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Efficiency and Competitiveness of Corn Farming in Sumbawa Regency

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***Abstract**: This research was intended to identify efficiency level and competitiveness of corn farming in dry land and wetland in Sumbawa. The research was conducted on 100 farmer respondents in each selected location purposively. Stochastic Frontier version 4.1 analysis and PAM (Policy Analysis Matrix) were applied in analysis. Result or data estimation using FRONTIER indicated that average technical efficiency (TE) at dry land and wetland are 0.863 and 0.849%, respectively. Mean economic efficiency of corn farming in dry land and wetland are 0.505 and 0.355 respectively. Mean price efficiency from corn farming in dry land and wetland are 0.585 and 0.425, respectively. Gamma value parameter in dry land and wetland were 0.697 and 0.552, respectively. This means that the technical efficiency of farming in dry lands constitute 70 percent of management or management capabilities of farmers and the rest of nature or influenced by the weather . Being in wetlands 55 percent of the technical capabilities of farmers in the management and the rest is the influence of natural factors. PAM results show corn farming in Sumbawa have competitive and comparative advantage . It is shown from the PCR value of 0.25 (PCR < 1) and the DRC at 0.39 (PCR<1).*
***Keywords**: efficiency, corn farming, competitiveness*

I. Introduction

Corn is one of cereal commodity which have relatively high economic. Corn plays role as food and feed and now it is used as fuel and industrial raw material in which its needs increase continuously every year. Opportunity for corn production improvement in domestic area is broad, through productivity improvement or extension of planting area, particularly in dryland outside Java Island or through increase in cropping index. Although national corn productivity increases, in general national corn productivity is low. Result of various researches from government and private institutions indicate productivity of 6.0-10.0 ton/ha depending on land condition and its technology application. (Directorate General of Food Crop, 2011).

Corn agribusiness development is a of rural-based economic development acceleration through optimization of natural resource, artificial resource and farmer resource management to increase farmer income and welfare. Increase in agricultural production in Sumbawa regency till end of 2011 was still prioritized in improvement of rice production, secondary crops/palawija (such as soybean, corn, mung bean, cassava) production and horticulture development particularly vegetable and fruit crops (Food Crop Agriculture Office, Sumbawa regency, 2012).

Rural agribusiness institution that grows from bottom and benefits much people is a requirement for sustainable adoption of innovation technology. Past experience teach us that technology adoption did not continue after the project end. One of cause is no rural institution that can supply farmer needs such as seed, fertilizer, working capital and marketing facility. Sumbawa regency as one of regencies in West Nusa Tenggara have great potential to develop corn, because it has climate, soil type and topography that support good corn development both in dryland and wetland. Considering biological potential and increase in corn demand, it is necessary policy that supports the commodity development to be superior commodity to accelerate economic life in Sumbawa regency.

Dryland is one of agro-ecosystem having great potential for agriculture, for food crop, horticulture and perennial plant as well as livestock. Considering wide land availability and great variations of farming, dryland is potential and can play big role in providing agricultural business than wetland in the future. Agricultural census in 1983 and 1993 indicated that there was increase in household using dryland, when use of wetland decreased due to functional shift (Agung in Wedastra, 2010). It indicated that role of dryland farming as income source and employment is increasingly higher. Therefore, developing of dryland as productive area based on agribusiness need to be considered.

In irrigated land in West Nusa Tenggara, there is tendency that corn planting have shifted soybean as second plant after rice. In addition, in dryland it has been done corn planting orienting on market by planting Lamuru variety that is relatively resistant to dryness compared with other varieties. With non soil processing technology farmers can reduce cost they expend. Business persons have also read market opportunity for corn. It

is indicated with emerging corn business person in this country. However, based on fact, corn agribusiness has not run yet optimally (Masyhuri, 2003).

According to Soekartawi (2002), in essence farming is as corporation. So, before manage their farming farmers or producers will consider cost and income by allocating available resource in effective and efficient manner to obtain high profit in certain time. It is said effective when farmer or producer can allocated their resource well and efficiently when they use their resource by producing output exceeding input. Unachieved efficiency in farming are due to less farmer knowledge in using limited production factor, difficulty in obtaining production factor in appropriate amount and outside factors such as climate, geographical condition, temperate and so on. Efficiency in farming is distinguished to be technical efficiency, allocative efficiency and economic efficiency.

Production efficiency is one of factors determining competitiveness. Efficient production will decrease production cost that will cause increase in farmer income and competitiveness of the commodity. In effort to increase farming effectiveness and efficiency to give benefit for farmer income, farming should consider comparative and competitive advantages. Agricultural product development faces increasingly open market as impact of economic globalization (Kariyana and Adnyana, 1998). Comparative advantage will be able to reach when a product of same commodity will be produced with lower input, while competitive advantage occurs when with given land area can produce relatively high income. The point is that it is not only about productivity, but also quality for relatively high selling value. Input price and output price is key in comparative and competitive advantage.

II. Material And Methods

Descriptive analytical method was applied as basic method. Research site was determined purposively in Sumbawa regency with two locations of Utan district (wetland) done in MK-1 harvest season in August 2013 and Labangka district (dryland) in end of rainy season in March 2014. Both districts are corn production center and have great potential as area for developing corn crop in Sumbawa regency.

Farmer sample was taken using random sampling including 100 farmers in each district, so total sample was 200. Data used was primary data obtained with observation technique (survey) and interview using questionnaire.

Data Analysis

Analysis of Frontier Stochastic production function

Data was analyzed using Frontier Stochastic production function and dual cost function. Analysis of Frontier Stochastic production function is used to measure technical efficiency of corn farming and factors affecting technical efficiency. The model is:

$$LnY= \alpha_0+\beta_1 lnX_1+\beta_2 lnX_2+\beta_3 lnX_3+\beta_4 lnX_4+\beta_5 lnX_5+\beta_6 lnX_6+\beta_7 lnX_7+\beta_8 lnX_8 +(vi-ui) \text{ ..... } (1)$$

Note: Y= corn production (kg), X_1=land area, X_2= seed amount (kg), X_3= urea fertilizer usage (kg), X_4= npk fertilizer usage (kg), X_5= za fertilizer usage, X_6= herbicide usage (lt), X_7= insecticide usage (lt), X_8= labor usage (HOK), (vi-ui)=error term technical inefficiency in the model. There are expected that the coefficient β_1-β_8>0.

Technical efficiency analysis

Technical efficiency method used in this research refers to model developed by Battese and Coeli (1996). To determine score parameter of technical inefficiency effect distribution (ui) the research used following model

$$\mu i = \delta_0+ \delta_1 Z_1+ \delta_2 Z_2+\delta_3 Z_3 \text{ .....} (2)$$

Note: Ui is production inefficiency achieved by the farmer i^{th}, Z_1-Z_3 are farmer experience, farmer age, and farmer education.

Parameter of model (1) is estimated with Maximal Likelihood model (MLE) using Frontier 4.1 software developed by Coellu (1996). The software follows three procedures as follows.

1. OLS to obtain all estimated parameters (except intercept- α_0)
2. Grid search of y
3. Score obtained from step 2 is used as beginning score in iterative procedure to obtain maximal likelihood estimation score.

Analysis of allocative and economic efficiency

Allocative and economic efficiency measurement was done by deriving dual cost function from production function. Method was done by minimizing input cost function with production function constrain at equation (3.6) to obtain frontier dual cost function.

Therefore equation of cost function is as follows

$\ln C = \beta_0+\beta_1 \ln P_1+\beta_2 \ln P_2+\beta_3 \ln P_3+\beta_4 \ln P_4+\beta_5 \ln P_5+\beta_6 \ln P_6+\beta_7 \ln P_7+ \beta_8 \ln P_8+\beta_9 \ln Y +\beta_{10} \ln X+U_i$ .....(3)

Note: C is production cost of individual farmer calculated in rupiah; P_1=seed price, P_2=urea price, P_3= npk price, P_4= za price, P_5=herbicide price, P_6= insecticide price, P_7= labor wage, P_8= equipment and machine rent price, Y= production, X= land area, U_i= random variable describing technical inefficiency in the model.
According to Jondrom et al (1982) in Ogundari and Ojo (2006), economic efficiency of corn farming is defined as minimal ratio obtained from total production cost (C*) with actual production cost at whole (C) using equation (1)

$EE = \frac{C^*}{C}$ .....(4)

Economic efficiency is invesr of cost efficiency (CE) (Coelli, 1996):

$EE = \frac{1}{CE}$ .....(5)

CE is obtained from calculation with frontier 4.1c software.
EE is between 0 and 1. EE is multiplication of technical efficiency (TE) and allocative efficiency (AE), so AE is obtained from

$EE = \frac{EE}{ET}$ .....(6)

With AE $0 \leq EA \leq 1$

Competitiveness analysis method

To analyze corn farming competitiveness in dry land in Labangka subdistrict of Sumbawa regency, domestic resource usage and tradable input usage approach were used. It used policy analysis matrix (PAM) that is analytical tool used to identify economic efficiency and impact of intervention in doing various farming activities in entire and systematic way (Monke and Pearson, 1989). Based on PAM table, criteria is determined as follows

(1) Private cost ratio (PCR)

PCR indicates the extent of corn farming production system can produce to pay all domestic factors used and still in competitive condition. Maximal profit will be obtained when corn farming production system can minimize PCS. PCR score is a criterion of competitive advantage for corn farming. According to Asian Development Bank (1992), competitive advantage is tool to measure private profitability and is calculated based on market price and official foreign exchange.

(2) Domestic resource cost ratio (DRCR)

DRCR is one of criteria of corn farming system capability in financing domestic factor at its shadow price or criteria of relative economic efficiency of a production system. When DRCR <1, it means that corn farming production system is increasingly efficient and have competitiveness in world market, so it have greater export opportunity. DRCR is criteria for comparative advantage of corn farming. According Asian Development Bank (1992), comparative advantage is capability of a region or country in producing a unit of some commodity with relatively low cost compared with social balance cost of other alternative

Correlation analysis

Correlation analysis was done to identify association between efficiency and competitiveness. The research used SPSS v.16. Analytical tool consisted of Kendall's tau (r) and Spearman correlation (p). Result of correlation analysis indicates that the correlation coefficients were used to identify correlation and correlation direction, while significance was done to identify whether the association is significant or not. Effect of efficiency on competitiveness was identified by increasing allocative efficiency trough decrease in excessive input usage. Then, PCR and DRCR were calculated. Hypothesis test between efficiency and competitiveness was done by considering significance with following formulation
H0: significance >0.05 means there is no association between efficiency and competitiveness
H1: significance ≤0.05 means there is association between efficiency and competitiveness

III. Result And Discussion

Analysis of Frontier Stochastic production function

Technical efficiency was analyzed using Frontier Stochastic production function. Technical efficiency is a condition to measure price efficiency and economic efficiency. Estimation of technical, price and economic efficiency was obtained using Cobb-Douglas stochastic frontier with Maximum Likelihood estimated (MLE). MLE score was obtained using Frontier 4.1c software. Early step in Frontier 4.1 resulted in score based on

ordinary least square (OLS) to estimate all parameter scores that describe average best fit of farmer production in available technological level. Next steps is used MLE method to estimate all parameters of production factor, intercept and variant of both vi and ui error components. MLE method describes best practice of farmer behavior in production process.

Production factors (independent variable) that is estimated affecting corn production is area, seed usage, amount of urea fertilizer usage, NPK fertilizer usage, Za fertilizer usage, insecticide usage, herbicide spray, and man power usage. Result of production function estimation with stochastic frontier approach in corn farming is presented in table 1 below.

Table 1. Stochastic Frontier production function of corn farming in Sumbawa Regency

Variable	Dryland				Wetland			
	expectation sign	coeff	standard error	t-ratio	coeff	standard error	t-ratio	
Constant	+	6.727	0.246	27.382 ***	8.067	0.298	27.102	***
land area	+	0.084	0.065	1.290 Ns	0.610	0.092	6.603	***
Seed	+	0.828	0.079	10.432 ***	0.236	0.092	2.573	***
Urea	+	0.031	0.018	1.691 **	-0.004	0.017	-0.257	Ns
NPK	+	0.000	0.005	-0.077 Ns	0.014	0.016	0.904	Ns
Za	+	-0.003	0.005	-0.600 Ns	0.000	0.005	-0.079	Ns
Herbicide	+	0.002	0.007	0.321 Ns	-0.003	0.009	-0.396	Ns
Insecticide	+	0.027	0.008	3.513 ***	-0.004	0.007	-0.659	Ns
Labor	+	-0.001	0.014	-0.086 Ns	0.012	0.024	0.512	Ns
sigma squared		0.308	0.126	2.440 ***	0.325	0.142	2.295	**
Gamma		0.697	0.199	3.507 ***	0.552	0.355	1.552	*
mean TE		0.863			0.849			

Source: analysis of primary data, 2013

Notes:

***) significant at 99% confidential level (α=0.01) (t=2.374)

**) significant at 95% confidential level (α=0.05) (t=1.665)

*) significant at 90% confidential level (α=0.10) (t=1.292)

ns: not significant

Based on Table 1 the value of σ^2 is small enough, this shows the distribution of the inefficiency error term (ui) is normally distributed. While the value of γ is the ratio between deviation technical inefficiency (ui) against deviations that may be caused by random variables (vi). Statistically dryland farming γ value of 0.697 and significant at the 99 percent confidence level (α = 0.01). Γ coefficient values indicate positive dryland farming, this means that the technical efficiency in dryland farming more influenced by the ability of management or the management of the farmers themselves in managing their farming. Based on the results of the estimation model of stochastic frontier production function variables were positive and significant effect on the production of corn on dryland ie the number of seeds, number of Urea fertilizer, and insecticide.

Variable number of seeds significantly (at the level of 1%) and are positive towards the cost of production. The coefficient of the amount of seed of 0.828, meaning that increasing the number of seeds (ceteris paribus) of 1% would increase production by 0.828 percent. The coefficient of the amount of urea 0,031 indicates that the addition of urea (ceteris paribus) of 1% would increase production by 0,031 percent. Coefficient value for insecticide of 0.027 means that the 1% increase amount of insecticide (ceteris paribus) will increase the production of maize by 0,027 percent.

In statistic perspective, the value of γ farming in wetland fields by 0.552 and showed significant at the 90 percent confidence level (α = 0.1). Value of 0.552 explained that amounted to 55.4% of the errors that exist in technical production functions of farmers is not caused by random error variable or stochastic effects such as the effects of weather, pest and disease modeling errors. It is clear that all of the variation in the output of the production frontier can be considered as a result of technical efficiency level of achievement with regard to the managerial problems in farm management. Based on the results of the estimation model of stochastic frontier production function that variable is positive and significant impact on corn production in paddy fields, namely land area and number of seeds. Land area and number of seeds significantly (at the level of 1%) and is positively related to the production. Land area coefficient value 0.610, meaning that increasing 1% of the land area (ceteris paribus) would increase maize production by 0.610 percent. Coefficient value of 0.236 indicates the number of seeds that increasing the number of seeds (ceteris paribus) of 1% would increase maize production by 0.236 percent in wetland fields (Subdistrict Utan).

Technical efficiency analysis

Technical efficiency levels of corn farming in dryland is classified into 5 groups and result of stochastic frontier production function model using FRONTIER 4.1c is presented in table 2 below.

Table 2. Distribution of technical efficiency level of corn farming on respondent farmer in dryland in 2013

Technical efficiency level	amount (person)	percentage (%)
0<0.5	1	1
0.5≤TE<0.6	1	1
0.6≤TE<0.7	2	2
0.7≤TE<0.8	7	7
0.8≤TE<0.9	60	60
0.9≤TE≤1.0	29	29
Total	100	100
minimum TE	0.355	
Maximum TE	0.958	
Average	0.863	

Source: analysis of primary data, 2013

Table 2 reveals that mean technical efficiency by farmer in running corn farming in dryland was 0.863 with lowest rate of 0.355 and the highest rate of 0.958. The mean efficiency is still below 1.00 and means that corn farming in dryland in Sumbawa regency is not efficient technically and still allows adding some variables of production factor to obtain higher result until reach maximal result.

Technical efficiency of corn farming in wetland is classified into five groups that is result of stochastic frontier production function using FRONTIER 4.1 software as presented in table 3.

Table 3. Distribution of technical efficiency level of corn farming on respondent farmer in wetland, 2013

Technical efficiency level	amount (person)	percentage (%)
0<0.5	2	2
0.5≤TE<0.6	1	1
0.6≤TE<0.7	3	3
0.7≤TE<0.8	13	13
0.8≤TE<0.9	51	51
0.9≤TE≤1.0	30	30
Total	100	
Minimum TE	0.384	
Maximum TE	0.955	
Average	0.849	

Source: analysis of primary data, 2013

Table 3 indicated that mean technical efficiency by farmer in running corn farming in wetland was 0.849 with lowest rate of 0.384 and the highest rate of 0.955. The mean efficiency is still below 1.00 and means that corn farming in wetland in Sumbawa regency is not efficient technically and still allows adding some variables of production factor to obtain higher result until reach maximal result. Estimation of technical inefficiency from model used is presented in table 4.

Table 4. Factors affecting technical inefficiency of corn farming in Sumbawa Regency

Variable		Dryland				Wetland			
	expectation sign	Coeff	standard error	t-ratio		coeff	standard error	t-ratio	
Constant	-	-8.576	7.602	-1.128		6.037	6.184	0.976	
Experience	-	-0.131	0.084	-1.549	*	-0.955	0.504	-1.894	**
Age	-	2.139	1.862	1.149	Ns	-1.488	1.614	-0.922	Ns
Education	-	0.06	0.07	0.86	Ns	-0.076	0.052	-1.467	*

Source: analysis of primary data, 2013

Notes:

**) significant at 95% confidential level (α=0.05) (t=1.665)

*) significant at 90% confidential level (α=0.10) (t=1.292)

Ns: not significant

Based on Table 4, it may be known that this research estimated three variables affecting technically corn farming in Sumbawa regency. However, from the three variables were analyzed from these there is only one variable affecting the inefficiency of corn in dryland farming that is the experience of farmers and in wetland there are two significant that the experience of farmers and farmer education

Analysis of allocative and economic efficiency

Allocative and economic efficiency is obtained through analysis from production input side, using input priced valid in farmer level and is added with physical factor and farming management. Economic efficiency of corn farming in Sumbawa regency is obtained from estimation result of stochastic frontier cost function with MLE method using Frontier 4.1c software. Result of estimation of stochastic frontier cost function with MLE is revealed in table 5.

Table 5. Stochastic Frontier production cost function of corn farming in Sumbawa Regency

Variable	Dryland				Wetland			
	expectation sign	coeff	standard error	t-ratio	coeff	standard error	t-ratio	
Constant	+/-	-3.508	0.994	-3.528 ***	-3.781	0.680	-5.565	***
land area	+	0.356	0.112	3.170 ***	0.302	0.087	3.473	***
Production	+	-0.008	0.008	-0.941 Ns	0.002	0.018	0.112	Ns
seed price	+	0.013	0.025	0.521 Ns	-0.006	0.015	-0.404	Ns
urea price	+	0.013	0.006	1.997 **	-0.001	0.011	-0.125	Ns
NPK price	+	0.003	0.008	0.402 Ns	0.003	0.005	0.625	Ns
Za price	+	-0.007	0.008	-0.861 Ns	0.003	0.006	0.487	Ns
herbicide price	+	-0.007	0.009	-0.834 Ns	-0.001	0.005	-0.153	Ns
insecticide price	+	-0.015	0.018	-0.826 Ns	-0.029	0.017	-1.680	**
labor wage	+	0.000	0.008	-0.052 Ns	0.012	0.009	1.241	Ns
tractor rent	+	-0.004	0.006	-0.715 Ns	-0.015	0.006	-2.507	***
sprayer rent	+	-0.001	0.005	-0.205 Ns	0.001	0.005	0.307	Ns
corn seller rent	+	0.058	0.032	1.804 **	0.061	0.072	0.848	Ns
sigma squared		0.395	0.102	3.851 ***	0.123	0.023	5.400	***
Gamma		1.000	0.259	3.860 ***	0.832	0.272	3.060	***

Source: analysis of primary data, 2013

Notes:

***) significant at 99% confidential level (α=0.01) (t=2.374)

**) significant at 95% confidential level (α=0.05) (t=1.665)

Ns: not significant

Based on result of estimation of stochastic frontier cost function, the model has γ score of 1.000. Estimated parameter γ is ratio between technical inefficiency (ui) on deviation that is caused by random factor. Statistically, score of 1.000 means that 100% error in the production cost function describes that cost inefficiency of farming may be assumed as effect achieved cost efficiency related to managerial problem in farming management.

Based on the table there are three significant variables that influence or positively towards the total cost of corn on dryland farming (District Labangka). The variable is the area of land, the price of urea and rent thresher. Test results on a t-ratio of land area showed significant with 99 percent confidence level (α = 0.01) and a positive value. It is understood that the land will add to the cost of farming. In the variable price of urea and rent thresher significant at 95 percent confidence level (α = 0.05) and a positive value. This may imply greater the urea price and rental rates thresher then the cost of farming are also getting bigger.

The estimation results of stochastic frontier production function costs on wetland models have γ parameter value of 0, 832, means that for 83.2% of the error is in the function of the cost of production in farming in wet land illustrates the inefficiency costs of farming as a result of the level of achievement efficiency costs associated with the managerial problems in farm management. In wet land, significant variables that influence positively to the total cost of farming corn is, variable land area. This may imply that the more extensive the greater farmland farming costs incurred by farmers. variable sprayer rental prices show a significant effect on the 99 percent confidence level (α = 0.01) and a negative worth, can mean the costs incurred for the rental sprayer not so influential adds to the cost of farming but instead affect the production of corn farming.

Table 6. Factors affecting cost inefficiency of corn farming in Sumbawa Regency

Variable	Dryland				Wetland			
	expectation sign	Coeff	standard error	t-ratio	coeff	standard error	t-ratio	
Constant	+/-	0.043	0.998	0.044	-10.306	1.816	-5.676	***
Experience	-	-0.461	0.290	1.589 *	-0.136	0.161	0.841	Ns
Age	-	-0.012	0.017	-0.681 Ns	-0.035	0.044	0.799	Ns
Education	-	-0.075	0.100	-0.748 Ns	-0.716	0.117	6.121	***

Source: analysis of primary data, 2013

Notes:

***) significant at 99% confidential level (α=0.01) (t=2.374)

*) significant at 90% confidential level (α=0.10) (t=1.292)
Ns: not significant

Based on the above table, there is one variable affecting significantly positively corn farming in dryland that is experience variable with 90% confidential level (α=0.1). In wetland there is one too variable affecting cost inefficiency that is farmer education with 99% confidential level (α=0.01).
Economic efficiency is inversion of cost efficiency. Distribution of economic efficiency from respondent farmers in research site is presented in table 7.

Table 7. Distribution of economic efficiency level of corn farming on respondent farmer in Sumbawa Regency in 2013

Technical efficiency level	Dryland		Wetland	
	Economy	percentage (%)	Economy	percentage (%)
0<0.5	52	52	79	79
0.5≤TE<0.6	19	19	8	8
0.6≤TE<0.7	9	9	4	4
0.7≤TE<0.8	6	6	7	7
0.8≤TE<0.9	8	8	1	1
0.9≤TE≤1.0	6	6	1	1
Total	100		100	
minimum TE	0.124		0.091	
Maximum TE	1.000		0.917	
Average	0.505		0.355	

Source: analysis of primary data, 2013

Table 7 indicated that mean economic efficiency by farmer in running corn farming in wetland was low. The mean efficiency was below 1.00 and means that corn farming in wetland in Sumbawa regency is not efficient economically and still allows adding some variables of production factor to obtain higher result until reach maximal result.

Allocative efficiency is capability of corn farmer to select minimum input usage in given production factor prices and technology. It is said efficient in allocative perceptive when with certain input and output price, proportion of input usage is optimum. It occurs because marginal revenue product is same as marginal cost of input used. Distribution of allocative efficiency from respondent farmers in research site is presented in table 8.

Table 8. Distribution of Allocative efficiency level of corn farming on respondent farmer in Sumbawa Regency in 2013

Technical efficiency level	Dryland		Wetland	
	Allocative	percentage (%)	Allocative	percentage (%)
0<0.5	40	40	70	70
0.5≤TE<0.6	16	16	12	12
0.6≤TE<0.7	15	15	4	4
0.7≤TE<0.8	5	5	2	2
0.8≤TE<0.9	12	12	6	6
0.9≤TE≤1.0	12	12	6	6
Total	100	100	100	100
minimum TE	0.168		0.097	
Maximum TE	1.059		1.036	
Average	0.585		0.425	

Source: analysis of primary data, 2013

A farming is stated achieving allocative efficiency when allocative efficiency (AE) =1. In fact, AE is not always same as 1. When AE <1, the farming have not reach allocative efficiency so use of production factor should be added to achieve optimal result. When AE<1, usage of production factor in the farming should be reduced to reach optimal condition (Darwanto, 2010).

Mean allocative efficiency is obtained by dividing economic efficiency by technical efficiency. Result of analysis indicated that mean allocative efficiency obtained in corn farming in dryland was 0.585 and in wetland were 0.425, respectively. It may be said that allocative efficiency of corn farming in Sumbawa regency is not efficient. To achieve allocative efficiency, sue of production factor in corn farming in Sumbawa regency should be reduced to reach optimal condition.

Result of corn farming competitiveness analysis

Comparative advantage in this research was used to analyze economic efficiency of domestic resource usage of corn production in Sumbawa regency in order to save/add foreign exchange trough import reduction and export improvement. Comparative advantage is indicated by DRCR. When DRCR <1 it means that

domestic corn production is more profitable than import or in other words, developing corn production in Sumbawa is economically efficient. In contrary, when DRCR >1, to meet domestic corn demand, it is profitable to import corn compared with producing in domestic area, because domestically producing corn is not efficient or its competitiveness is low. Competitive advantage is used to measure financial feasibility of corn farming in Sumbawa regency. Competitive may be indicated with private profit and private cost ratio. The indicator reveals financial profitability and efficiency of resource usage. When PCR <1, corn farming in Sumbawa is financially profitable and feasible to develop.

Result of Policy Analysis Matrix (PAM) that measure competitiveness through competitive and comparative advantages and impact of policy on input and output may be seen in table 9.

Tabel 9. Policy Analysis Matrix (PAM) of Corn Farming in Sumbawa Regency, 2013 (Rp/kg)

Indicator	Revenue	Input		Profits
		Tradable	Non Tradable	
Wetland				
Private	14.691.250	3.161.910	3.372.107	8.157.233
Social	17.203.754	9.699.710	3.838.907	3.665.136
Divergences	-2.512.504	-6.537.800	-466.800	4.492.097
Dryland				
Private	13.164.255	1.838.600	2.393.937	8.931.718
Social	15.799.311	5.433.907	2.768.189	7.597.216
Divergences	-2.635.056	-3.595.306	-374.252	1.334.502

Source: analysis of primary data, 2013

Based on Table 9 , the value as indicators PAM decisive comparative advantage and competitive farming corn in Sumbawa , as shown in Table 10 , the following :

Tabel 10. Indicators Policy Analysis Matrix of Corn Farming in Sumbawa Regency, 2013

Indicator	Score		average
	wet land	dry land	
private cost ratio	0.29	0.21	0.25
social profit	3,665,136	7,597,216	5631,176
domestic resource ratio	0.51	0.27	0.39

Source: analysis of primary data, 2013

Technical efficiency with competitiveness

Association between technical efficiency and corn farming competitiveness in this research was analyzed using Kendal's tau_b and Spearman's rho correlation analysis. Result of correlation analysis over two variables was -1.00 indicating strong correlation. Negative sign indicates negative correlation direction because result of allocative (price) efficiency analysis in corn farming reveal less than one so production factor should be reduced to obtain economic and allocative efficiency. Result of significance test indicates score of 0.01, which is less than 0.05. Therefore, significant test in this research shows significant association between efficiency level and competitiveness of corn farming in research site.

IV. Conclusion

Mean technical efficiency (TE) at dryland and wetland are 0.86% and 0.85%, respectively. Gamma value parameter in dryland and wetland were 0.697 and 0.552, respectively. The gamma value indicating that technical efficiency in corn farming is more influenced by factor management capability of farmer, or technical efficiency achievement related to the farmer managerial problem in managing farming. Mean efficiency of corn farming in Sumbawa for technical, economical and allocative efficiencies are below 1.00 that means corn farming in Sumbawa regency by farmer has not been efficient yet.

Corn farming in Sumbawa regency is financially profitable and has competitive advantage when it is run without intervention from government through policy, particularly aids of production input. Corn farming in Sumbawa regency is economically profitable and has comparative advantage. It is shown from the PCR value of 0.25 (PCR < 1) and the DRC at 0.39 (DRC < 1) .

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