CHAPTER V

TECHNICAL EFFICIENCY OF GROUNDNUT PRODUCTION

5.1 Groundnut Production and Technical Efficiency Model

5.1.1. Explanation of the Variables used in the Technical Efficiency Model

As mentioned in Chapter 3, the variables included in the model are seed rate (kg/ha), area grown by groundnut (ha), amount of chemical fertilizers application (kg/ha), amount of farmyard manure application (kg/ha), cost of insecticides and pesticides application (kyats/ha), labor used per hectare (man-day) in the groundnut production and dummy variables for soil quality. These were provided to predict the efficiency of groundnut production in the central region of Myanmar.

However, after the basic analysis of obtained data as shown in chapter 4, seed rate in kg per hactare and cost of insecticides and pesticides application in kyats per hectare need to be excluded from the model. The reason is there was no difference of seed rate among sample farmers. Generally, most of the farmers in Mandalay used seed rate of about 53.5 kilogram per hectare and about 54.7 kilogram per hectare for Magway. Also, most farmers did not apply insecticides and pesticides in their groundnut production. Similarly, most of sample farmers who applied the farmyard manure were nearly same the average amount of manure application in their groundnut firms. The average of manure application rate was about 3.3 tons per hecture in Mandalay and 3.9 tons per hectaure in Magway.

Hence, the empirical model used in this study is as follows;

$$\begin{aligned}\ell nY &= \beta_0 + \beta_1 \ell nAREA + \beta_2 \ell nCHEM + \beta_3 \ell nLABOR + \beta_4 \tfrac{1}{2}(\ell nAREA)^2 + \\ &\beta_5 \tfrac{1}{2}(\ell nCHEM)^2 + \beta_6 \tfrac{1}{2}(\ell nLABOR)^2 + \beta_7(\ell nAREA * \ell nCHEM) + \\ &\beta_8(\ell nAREA * \ell nLABOR) + \beta_9(\ell nCHEM * \ell nLABOR) + \beta_{10} D_{goodsoil} + \\ &\beta_{11} D_{fairsoil} + v_i - \mu_i \qquad (1)\end{aligned}$$

Where,

ln natural logarithms

Y Yield of groundnut (kg/ha);

AREA Area grown by groundnut production (kg/ha);

CHEM Amount of chemical fertilizer application (kg/ha);

LABOR Labor used in the groundnut firm (man- day/ha);

$D_{goodsoil}$ Good in soil quality in the groundnut production; dummy variable *is* used that value is 1 if the soil condition is the best, 0 is otherwise;

$D_{fairsoil}$ Fair in soil quality in the groundnut production; dummy variable is used that value is 1 if the soil condition is the fair , value will be zero;

v_is random error; and

u_is non-negative random variables

The groundnut production frontier is estimated simultaneously with the technical inefficiency equations written empirically as follows;

$$\mu = \delta_0+\delta_1 SCHL+\delta_2 AGE+\delta_3 LFORCE+\delta_4 D_{CDT} + \delta_5 D_{EXT\,+}\ \varepsilon \text{ ------- (2)}$$

Where,

SCHL Number of years in school of household heads (years);

AGE Age of household heads (years);

LFORCE Availability of labor force in the household (in the Man-equivalent unit);

D_{CDT} Access to credit as dummy variable is used, if farmer has access to credit, the value was 1, and if not, the value was 0;

D_{EXT} Extension services as dummy variable is used, if farmer contact to extension officers, value was 1 and 0 if otherwise;

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δ_is are unknown parameters to be estimated. σ^2_u and σ^2_v are the variance of one-sided (u_i) and systematic (v), disturbance components in the groundnut production. Therefore, $\sigma^2 = \sigma^2_u+\sigma^2_v$ is defined as the total variation of output from the groundnut production frontier which is attributed to technical inefficiency. And the ratio of the two standard deviations is calculated as $\gamma= \sigma^2_u / (\sigma^2_u+\sigma^2_v)$ which is a measure of level of inefficiency in the variance parameter of the stochastic frontier. In other words, Gamma γ, the key parameter, is an indicator of the relative variability of the two sources of error terms given by σ^2_u / σ^2 which lies between 0 and 1. Value of γ is equal to 0 implying that technical inefficiency is not present and the ordinary least square estimation would be an adequate representation. Value of γ is close to or equal to 1 implying that the frontier model is appropriate.

5.1.2. Statistics summary of the variables of the sample groundnut firms in Mandalay

Table 5.1 describes statistic summary of the variables used in estimation of the stochastic production function in the sample farms. The average yield of Mandalay groundnut is 649 kilogram per hectare with a range of about 210 to 1682 kilogram per hectare. The land is measured in hectare, on which groundnut is grown in the year of survey. The average area produced by groundnut in Mandalay is 0.9 hectare with a range of 0.2 to 7.3 hectares. The soil plays an essential role in the groundnut production of study areas. Only 26 percent of total samples farmers in Mandalay have good soil quality and about 42 percent in Magway have fair quality of soil for groundnut production. The average amount of chemical fertilizer applied in the groundnut production is 32.5 kilogram per hectare. Among the variables, average labor used for groundnut production in Mandalay division is 60.1 man-day per hectare with the range of 17.5 man-day per hectare to 128.5 man-day per hectare.

For variables used in technical inefficiency equation, the average years in school of household heads is 5 years which is the time to finish primary school in Mandalay. The age of households head in Mandalay is 49 years old with a range of 23 to 83 years old. About 89 percent of sample farmers in Mandalay have access to credit while about 13 percent of farmers received contact to extension services.

5.1.3. Statistics summary of the variables of the sample groundnut firms in Magway

In Magway division, the average yield is 993 kilogram per hectare with a range 290 to 2428 kilogram. The average area produced by groundnut in Magway is 1.64 hectare with a range of 0.4 to 12.14 hectares. Based on farmers's opinion, 55 percent of Magway firms have a good soil for groundnut production and 42 percent of total firms in Magway have a fair soil quality for groundnut production. The average amount of chemical fertilizer applied in the groundnut production is 35.5 kilogram per hectare with maximum range of 247.1 kilogram per hectare. The average labor used for groundnut production in Magway is 61.6 man- day per hectare (see Table 5.1)

The schooling years of household heads in Magway are about 7 years. The average age of household heads in Magway is 49 years old with a range 24 to 75 years. 63 percent of total farmers in Mandalay have access to credit and 34 percent of farmers have contact to extension services in Magway (see Table 5.1).

Table.5.1 Statistic summary of the variables used in the analysis of sample groundnut firms in central region of Myanmar.

Variables	Mandalay (n=118)				Magway (n=151)			
	mean	std	max	min	mean	std	max	min
Production function								
Yield (kg/ha)	649	250	1612	210	993	465	2428	290
Planted area (ha)	0.2	0.95	7.3	0.2	1.64	1.7	12.14	0.4
Chemical Fertilizer(kg/ha)	32.5	35.5	164.7	-	35.5	38.8	247.1	-
Labor used (Man-day/ha)	60.1	-	-	-	61.2	-	-	-
Dgoodsoil (%of samples)	26	-	-	-	55	-	-	-
Dfairsoil (% of samples)	63	-	-	-	42	-	-	-
Technical inefficiency effects								
Years in school (years)	5	2	11	1	7	3	15	4
Age of household head	49	13	83	23	49	11.4	75	24
Labor force availability (adult equivalent unit)	4.1	1.4	9	1	4.4	1.68	9.5	1
Credit access (%)	89	-	-	-	63	-	-	-
Extension contact (%)	13	-	-	-	34	-	-	-

Source: Field survey: 2007.

5.2 Hypothesis Testing

Hypothesis testing was performed to test the suitability of the frontier model incorporating inefficiency effects. There are three hypothesis tests in the model of groundnut production as follows.

1. H_0: $\beta_i = 0$, i is the subscript of the cross terms in the (1) equation. The null hypothesis identifies an appropriate functional form between the restrictive Cobb-Douglas and the translog production function. It specifies that the cross terms are equivalent to zero. If the null hypothesis is accepted, it implies that the Cobb-Douglas function is an appropriate model.

2. H_0; $\gamma = \delta_0 = \delta_1 = \delta_2 = \ldots\ \delta_5 = 0$, the null hypothesis specifies that each farm is operating on the technical efficient frontier and that the asymmetric and random technical efficiency in the inefficiency effects are zero. This is rejected in favor of the presence of inefficiency effects.

3. H_0; $\delta_0=\delta_1= \delta_2=\ldots\ \delta_5=0$, the null hypothesis specifies that the technical inefficiency effects are not present in the model at every level; the joint effect of these variables on technical inefficiency is statistically insignificant.

The hypotheses requires testing with the generalized likelihood ratio test, $\lambda_{LR} = 2[L(H_1)-L(H_0)]$, where $L(H_1)$ and $L(H_0)$ are the maximum values of the log Likelihood functions under the alternative and null hypothesis, respectively. The null hypothesis is rejected when $\lambda_{LR} > \chi^2$ critical value.

5.2.1 Results of Hypothesis Testing in Mandalay Model

Hypothesis 1: to test whether Cobb-Douglas or Translog Model is appropriate

A likelihood ratio (LR) test is conducted to test whether model is a mathematical form of Cobb-Douglas or Translog. Hypothesis testing was performed to test the suitability and variability of the frontier model incorporating inefficiency effects. The hypothesis is as follows.

H_0: $\beta_4= \beta_5= \beta_6= \beta_7 = \beta_8 = \beta_9 = 0$

H_1: β_4 or β_5 or β_6 or β_7 or β_8 or $\beta_9 \neq 0$

If hypothesis is accepted, it implies that the model is Cobb-Douglas and if hypothesis is rejected, model is assumed Translog.

Using the Log likelihood ratio test,

LR = $-2\{\ln [L (H_0)] - [H_1]\}$

Where,

Ln $[L (H_0)]$ = value of the log likelihood function from the Cobb-Douglas model,

Ln $[L (H_1)]$ = value of the log likelihood function from the Translog model,

The log likelihood values of both models are shown in table 5.3 and 5.4.

Therefore,

LR = $-2\{(-47.78) - (-43.41)\}$

= $-2 \{-4.37\}$

= 8.74

d.f = d.f from Translog – d.f from Cobb-Douglas = 11-5 = 6,

The calculated value of $\chi 2$ = 8.74 but the critical value of $\chi 2$ = 12.59

The $\chi 2$ calculated value, 8.74, is less than $\chi 2$ critical value, 12.59, which means that the null hypothesis is accepted. It implies that the Cobb-Douglas function is an appropriate model in the groundnut production function of Mandalay.

Hypothesis 2: to test whether there is the technical effect model in Mandalay

A likelihood ratio (LR) test is conducted to test whether the model has only traditional production function or there is also the technical inefficiency function. The hypothesis is as follows.

H_0: $\gamma = \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$

H_1: γ or δ_0 or δ_1 or δ_2 or δ_3 or δ_4 or $\delta_5 \neq 0$

If hypothesis is accepted, it implies that there is only traditional production function in the model. But if hypothesis is rejected, there is also the technical effect in the model.

From the result of frontier analysis, LR test of the one-side error = 10.47. The degree of freedom is 7. The critical value of γ_7 at 0.25 significant level = 8.461 (Kodde and Palm, 1986). The null hypothesis is rejected at 25 percent level of significance. It implies that there are also technical efficiency effects in the groundnut production function for Mandalay model.

Hypothesis 3: to test whether the explanatory variables used in technical inefficiency model are significant

The hypothesis is as follows.

H_0: $\delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$

H_1: δ_0 or δ_1 or δ_2 or δ_3 or δ_4 or $\delta_5 \neq 0$

If hypothesis is accepted, the coefficients of the variables in the inefficiency model equal to zero which means that the variables used in the model are not able to explain the technical inefficiency of the groundnut production model.

$$LR = -2\{\ln [L (H_0) / L (H_1)]\} = -2 \{\ln [(H_0)] - \ln [L(H_1)]\}$$
$$= -2 \{(-51.56) - (-47.78)\}$$
$$= -2\{- 3.78\}$$
$$= 7.56$$

The degree of freedom is 6. The calculated value of $\chi 2 = 7.56$ and the critical value of $\chi 2 = 12.592$. The calculated value is less than the critical value of $\chi 2$. Then, the null hypothesis is accepted. This implies that the explanatory variables used in the technical inefficiency model are not suitable and cannot properly explain the technical inefficiency in the groundnut production of Mandalay. Other explanatory variables are needed to be considered.

5.2.2. Results of Hypothesis Testing in Magway Model

The same process of hypothesis testing is done for the model of groundnut production in Magway.

Hypothesis 1: to test whether Cobb-Douglas or Translog Model is appropriate

The hypothesis is as follows.

H_0: $\beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = 0$

H_1: β_4 or β_5 or β_6 or β_7 or β_8 or $\beta_9 \neq 0$

If hypothesis is accepted, it implies that there is only traditional production function in the model. But if hypothesis is rejected, there is also the technical effect in the model.

Using the Log likelihood ratio test,

$$LR = -2\{\ln [L (H_0)] - [H_1]\}$$

Where,

Ln [L (H_0)] = value of the log likelihood function from the Cobb-Douglas model,

Ln [L (H_1)] = value of the log likelihood function from the Translog model,

Therefore,

LR = -2{-58.15 – (-53.06)}

= 10.18

d.f = d.f from Translog – d.f from Cobb-Douglas = 11-5= 6,

The critical value of $\chi 2$ = 12.592

The calculated value of $\chi 2$. = 10.18

The critical value of $\chi 2$ exceeds the calculated value of $\chi 2$. Then, the null hypothesis is accepted. It implies that the Cobb-Douglas function is an appropriate model in the groundnut production function of Magway.

*Hypothesis 2: to test whether there is technical effect model in Magwa***y**

The hypothesis:

H_0 $\gamma = \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$

H_1: γ or δ_0 or δ_1 or δ_2 or δ_3 or δ_4 or $\delta_5 \neq 0$

If hypothesis is accepted, it implies that there is only traditional production function in the model. But if hypothesis is rejected, there is also the technical effect in the model.

From the result, LR test of the one-side error = 89.96. The degree of freedom is 7. The critical value of γ_7 = 13.401 (Kodde and Palm, 1986). The calculated value of γ exceeds the critical value; the null hypothesis is rejected at 0. 05 level of significant. It means that there are also the technical inefficiency effects in the groundnut production function from Magway model.

Hypothesis 3: to test whether the explanatory variables used in technical inefficiency model is significant in Magway

The hypothesis:

H_0 $\delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$

H_1 δ_0 or $\delta_1$or δ_2 or δ_3 or δ_4 or $\delta_5 \neq 0$

and

$LR = -2\{\ln [L (H_0) /L (H_1)]\} =-2 \{\ln [(H_0)] - \ln [L (H_1)]\}$

$= -2 \{(-71.13) - (-58.15)\}$

$= -2\{- 12.98\}$

$= 25.96$

The degree of freedom is 6. The calculated value of $\chi2$= 25.96. The critical value of $\chi2$ =12.59.

Since the calculated value exceeds the critical value of $\chi2$, the null hypothesis is rejected. It can be interpreted that the explanatory variables used in the technical inefficiency model can significantly explain in the technical inefficiency of groundnut frontier production function in Magway.

Therefore, a nested hypothesis indicated that the groundnut production functions are the Cobb-Douglas specifications with inefficiency effects in both areas.

Table 5.2 Likelihood ratio tests of hypothesis involving parameters of the stochastic frontier inefficiency model for Mandalay and Magway groundnut firms in Myanmar.

Null hypothesis	Likelihood ratio test (λ)		Critical Value of $\chi2$	Decision
	Mandalay	Magway		
H_0: $\beta_4= \beta_5=....=\beta_8= \beta_9 = 0$	8.74	10.18	12.59	Accept H_0
H_0: $\gamma = \delta_0 =\delta_1 = ... = \delta_5 =0$	10.48	89.96	8.46 at P<0.25 13.40 at P<0.05	Rejected H_0
H_0: $\delta_0 =\delta_1 = ... = \delta_5 =0$	7.56	25.96	12.59	Accept H_0 for Mandalay and Rejected H_0 for Magway

Note; The critical values correspond to 5%level of significance.

5.3. Results of maximum-likelihood estimates of stochastic frontier Cobb-Douglas groundnut production function

5.3.1 Maximum-likelihood estimation of stochastic frontier Cobb-Douglas groundnut production functions for Mandalay

The maximum likelihood estimation of the stochastic frontier model is presented in Table 5.3 using the program FRONTIER 4.1. At this step, the Cobb–Douglas production function is expected to have a significant influence on output.

Table 5.3 indicated that explanatory variables of groundnut firms in the model contribute significantly to the explanation of yield of groundnut within the selected study area of Mandalay. It shows that the joint effects of these variables on technical efficiency are statistically significant using maximum likelihood estimation of technical efficiency.

The results show that the coefficient for good soil quality was significantly positive at the 5 percent level. A positive relationship between soil and yield implies that farmers who owned the good soil quality in farms can produce higher groundnut yield than farmers who have no good soil quality. The other variables in groundnut production were not significant in Mandalay.

For technical inefficiency model of Mandalay, result of the third hypothesis testing (see 5.2.1) showed that all the explanatory variables used in the model cannot properly explain the technical inefficiency in the groundnut production in Mandalay.

For the Cobb-Douglas model in Mandalay, γ is estimated to be 0.22, which implies that 22 percent of random variation in groundnut production is explained due to the inefficiency effect. It indicates that the average production function is not a suitable specification of groundnut production.

5.3.2 Maximum-likelihood estimation of stochastic frontier Cobb-Douglas groundnut production functions for Magway

The estimation of Cobb-Douglas production function in Magway with technical inefficiency effects model generates the results presented in Table 5.3. All coefficients of the resources in the production function are positive; however, there are only three variables are significant. The size of groundnut production areas is statistically significant at 1 percent levels and the coefficient is 0.18, which means that if farmers increase their production area 1 percent, the yield will increase 0.18 percent. That is a larger groundnut farms will provide a higher average yield. Even though most of the groundnut farmers in Magway normally practice traditional technology, it seems scale economies in that area.

Both dummy variables of good and fair soil quality based on subjective judgment of the farmers are statically significant at 1 percent levels. The indicator of soil quality was positively related to groundnut yield, implying that farmers who have a good or fair soil quality can get higher groundnut productivity than who have bad quality of soil. The soil quality is positively associated in the production function. Thus, farmers located at more fertile regions achieve significantly better than other farmers (their peers) in less fertile regions, thereby, improvement in soil fertility is an essential factor in increasing productivity.

In technical inefficiency model, four out of the five variables are statistically significant at 1 and 5 percent levels. There are two variables related to household head as main decision maker in a family. The education variable represented by years in school of household heads was negatively related to technical inefficiency with significant level of 5 percent. This finding indicates that household heads with higher level of education have more efficient in using of scarce resources than ones with lower level of education. The variable of age of household heads is positive and significant at 10 percent level, indicating that younger household heads in Magway become more efficient than elder farmers.

The variable of labor force availability also is positively significant at 5 percent levels, meaning that more use of family labor seems to be inefficient in production of groundnut. The access to credit is negative and significant at 1 percent level, indicating that farmers who had access to credit proved to be more efficient in utilization of resources than who do not have. The results found that the access to credit of sample groundnut farmers in Mandalay was 89 percentage and 63 percentage of total sample farmers was in Magway. Therefore, program on rural credit can improve the technical efficiency of groundnut production. Some progress in accessibility of credit has been made in recent year in the rural area of Magway but there is still in question of improvement.

Access to extension service does not show that it is a significant variable in explaining technical efficiency. Extension services were still weak in both study areas and training should be improved to develop the farmers' analytical skills, critical thinking, and creativity to make better decisions. A training program should be able to improve the knowledge and skill of farmers in groundnut production.

For the Cobb-Douglas model in Magway, γ estimated to be 0.99, which implies that 99 percent of random variation in groundnut production explained due to the inefficiency effect. It indicates that the average production function is an appropriate specification of ground production.

Table.5.3 Maximum likelihood estimates of the parameters of the Cobb-Douglas stochastic frontier groundnut production function in Myanmar

Variables	parameters	Mandalay Coefficients	Mandalay t-ratio	Magway Coefficients	Magway t-ratio
Stochastic Frontier Production Function					
Constant	β_0	6.05***	20.76	5.96***	21.15
AREA	β_1	0.08	1.49	0.18***	3.58
CHEM	β_2	-0.03	-1.44	0.02	1.16
LABOR	β_3	0.11	1.59	0.05	0.85
$D_{GOODSOIL}$	β_4	0.25**	2.23	1.16***	6.56
$D_{FAIRSOIL}$	β_5	0.15	1.49	0.60***	3.44
Inefficiency effects					
Constant	δ_0	-0.47	-0.81	12.33**	-2.02
SCHL	δ_1	0.014	0.30	-0.41**	2.36
AGE	δ_2	0.07	1.22	0.04*	1.64
LFORCE	δ_3	-0.21***	-2.61	1.16**	2.26
CDT	δ_4	0.99***	2.82	-1.10*	-1.90
EXT	δ_5	0.12	0.57	1.38	1.54
Variance Parameters					
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	σ^2	0.15***	3.54	3.19**	2.31
	σ	0.39		1.79	
$\gamma = \sigma_u^2 / \sigma^2$	γ	0.22	1.00	0.99	158.4
Log likelihood		-47.78		58.15	
LR ratio test		10.47		89.95	
Mean Efficiency		0.895		0.73	
Number of observations		118		151	

Note; *Significant at 0.1 level, **Significant at 0.05 level, ***Significant at 0.01 level.

Source: Analyzed by FRONTIER 4.1.

5.4. Technical Efficiency of groundnut producers in Mandalay and Magway

As described in the chapter III, technical efficiency of the firms is calculated and measured the deviation of current output from its possible maximum. Technical efficiency is calculated using the conditional expectation of the following equation, conditioned on the composed error (ε_i=v_i-μ_i), Thus,

$TE_{output} \leq 1$ with TE =1 capturing zero inefficiency.

$TE_i = \exp(-\mu_i) * 100$

(TE is converted into a percent by multiplying this equation by 100)

In two study areas of Myanmar, the technical efficiencies of sample firms in a cropping season can be predicted using conditional expectation of TE = exp ($-u_i$) using computer program FRONTIER VERSION 4.1. These technical predictions are between zero, reflecting the existence of technical inefficiency, and the index takes the value one, with fully technical efficient for farms in the production frontier.

The predicted technical efficiencies scores of farms households in each region were presented in Table5.5. The technical efficiency ratings are aggregated into a frequency distribution where the class interval is 20 (see Table 5.4). The groups are classified as the technical efficiency levels between 0.01-0.19 as very low, 0.20-0.39 as low, 0.40 -0.59 as medium, 0.60- 0.079 as high, and 0.80- 0.99 as very high, which represents the distribution of technical efficiency levels. For further illustration of the results, Figure 5.1 depicts the distribution of efficiencies of groundnut in Mandalay and Magway.

The mean efficiency of total groundnut producers of **Mandalay** is 0.89 with a range 0.45 to 0.98. This is interpreted that there is a scope for increasing groundnut production by 11 percent by using present technologies in groundnut firms of Myanmar. About 80 percent of total farmers of Mandalay fall in the very high level of technical efficiency. This may indicate that the groundnut farmers in Mandalay can gain at least an average crop output growth of 11 percent through full improvements in technical efficiency.

The mean efficiency for **Magway** is 0.73 with a range 0.16 to 0.94, meaning that there will be increase in groundnut production by 27 percent by existing technologies for producing groundnut in Magway. According to the technical efficiency of groundnut production in Table 5.4, about 47 percent of the farmers are observed with high level of efficiency in producing of groundnut in Magway.

Table.5.4 Technical Efficiency scores of farm household heads

Level of technical efficiency	Mandalay		Magway	
	Persons(number)	Percent (%)	Persons(number)	Percent (%)
0.01- 0.19(very low)	0	0	3	1.99
0.20-0.39(low)	0	0	5	3.3
0.40-0.59(medium)	1	0.8	27	17.89
0.60-0.79(high)	22	18.7	45	29.8
0.80-0.99(very high)	95	80.5	75	47.02
Total	118	100.0	151	100.0
Average	0.89		0.73	
max	0.98		0.94	
min	0.45		0.16	
Observations	118		151	

Source; Field survey, 2007.

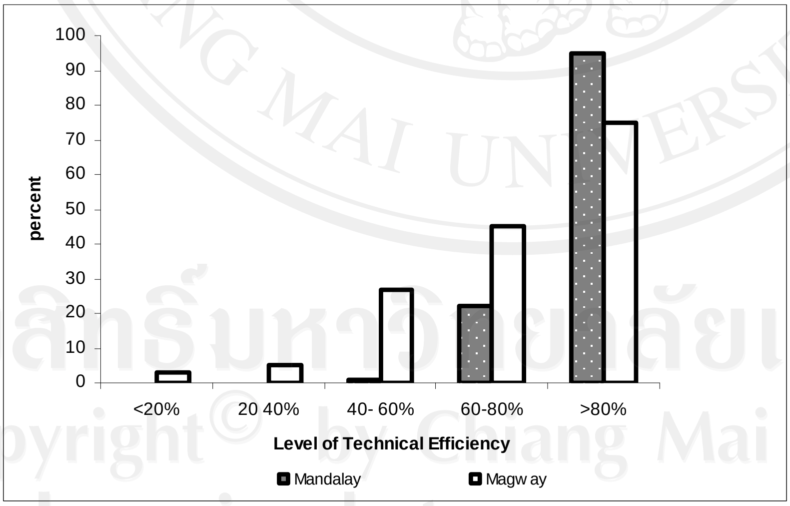

Fig.5.1. Distribution of technical efficiency indexes for groundnut producers in Mandalay division and Magway division Myanmar.

Source: Field survey, 2007.

In conclusion, famers who differ in efficient use of resources can explain differences in technical efficiency. The lowest technical efficiency of groundnut producers is 45 percent in Mandalay and 16 percent in Magway. Thus, the relatively low level of efficiency in Magway points out that there needs an improvement of groundnut systems under the existing technology and Mandalay is also required to improve the technical efficient in the groundnut production.

Identification of specific factors that led to variation in the farm-specific technical inefficiency is necessary to narrow the existing gap and increase productivity. In the groundnut production frontier function, it seems that there are other some limitations in available information about the groundnut firms of the study areas. If the variables are considered: the chemical application and the labor used in groundnut, it is thought that more chemical application and at least labor used could be more intensive to be more yield per hectare in groundnut firms. As a result, the variables become better in terms of efficiency. However, if farmers used more inputs than necessary, the result would be decreased in efficiency in their groundnut production system.

The result found a negative relation between technical efficiency and chemical application variables, however, labor used in groundnut production function which positively related to groundnut yield in Mandalay. As a result, Mandalay is likely to decrease in efficiency.

The soil quality is positively associated with technical efficiency. Thus, according to the results, farmers located in good soil regions exhibit higher level of efficiency than those in less fertile regions. Improving soil quality in practiced of the groundnut production is essential to sustain for increasing groundnut productivity.

The presence of shortfalls (means that it is amount which is less than the level that was expected) in technical inefficiency indicated that groundnut yield can be increased without requiring additional resources used in groundnut production.

From an efficiency analysis point of view, the obtained measurement of efficiency indicates that the situations from the groundnut production could be possible that exists for improving technical efficiency.