International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2019, 9(6), 142-150.

Government Institutional Support in Increasing the Productivity of Soybean Seed Breeders Indonesia

Bahari[1]*, Haji Saediman[1], Laode Geo[1], Norma Arif[2]

[1]Departement of Agribusniness, Faculty of Agriculture, Halu Oleo University, Indonesia, [2]Departement of Agrotechnology, Faculty of Agriculture, Halu Oleo University, Indonesia. *Email: bahari.uho.03@gmail.com

Received: 20 August 2019 **Accepted:** 10 October 2019 **DOI:** https://doi.org/10.32479/ijefi.8645

ABSTRACT

In general, this study was aimed to reveal the extent of government contributions in encouraging increased productivity of seed breeders in Southeast Sulawesi Indonesia. This study was conducted in Southeast Sulawesi using cross-sectional data from 81 respondents obtained by census. The results of the research data were analyzed descriptively and used the stochastic frontier analysis. The results of the analysis showed that the increase in soybean seed production was significantly affected by the area of land, SP36/NPK Fertilizer, Increased labor for threshing, and labor for drying. Overall, soybean breeder farmers had not achieved maximum productivity because still had productivity gap of 15%. The role of the government that significantly increases production and productivity could be done through fertilizer input subsidy program, increase in land area, and increase the intensity of BPSB counseling/supervision in each planting season. For this reason, the government needs to ensure access, availability and price of fertilizer during the soybean growing season. In addition, the government can intensify assistance and supervision of farmers while increasing the adoption of agricultural mechanization technology in the process of threshing and drying of seeds.

Keywords: Government Institutional, Soybean Farm, Productivity, Soybean Seed Breeder
JEL Classifications: D02, Q16, D24, Q12

1. INTRODUCTION

The main problem of soybean commodities that have not been resolved since long is the disparity between consumption and domestic production that is getting bigger. It can be seen from the decreasing share of domestic soybeans to the share of imported soybeans in the domestic market. Even in 2012 the share of domestic soybeans only reached 28%, the rate of decline since 2003 was 0.89% on average per year (Nainggolan and Rachmat, 2014). Meanwhile, soybean demand is increasing along with the increase of soybean-based industries. Based on the calculation of the estimated amount of domestic soybean demand in 2020, the demand will reach 2.638 million tons (Harsono, 2015). oybean imports to tackle low food independence is not a good solution. Dependence on imports causes the domestic market to be very responsive to world market turmoil that can never be predicted. Soybeans are a cheap source of protein for the poor so it is an important commodity for Indonesia. Soybean imports will consume foreign exchange which should be used for other purposes that have a greater multiplier effect on economic growth (Budhi and Aminah, 2016). In this condition, the achievement of soybean independence through increasing national production becomes very important.

Increasing national production leads to various obstacles such as land availability, production and seed technology. Specific land for soybean farming has not been yet realized, resulted in soybean farming land competing with more profitable crops, particularly other food crops and oil palm. Increasing land cannot be used as an optimal and responsive solution to the problem of increasing soybean production. In terms of technology, there are many breakthroughs that Indonesia has made in developing it. The success of these technology improvement programs is hampered by the application at the farm level which is constrained by the high relative costs in the application of these technologies. While there is no clear price certainty at harvest time and the high opportunity cost in cultivating soybean intensively on other farmers. Efforts to apply the right technology at the farmer level will be difficult to be solved (Nainggolan and Rachmat (2014), Budhi and Aminah (2016)).

Seed problems play an important role in increasing soybean production because seeds are determinants of genetic productivity that cannot be changed even though they are carried out in the best possible farms and the maximum possible input. One of the problems in seeding is the availability of high-quality seeds at the right time at the farm level so that farmers use their low-yield crops. The only effort that can ensure good seed distribution is developing soybean seed breeders at the production center level (Suastika and Kariada, 2012). Adequate seed quality is a responsive solution that can minimize constraints on land and technology aspects. High seed demands in the soybean production centers show good prospects in improving seed quality and productivity at the farmer level. The increasing number of breeders will overcome the problems of seed availability.

Given the vital position of seed breeders for seed availability, one of the ways to develop them is to increase the profitability of the seed breeder business. By increasing productivity resulting in increased profitability, therefore it is feasible to cultivate compared to other farming businesses. The productivity of seed breeders is assumed to be influenced by several factors. One obstacle is the low quality of seeds because of the delays in drying that occur due to harvesting in the rainy season. Drying technology is very important to be owned by seed breeders. The next obstacle is the rapid decline in seed variability (deterioration) caused by inadequate varieties and storage patterns. For this reason, it is necessary to have good seed storage (Awaludin et al., 2016). In addition to the seed legislation issue, it is very important to ensure the quality of seeds that reach farmers (Darwis, 2016).

The main reason for the important role of government to intervene in economic activities in increasing the productivity of seed breeder farming is as follows. The availability of quality seeds is important to increase national soybean's productivity but the low production of seeds shows a positive externality. A positive externality is a form of market failure in the economy because the market fails to assess the benefits of good or service. In such a case of positive externalities, failed valuation is in the form of low prices on goods/services but it has high-value level in improving the economy (Mankiw, 2011). In the case of positive externalities in increasing seed production, the best way to overcome this problem is to increase the amount of seed production because increasing seed production will have a major impact in increasing national productivity. Certainly, to do this requires the government's role.

The source of seed production increased in Indonesia is from seed breeding farms. However, there are other market failure constraints in increasing the production of seed breeders. One of the constraints to market failure is the incomplete market. The incomplete market is a constraint encountered by seed breeders in the form of high costs in producing seeds at the breeder level compared to market prices paid by seed consumers. The cost of producing seed production is very large because of several things, namely (1) the high opportunity cost that occurs due to the choice of using land, capital and labor between producing soybean seeds and cultivating other agricultural crops that have higher profit than producing soybean seeds, (2) low productivity results in high total cost per unit of production, (3) high postharvest costs in managing soybean farming to be used as seeds.

To overcome positive externalities in seed availability, the government must first solve incomplete market problems at seed breeders level. The only way to overcome incomplete markets in seed breeding farms is to reduce the total cost per unit of output and increase the profitability of seed breeders so that they may compete with the profitability of other food farming. Based on this information, this study aims to analyze: (1) Factors influencing the production of soybean seed breeder farming, (3) how much efficiency level of soybean seed breeder farming, and (4) the role of government and other factors affecting productivity.

2. THEORETICAL FRAMEWORK

Incomplete market problems in agriculture sector can be solved by: (1) Increasing productivity, (2) increasing input subsidies, (3) increasing output. Debertin (2012) argues that increasing productivity can be done in two ways, namely (1) an increase in external factors beyond production factors that can encourage production without having to add input. That way, multiplicatively increasing factors will also increase production, and (2) accuracy in input allocation and increase in production factors elasticity towards output. Factors that drive this productivity can come from (1) the ability of the production management skills of each producer to apply technical production, and (2) the ability of producers appropriately allocate inputs.

The main concept in calculating productivity level is using Total Factor Productivity (TFP) concept which is better in generating productivity estimation because it involves all factors calculated in determining productivity level. One concept of productivity measurement using TFP is the concept of efficiency measurement used by Murillo-Zamorano (2004) which was applied by Coelli et al. (2005). This concept becomes an efficiency analysis of stochastic frontier. Coelli et al. (2005) suggested that efficiency is an indicator of productivity level which describes producer ability to produce maximum output using a certain set of inputs. To measure the efficiency, it can be done by estimating the maximum production level of both deterministic and stochastic output.

As for stochastic, Coelli et al. (2005) conducted it by estimating parameters from frontier production in the form of Cobb-Douglass function assuming using a number of N-samples, which are defined as follows.

$$\ln\left(y_i\right) = \left(x_i\beta - u_i\right) \quad (1)$$

Where, ln (yi) is the output of producer i, x_i is capital input from producer i, and u_i is non-negative random variable, which is technical efficiency in producer i.

$$TE_i = \frac{exp\left(x_i\beta - u_i\right)}{\exp\left(x_i\beta\right)} = exp\left(-u_i\right) \quad (2)$$

Where, TE_i is the level of technical efficiency which is an indicator of productivity level of producer *i*. The equation of $exp\left(x_i\beta\right)$ is the amount of output production at the highest productivity level. Whereas, the equation of $exp\left(x_i\beta - u_i\right)$ is the actual production level of the producer *i*.

$$u_i = \sum \delta_i z_i \quad (3)$$

The u_i value in equation (2) is technical inefficiency which is assumed to be influenced by several specific factors that also influence the output so that it is fathomed to determine productivity level.

Based on this description, those theory can be concluded that various government policies to increase productivity is one factor (z_i) determining inefficiency level of producers. The more factors used by the government in reducing inefficiency will increase producer productivity. The increase in input subsidies is a form of government policy that affects the number of producer input requests. In this case, the input subsidy determines the amount of input usage (x_i) in equation (1). The higher government subsidies for inputs will increase production (y_i).

3. LITERATUR REVIEW

Efficiency research has directed various studies to reveal factors that determine good productivity differences between producers. Likewise, in soybean farming, there are many factors that are thought to determine the level of efficiency of soybean farming business. Olayiwola (2008) examined differences in technical efficiency in small-scale, medium-scale and large-scale farmers. His findings indicate that the larger the business scale of soybean farmers is created, the more efficient soybean farming is done. Bahari (2014) found that socioeconomic conditions can determine changes in the level of productivity of soybean farmers, both in terms of technical efficiency, allocative efficiency and economic efficiency. Mounirou and Balogoun (2016) analyze the factors that influence efficiency by involving more factors than those proposed Bahari (2014). His findings indicate that the level of technical efficiency is influenced by gender, technical training, activities on secondary work of farmers, business scale, and access to credit. Etwire et al. (2013) found that increasing productivity through training of Danish International Development Agency and the Alliance for a Green Revolution in Africa showed very significant results and had the greatest impact on improving efficiency. These findings indicate that the role of institutions is very important in increasing the productivity of soybean farming.

Based on these findings it can be seen that the determinants of soybean productivity are only determined by socioeconomic conditions, conditions of farming, access to credit, and institutional roles. It is clear that studies in government in soybean productivity is still very limited. Meanwhile, one of the allocators in the economy is the government that is able to overcome market failures and is able to provide policies to improve the agricultural sector in general and soybean farming in particular. Agada (2015) found that government's role is very important to provide market information to soybean farmers and to be able to build local markets with excellent infrastructure, so as to increase investment and encourage soybean production. Hutapea and Hanapi (2017) found a very important role of the national seed centre institutions that were able to encourage and support seeds availability increase. Mardiana et al. (2011) also shows that the government plays a role in regulating the distribution of soybean seeds between regions. The arrangement of the distribution flow resulted in reinforcement in soybean seed agribusiness. By considering this matter, with the aim of expanding soybean productivity studies, the research should be directed to see how much the impact of government intervention on soybean farming and soybean seed breeders in order to increase productivity.

4. RESEARCH METHODS

4.1. Location and Research Period

The study was carried out in the Konawe Selatan Regency, Konawe Regency, and Kolaka Regency, Southeast Sulawesi Province, which were deliberately chosen because it represented each seed breeder group. The period of this study was from April 2018 to August 2018.

4.2. Determination of Respondents

In determining the respondents in this study, quota sampling was conducted on all populations in the soybean seed breeder group, namely 81 respondents.

4.3. Subsection

The primary data used in this study was the cross-section data obtained from the documentation through interviews including the study of production economics. Interviews were conducted using questionnaire. The secondary data in this study used time series data obtained at the Agriculture Service, Seed Supervision and Certification Agency.

4.4. Data Analysis Method

In this study, the data analysis method using stochastic frontier analysis to answer the first goal to the third goal. The method was carried out using (1) estimating the frontier line describing the maximum productivity level of each respondent, (2) measuring the level of technical efficiency, and (3) estimating the parameters of the factors influencing efficiency level. To answer the first goal and estimate the frontier line, parameter estimation is performed on the output-input relationship function as in equation (1) which in this study is arranged into an economic model of the production function of seed breeders with the following equation.

$$\ln Y_i = \beta_0+\beta_1 X_{1i}+\beta_2 X_{2i}+\beta_3 X_{3i}+\beta_4 X_{4i}+\beta_5 X_{5i}+\beta_6 X_{6i}+\beta_7 X_{7i}+\beta_8 X_{8i}+\beta_9 X_{9i}+v_i-u_i \quad (5)$$

Description: X_1=Seed Production, X_2=Land area (Ha), X_3=Number of seeds (kg), X_4= Urea Fertilizer (kg), X_5=SP36/NPK Fertilizer (kg), X_6=Pesticide (liter), X_7=Pest Control (HKP), X_8=Harvest

(HKP), X_9=Threshing (HKP), β_0, β_i=Constants, Estimation Parameters (i=1,2.,7), v = symmetric normally distributed random error, u = a one-side error term.

To answer the third goal, namely how much efficiency level of soybean seed breeder farming, the measurement results are generated from the ratio between actual output and output at the maximum productivity level, as in equation (2) formulated as follows.

$$TE_i = \frac{exp\left(x_i\hat{a} - u_i\right)}{\exp\left(x_i\beta\right)} = exp\left(-u_i\right) \quad (6)$$

Description: TE=efficiency level, X_i= Production Input.

To answer the fourth goal of analyzing government's role and other factors that affect productivity, parameter estimation is carried out on the function between inefficiency level (u_i) to several factors, as in equation (3) in this study compiled into an economic model of business determinant of seed breeder with the following equation.

$$\ln Y_i = \beta_0+\beta_1 PT_i+\beta_2 SA_i+\beta_3 EQ_i+\beta_4 JT_i+\beta_5 EDU_i+\beta_6 TS_i+\beta_7 EXP_i+\beta_8 STO_i \quad (7)$$

Description: PT = Dummy Cropping Pattern (Rice-Soybean – Rice = 0) or Rice – Soybean – Corn = 1), SA = Dummy Water Source (Far = 0; Close = 1), EQ = Dummy Seed Cleaner (None = 0; Exist = 1), JT = Size of Planting Distance ([20x40] = 0 and [25x45] = 1), EDU = Seed Breeder Education Level (years), TS = Intensity of Extension/Supervision of BPSB in annuals (frequency), EXP = Experience in Breeding Seeds (years), STO = Soybean Seed Storage Facility (None = 0; Exist = 1).

5. ANALYSIS RESULTS

In this analysis, two stages were carried out, namely (1) describing the government's role in the provision, technical assistance and physical capital as well as other supporting policies on technical and technological management (Seed Cleaner Equipment, Extension, Seed Storage Facilities, storage warehouse construction and drying floor availability); and (2) analyzing the impact of the government's role and community institutions (technical and management technology) on the productivity of seed breeders in Southeast Sulawesi.

5.1. Soybean Seed Breeding Farming Business in Southeast Sulawesi

The economic model of the production function of the seed breeder that was built showed good ability in explaining the phenomenon of seed production at the breeder level which is presented in Table 1. The R^2 value which shows 89.30 means that as many as 89.30% of independent variables are able to explain the variation of seed production. Fhit value of 74.92 which is very significant indicates that jointly independent variables have a significant effect on increasing seed production. The results of parameter estimation on the ordinary least square (OLS) method can be seen that the increase in fertilizer variables shows a significant effect in increasing seeds yields. The variables of urea fertilizer and harvest labor show a negative marginal value towards fertilizer production variables indicating that the addition of these inputs will only reduce seed production.

The results of parameter estimation in maximum likelihood estimator (MLE) method show different results from OLS method. Based on Table 1, the parameter estimation result of OLS method shows that all variables in the model have no significant effect, even though the error level is 10% on the amount of seed production, except for the SP36/NPK fertilizer variable. The urea fertilizer variable shows a negative marginal value on the number of OLS estimation results. Urea fertilizer variables and harvest labor are variables that need to be reduced because the addition of these inputs will only increase input costs that can actually be transferred to other inputs that can significantly increase seed production, particularly for the addition of SP36/NPK. The utilization of urea fertilizer has a role to increase vegetative growth at the beginning of growth (Yagoub et al., 2012). Its utilization is intentionally over-allocated with the aim that vegetative growth reaches perfection to support generative growth. It is expected that with the achievement of perfect vegetative growth will be able to support soybean plants to produce more pods. The use of harvest labor does not directly affect physiological growth but its use is to prevent yield loss during harvest. The use of harvest labor is often excessive to reduce yield loss during harvest due to labor errors during harvest.

SP36/NPK fertilizer has a very significant effect in producing seeds because it is an important input in farming and soybean growth. SP36/NPK fertilizer functions in generative growth to increase the number of pods and the protein content in the pod (Yagoub et al., 2012). These nutrients are very important in producing quality soybeans to be used as seeds. The reduction in nutrients will reduce the amount and quality of soybeans, thus there will be many non-quality pods not selected to be used as seeds. Economically, SP36/NPK fertilizer is an important input because it is an input that has a very high marginal level and is significant in increasing soybean seed production.

Table 1: Estimation of parameters on stochastic production frontier function of soybean breeding farming business, 2018

Variable	OLSE		MLE	
	Coefficient	t-ratio	Coefficient	t-ratio
X_0	4.0196	4.4500	6.1874***	43.00
X_1	0.2597	0.9256	0.7793***	15.84
X_2	0.2040	1.0768	0.0870***	3.14
X_3	−0.0438	−0.3536	−0.1098***	−14.06
X_4	0.2445***	2.2114	0.1291***	18.98
X_5	0.0604	0.3194	−0.0970***	−8.77
X_6	0.0177	0.1135	−0.0877***	−13.36
X_7	−0.0122	−0.2035	0.0721***	19.58
X_8	0.2367	1.4250	0.1477***	25.89
X_9	0.2696	1.3742	0.1774***	31.86
R^2	89.30			
F_{Hit}	74.9260***			
σ^2			0.9782***	7.1363
γ			0.9999***	10344
LR test			128.792***	

Description: *** significant on α=1%, Source: Processed Data (2018) based on FRONTIER 4.1

The difference of the parameter estimation results between OLS and MLE can be due to the estimation in MLE method also involves variations of errors from each observation in the estimation method so that the relative maximization value of the dependent variable between observations is obtained. Although this is the case, there are similarities in the results of the parameter estimation on the variable of Urea fertilizer use which also shows a negative marginal value. This finding supports the findings of OLS parameter estimation that also found similar things. The use of urea fertilizer is a source of inefficiency in input allocation.

Table 1 also shows that pest control activities are also a source of efficiency in the inputs allocation in the results of MLE estimation method. Pest control activities involve the use of pesticides and the use of labor for all pest control activities. Variables of pesticide use and the number of workers for pest control show a parameter with negative sign indicating that increasing the use of inputs will actually reduce seed production. The addition of input allocations can reduce production because the addition of these inputs will only increase input expenditure that does not increase production.

While, on the other hand, the expenditure on the use of pesticide inputs and the number of workers for pest control is an opportunity cost for the addition of other inputs that can significantly increase seed production. The addition of pesticide use and the number of workers for pest control will relatively reduce the level of production that should be achieved.

Nevertheless, the role of pesticide inputs and the number of workers for pest control are different from other input characteristics. Pesticide input which is an input serves to prevent loss of results due to pest attacks makes usage level is highly dependent on the condition of pest attack level. Excessive use is not very relative to field conditions. Its use is intentionally over-allocated with the aim of ensuring the absence of pest disturbances that can reduce seeds yield.

The parameter estimation results of MLE method in Table 1 also show that land is the most significant variable in increasing seed production compared to the utilization of other variables. Moreover, the highest marginal value of land area to increase seed production is in the MLE method compared to other production inputs. An increase in land area of 1% will increase soybean seed production by 0.779%. The findings show that increasing business scale is a factor that increases soybean seed production.

Postharvest labor variables, namely labor for threshing (X_8) and labor for drying (X_9) also show a very large impact on soybean seed production, based on the parameter estimation results of the MLE method. Increasing labor for threshing (X_8) and labor for drying (X_9) by 1% will increase soybean seed production by 0.147% and 0.177%, respectively. The findings indicate that threshing and drying activities are very important for soybean seed production.

The explanation of parameter estimation in the economic model of the production function of seed breeders shows several variables which have significant impact on increasing soybean seed production, both based on the OLS method and the MLE method. These variables are (1) land area, (2) SP36/NPK fertilizer, (3) Increasing labor for threshing, and (4) labor for drying.

5.2. Level of Efficiency of Soybean Breeder Farmers

The tabulation results of technical efficiency level distribution presented in Table 2 are the comparison between the estimation of the frontier value of number of seeds production and the number of actual seed production of the breeder farmers. Estimating the frontier value of the number of seeds production is determined by using the parameters generated from the MLE estimation method in the economic model of the production function of the seed breeder in the equation (4) that has been previously built. To ensure that the economic model and data used are able to provide good results in estimating the frontier production of the number of seeds it can be seen using the following indicators. The LR test value of 128.779 is greater than what indicates that there are technical inefficiency effects affecting soybean seed production. The value of σ2 shows significance at 1% error level which means that seed production level is influenced by significant factor outside the economic model of the production function of seed breeder. The value of γ also shows significance at the level of error 1% and is 0.999, it means that 99% of error variations affecting soybean seed production come from errors resulted in technical inefficiency effects.

The results of technical efficiency level estimation in soybean seed production presented in Table 2 shows that more than 80% of soybean seed breeders are able to achieve efficiency levels above 0.700. On average, technical efficiency achieved by seed breeders reaches 0.848 which means that productivity level of the new soybean seed breeder reaches 84.8% to the maximum productivity level. The productivity value of 84.8% also indicates

Table 2: Results of tabulation on technical efficiency levels distribution, 2018

Stratification of efficiency outcomes	Technical efficiency level of soybean seed production			Total production of soybean seeds
	Number of seed breeders	Average achievement	Percentage of seed breeders	
0.000-0.599	3	0.5512	3.70	683.33
0.600-0.699	6	0.5715	7.41	2298.33
0.700-0.799	18	0.7671	20.99	2469.71
0.800-0.899	22	0.8516	27.16	2728.18
0.900-1.000	33	0.9649	40.74	2563.48
Sum	81		100	2148.61
Minimum	0.098			
Maximum	0.999			
Average	0.848			

Source: Processed Data (2018) based on FRONTIER 4.1

that there is a gap in the maximum productivity level of 15.2%. The gap of 15.2% means that there is an influence of 15.2% outside of input variables influence that can affect productivity level of soybean seed breeders. So there is still a wide open space in increasing soybean seed production without increasing input through increasing factors affecting the productivity.

Using the results of efficiency level presented in Table 2, it can be determined the amount of production lost due to not achieving the maximum productivity level caused by inefficiency effect. Determination is based on the following calculation, (Production lost = [(Total Production)/(Efficiency Level)] - Total Production). By using this formula, the average amount of soybean seed production lost due to inefficiency effect on the level of efficiency achievement (0.000-0.599) of 556.39 Kg. The average amount of soybean seed production lost in the achievement level of efficiency level (0.600-0.699), (0.700-0.799), (0.800-0.899), and (0.900-1000) are 1732.25 Kg, 749.83 kg, 475.41 kg, and 93.25 kg, respectively. Based on these calculations, the total loss of seed production due to the total inefficiency effect by calculating the number of respondents is 39041 Kg. While, the amount of seed production loss due to the effect of inefficiency on average on all respondents is 719, 63 Kg. The results of this analysis indicate the magnitude of the inefficiency effects arising from inefficiencies in soybean seed production which are also influenced by certain factors. In this study, the factors that can influence the technical inefficiency come from several factors presented in Table 3.

5.3. Efficiency Determinants of Soybean Seed Breeding Business

Table 3 presents parameter estimation on the economic model of business determinant of seed breeders formed to describe the factors affecting productivity in soybean seed breeders. All variables in the determinant model of inefficiency of soybean seed breeders show significant effect on the degree of error of 1%. Planting Pattern Factor (PT) is a dummy variable showing a negative influence on the inefficiency of soybean seed production which means that cropping patterns with more than two types of crops (Rice-Soybean-Corn) has more efficient productivity compare to one type of crop (Rice-Soybean). The cropping system with more plants is able to cause efficiency level in the use of nutrients, absorption of soil carbon, soil quality, and biodiversity in the soil higher than that of in monocultures. Furthermore, cropping patterns with more plants also reduce pathogen infection to a greater degree than monocultures (Du et al., 2018). The improvement of soil quality can improve nutrients that can be absorbed by plants in cropping patterns with more plants so that it is relatively more productive than on land that is only planted with fewer types of plants. In addition, the cropping pattern of corn-soybean is more capable because it is able to grow well despite element N deficiency in the soil (Tsujimoto et al., 2015). Based on this matter, the Rice-Soybean-Corn cropping pattern shows a more efficient performance compared to the cropping pattern that is only Rice-Soybean.

Table 3: Determinants of soybean seed breeder inefficiency, 2018

Variable	Coefficient	Standard error	t-ratio
Dummy planting pattern	−0.5837	0.3338***	−1.7483
Dummy water source	−0.5774	0.3263***	−1.7699
Dummy seed cleaner	9.2359	1.7820***	5.1830
Plant spacing	−6.7251	1.2587***	−5.3428
Educational level breeder	0.4451	0.0706***	6.3018
Intensity of extension/ Supervision of BPSB in a season	−1.2334	0.1945***	−6.3421
Experience in breeding seeds	−1.4094	0.2856***	−4.9349
Soybean seed storage facility	4.5560	0.7400***	6.1566

Description: *** significant on α=1%. Source: Processed Data (2018) based on FRONTIER 4.1

Table 3 also shows that the proximity of the water source to soybean farming land significantly determines the inefficiency in farming. Proximity variables of water source is a dummy variable. The parameter estimation results indicate a negative sign which means that the further the water source will increase inefficiency in producing soybean seeds. Gaballah et al. (2008) suggested that the lack of water availability to soybean plants would result in a decrease in plant height and leaf wide-area, decrease in grain yield and inhibit the flowering process. In addition, the final yield of soybeans would decrease if there was a sufficient decrease in water intake. Water is very important in achieving the productivity of soybean plants. However, the distance of water source from soybean farming will result in relative costs for producers. As a result, the effort to minimize costs and maximize profits is one of the causes of the lack of water intake for soybean plants.

Seed Cleaner equipment is also a source of inefficiency in soybean seed breeder farming. The use of seed cleaner equipment actually increases the inefficiency of soybean seed production. The marginal value of Seed Cleaner against inefficiency does not match expectations. In the research areas, there were two ways to clean soybeans, using traditional equipment and Seed Cleaner machines. This finding can be caused by the seed cleaner machine equipment having a filter that is smaller than the size of the seed that meets the standards. As a result, a lot of soybean seeds which fulfill the standard were wasted in selection method using seed cleaner machine. It is different from traditional methods based on observation and sieve equipment. Although the equipment is more traditional, but it can be more accurate in sorting seeds that meet the standard but not giving a lot of yield loss. Kostić et al. (2013) suggested that the need for size calibration on seed cleaner machine equipment periodically so as not to result in much loss.

One of the factors that can significantly reduce inefficiency in soybean seed breeder farming is the arrangement of soybean spacing. The main difference in soybean spacing in this study is the distance between rows and columns, namely 20 × 40 cm and 25 × 45 cm. The parameter estimation results in Table 3 show that the soybean spacing of 25 × 45 cm gives a higher level of efficiency compared to a spacing of 20 × 40 cm. Spacing between plants actually depends on the type of seed. Research conducted by Boydak et al. (2002) found that spacing of 50 cm was able to produce more oil and linolenic acid. Likewise, Çalişkan et al. (2007) showed that plant spacing that produced a significantly higher production was at a distance of 50 cm. These findings are in line with our finding which show that soybean spacing of 25 × 45 is more efficient than the spacing of 20 × 40 cm.

Education level shows a significant influence on the inefficiency of seed production, but it has different sign from the theory predictions. Based on Table 3, the increasement of school years received by seed breeders will increase inefficiency in producing soybean seeds. These results mean that education level has a negative impact on the efficiency of the soybean seed breeder farming. The findings of this study show a negative relationship between education levels to increasing efficiency which are in line with the findings of Zoundji et al. (2015) who also found the impact of education levels are negatively related to soybean farming efficiency. Based on this finding, it can be seen that education level in soybean farming does not play a significant role in determining the technical procurement of farming well.

The education level has a negative influence because experience of farming and extension intensity is far more important than the level of education. In addition, the level of formal education may not affect the level of farm efficiency that can be achieved by farmers. The cause is common for farmers to share experiences so that illiterate farmers can learn from other farmers (Sumaryanto et al. (2003), Bahari (2014)). The farming pattern of soybean seed breeders in this research areas does not use high technology production processes. That way, the breeder farmers who even have a low education level are able to produce efficiently. The level of education has a significant role in adaptation proccess of new technologies. Higher levels of education are relatively always faster in mastery and faster in achieving the efficiency level in utilizing technology (Stefanou and Saxena, 1988).

The intensity of the extension/supervision of BPSB in a season shows a significant influence and has a negative sign of inefficiency in producing soybean seeds. This finding is in line with the findings of Fabiyi (2015) who suggested that agricultural supervisory extension agents play an important and effective role in enhancing the ability of human resources in soybean farming. This important role is due to the agricultural extension/supervision agents being the only government agents tasked with explaining various innovations and programs to increase soybean production. Sundari et al. (2015) also suggested the role of agricultural extension agents/supervisors as motivators, educators, and dynamists for farmers who can educate farmers on farming techniques and methods in order to increase production. Based on this matter, the lack of education level will be offset by a high intensity of education. Thus, the intensity of extension/supervision is able to encourage productivity of soybean breeder farmers. In this research areas, agricultural extension agents/supervisors play a role not only in agricultural technical matters but also as mentors in regulating cropping patterns and irrigation water regulation.

The farming experience is an important element in increasing productivity because it is able to improve the technical quality of farming from time to time. Bahari (2014) suggests that the longer a farmer does farming, the more excellent the level of farm management. In every change of farming period, each farmer will produce technical improvements periodically. As a result, along with the increase in the implementation of farmer farming, it will be better in applying technical and improving the ability to adjust the production process in extreme conditions. The findings in the study area are in line with the previous statement which shows that technical inefficiency is negatively and significantly affected at an error rate of 1%. These results mean that inefficiency in producing soybean seeds decreases along with the increase in experience in the duration of seed breeding farming carried out by respondents. This finding is consistent with the findings of Ainembabazi and Mugisha (2014) who suggested that farming experience plays a major role in the application of farming technology, especially at the beginning of technology adoption to achieve the highest level of efficiency. Agada (2015) also stated the same thing, namely the increase in soybean farming experience will have an impact on increasing the ability to increase investment, productivity, and the ability to apply technology.

The soybean seed storage facility in this study is in the form of a special deviation building originating from government assistance. Based on Table 3, the presence or absence of soybean seed deviation facilities shows a positive and significant influence on the increase in inefficiency of soybean seed breeder business. These results mean that soybean seed breeders who have soybean seed storage facilities are relatively more inefficient compared to breeders who do not have seed storage facilities. Previous research shows that storage building facilities of soybean seeds are not important in determining productivity in producing seeds. However, to maintain the quality of the seed depends on the treatment given. Neve et al. (2016) suggests that good storage must be able to prevent the occurrence of fungi in soybeans. Shelar et al. (2008) suggested that seeds are very susceptible to mechanical damage and the presence or absence of fungi on the seeds during storage is determined by the way the seeds are stored. Vieira et al. (2008) suggested another important factor that determines the success of the seed storage process, namely storage room temperature. Unsuitable storage room temperature will result in a decrease of seed quality. Based on this research it can be seen that the unsuccessful storage building facilities of soybean seeds in increasing the productivity of soybean seeds can be caused by the storage process in the building facilities that are not in accordance with the standards.

6. DISCUSSION

The Indonesian government strives to achieve soybean self-sufficiency by increasing soybean production and its intervention in soybean farming. One form of intervention is to improve the upstream subsector by increasing the availability of good seeds for soybean farming to meet the national soybean demand. One of the improvements is done by trying to improve the profitability of soybean seed breeder farming. The purpose of this improvement is to lower opportunity cost of soybean seed breeder farming and to make this commodity becomes one of the favorite commodities to be cultivated in addition to other food crops that have high profitability. Increased profitability can be done with various things, one of which is by increasing productivity. Thus, in addition to being expected to increase the profitability of soybean seed breeding business, it is also able to increase the capacity to provide quality seeds in a timely and good quality manner.

Government intervention in soybean seed breeding is carried out by providing certain programs to breeding farmers, namely: (1) Fertilizer subsidies, (2) extension, guidance and technical supervision of seed breeding, (3) postharvest equipment assistance (seed storage buildings and seed cleaners), (4) Prices, and (5) Marketing. Nevertheless, not all of these programs have a large impact or are able to significantly increase the productivity of soybean seed breeder farming. Moreover, there is a limitation on the government budget so that financing efficiency is to be more focused on the program designation which significantly increases soybean seed production. Based on this research, it can be determined the comparison of the impact of government programs that can increase soybean seed production.

The presentation of analysis result in the previous section shows that government policies that are able to increase soybean seed production are the provision of seed inputs, fertilizer subsidies, and extension and supervision of seeds. The policy programs that cannot increase soybean seed production are the provision of seed storage buildings and the provision of Seed Cleaner. If compared between policy programs on soybean farming, the government's policy program in increasing soybean seed production has a significant effect on the side of increasing inputs, particularly the input of SP36/NPK Fertilizers. Moreover, the provision of seed storage buildings and the provision of Seed Cleaner shows a negative effect on increasing productivity.

The results of the analysis in Table 1 also show that the number of coefficients of each variable in the economic model of the production function of seed breeders in the OLS and MLE methods are 1236 and 1098, respectively. The value of coefficients number for each variable in the model of the production function is >1 which indicates that increasing return to scale. In this condition, farming should be more directed to increase input than to increase productivity because the addition of production inputs together by 1% will increase soybean seed production by more than 1%. Based on this matter, the government should develop program further to improve the farming side, whether it is planting techniques or production inputs.

Increasing business scale in term of increasing land area is important to increase soybean seed production. Soybean seed farming which is not yet a favorite business for the farmers will result in this farming being intercropped on the sidelines of the planting time. As a result, soybean seed breeder farming always uses intercropping land with other crops, so that the land area for soybean production is also not increased. The results of the analysis in this study indicate that both the results of OLS and MLE methods of increasing land area have a large marginal value for increasing soybean seed production compared to various government policies on soybean seed breeders. In terms of increasing soybean seed production, the government should create policies to increase soybean seed farming land compared to post-harvest programs which actually do not result in an increase in the productivity of soybean seed breeders.

7. CONCLUSION, POLICY IMPLICATIONS AND SUGGESTIONS

Based on the description in the discussion, it can be concluded that:

1. Input of soybean seed breeder farming significantly influences the increase in soybean seed production, namely (1) land area, (2) SP36/NPK fertilizer, (3) Increasing labor for threshing, and (4) labor for drying.
2. The average efficiency level achieved by soybean breeding farmers is 0.848 which means that the level of productivity of soybean seed breeders reaches 84.8%. This value also shows that there is a gap in the maximum productivity level of 15.2%.
3. Factors outside the input of soybean seed farming that are able to encourage increased productivity are Cropping Patterns, Water Sources, Planting Distance, Intensity Extension/ supervision of BPSB in annuals, and Experiences in seed breeding.
4. The role of government in the policy of subsidizing fertilizer inputs and increasing land area is a very significant policy towards increasing the production of soybean seeds by breeders.

Based on these findings it can be seen that in order to promote the production of seed breeders the government must encourage policies:

1. Fertilizer subsidy, particularly SP36/NPK fertilizer to increase access, availability and price of fertilizer during the planting period.
2. To increase soybean seed production, it can be done by adopting mechanization technology for threshing and drying of seeds to save labor.
3. Anything to improve the productivity of soybean seeds can be done by increasing farmers' access to cheaper water sources with closer distance from farming.

The suggestions for further research that can be conducted are:

1. The existence of research that also analyzes the integration of policies regarding soybean seeds between the central government and the relevant regional governments.
2. Further research can be expanded to the risk study of production and the economy of agricultural households which also includes the effect of intercropping on the productivity of soybean seeds.
3. Further research is expected to reveal more factors affecting productivity from the side of the farming process and its various constraints.

REFERENCES

Agada, M. (2015), Constraints to increase soybean production in Benue state, Nigeria. Asian Journal of Agricultural Extension, Economics and Sociology, 4(4), 277-284.

Ainembabazi, J.H., Mugisha, J. (2014), The role of farming experience on the adoption of agricultural technologies: Evidence from smallholder farmers in Uganda. Journal of Development Studies, 50(5), 666-679.

Awaludin, H., Fitratunnisa, Herawati, N. (2016), Kajian Daya Simpan Benih Beberapa Varietas Kedelai. Prosiding Seminar Nasional Inovasi Teknologi Pertanian. Litbang Pertanian Kalimantan Selatan. p767-775.

Bahari. (2014), Analisis efisiensi teknis usahatani padi sawah pada sentra produksi di kabupaten bombana dan kabupaten konawe selatan. Jurnal Agriplus, 24(1), 26-35.

Boydak, E., Alpaslan, M., Hayta, M., Gerçek, S., Simsek, M. (2002), Seed composition of soybeans grown in the Harran region of Turkey as affected by row spacing and irrigation. Journal of Agricultural and Food Chemistry, 50(16), 4718-4720.

Budhi, G.S., Aminah, M. (2016), Swasembada kedelai: Antara harapan dan kenyataan. Forum Penelitian Agro Ekonomi, 28, 55-68.

Çalişkan, S., Arslan, M., Üremiş, I., Çalişkan, M.E. (2007), The effects of row spacing on yield and yield components of full season and double-cropped soybean. Turkish Journal of Agriculture and Forestry, 31(3), 147-154.

Coelli, T.J., Rao, D.S.P., O'Donnell, C.J., Battese, G.E. (2005), An Introduction to Efficiency and Productivity Analysis. New York: Springer Science and Business Media.

Darwis, V. (2016), Implementasi legislasi benih dalam mensukseskan swasembada pangan. SEPA: Jurnal Sosial Ekonomi Pertanian dan Agribisnis, 12(2), 133-145.

Debertin, D.L. (2012), Agricultural Production Economics. USA: University of Kentucky.

Du, J.B., Han, T.F., Gai, J.Y., Yong, T.W., Sun, X., Wang, X.C., Yang, F., Liu, J., Shu, K., Liu, W.G. (2018), Maize-soybean strip intercropping: Achieved a balance between high productivity and sustainability. Journal of Integrative Agriculture, 17(4), 747-754.

Etwire, P.M., Martey, E., Dogbe, W. (2013), Technical efficiency of soybean farms and its determinants in Saboba and Chereponi districts of Northern Ghana: A stochastic frontier approach. Sustainable Agriculture Research, 2, 106-116.

Fabiyi, E.F. (2015), Impact of agricultural extension on adoption of soyabean innovations in Bauchi, Nigeria. Case Studies Journal, 4, 1-7.

Gaballah, M.S., Ouda, S.A., Khalil, F.A. (2008), Effect of Water Stress on the Yield of Soybean and Maize Grown Under Different Intercropping Patterns. Twelfth International Water Technology conference, IWTC12. Alexandria: International Water Technology Journal. p27-30.

Harsono, A. (2015), Strategi pencapaian swasembada kedelai melalui perluasan areal tanam di lahan kering masam. Iptek Tanaman Pangan, 3(2), 244-257.

Hutapea, Y., Hanapi, S. (2017), Kinerja Kelembagaan Perbenihan Padi di Sumatera Selatan [Performance of Seeding Rice in South Sumatra]. Prosiding Seminar Nasional Teknologi Pertanian. Available from: https://www.jurnal.polinela.ac.id/index.php/PROSIDING/article/view/420.

Kostić, M., Balešević-Tubić, S., Tatić, M., Đorđević, V., Lončarević, V., Đukić, V., Ilić, A. (2013), Seed germination and initial seedling growth as affected by seed size. Journal on Processing and Energy in Agriculture, 17, 127-129.

Mankiw, N.G. (2011), Principles of Economics. 6th ed. Australia: Cengage Learning.

Mardiana, Yohanes, G.B., Irianto, B. (2011), Peran Kelembagaan Pertanian Dalam Penyebaran Inovasi Teknologi Produksi Benih Kedelai di Nusa Tenggara Barat. Indonesia: Prosiding Seminar Hasil Penelitian Tanaman Aneka Kacang dan Umbi. Nusa Tenggara Barat (NTB). p428-437.

Mounirou, I., Balogoun, I. (2016), Estimation of stochastic frontier of the technical efficiency of the soybeans production's determinants in Benin: The case of the commune of savé. Global Journal of Agricultural Economics, Extension and Rural Development, 4, 410-420.

Murillo-Zamorano, L.R. (2004), Economic efficiency and frontier techniques. Journal of Economic Surveys, 18(1), 33-77.

Nainggolan, K., Rachmat, M. (2014), Prospek swasembada kedelai Indonesia selfsufficiency prospect of soybean in Indonesia. Jurnal Pangan, 23(1), 83-92.

Neve, J.M.G., Oliveira, J.A., da Silva, H.P., de GE Reis, R., Zuchi, J., Vieira, A.R. (2016), Quality of soybean seeds with high mechanical damage index after processing and storage. Revista Brasileira de Engenharia Agrícola e Ambiental, 20(11), 1025-1030.

Olayiwola, O.O. (2008), Technical efficiency of soybean production in ijebu-ode local government area of Ogun state, Nigeria. International Monthly Refereed Journal of Research In Management and Technolog, 11, 7-13.

Shelar, V.R., Shaikh, R.S., Nikam, A.S. (2008), Soybean seed quality during storage: A review. Agricultural Reviews, 29(2), 125-131.

Stefanou, S.E., Saxena, S. (1988), Education, experience, and allocative efficiency: A dual approach. American Journal of Agricultural Economics, 70(2), 338-345.

Suastika, I.B., Kariada, I.K. (2012), Kajian Sistem Penyediaan Benih Unggul Bermutu Kedele dalam Mendukung Program Strategis Peningkatan Produksi Kedele Wilayah Bali. Makalah Disampaikan Pada Seminar Nasional Kedaulatan Pangan dan Energi. Fakultas Pertanian, Universitas Trunojoyo, Madura.

Sumaryanto, N.F.N., Wahida, M., Siregar, M. (2003), Determinan efisiensi teknis usahatani padi di lahan sawah Irigasi. Jurnal Agro Ekonomi [Journal of Agroeconomic], 21(1), 26-35.

Sundari, S., Yusra, A.H.A., Nurliza, N. (2015), Peran penyuluh pertanian terhadap peningkatan produksi usahatani di kabupaten pontianak. Jurnal Social Economic of Agriculture, 4(1), 26-31.

Tsujimoto, Y., Pedro, J.A., Boina, G., Murracama, M.V., Ito, O., Tobita, S., Oya, T., Cuambe, C.E., Martinho, C. (2015), Performance of maize-soybean intercropping under various N application rates and soil moisture conditions in Northern Mozambique. Plant Production Science, 18(3), 365-376.

Vieira, R.D., TeKrony, D.M., Egli, D.B., Bruenning, W.P., Panobianco, M. (2008), Temperature during soybean seed storage and the amount of electrolytes of soaked seeds solution. Scientia Agricola, 65(5), 496-501.

Yagoub, S.O., Ahmed, W.M.A., Mariod, A.A. (2012), Effect of urea, NPK and compost on growth and yield of soybean (*Glycine max* L.), in semi-arid region of Sudan. ISRN Agronomy, 2012, 1-6.

Zoundji, C.C., Houngnandan, P., Dedehouanou, H., Toukourou, F. (2015), Determinants of soybean [*Glycine Max* (L.) Merrill] production system in Benin. Journal of Experimental Biology and Agricultural Sciences, 1, 432-439.