**THE IMPACT OF THE GOVERNMENT EFFORTS TO INCREASE RICE PRODUCTION**

**ON ITS PRODUCTIVITY AND HARVEST AREA IN INDONESIA**

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**ABSTRACT**

A high production of rice is very important to fulfill its need in Indonesia. To obtain it, since the 1960’s, the Indonesian government has been implementing the production increasing program in rice. In 1984, Indonesia was self-sufficiency in rice. However, it had been happening just for four years. The question is whether the program has the significant impact on the increasing of the rice productivity and harvest area in order to increase its production. This study attempts to answer these questions. The data used in this study are the FAO’s data. They are time series data, i.e. from 1961 to 2017. They were analyzed by using the econometric models. Their dependent variables are the rice productivity for Model 1 and the rice harvest area for Model 2. Both models have six dummy variables as the independent variables for differentiating seven periods of the government efforts. The result revealed that it had been statistically significant in increasing the productivity and the harvest area. At the beginning of the green revolution (1961-1967), the average of its productivity was 1.76 tons/ha and in the period 2015-2017 (Upsus), the average of its productivity was 5.24 tons/ha. In addition, the average of its harvest area was 7.20 million ha in the period 1961-1967 and it was 15.02 million ha in the period 2015-2017 (Upsus). The average rate of the increment in rice productivity in the Upsus program was 0.23 tons/ha per year being the second highest and the average rate of the increment for the rice harvest area in the Upsus program was 0.72 million ha per year being the highest. Therefore, the Upsus is a government program that has the highest influence in increasing rice production.

Keywords: intensification, extensification, productivity, harvest area

**1. INTRODUCTION**

Since rice is the main staple food for Indonesian, its production has to increase every year along with the population growth. To obtain it, there are two programs of the government efforts, i.e. intensification to increase the productivity and extensification to increase the harvest area.

The International Rice Research Institute (IRRI) founded some new rice varieties, such as IR-5 and IR-8, at the beginning of 1960’s. Their productivity is higher and the production time is shorter than those of the local rice varieties. Since they are responsive to the use of chemical fertilizers, their productivity is quite high.

The research results done by IRRI had been responded by many countries in order to disseminate them to the farmers through the intensification program. Some its activities were the rice farming extension and the distribution of inputs, especially seeds and fertilizers. The same thing happened to wheat and corn in countries where the staple food of these two plants. The result was that world food grain production tripled in the period 1965-1985. Therefore, this period is referred to as the Green Revolution (Pingali, 2012).

In Indonesia, the IR5 and IR8 rice varieties called PB5 and PB8 began to be introduced to farmers in the Karawang District on a limited scale in the 1964/1965 and 1965/1966 planting seasons through a mass demonstration conducted by the Bogor Agricultural Institute (IPB). Furthermore, according to Badan Pengendali Bimas (1997), starting from the 1968/1969 planting season, the rice intensification program was carried out nationally through Bimas (Bimbingan Massal meaning the Mass Extension) and Inmas (Intensifikasi Massal meaning Mass Intensification). The result was that in 1984 Indonesia became self-sufficient in rice. However, this self-sufficiency only lasted four years even though those government efforts was still being implemented (Hudoyo et al., 2016). Therefore, the problem is whether the government efforts to increase rice production are significantly influential in increasing its productivity and its harvest area. This study seeks to answer these questions.

**2. METHODOLOGY**

The data used in this study are the production and area harvested of Indonsia Rice. They are the time series data, i.e. from 1961 to 2017. The data source is the FAO’s official website.

We categorize the period 1961-2016 into the following eight periods:

1961-1967: The beginning of the green revolution and introduction of Bimas (Bimbingan Massal meaning Mass Extension)

1968-1979: Bimas/Inmas (Intensifikasi Massal meaning Mass Intensification)

1980-1986: The Diffusion of innovation - Insus (Intensifikasi Khusus meaning Special Intensification)

1987-1997: Supra Insus

1998-2004: Monetary crisis and the era of reformation

2005-2014: Agricultural Revitalization

2015-2016: Upsus (Upaya Khusus meaning Special Effort)

The econometric model for analyzing data for this study is as follows:

Where:

*i* = 1 and 2

*Y1* : Rice productivity (ton paddy/ha)

*Y2* : Area Harvested (million ha)

*b0, b1, …, b6*: Estimators

*D1* : *D1*=1 for 1961-1967, *D1*=0: the others

*D2* : *D2*=1 for 1968-1979, *D2*=0: the others

*D3* : *D3*=1 for 1980-1986, *D3*=0: the others

*D4* : *D4*=1 for 1987-1997, *D4*=0: the others

*D5* : *D5*=1 for 1998-2004, *D5*=0: the others *D6* : *D6*=1 for 2005-2014, *D6*=0: the others

*e* : Error term

*t* : 1961, 1962, …, 2017

**3. RESULT AND DISCUSSION**

The rice production in 1961 and 2017 were respectivelly 12.08 and 81.38 million tons paddy. In addition, their harvest areas were 6.86 million ha in 1961 and 15.79 million ha in 2017 (Figure 1).

**Figure 1**. The rice production and harvest area

Figure 1 reveals that the harvest area had been steadly increasing during the period 1961-2017. On the average, it had been increasing 0.16 million ha per year. In the last period, 2016-2017, it drastically increased, i.e. 1.51 million ha.

The productivity can be calculated based on the production data and harvest area. The results of this calculation are shown in Figure 2. Rice productivity is 1.76 tons/ha in 1961 and 5.15 tons/ha in 2017. Figure 2 shows that rice productivity has increased during the period 1961-2017. In 1998, Indonesia experienced a monetary crisis affecting the productivity declined from 4.42 tons/ha in 1977 to 4.20 tons/ha in 1998. The productivity dropped from 5.41 tons/ha in 2016 to 5.15 tons/ha in 2017.

**Figure 2**. The rice productivity

The results of data analysis can be seen in Table 1. This table shows that based on the F tests, all the independent variables have a significant effect (α = 1%) on the rice productivity for Model 1 and on the rice harvest area in Model 2. In addition, the independent variables explain 97.47% variation in the rice productivity (Model 1) and explain 95.36% variation in the rice harvest area (Model 2). The DW (Durbin Watson) statistics obtained by using FGLS reveals that both models are not suffered of autocorelation.

**Table 1**. The estimation of the empirical model

|  |  |  |
| --- | --- | --- |
| Independent  Variables | Coefficients in each model | |
| Model 1  Y:Productivity | Model 2  Y:Harvest A. |
| Intercept | 5.24\* | 15.02\* |
| *D1* | -3.48\* | -7.82\* |
| *D2* | -2.67\* | -6.67\* |
| *D3* | -1.50\* | -5.56\* |
| *D4* | -0.94\* | -4.26\* |
| *D5* | -0.85\* | -3.32\* |
| *D6* | -0.32\* | -2.17\* |
| *Ftest* | 321.63\* | 171.38\* |
| *R2* | 97.47 | 95.36 |
| *DW* | 2.20 | 2.32 |

Note:

\*: Significant level (α)=1%

The dependent variable for Model 1: Productivity

The dependent variable for Model 2: Harvest Area

Table 1 also shows that each independent variable has a significant effect (α = 1%) on the productivity in Model 1 and on the harvest area in Model 2. Based on the results of the F Test and this t test, the empirical model can be used for further analysis.

Based on the operational definition of the various dummy variables, the rice productivity and the harvest area can be calculated for the various periods. The results of this calculation can be seen in Table 2.

At the beginning of the green revolution (1961-1967), the average productivity per year was 1.76 tons/ha. In the following period (1968-1979), its average was 2.58 tons/ha. The average incremant in productivity was 0.07 tons/ha/year (Table 2). Meanwhile, the average harvest area per year was 7.20 million ha in the period 1961-1967. In the period 1968-1978, its average was 8.35 million ha. Therefore, its increament was 0.10 million ha/year.

**Table 2**. The rice productivity and the harvest area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Periods | Productivity  (tons/ha) | | Harvest Area  (million ha) | |
| Average  per year | Increment  per year | Average  per year | Increment  per year |
| 1961-67 | 1.76 |  | 7.20 |  |
| 1968-79 | 2.58 | 0.07 | 8.35 | 0.10 |
| 1980-86 | 3.74 | 0.17 | 9.46 | 0.16 |
| 1987-97 | 4.30 | 0.05 | 10.76 | 0.12 |
| 1998-04 | 4.40 | 0.01 | 11.70 | 0.13 |
| 2005-14 | 4.92 | 0.05 | 12.85 | 0.11 |
| 2015-17 | 5.24 | 0.11 | 15.02 | 0.72 |

The period 1968-1979 was when mass intensification was carried out in the various rice production centers through the implementation of Bimas/Inmas program. Bimas is a mass agricultural extension conducted through intensification and extensification. The farmers were persuaded to implement of the five elements of the new rice technology called Panca Usahatani, such as follows:

a. Use of high yield seeds

b. Appropriate use of fertilizers

c. Good farming methods

d. Control of pests and diseases

e. Maintaining the irrigation systems

Meanwhile, Inmas is the next step in the Bimas program which is carried out through the provision of the farming loans.

The goal of the extension activities was to get as many as targeted farmers who are willing to adopt the new technology (panca usahatani). According to Rogers (2003), adoption and diffusion of an innovation is passed in the following five stages:

a. Knowledge

b. Persuasion

c. Decision: reject or continue

d. Implementation

e. Confirmation

The five stages of the innovation diffusion take a long time. Table 2 shows that it takes around 20 years, i.e. from the mid 1960s to the mid 1980s. In the period 1980-1986, the average productivity of rice was 3.74 tons/ha. This figure shows that the average increase in the productivity in this period was 0.17 tons/ha/year (Table 2). Meanwhile, in this period, the average harvest area was 9.46 million ha and its average increment was 0.16 million ha/year.

Starting in the 1979/1980 planting season, a special intensification program (Insus) was implemented. Insus is the Bimas program carried out by a farmer group of 1,000 ha. In this program, farmers in one group optimize the use of paddy fields, the application of technology, efforts and funds. The activities of the farmer group in this program are to formulate a work plan, seek information and simultaneously disseminate it, coordinate and supervise the activities of members, carry out various efforts in fostering collaboration between members and cooperation with outside parties, and attend various communication forums with community leaders in the working region.

In the period 1987-1997, the average productivity was 4.30 tons/ha. Its average increase was 0.05 tons/ha/year (Table 2). This increase was lower than the increase achieved in the previous period. This shows that after the diffusion of innovations, rice productivity increased with decreasing rate. Meanwhile, in the same period, 1987-1997, the average of the harvest area was 10.76 million ha. Its increament was 0.12 million ha/year.

Since 1987, the Bimas program has been implemented through the Supra Insus program. This program is an the Insus program that is carried out in collaboration among farmer groups in one Agricultural Extension Agent Area (Wilayah Kerja Penyuluh Pertanian or WKPP). In this program 10 elements of the following technologies are applied:

a. Cropping pattern setting

b. Perfect tillage

c. Use of certified seeds

d. Variety rotation

e. Application of spacing according to technical standards

f. Balanced fertilization

g. Water use at the farm level

h. Use of liquid supplementary fertilizer

i. Wise use of pesticides and integrated control of pests and diseases

j. Handling harvest and postharvest

The goal for the implementation of the Insus is to avoid a decrease in the productivity in order to maintain rice self-sufficiency. However, the increase in productivity at the time of the Supra Insus (1987-1997), which was 0.05 tons/ha/year, was lower than its increase in the previous period (1980-1986), which was 0.17 tons/ha/year. One reason was the attack of the wereng pest in the various rice production centers. This pest attack due to the use of IR64 rice varieties on a wide scale and not rotated with the other rice varieties which resulted IR64 variety susceptible to the wereng attacks (BP3K Sukahening, 2015). This reveals that the adoption and diffusion of innovations in the rice variety rotation in the Supra Insus program has not been widespread.

Other factors that caused susceptibility to pests against pesticides were their excessive use. This is because the Bimas/ Inmas program from the start was very intense in reinforcing the use of pesticides (Rolling and van de Fliert, 1994). Therefore, in the Supra Insus program, the farmers are encouraged to use pesticides wisely. In addition, integrated technology for controlling pests and diseases follows FAO's recommendations, i.e. a technology called Integrated Pest Management (IPM). IPM is the integration of the various methods to control plant pests and diseases by reducing the population until below the level of its economic damage. In the application of IPM, the minimum pesticides used are to reduce the risk of environmental damage and human health.

The IPM program in Indonesia began in 1989 by educating selected farmers in the Farmer Field School. After graduating from this education, the farmers spread their knowledge to other farmers. There are two phases of this activity, i.e. the First Phase 1989-1992 and the Second Phase from 1993-1999 (Mariyono et al., 2010).

In 1998, Indonesia experienced a monetary crisis (krismon) which affected all sectors. In the period 1998-2004, (during the krismon and the reformation era), there were three times the presidential change, i.e. President Habibi (1998-1999), President Abdurrahman Wahid (1999-2001) and President Megawati (2001-2004).

The monetary crisis and the transition to the reformation era affected the rice productivity. In 1997, one year before the krismon, the productivity was 4.43 tons/ ha. Furthermore, compared to 1997, its productivity was lower in the following four years, i.e. in 1998, 1999, 2000 and 2001 at 4.20, 4.25, 4.40 and 4.39 tons/ha respectively. In 2002, the productivity began to be higher than its productivity in 1997, i.e. 4.47 tons/ha. Therefore, the average productivity in the 1998-2004 period was 4.40 tons/ha with its average increase was only 0.01 tons/ha per year.

The next period, 2005-2014, is the Agricultural Revitalization, or in full called the Revitalization of Agriculture, Fisheries and Forestry (RAFF). In this period, the development of food security was directed at domestic economic forces that were able to provide sufficient food for the entire population, especially from domestic production, in sufficient and safe amounts and diversity from time to time. The development goals are directed towards food independence which is defined as the ability of a nation to ensure that all its inhabitants obtain adequate, quality, safe food; which is based on optimizing utilization and based on resource diversity. Related to this goal, fulfilling rice needs is carried out through increasing domestic rice production which is a national development priority. The activities carried out to increase rice production are directed to the following activities (IAARD, 2018):

a. Build and develop modern rice centers

b. Improve farming efficiency through technological innovation

c. Optimal use of natural resources

d. Empower farmers and rural communities

e. Develop institutions and partnerships

f. Develop infrastructure

g. Expand planting area

h. Develop seed systems

The average rice productivity in this period was 4.92 tons/ha with an average increase of 0.05 tons/ha/year. This figure was the second lowest increase rate among other periods.

One of the causing factors is the implementation of the decentralization law. It made some development activities changed from being conducted by the central government to the district/city governments. One consequence is that the agricultural extension has been carried out by the district/city governments that were not yet ready to adjust this change. For example, the agricultural extension agents were transferred to the non-agricultural institutions, while employees who did not have the agricultural backgrounds were given the job for the agricultural extension.

The last period was 2015-2017, which was the first three years of the Special Efforts program to increase rice, corn and soybean production (Upsus Pajale). The activities on this program to increase rice production have been as follows (Permentan No. 03/2015):

a. Development of irrigation infrastructure

b. Land optimization

c. Development for System of Rice Intensification (SRI)

d. Movement for the Application of Integrated Crop Management Rice

e. Providing seed

f. Providing fertilizer

g. Providing the agricultural machinery and equipment

h. Pest control and the impact of climate change

i. Agricultural Insurance

j. Escort and assistance to the farmers

The Agricultural Ministry Decree No. 14/2015 is an integrated and mentoring guide for the extension agents, the college students, and the rural counseling officers in increasing the production of rice, corn and soybeans. Based on this guideline, the accompanying and mentoring organization consisted of four teams, i.e. the central level guiding team, the provincial level guiding team, the District/City Level of implementation team, and the sub-district level implementation team. The involvement of the Indonesian Army from the chief at the central level (Kasad) to the army officer at the sub-district level (Babinsa) and the involvement of universities, both lecturers and students in escort and mentoring activities can accelerate the achievement of the goal of increasing rice, corn and soybean production.

In the period 2015-2017, the average rice productivity was 5.24 tons/ha and its average increase was 0.11 tons/ha/year (Table 2). This rate is the second highest increase. The highest rate occurred in the period 1980-1986, i.e. 0.17 tons / ha / year. There are similarities in the approach for these two periods, i.e. the escort and the assistance to farmers in increasing the rice production.

They also affected the increase in harvest area. In the 2015-2017 period, the average harvest area per year was 15.02 million ha and its average increase was 0.72 million ha/year. This is the highest rate (Table 2).

**4. CONCLUSION**

a. Government efforts to increase rice production have a statistically significant effect on increasing productivity and harvest areas.

b. At the beginning of the green revolution (1961-1967), the average productivity of rice was 1.76 tons/ha and in the period 2015-2016 (Upsus), the average productivity of rice was 5.38 tons/ha.

c. At the beginning of the green revolution (1961-1967), the average rice harvest area was 7.20 million ha and in the period 2015-2016 (Upsus), its average was 15.02 million ha.

d. The average rate of the increment in rice productivity in the Upsus program was 0.23 tons/ha per year. This rate is the second highest rate. Meanwhile, the average rate of the increment for the rice harvest area in the Upsus program was 0.72 million ha per year. This is the highest rate compared to previous government programs. Therefore, Upsus is a government program that has the highest influence in increasing rice production.

**REFERENCES**

Badan Litbang Pertanian. 2018. Revitalisasi Pertanian, Perikanan, dan Kehutanan. e-file RPKK. <http://www.litbang.pertanian.go.id/special/rppk/efile>

Badan Pengendalian Bimas. 1997. Sejarah Bimas (perkembangan intensifikasi Pertanian dan peranannya dalam pembangunan pertanian). Sekretariat Badan Pengendalian Bimas. Jakarta.

BBP3K Sukahening. 2015. Pengertian, Sejarah, Varietas Benih Padi dan Pembuatan Persemaian. <http://sukaheningbp3k.blogspot.com/2015/10/pengertian-sejarah-varietas-benih-padi_27.html>.

FAO. 2018. <http://faostat3.fao.org/home/E>.

Hudoyo, A., Nurmayasari, I., Haryono, D. 2016. Analysis for self-sufficiency of rice in Indonesia: Forecast of its production and consumption. *The USR Seminar on Food Security (UISFS)*, Bandar Lampung, Indonesia, August 23-24, 2016.

Mariyono J., Kompas T., and Grafton R. 2010. [Shifting from Green Revolution to environmentally sound policies: technological change in Indonesian rice agriculture](https://ideas.repec.org/a/taf/rjapxx/v15y2010i2p128-147.html). [*Journal of the Asia Pacific Economy*](https://ideas.repec.org/s/taf/rjapxx.html)*, Taylor & Francis Journals*, vol. 15(2), pages 128-147.

Pingali, P.B. 2012. Green Revolution: Impacts, limits, and the path ahead. *PNAS*, 109, 12302-12308.

Rogers, E.M. 2003. Diffusion of Innovations. 5th Edition. Free Press, New York.

Rolling, N. and van de Fliert, E., 1994. Transforming extension for sustainable agriculture: the case of integrated pest management in rice in Indonesia. *Agriculture and human value*, 11 (2/3), 96–108.