \frac{\sum_{i=1}^{n} P}{\sum_{i=1}^{n} F}$$

Where P is the yield of wetland paddy per hectare without incorporating by-products. F is input factor used for producing unit P. In this study, F includes five inputs; seed, fertilisers, pesticides, wages of workers and other components (watering, drying, hulling, paddy bags and transport costs).

Table 1. Factor Productivity of Conventional Wetland Paddy by Provinces in Indonesia

No.	Province	Factor productivity						
		2004	2005	2006	2007	2008	2009	2010
1	North Sumatra	4.43	4.03	3.92	3.95	4.42	4.78	5.05
2	West Sumatra	3.13	2.81	2.80	2.81	2.87	3.09	3.15
3	Riau	5.30	4.82	4.54	4.78	5.37	6.01	6.36
4	Jambi	4.80	4.40	4.22	4.25	4.53	4.84	4.88
5	South Sumatra	6.43	5.94	5.77	5.95	7.36	7.83	8.11
6	Bengkulu	4.34	3.91	3.58	3.64	4.30	4.56	4.69
7	Lampung	4.22	3.87	3.64	3.66	5.42	5.77	5.96
8	Bangka Belitung	4.75	4.91	3.94	3.68	3.59	3.87	4.37
9	DKI Jakarta	2.90	2.83	2.63	2.91	3.46	3.98	4.03
10	West Java	2.96	2.67	2.60	2.66	3.42	3.71	3.75
11	Central Java	2.97	2.67	2.61	2.63	3.71	3.93	4.03
12	DI Yogyakarta	2.72	2.45	2.27	2.25	3.17	3.37	3.34
13	East Java	3.07	2.77	2.70	2.71	3.82	4.01	4.10
14	Banten	4.11	3.69	3.53	3.56	4.71	4.97	5.04
15	Bali	4.26	3.90	3.90	3.97	5.31	5.58	5.57
16	Nusa Tenggara Barat	3.39	3.03	2.83	2.83	4.23	4.57	4.42
17	Nusa Tenggara Timur	4.50	3.82	3.39	3.46	4.07	4.35	4.38
18	West Kalimantan	6.88	6.31	5.57	5.78	7.44	7.79	8.05
19	Central Kalimantan	10.60	9.31	8.10	8.12	8.52	9.50	9.43
20	South Kalimantan	6.35	5.82	5.66	5.75	7.26	7.88	7.84
21	East Kalimantan	4.93	4.74	3.80	3.76	3.85	4.12	4.34
22	North Sulawesi	3.47	3.24	3.27	3.23	3.06	3.25	3.36
23	Central Sulawesi	3.51	3.21	3.16	3.17	4.12	4.20	4.36
24	South Sulawesi	4.64	4.19	4.19	4.23	5.94	6.42	6.46
25	Southeast Sulawesi	4.62	4.08	3.86	3.91	5.80	6.39	6.62
26	Gorontalo	3.66	3.24	3.25	3.25	4.87	5.39	5.67
27	Maluku	4.87	4.38	4.44	4.58	5.76	6.46	6.41
28	Papua	5.09	4.77	4.84	4.96	5.30	5.93	6.20
Indonesia (average)		4.53	4.14	3.89	3.94	4.84	5.24	5.36

Source: Calculated from BPS Agricultural Statistics.

in the same period, the total increase in rice productivity was only around 6.31%. In other words, although the use of chemical fertilisers increased four times it was not matched by a corresponding productivity gain.

Second, unjust incentive systems for the farmers. In Indonesia, farmers are in a weak position, politically and economically. The government controls the prices of harvested dry paddy grain (GKP, gabah kering panen), hulled dry paddy grain (GKG, gabah kering giling) and rice. On the other hand, prices of agricultural inputs, such as seed, pesticides, fertilisers, agricultural machinery and workers' wages are determined by market forces. In fact, the government only provides subsidies for seed and fertiliser. Therefore, in

the period 2004 to 2007, the increase in the average production costs of wetland paddy farming was higher than the average price increase of harvested unhusked rice grain price (GKP), of processed unhusked rice grain (GKG) and of rice. The productivity of wetland paddy tended to decrease during that period.

Third, human capital development, particularly the technical farming skills of farmers, is still low. Most of the Indonesia's farmers have elementary education only and work on small farms. What is the relation between low levels of technical farming skill and declining factor productivity? The immediate answer is that farmers cannot quickly change and adopt new farming techniques or new technologies and appropriately without intensive guidance from experts. Farmers are aware the productivity of their paddy farming has been decreasing; however, they have little or no access to new methods and techniques for increasing productivity. Many of them cannot make the best use of new agriculture technologies. They also have inadequate knowledge of how to plant, to take care of and to harvest paddy correctly. In some places, they just choose to switch from paddy farming to other secondary food crops.

From a theoretical point of view, Zepeda (2001) stated that human capital directly influences agricultural productivity by affecting the way in which inputs are used and combined by farmers. Improvements in human capital affect acquisition, assimilation and implementation of information and technology. Human capital also affects one's ability to adapt technology to a particular situation or to changing needs.

A study by Jamison and Lau (1982) mentioned that the success of Thailand, Korea and Malaysia in increasing the productivity of their agriculture sector was by education.

III. PROMOTING ORGANIC FARMING

As shown in Table 1, all provinces in Indonesia have experienced a decline of FP values of conventional wetland paddy, which indicates that the ability of non-organic farming to produce the same output per unit input becomes depleted over time. After studying these conditions and the causal factors of the declining FP value of non-organic wetland paddy, we suggest that the system of paddy farming in some places in Indonesia should be invigorated by employing systems that will provide a more solid foundation for agricultural sustainability and for food security. For farmers, any suggested new systems also have to benefit them. A new farming system that is probably suitable for improving current paddy farming in some places in Indonesia is a combination of organic farming and system rice intensification (SRI).

Suggestions for promoting organic farming systems in Indonesia are not new. Since 2001, the government has supported the development of organic farming. The policies and their application are not well advanced and we

consider that the reason is that the government has no grand design for organic farming or for promoting it in Indonesia.

To promote and develop organic agricultural practices in Indonesia, the Indonesian government in 2001 launched Go Organic 2010, which could be interpreted as a movement towards a fully organic agriculture by 2010. This program is one of the strategic measures to hasten government development programs in agribusiness that emphasise environmental sustainability as well as food security and welfare in general. One of the goals of Go Organic 2010 is to realise Indonesia's potential to be one of the world's biggest organic agricultural producers. The Ministry of Agriculture is in the continuing process of laying the foundations of the infrastructure, that is, the regulations, guides, certification institutions, and training centres for organic agriculture.

In most countries, organic farming is typically small scale. For Indonesia, we propose that promoting organic farming be in two phases; short run and long run. In the short run we suggest promoting small-scale organic farming, which is typical of organic farming in many places in the world. Large scale organic farming is the strategy for organic farming in the long run. The strategy to promote organic farming in two phases, small and large scale, is based on four considerations: food security; food safety; poverty reduction; and environmental sustainability. Based on our direct observations of the organic farming at Gede Bage Bandung, West Java, we suggest combining organic farming with the System Rice Intensification (SRI) method in the short and long run.

3.1 Phase I: Promoting Small Scale Organic Farming

Promoting organic farming on a small scale is intended to avoid food shortages in the short run. It has been widely acknowledged that the yield of organic rice farming is lower than conventional rice farming. Thus, promoting organic farming on a small scale will not affect food security. Currently, the issue of food shortages has become a big issue in Indonesia. The government has stated that food security is a priority program of agriculture sector development. From the mid 1980s until 2006, domestic rice supply did not meet domestic demand. Table 2 shows the data for conventional rice supply and demand in Indonesia since 1997.

Table 2 reveals that, over the period 1997 to 2006, rice consumption was higher than rice production. Therefore, every year Indonesia has had to import rice, mostly from Thailand and Vietnam. Nevertheless, the ability of domestic rice producers to supply domestic demand tends to increase from year to year. This is shown by the data: the gap between rice consumption and production has tended to decrease year by year, which automatically leads to decrease in rice imports. In 1997, the rice import was 5765 thousand tons but the amount imported declined over the following years to 900 thou-

Table 2. Paddy and rice production, rice consumption, gap between consumption and production and rice import of Indonesia, 1997–2008

	Paddy production	Rice production*	Rice consumption	Gap (production less consumption)	Percentage shortfall in rice production	Rice imports
	'000 tons	'000 tons	'000 tons	'000 tons	(%)	'000 tons
Year	a	B	c	b-c	(b-c)/b*100	
1997	49,377	31,206	34,667	-3,461	-11.09	5,765
1998	48,472	30,634	35,033	-4,399	-14.36	3,729
1999	50,866	32,147	35,400	-3,253	-10.12	1,500
2000	51,899	32,800	35,877	-3,077	-9.38	1,300
2001	50,461	31,891	36,382	-4,491	-14.08	1,600
2002	51,490	32,541	36,500	-3,959	-12.17	2,750
2003	52,138	32,951	36,000	-3,049	-9.25	650
2004	54,341	34,343	35,850	-1,507	-4.39	900
2005	54,151	34,223	35,739	-1,516	-4.43	na
2006	54,455	34,224	35,550	-1,326	-3.87	na
2007	57,157	36,009	35,906	104	0.29	na
**2008	60,280	37,976	36,265	1,712	4.51	na

Sources: BPS, FAS USDA

*Rice production is calculated using a conversion factor from paddy to rice of approximately 0.63

**Paddy production for 2008 is based on BPS estimates

Note: the assumption of rice consumption growth in 2008 is 1%

sand tons in 2004, a decline of more than 500%. Since 2007, the domestic rice supply has been sufficient to meet domestic demand entirely. BPS estimates that domestic rice surplus in 2008 will reach at least 1.7 million tons. The main reason for the sharp increase in paddy production in 2007 and 2008 was an expansion of the harvest area. In 2007, the harvested area increased by 3.06% (361,207 hectares), from 11,786,430 hectares in 2006 to 12,147,637.00 hectares in 2007. The area under cultivation has continued to grow annually by 1.61% to become 12,343,617 hectares in 2008.

Based on the FP value calculations and explanations about organic farming in the previous section, organic farming in the short run is probably more suitable for the following provinces, which have low FP values (bottom 40% as mentioned in Table 1): DKI Jakarta, East Java, West Java, Central Java, DI Yogyakarta, Banten, Gorontalo, North Sulawesi, Central Sulawesi, Nusa Tenggara Barat, and West Sumatra.

Most of the provinces in Java (DKI Jakarta, East Java, West Java, Central Java, DI Yogyakarta, Banten) have low FP values because of the high cost of inputs. Under these circumstances, promoting organic farming will give benefits to the farmers as follows.

Reduction of production costs. Implementing organic farming can help reduce inputs cost in producing paddy. Organic farming requires fewer inputs than conventional farming. Even though there are fewer inputs, farmers should not worry about productivity. Organic farming in some places in Java yields 4 to 11 tons per hectare. This organic farming yield is similar or better than conventional paddy farming.

Easy access to the market. So far a lot of organic products (rice, fruit and vegetables) have been marketed in many places in Java. Thus, if organic farming is promoted in Java, farmers will have more access to the domestic market directly.

Increasing income for the farmers. If costs of production become lower, organic paddy productivity will be similar to the productivity of conventional paddy farming. If the prices of organic produce are higher than for inorganic, then farmers will have higher revenues with decreasing costs and their income will increase. As mentioned in the previous section, one of the goals of developing the agricultural industries is poverty reduction. Most farmers in Java are engaging in small farming. Therefore, in the medium and long term, organic farming is hoped to contribute in poverty alleviation.

As mentioned earlier, there are problems for paddy farming that come from inadequate farming skills and lack of capital resources. These problems appear, too, in conventional paddy farming. If organic farming is to be promoted to farmers who have limited knowledge of organic farming techniques as well as lack of capital, then much care has to be put into education programs, disseminating information and arranging practical demonstrations to ensure that new ways of farming are seen to be acceptable and profitable and that encourage change.

In the short run, the government and the private sector have to be involved actively in empowering farmers in organic farming. The government, particularly agriculture departments, need to provide trainers to educate and guide novice organic farmers. At the same time, the private sector can contribute to promoting organic farming by offering contracts to farmers who use organic farming methods.

Another model that can be used in promoting organic farming is the nucleus-plasma model. In this model, investors act as a nucleus and farmers act as plasma. Investors supply funds for seed, fertilisers, pesticides and the costs of harvesting; farmers provide land, irrigation and themselves as workers. This collaboration model is suitable for farmers who not have enough funds nor access to a financial institution.

Recently, collaboration between farmers and investors using the nucleus-plasma model has become a

trend in promoting organic farming in some regions in Indonesia. It is interesting that our field research in Gede Bage Bandung found that there is involvement from members of a non-government organisation (NGO) in promoting organic farming under the nucleus-plasma scheme. They use system rice intensification (SRI) in organic rice farming and the members of that NGO act as consultants for organic farming.

According to Suiatna (personal communication, 2008), a supervisor of organic farming in Bandung, Garut, Bogor and Subang (all in West Java), the role of NGO consultants is very important in ensuring collaboration between farmers and investors. Their role is not only to provide training in correct organic farming methods but they also seek investors and arrange agreements between farmers and investors. The trainers and supervisors from the NGO also make regular inspections to check whether the farmers are using correct methods. Inspection and supervision are needed because some farmers will use chemical fertilisers when they worry that their paddy's growth is too slow.

From our observations, this method has contributed to the rising productivity of organic rice farming. Agung (personal communication, 2008), an organic farmer in Bandung, reported that the productivity of his organic rice land had increased after he converted to organic methods and practices. Under nucleus-plasma-NGO collaboration, the pattern of yield sharing is based on the agreement at the beginning of the collaboration. Generally the formula for yield sharing is 50% for the farmer, 25% for the investor and 25% for the consultant.

3.2 Phase II: Promotion of Organic Farming on a Large Scale

In the next five years, large-scale organic farming should be promoted. The main considerations are food safety, environment sustainability and poverty reduction. Many people assume that organic farming has low productivity. Therefore, food security will become a big issue in the long run when promoting organic farming. Our prediction is that promoting large-scale organic farming in Indonesia in the long run will not affect food security. This view is strengthened by our field study of organic farming in Bandung, which showed that organic farming combined with system rice intensification methods is highly productive.

System rice intensification is a method of increasing rice yield that emphasises changing of soil, and water and nutrient management and was invented by Fr Henri de Laulanie in Madagascar in the 1980s. Instead of changing the genetic characteristics of crops and increasing external inputs, SRI methods change the way that plants, soil, water and nutrients are managed, using only the resources that farmers already have. SRI methods have worked with practically all rice varieties; traditional, improved, modern and hybrids. In relation to

organic farming practices; SRI methods try to stop or reduce the use of agrochemical fertilisers. Compared with traditional paddy farming, SRI has several advantages, such as lower water consumption, reduced fertiliser and pesticide use, stronger paddy roots, and increased soil organisms. These advantages reduce costs of production as well as increasing productivity.

All provinces in Indonesia should be involved actively in developing organic farming in the long run. However, as a priority, we propose that provinces in the 'middle 30% ' category promote large-scale organic farming actively over the next five years. Therefore, if we treat the bottom 40% and the middle 30% together as one set in promoting organic farming in the short run, we will have 70% of the paddy farming areas for promoting organic farming in the long run with the targeted land area of 430,059 hectares or 3.54% to total paddy land.

In the long run, as organic farmers gain more knowledge of organic farming, the promotion of organic farming can be done using several models, such as contract farming, nucleus-plasma and self-sufficient farming. Contract farming and the nucleus-plasma model are intended for those farmers who have a relatively small area of land and lack capital funds. Meanwhile, self-sufficiency is stressed for the farmers who have enough funds for organic farming on their own account.

3.3 Organic Rice Consumers

The domestic market for organic products is growing and this trend will continue. Novianty and Andoyo (2006) mentioned that the potential market for organic products in Indonesia is around 37% of the population, a group that comprises mainly middle and upper-middle class people who mainly live in the cities. In 2008, consumers of organic rice are around 1.07% of Indonesia's population (Table 3). We estimate in ten years time, the number of consumers to be approximately 12.9 million or 5.02% of Indonesia's population. This estimation is based on supply side data.

Price determination of organic Rice

Before explaining how the price of organic rice should be determined, we will explain how current prices are decided in Indonesia.

The government sets the price of rice at the farmer level (production base) through president instructions (Inpres). But rice prices in the market (consumer base) are not controlled; there is no retail floor or ceiling price.

In 2007, the government set the price of rice under Inpres 3 of 2007. On 22 April 2008, this regulation was superseded by Inpres 1 of 2008. Under this new regulation, the government has changed the government purchasing price (harga pokok pembelian) for harvested dry paddy grain (GKP), hulled dry paddy grain (GKG) and rice (Table 4).

Table 3. Estimation of Consumers of Organic Rice, 2008 To 2017

Year	Organic rice consumers ('000,000)	Indonesia's population ('000,000)	Organic rice consumers as a percentage of population
2008	2.4	225.0	1.07
2009	2.6	228.3	1.21
2010	3.2	231.8	1.37
2011	3.8	235.3	1.62
2012	4.6	238.3	1.92
2013	5.5	242.4	2.27
2014	6.6	246.0	2.68
2015	8.3	249.7	3.31
2016	10.3	253.5	4.07
2017	12.9	257.3	5.02

Source: Calculated from BPS Agriculture Statistics
Note: it is assumed that each consumer requires 120 kg per year of organic rice and that population growth is 1.5% annually.

Table 4. President Instruction for Rice Price Determination

Commodity	Inpres 3 of 2007 Price per kg	Inpres 1 of 2008 Price per kg
Harvested dry paddy grain	Rp2000	Rp2200
Hulled dry paddy grain	Rp2600	Rp2840
Rice	Rp4000	Rp4300

Sources: Inpres 3 of 2007 and Inpres 1 of 2008

Control of rice prices is only intended for the paddy and rice, which are bought by BULOG (a government agency that has statutory privileges in rice distribution). Should farmers want to sell their paddy and rice to the non-BULOG buyers, the price is determined by negotiation. Unfortunately, in most cases, if farmers sell their paddy to non-BULOG buyers, they will receive a lower price. Therefore, selling to BULOG is advantageous for the farmers. Mostly, farmers sell their paddy to the non-BULOG buyers because they made a contract at the beginning of cultivation; they need money quickly and transactions with BULOG take a longer time than transactions with non-BULOG buyers; or they are in debt to the non-BULOG buyers and must repay what they owe.

The government also sets the price of rice for special purposes, the main one being the program that subsidises rice for the poor, at a price that is 30% of the normal price. Poor people can buy up to 15 kg of rice per month per household under the rice for poor program.

The price of organic rice in Indonesia is determined by market forces. The government neither controls the price at the production base, nor at the con-

sumer base. At present, organic rice sells at a premium price. The average price of organic rice in retail markets is Rp10,000 per kilogram or 65% higher than the price of regular rice, which sells at Rp6000 per kilogram on average. Established organic farmers are quite happy with this premium price because their incomes are higher than previously when they were engaging in conventional rice farming.

Regarding the price determination policy of organic rice and non-organic rice in the long run, we recommend that the price of organic rice be determined by the market mechanism only.

The government should not control the price of organic rice, neither at the production base nor the consumer base. By letting the organic rice price be determined by the market, we predict that it will sell at a premium price. This will be an incentive for the farmer to continue with organic farming and help its sustainability. To avoid the risk of falling prices because of force-majeure (floods, diseases, etc.) or oversupply, we propose that organic rice farmers subscribe to an organic agriculture insurance program. The agent for this program may be a government or a private agent. This insurance program could be similar to 'the rice farming stabilisation program' in Japan. Under this program, organic farmers have to pay an amount of money or a percentage (let's say 2% like Japan) of the value of their harvest to the insurance agent. If the organic rice price falls drastically below a standard or common price, organic rice farmers will receive compensation from the insurance agent to cover at least some of their production costs.

In the long run, as organic farming is promoted in the large scale, the difference between premium price of organic rice and price of non-organic rice probably will be lower than it currently is. Therefore, government should not worry that the premium price of organic rice will lead to inflation. In such a situation, the government needs to keep regulating the price of non-organic rice. This is needed to ensure rice price stability, inflation is controlled and macroeconomic conditions remain stable. In Indonesia, rice is an important commodity, not only because of main staple food, but also as an indicator of inflation. If the price of rice is increasing, then other commodities tend to increase too.

3.4 Cost-Benefit Analysis (Farmers, Government, Distributors, Retailers) Based on Field Research in Bandung, West Java

Currently, organic rice is becoming a business prospect business in the agriculture sector. Financially, established organic-rice farming produces higher profit compared with conventional rice farming. Data from our field research in organic farming in Bandung shows that organic-rice farmers receive higher incomes compared with farmers who cultivate rice in the conventional way. From Tables 5 and 6, we can see that a typical organic-rice farmer receives Rp13.8 million per harvest or Rp2.3

Table 5. Cost and Revenue Structure of Organic Rice Farming with System Rice Intensification Method Per Hectare in Bandung, West Java, 2008

No.	Description (organic rice)	Unit		Unit (Rp)	Total (Rp)
A	Land preparation cost				
	Hoeing, harrowing and ploughing	40	WPD*	15,000	600,000
	Total A				600,000
B	Production means				
	1. Seed	5	Kg	10,000	50,000
	2. Manure	8,000	Kg	500	4,000,000
	3. Organic fertiliser (liquid)	5		40,000	200,000
	4. Organic pesticide	1		50,000	50,000
	Total B				4,300,000
C	Transplanting and maintenance				
	1. Sowing	30	WPD	15,000	450,000
	2. Fertilising	20	WPD	15,000	300,000
	3. Irrigation	20	WPD	15,000	300,000
	Total C				1,050,000
D	Harvest and post harvest				
	1. Harvesting	40	WPD	15,000	600,000
	2. Drying	20	WPD	15,000	300,000
	3. Hulling	4,900	Kg	200	980,000
	4. Transport	1		50,000	50,000
	5. Bags	300		1,000	300,000
	Total D				2,230,000
	Total cost (A+B+C+D)				8,180,000
E	**Income**				
	Rice sale	3,150	Kg	7,000	22,050,000
F	**Income or profit per harvest**				13,870,000
	Income per month				2,311,667

Source: Survey result in farming area in Bandung, 2008
* WPD = Working Person Day
Note: the assumption is that the yield per hectare is 5.25 tons of hulled dry paddy grain. Rice is harvested twice a year. It needs 110 to 120 days or around four months from seeding to harvest. Income per month is calculated by income per harvest divided by six.

Table 6. Cost and Revenue Structure of Conventional Rice Farming Per Hectare in Bandung, West Java, 2008

No.	Description (conventional rice)	Unit		Unit (Rp)	Cost (Rp)
A	Land cultivation costs				
	Hoeing, harrowing and ploughing	30	WPD	15,000	450,000
	Total A				450,000
B	Production means				
	1. Seed (pandan wangi)	50	kg	10,000	500,000
	2. Urea	300	kg	1,200	360,000
	3. Potash	100	kg	1,600	160,000
	4. Super phosphate	100	kg	1,550	155,000
	5. Compound fertiliser	100	kg	800	80,000
	6. Pesticides	1		40,000	40,000
	Total B				1,295,000
C	Transplanting and maintenance				
	1. Sowing	30	WPD	15,000	450,000
	2. Fertilising	20	WPD	15,000	300,000
	3. Irrigation	30	WPD	15,000	450,000
	Total C				1,200,000
D	Harvesting and post harvest				
	1. Harvesting	30	WPD	15,000	450,000
	2. Drying	20	WPD	15,000	300,000
	3. Hulling	4,900	kg	200	980,000
	4. Transport	1	Unit	50,000	50,000
	5. Bags	280		1,000	280,000
	Total D				2,060,000
	Total cost (A+B+C+D)				5,005,000
	Income				
E	Rice sale	3,360	kg	4,000	13,440,000
	Income or profit per harvest				8,435,000
	Income per month				1,405,833

Source: Survey result in farming area in Bandung, 2008
WPD = Working Person Day
Note: the assumption is that the yield per hectare is 5.6 tons of hulled dry paddy grain. Rice is harvested twice a year. It needs 110 to 120 days or around four months from seeding to harvest. Income per month is calculated by income per harvest divided by six.

million per month whereas rice farmers using conventional methods get only Rp8.4 million per harvest or Rp1.4 million per month. This variation of incomes is not confined to Bandung; studies conducted by Surono (2003) in Boyolali (a district in Central Java) and by Sulaeman (2006) in Sragen (also in Central Java) also show that the incomes of organic-rice farmers are higher than that of conventional farmers.

3.5. Organic Farming and Poverty Alleviation

Promoting organic farming can also help in overcoming poverty, particularly for those who work as farmers. According to BPS, there are around 31 million poor people in Indonesia in 2010. Most are engaged in agriculture and living in rural areas.

By assuming all organic farming is by poor farmers, and that the family

Table 7. Estimation of Role of Organic Farming in Poverty Alleviation

Year	Organic Farming Area (Ha)	Poor farmers engaging in organic farming (People)	Contribution of organic farming to poverty reduction (People)
2008	80,293	160,586	481,758
2009	92,337	184,674	554,022
2010	106,188	212,375	637,125
2011	127,425	254,850	764,550
2012	152,910	305,820	917,460
2013	183,492	366,984	1,100,952
2014	220,190	440,381	1,321,142
2015	275,238	550,476	1,651,428
2016	344,048	688,095	2,064,285
2017	430,059	860,119	2,580,356

Source: Calculated from BPS Agriculture Statistics

Note: Table 7 assumes the following:

Poor farmers are categorised as those who have less than 0.5 hectare. The number of poor farmers engaging in organic farming is calculated by dividing the organic farming area by 0.5.

A poor family comprises three people on average.

Indonesia's poor in 2010 were 31 million and it is assumed that there will be no change to this number.

The area of organic farming is calculated based on SOEL survey in Daniele (2005), which mentioned that the organic farming area in Indonesia was around 40,000 hectares (0.09% to total area or equal to 0.33% of total paddy area).

That over the period 2003 to 2008 there was increase in the area of organic farming by 15% per year (based on supply for organic rice).

Average growth of organic farm area for 2009–10 is 15%; for 2011–14, 20%; and 2015–17, 25%.

of each poor farmer comprises three people, then it is estimated that in 2017 organic farming would contribute to the reduction of poverty for up to 2.58 million people, which is 8.3% of total poor people in Indonesia (Table 7).

IV. CONCLUSION

Experience has shown that intensification of agriculture causes environmental damage from the excessive use of agrochemical inputs such as chemical fertilisers and pesticides. Such 'green revolution' methods boost agricultural productivity considerably in the short term. However, in the long run, this method has costly because it has lead to serious environmental damage; soil becomes infertile and the agricultural productivity in terms of output per hectare of paddy field gradually declines.

To gain the benefits of agricultural development without any further environmental damage, Indonesia has a large opportunity of promoting organic farming practices. Organic farming is relatively new in Indonesia, so the main challenges are low-skilled human resources in the agricultural sector, and no specific and established regulation of organic agriculture (such as subsidies, inspections, and certification). Furthermore, little access to financial services and the pervasiveness of middle men hamper farmers from realising the benefits of organic agricultural practices.

The premium price of organic agricultural products in world markets will have a positive effect on the Indonesian economy and particularly for farmers. This can lead to improvements in farmers' welfare that will eventually contribute to poverty alleviation. However, a caveat: organic agricultural practices initially lead to declining output. In the effort to develop organic agriculture over a broader area of Indonesia, there needs to be transitional policies to support organic agriculture. There are some preliminary steps: first, support and help for the farmers who want to convert their land for organic agriculture because it takes time for the soil to be rid of agrochemicals. Second, the government can run cash transfer programs to mitigate the effects of interim income loss while waiting for their land to be ready of organic farming. Third, help farmers to restore the use of traditional or local seed varieties. In the interests of maintaining high productivity, this study, based on field observation, recommends that farmers apply the method of system rice intensification.

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