# Economic Efficiency of Sugarcane Production in Northern Region of Bangladesh

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## ABSTRACT

The present study was undertaken to estimate the economic efficiency of sugarcane farmers and to identify and measure the impacts of different factors affecting inefficiency of sugarcane production in Bangladesh. The study employed farm level cross sectional data from three sugarcane growing areas of Bangladesh during the period of November 2007 to December 2008. Economic efficiency of sugarcane farmers' was found to vary across locations. The study showed that the wage rate of human labour, price of organic manure (OM), Muriate of Potash (MP), and irrigation cost contributed significantly. The average economic efficiency of sugarcane farmers was 62 percent. This indicates a good potential for increasing sugarcane output by 38 percent with the existing technology and levels of inputs while considering the amount and cost of inputs. The education, experience and extension contacts were found to have significant effect on yield and economic efficiency of sugarcane farmers. Therefore, educational level, experience and extension are the important factors for obtaining maximum achievable yield.

**Key words:** Economic efficiency, sugarcane growers, educational level, extension contact

## INTRODUCTION

Agriculture plays an important role in the economy. It contributes 20.60 percent of GDP. Among them, crop sector contributes 11.55 percent (BBS 2008) and sugarcane alone contributes 0.74 percent to the national economy (Pal *et al.*, 2005). Currently, on an average, sugarcane is grown in 0.18 million hectare of land of which almost 50% is located in the mill zones, where sugarcane is mostly utilized for sugar production and remaining 50% is situated in the non-mill zone, which is used for *gur* and juice production (Alam, 2005). Most of the sugar mills of Bangladesh are located in the North Western zones of the country where concentration of sugarcane cultivation is higher. Panchagar, Thakurgaon and Rajshahi districts are the potential sugarcane producing area and are situated in the northern part of Bangladesh. Per hectare yield of sugarcane in Bangladesh, is 46 t/ha which is less than others countries. Average cane yield in Pakistan, India, Thailand, China and Brazil was 53.20 t/ha, 66.93 t/ha, 63.71t/ha, 80.82 t/ha and 774.42 t/h respectively (FAO, 2007).

It is believed that farmers' performance is lower than their potential capacity due to underutilization of the most recently developed production technologies. The socio economic constraints to higher production of sugarcane are of vital importance. The socio economic constraints may explain why farmers are not utilizing the practices and inputs identified as capable of raising yields. The socio economic factors are farmers' age, education, occupation, experience in farming, family size, access of information, physical infrastructure, cost of inputs and outputs etc. These factors influence farmers to adopt any technology fully or partially. Profitability is certainly an important consideration in the farmers' selection of crops and in the adoption of new technologies.

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Like other food grains, sugarcane output could increase by efficient use of inputs such as land, labour and capital and organizing the management of production effectively. Efficient utilization of present level of inputs may be advised for higher productivity.

Understanding the determinants of economic efficiency of sugarcane production is very important for both farmers and policy makers to increase the productivity and profitability of sugarcane production. Therefore, the study estimates the farm specific economic efficiency of sugarcane production in the study area and to identify and measure different factors associated with economic efficiency of sugarcane farmers.

## MATERIALS AND METHODS

Primary data were collected from total 300 sample farmers from the 12 (3×4) upazilla taking 25 farmers randomly from each upazilla during the cropping season of 2007-08 through interview. A pre-tested interview schedule was applied to collect data.

### Selecting the Functional form of the Production Function

Cobb-Douglas is a special form of the translog production function where coefficients of the squired and interaction terms of input variables are assumed to be zero. In order best specification for the production (Cobb-Douglas or translog) for the stochastic frontier model using the generalized likelihood-ratio statistic "LR" defined by

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

where, $L(H_0)$ is value of the livelihood function of the Cobb-Douglas stochastic production frontier model, in which the parameter restrictions specified by the null hypothesis, $H_0 = \beta_{ij}=0$, (i.e. the coefficient on the squared and interaction terms of input variable are not zero). If the null hypothesis is true, then "LR" has approximately a chi-square distribution with degrees of freedom equal to the difference between the number of parameters estimated under $H_1$ and $H_0$, respectively. We use the Cobb- Douglas and translog production function and on the basis of the test statistic we discover that the CD is the best fit to our data set. On the basis of this test statistic we selected the Cobb-Douglas production function. Besides this, its coefficients directly represent the elasticity of production. The Cobb-Douglas form was used in many empirical studies, particularly those relating to developing country in agriculture. In this study, it is assumed that the Cobb- Douglas is the appropriate form of the frontier production function

### Empirical Cobb-Douglas frontier cost function model

Schmidt and Lovell (1979) developed a simultaneous equation cost frontier model designed to provide estimates of input-oriented technical efficiency and input allocative efficiency. The production equation is the self-dual, (e.g., Cobb-Douglas functional form) allowing an examination of economic efficiency. The corresponding cost frontier, derived analytically, can be written in general form as:

$$C = h(P, Q) \quad \text{.............................. (ii)}$$

Where, C is the minimum cost associated with the production of output Q, and P is a vector of input prices. Applying Shephard's lemma, we obtained

$$\frac{\delta C}{\delta P_i} = X_i(P, Q) \quad \text{..................................(iii)}$$

This is the system of minimum cost input demand equations.

The empirical Cobb – Douglas frontier cost function with double log form can be written by normalizing with price of seed as:

$$Ln(C_i/P_s) = \beta_0 + \beta_1 Ln(Q_i) + \beta_2 Ln(W_{HL}/P_s) + \beta_3 Ln(P_{AL}/P_s) + \beta_4 Ln(P_{OM}/P_s) + \beta_5 Ln(P_u/P_s) + \beta_6 Ln(P_{TSP}/P_s) + \beta_7 Ln(P_{MP}/P_s) + \beta_8 Ln(P_F/P_s) + \beta_9 Ln(P_{irri}/P_s) + D_1 + D_2 + v_i + u_i \quad \text{.........................(iv)}$$

Where,

$C_i$ = Minimum cost of production
$Q_i$ = Output of the ith farm(Tk./ha)
$W_{HL}$ = Wage rate of labour of the ith farm (Tk./ man-day)
$P_{AL}$ = Price of animal labour of the ith farm (Tk./ pair-day)
$P_s$ = Price of seed of the ith farm (Tk./kg)
$P_{OM}$ = Price of organic manure of the ith farm (Tk./kg)
$P_U$ = Price of urea of the ith farm (Tk./kg)
$P_{TSP}$ = Price of TSP of the ith farm (Tk./kg)
$P_{MP}$ = Price of MP of the ith farm (Tk./kg)
$P_F$ = Price of Furadan of the ith farm (Tk./kg)
$P_{irri}$= Price of irrigation charge of the ith farm (Tk./ha)
$D_1$= Dummy for location 1(Thakurgaon=1, others=0)
$D_2$ = Dummy for location 2 (Rajshahi=1, others=0))
v and u are assumed to have normal and half normal distribution, respectively.

**Economic inefficiency model**

To examine the role of relevant farm specific variables in efficiency the empirical model of farm specific technical inefficiency was

$$u_i = \delta_0 + \delta_1 z_{1i} + \delta_2 z_{2i} + \delta_3 z_{3i} + \delta_4 z_{4i} + \delta_5 z_{5i} + \delta_6 z_{6i} + W_i. \quad \text{............ (v)}$$

Where,

$u_i$ = Total economic or cost inefficiency of the i th farm operator
$z_{1i}$ = Experience in sugarcane farming of the ith farm operator (years)
$z_{2i}$ = Age of the ith farm operator (years)
$z_{3i}$ = Education level (year of schooling) of the ith farm operator.
$z_{4i}$ = Visit by field worker (no.)
$z_{5i}$ = Farm size of the ith farm operator (ha)
$z_{6i}$ = Dummy for sugarcane training of the ith operator (1 = yes, 0 = otherwise)
$W_i$ = Unobservable random variables or classical disturbance term, which were assumed to be independently distributed, obtained by truncation of the normal distribution with mean zero and unknown variance $\sigma^2$, such that $u_i$, is non negative.

The $\alpha$ and $\delta$ coefficients are unknown parameters to be estimated, together with the variance parameters

The economic efficiencies were estimated with the help of derived normalized cost frontier described in equations (iv), and (v) by the maximum likelihood estimates (MLE) method using the economic computer software package FRONTIER 4.1 (Coelli, 1996). Asides from estimates of coefficients the model, provides sigma squared ($\sigma^2$ ), gama ($\gamma$) and log livelihood function. To generate farm specific economic efficiency indices for sugarcane production in the study areas, the stochastic frontier cost function with production cost as dependent variable was estimated in which all input costs were normalized by seed price.

**Hypothesis testing**

The model for inefficiency effects mentioned in equation (vi) can only be estimated if the inefficiency effects are stochastic and have a particular distributional specification. Hence, it is important to test the null hypothesis that the inefficiency effects are not present, $H_0$: $\gamma = \delta_0 = \delta_1 = \cdots = \delta_6 = 0$ and the coefficients of the variables in the model for the inefficiency effects are zero, $H_0$: $\gamma = \delta_1 = \cdots = \delta_6 = 0$. These hypotheses can be tested using the generalized likelihood ratio statistic LR, defined by

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

Where, $L(H_0)$ and $L(H_1)$ are the values of the likelihood function under the null and alternative hypothesis ,$H_0$ and $H_1$, respectively.

## RESULTS AND DISCUSSION

**Selection of the Cobb Douglas Production**

We tested the hypothesis whether the Cobb-Douglas production function is an adequate representation of the data given the specifications of the translog model. Alternatively, we tested to see if the coefficients of interaction and square terms in the translog production function were zero. The values of the log likelihood for the Cobb-Douglas and translog production functions were 364.09 and 285.60 respectively. By employing equation (vi) we estimated the value LR equal to 156.90. This value was compared with the upper five percent point for the $\chi^2_{74}$ distribution, which is 90.53. Thus the null hypothesis that the Cobb-Douglas stochastic production frontier is an adequate representation of the data was accepted, given the specifications of the translog stochastic production frontier.

**Maximum Likelihood Estimates of Stochastic Cost Frontier and Economic Inefficiency Model**

The maximum likelihood Estimates (MLE) of the coefficients of stochastic Cobb- Douglas cost frontier economic inefficiency model showing the minimum cost performances are presented in Table1. The empirical results indicated that the coefficients of output, wage rate of human labour and price of MP were positive and significant implying that an increase in the magnitudes of these variables would result in the corresponding increase of cost of producing sugarcane for the farmers. The dummy variable for location Thakurgaon ($D_1$) was positive and significant which implies that the production cost of sugarcane at Thakurgaon was higher than that of Panchagar and Rajshahi. The coefficients of price of animal labour, organic manure, furadan and irrigation cost, and dummy of location ($D_2$) were positive but not significant.

In inefficiency model, the coefficient of experience, visit by the field worker and dummy for sugarcane training was negative and significant. This indicated that the farmers, who had greater experience about sugarcane production, were economically more efficient than the less experienced the plots which were visited by the field worker and the farmers who received sugarcane production training were economically more efficient than non visited plots and non trained farmers.

The coefficients of farmers education, farm size were negative but not significant which indicated that the education and farm size had the negative impact on economic inefficiency but not significant. The estimated value of the variance parameter $\sigma^2$ was large and significantly different from zero, which indicated a good fit and correctness of the specified distributional assumption.

**Table 1. Maximum likelihood estimates for parameters of Cobb-Douglas stochastic normalized cost frontier and economic inefficiency model for sugarcane**

| Independent variables | Parameters | Coefficients | Standard error | t-ratio |
|---|---|---|---|---|
| Constant | $\beta_0$ | -0.773 | 30.463 | -1.667 |
| Ln output (Tk/ha) | $\beta_1$ | 0.801* | 0.033 | 23.637 |
| Ln Human labour (Tk. /man days) | $\beta_2$ | 0.068** | 0.038 | 1.796 |
| Ln Animal labour (Tk./pair-days) | $\beta_3$ | 0.004 | 0.028 | 0.144 |
| Ln Organic manure (Tk./kg) | $\beta_4$ | 0.051 | 0.043 | 1.175 |
| Ln Urea (Tk./kg) | $\beta_5$ | -0.041 | 0.039 | -1.047 |
| Ln TSP (Tk./kg) | $\beta_6$ | -0.454 | 0.609 | -0.745 |
| Ln MP (Tk./kg) | $\beta_7$ | 1.323** | 0.600 | 2.204 |
| Ln Furadan (Tk./kg) | $\beta_8$ | 0.003 | 0.003 | 0.832 |
| Ln Irrigation (Tk./ha) | $\beta_9$ | 0.0003 | 0.002 | 0.156 |
| Dummy for Location (Thakurgaon=1, thers=0) | $D_1$ | 0.101* | 0.014 | 7.015 |
| Dummy for Location (Rajshahi=1, others=0) | $D_2$ | 0.029 | 0.017 | 1.67 |
| **Technical inefficiency model:** | | | | |
| Constant | $\delta_0$ | 0.017 | 0.090 | 0.141 |
| Experience (years) | $\delta_1$ | -0.002** | 0.001 | -1.204 |
| Age (years) | $\delta_2$ | 0.0008 | 0.0016 | 0.489 |
| Education (year of schooling) | $\delta_3$ | -0.003 | 0.003 | -0.904 |
| Visit by field worker (no.) | $\delta_4$ | 0.026* | 0.009 | 2.888 |
| Farm size (ha) | $\delta_5$ | -0.018 | 0.024 | -0.754 |
| Dummy for sugarcane training (1=Yes, 0= otherwise) $D_t$ | $\delta_6$ | -0.090* | 0.030 | -3.01 |
| **Variance parameters :** | | | | |
| Sigma- squared | $\sigma^2$ | 0.005* | 0.0005 | 10.392 |
| Gamma | $\gamma$ | 0.016 | 0.005 | 0.170 |
| Log likelihood function | 364.09 | | | |

*and** indicate significant at 1% and 5% level of probability, respectively.
Source: Field survey (2007-08)

**Maximum Likelihood Estimates of Location – Specific Stochastic Frontier Cost Function and Economic Inefficiency Model**

The maximum likelihood estimates of the coefficients of location specific stochastic frontier cost function and inefficiency effect was estimated from equation (iv) and (v) and are presented in Table 2. The empirical results indicated that at Rajshahi, the coefficients of output, human labour and irrigation cost were positive and significant implying that an increase in the magnitudes of these variables would result in corresponding increase of cost of producing sugarcane. The coefficient of organic manure cost was negative and significant at 1% level which meant that an increase in the magnitudes of organic manure price would result in the corresponding decrease of cost of producing sugarcane. The coefficients of urea, MP, furadan price were also positive but not significant which implies that urea, MP, furadan price had positive impact on production cost but not significant. On the other hand the coefficients of animal labour and TSP price were negative but not significant.

**Table 2. Maximum likelihood estimates for parameters of location–specific Cobb- Douglas stochastic normalized cost frontier and economic inefficiency model**

| Independent variables | Param -eters | Locations | | |
|---|---|---|---|---|
| | | Rajshahi | Thakurgaon | Panchagar |
| Constant | $\beta_0$ | -1.609**(0.812) | -0.046(1.059) | -0.656(1.005) |
| Ln output (kg) | $\beta_1$ | 0.922*(0.058) | 0.739*(0.067) | 0.726*(0.052) |
| Ln Human labour(Tk. /man days) | $\beta_2$ | 0.239**(0.118) | 0.110(0.111) | 0.120*(0.038) |
| Ln Animal labour(Tk./pair days) | $\beta_3$ | -0.019(0.041) | -0.007(0.053) | 0.007(0.025) |
| Ln Organic manure (Tk./kg) | $\beta_4$ | -0.123*(0.049) | 0.286*(0.088) | 0.209(0.213) |
| Ln Urea (Tk./kg) | $\beta_5$ | 0.015(0.049) | -0.195(0.105) | -0.012(0.029) |
| Ln TSP (Tk./kg) | $\beta_6$ | -0690(0.417) | -0.338(0.577) | -0.592(0.710) |
| Ln MP (Tk./kg) | $\beta_7$ | 1.137(0.734) | 1.163**(0.589) | 1.566**(0.702) |
| Ln Furadan (Tk./kg) | $\beta_8$ | 0.003(0.003) | 0.060**(0.394) | 0.009(0.017) |
| Ln Irrigation (Tk./ha) | $\beta_9$ | 0.004**(0.002) | -0.0014(.009) | -0.006**(0.003) |
| Inefficiency effect model: | | | | |
| Constant | $\delta_0$ | 0.246*(0.076) | 0.033(0.513) | 0.094(0.079) |
| Experience (years) | $\delta_1$ | 0.002(0.002) | 0.003*(0.001) | -0.004**(0.002) |
| Age (years) | $\delta_2$ | -0.004*(0.001) | 0.0005(0.0009) | 0.0002(0.0014) |
| Education (year of schooling) | $\delta_3$ | -0.006(0.004) | 0.002(.003) | -0.012*(0.004) |
| Visit by field worker (no.) | $\delta_4$ | -0.016(0.013) | -0.024**(0.013) | -0.024**(0.012) |
| Farm size (ha) | $\delta_5$ | 0.035(0.023) | -0.032(0.14) | 0.016(0.016) |
| Dummy for sugarcane training (1=Yes, 0= otherwise) Dt | $\delta_6$ | -0.073** (0.036) | -0.009(0.021) | -0.043*(0.003) |
| Variance parameters : | | | | |
| Sigma- squared | $\sigma^2$ | 0.004*(0.0007) | 0.006*(0.001) | 0.003*(0.0008) |
| Gamma | $\gamma$ | 0.186**(0.092) | 0.005(3.002) | 0.239**(0.126) |
| Log likelihood function | | 145.383 | 107.726 | 154.790 |

* and ** indicate significant at 1% and 5% level of probability respectively ; Figures in the parentheses indicate standard error

Source: Field survey (2007-08)

At Thakurgaon the coefficients of output, price of organic mmanure, MP and furadan were positive and significant implying that an increase in the magnitude of these variables would result in the corresponding increase of cost of producing sugarcane for the farmers (Table 2). On the other hand the coefficients of animal labour price, urea price, TSP price and irrigation costs were negative but not significant implying that the coefficients of animal labour price, urea price, TSP price and irrigation cost had decreased sugarcane production cost but this was not significant. In the inefficiency model the coefficients of sugarcane experience and visit by the field worker were negative and significant, which implied that sugarcane production experience and visit by field worker decreases the economic inefficiency. On the other hand the coefficients of farm size and dummy on training were negative but not significant implied that as size of farm increases inefficiency in cost decreases.

Table 2 also indicated that at Panchagar, the coefficients of output, wage rate of human labour, price of MP and irrigation cost were positive and significant implying that an increase in the magnitude of these variables would result in the corresponding increase of cost of producing sugarcane for the farmers. The coefficients of animal labour, organic manure and furadan price were found to be positive but not significant. In the inefficiency model of Panchagar, the coefficient of experience, education, sugarcane plot visit by field worker and dummy for sugarcane training were negative and significant. This indicates that the economic inefficiency of the sugarcane farmer decreases with the increase of the experiences of the farm operator. The experienced farmers are more efficient than less experienced ones in economic efficiency by using lower input cost. The coefficient of education was negative and significant at, which implied that the sugarcane farmers with greater year of schooling tend to be less economic inefficient. Sugarcane farmer's training increases the farmers' knowledge make a farmer more efficient than non trained farmers. This result is in line with those of Ahmad (2001), Kamruzzaman *et al.* (2008), Coelli (1996) and Battese *et al.* (1993). The estimated variance ($б_2$) is large and significantly different from zero which indicated a good fit and correctness of specified assumption. The γ parameter associated with the variances in the stochastic frontier in significant. It indicates that there are inefficiency effects in sugarcane production.

**Test of Hypothesis**

Here we are going to test the hypotheses for the study. The null hypothesis that the inefficiency effects are not present, $H_0$: $\gamma = \delta_0 = \delta_1 = \cdots\cdots = \delta_6 = 0$ and the coefficients of the variables in the model for the inefficiency effects are zero, $H_0$: $\gamma = \delta_1 = \cdots\cdots = \delta_6 = 0$ were tested using the generalized likelihood ratio statistic LR, defined by equation vii. It is imperative, according to Coelli (1995), to perform one sided generalized likelihood ratio test when ML estimation is involved because this test has the correct size (i.e., probability of Type I error).

The result of the hypothesis tests (Table 3) reveals that there are significant economic inefficiency effects in the production of sugarcane production in all regions since the null hypothesis is rejected. Another null hypothesis, $H_0$: $\gamma = \delta_1 = \cdots\cdots = \delta_6 = 0$ (Table 3) is also rejected for sugarcane production. Hence, it could be concluded that the inefficiency effects are significantly influenced by the variables included in the inefficiency model.

**Table 3. Tests of hypotheses for coefficients of the explanatory variables for the economic efficiency effects in the Cobb-Douglas stochastic frontier cost function**

| Null hypothesis | Log- likelihood value | Test Statistic | Critical value $\chi^2$ | Decision |
|---|---|---|---|---|
| $H_0:\gamma=\delta_0=\delta_1=\cdots\cdots=\delta_6=0$ | | | | |
| All | 364.09 | 80.32 | 15.51 | Rejected |
| Location specific: | | | | |
| Rajshahi | 145.38 | 52.79 | 15.51 | Rejected |
| Thakurgaon | 107.73 | 48.25 | 15.51 | Rejected |
| Panchagar | 154.79 | 60.04 | 15.51 | Rejected |
| $H_0:\gamma=\delta_1=\cdots\cdots=\delta_6=0$ | | | | |
| All | 296.36 | 65.26 | 12.59 | Rejected |
| Location specific: | | | | |
| Rajshahi | 122.30 | 41.64 | 12.59 | Rejected |
| Thakurgaon | 95.54 | 32.56 | 12.59 | Rejected |
| Panchagar | 132.45 | 52.63 | 12.59 | Rejected |

Note: Mixed $\chi^2$ Critical values are taken from Kodde and Palm (1986)

**Economic Efficiency and its Distribution**

Locations specific economic efficiency was estimated by using cost function and normalized by seed price (Table 4). It was observed that the mean value of economic efficiency was 0.62 with a range from 0.30 to 0.78. This implied that, on average, the sugarcane producers in the study area were producing sugarcane to about 62 percent of the potential (stochastic) frontier levels, given the levels of their inputs and the technology currently being used. This also indicated that there existed an average level of economic inefficiency of 28 percent. The mean economic efficiency was highest at Panchagar and Rajshahi (63%) compared to Thakurgaon (60%). The variation in economic efficiency was observed higher at Panchagar (ranged 30-78%) whereas it was 30-74 percent at Rajshahi and 30-71 percent at Thakurgaon. Considering different locations, the farmers at Panchagar were found to be economically more efficient in sugarcane production compared to farmers of other two locations. Seventy percent of the farmers of Panchagar achieved economic efficiency level of more than 60 -80 percent (Figure 1). There were no farmers who achieved more than 80 percent economic efficiency. On the contrary, more of the farmers at Thakurgaon (47%) achieved economic efficiency level of less than 60 percent followed by Rajshahi (31%) and Panchagar (30%). Nine percent of the farmers at Thakurgaon, 4 percent at Rajshahi and 2 percent at Panchagar had economic efficiency below 50 percent.

**Table 4. Farm specific economic efficiency of sugarcane production**

| Location | No. of farms | Economic efficiency | | | |
|---|---|---|---|---|---|
| | | Mean | Maximum | Minimum | Standard deviation |
| Rajshahi | 100 | 0.63 | 0.74 | 0.30 | 0.07 |
| Thakurgaon | 100 | 0.60 | 0.71 | 0.30 | 0.08 |
| Panchagar | 100 | 0.63 | 0.78 | 0.30 | 0.07 |
| All | 300 | 0.62 | 0.78 | 0.30 | 0.07 |

Source: Field survey (2007-08)

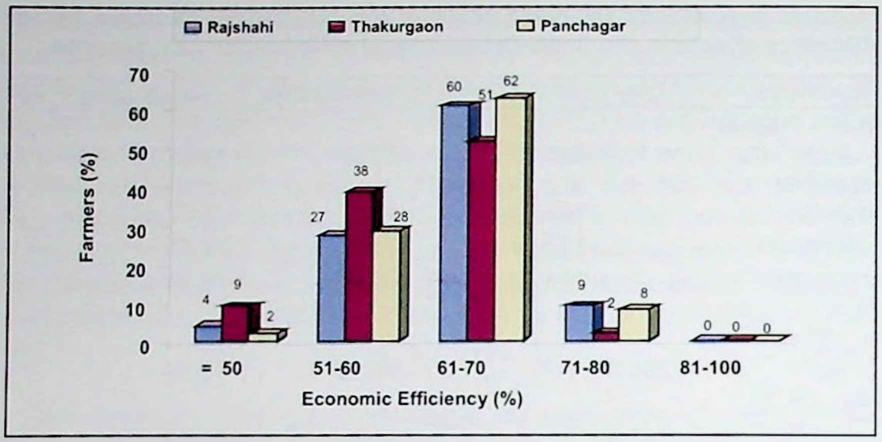


**Figure 1. Frequency distribution of economic efficiency of sugarcane farmers in different locations**

**Farm Specific Indices of Economic Efficiencies**

The frequency distribution of economic efficiency indices of sugarcane farmers are shown in Table 5. The average economic efficiency was 0.62 indicated that 38.00 percent cost saving is possible keeping the output constant. On the other hand, only 6.33 percent of the total farmers able to achieve economic efficiency level (frontier minimum cost) seventy one to eighty percent. There was a large number of farmers (36%) whose economic efficiency was less than 60 percent and thus 40 percent cost saving was possible.

**Table 5. Frequency distribution of farm specific economic efficiency estimates of sugarcane farmers**

| Efficiency level (%) | Economic efficiency | |
|---|---|---|
| | No. of farmers | Percentage of total farms |
| ≤ 60 | 108 | 36.00 |
| 61-70 | 173 | 57.67 |
| 71-80 | 19 | 6.33 |
| 81-100 | 0 | 0 |
| Total | 300 | 100 |
| Mean | 0.62 | |
| Maximum | 0.78 | |
| Minimum | 0.30 | |
| Standard Deviation | 0.07 | |

Source : Field survey (2007-08)

In this study it is indicated that economic inefficiency existed among the farmers. Experience, education and field visit (extension contact) have the positive impact in increasing production and economic efficiency of sugarcane farmers in the stochastic frontier cost function models. Economic efficiency increases (or inefficiency decreases) with the increase in education and experience on sugarcane farm operators. Besides these, extension service should be strengthened so that farmers' consciousness regarding improved production and management practices ensured to improve farmers' efficiency.

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