RESOURCE USE EFFICIENCY OF SMALL SCALE FURNITURE INDUSTRY IN SRI LANKA: A STOCHASTIC FRONTIER PRODUCTION FUNCTION APPROACH

Aruna Shantha, A [a], Asan Ali, B.G.H[b]

[a] *PhD Candidate, School of Economics, Collage of Business, Northern University of Malaysia, Malaysia*
arunaeconomics@yahoo.com
[b]*Professor, School of Economics, Collage of Business, Northern University of Malaysia, Malaysia*
aali@uum.edu.my

Abstract

In economics, it is well recognized that resources involved in the production process are limited in supply and that the scarce resources must be efficiently utilized with the minimum of wastage. Recent literature indicates that small scale entrepreneurs in the developing countries fall short of exploiting the full potential of current technological means. Thus, increasing the efficiency in production assumes greater significance in attaining potential output at the industry level. However it is an undeniable fact that the majority of small scale entrepreneurs are characterized by poor economic status due to inefficient utilization of available resources in Sri Lanka. This paper investigates the economic and technical efficiency of furniture industry in Sri Lanka and suggests policy recommendations for efficient utilization of resources. The field survey carried out among 335 small scale furniture producers in Moratuwa area which is furniture hub in Sri Lanka. The translog production frontier was found to be an adequate representation of the data. According to the results obtained from the stochastic frontier estimation, the average technical efficiency of selected farmers was found to be 69.9%, which in turn indicates a scope for further improvements without increasing the level of input. The analysis using the translog production function indicated miss-allocation of resources is primarily due to the lack of managerial experience on the part of the producers.

Keywords: Frontier Production Function; Furniture Industry; Resource use Efficiency; Small scale Entrepreneur

1. Introduction

Small and medium enterprises (SMEs) are playing important role in Sri Lankan economy. SEMs account for about 90% of all industrial establishments, 30% of the total industrial output and 35% country's employment (Dassanayaka & Sardana, 2010). Manufacture of furniture wood and products of wood and cork consists of 28,878 establishments and it engages, 104, 326 persons which is 10.1% of total workforce (DCS, 2011). In Sri Lanka furniture and wood product manufacturing enterprises operate either as individual enterprises or in group/cluster. During last three decades, many government supportive agencies have established for enhancing the SMEs in Sri Lanka such as: Board of Investment (BOI), Ministry of Enterprise Development and Investment Promotion, Industrial Development Board (IDB), SME Development authority, Urban Development Authority and Private Sector. The Sri Lankan wood and wooden products industry can be categorized under four major areas, namely, saw mill operation, manufacturing of furniture, manufacturing of wooden toys and manufacturing of components for construction and light engineering industry.

2. Background of the Problem

It is generally believed that resources in the SMEs, especially in under-developed countries are being utilized inefficient (Baten, Abdulbasah, & Fatama, 2009). Very little number of previous literature have examined that the main problems faced by small scale wooden product industry in Sri Lanka. Those problems are mainly included financial and credit relates issues, skill labour mismatching, technological problems, resource management issues and irresponsibility of state sector supportive agencies. (Dassanayaka & Sardana, 2010) (Dassanayaka , 2009). Most of small scale wooden product industries are below the frontier level and they can not gain the economies of scale due to isolation operation of those mils and inadequate skills and assests. However, very little literature has focused the technical efficiency of this industry and it's determinates. The absence of quantitative research on technical efficiency on wood industry is one of the main problems for policy makers in decision making. Consequently, it seems that there is a gap in the theoretical knowledge and quantitative measurements of technical efficiency of wood industry in Sri Lanka. Therefore, the problem addressed in this study is to measure technical efficiency and identified the main factors behind the technical efficiency of wooden industries in Sri Lanka.

3. Objectives of the Study

The main objective of this study is to measure the technical efficiency of furniture industry and to identify socio-economic and management practices that influence small-scale furniture industry in Sri Lanka. The specific objectives are; (a) To identify the more appropriate functional form for frontier analysis and (b) to identify the most suitable distributional function for inefficiency term.

4. Literature review and Conceptualization

Efficiency of a production unit is defined as how effectively used available resources for the purpose of profit maximization at given technology, available, fixed factor and factor prices (Sadoulet & Janvy, 1995). In 1957 M.J Farrell defined efficiency with three conventional economic concepts such as: technical efficiency, allocative efficiency and economic efficiency. According to Farrell (1957) "*Technical efficiency is defined as the ability archive a higher level of output given similar level of inputs, allocative efficiency deals with the extent to which farmers make efficient decisions by using inputs up to the level of which their marginal contribution to production value is equal to the factor costs and technical and allocative efficiencies are component of economic efficiency*" This definition is considered as traditional radial efficiency measures by recent literature (Briec, Cavaignac, & Kerstens, 2010). This radial input efficiency measure is the inverse of the input distance function that itself is dual to cost function (Shephard, 1970).

Technical efficiency on an individual decision making unit is defined in terms of the ratio of the observed output to the corresponding frontier output, conditioned on the level of inputs used by the firm (Russel, 1985). A firm is said to be technically efficient if a firm is producing the maximum output from a minimum quantity of inputs (Ziechang, 1984). Technical efficiency is necessary condition for allocative efficiency and allocative efficiency is necessary condition for optimal allocation of resources. In generally, technical efficiency defined as the ratio of the observed output to the corresponding frontier output, conditional on the levels of inputs used by that firm.

5. Materials and methods

The original specification involved a production function specified for cross-sectional data which had an error term composed into two components: a stochastic random error component and a technical inefficiency component (Lovell, 1993). The model expressed in the following form: $Y = f(X_i\beta) + \varepsilon_i$ I = 1,………, N. Where Y_i is the production (or the logarithm of the production) of the i-th firm; X_i = Kx1 vector of input quantities of the i-th firm; β = vector of unknown parameters; the essential idea behind the stochastic frontier model is that ε_i term can be written as V_i = the random variable which are assumed to be independently and identically distribute and independent of Ui (Lovell, 1993).

Further, it is two sided (-α < V < α) normally distributed and random error that captures the stochastic effects outside the farmers control (Lovell, 2006). (E.g. weather, natural disaster and lucks). Ui is non-negative random variables which are assumed to account for technical inefficiency in production and are often assumed to be independently and identically distributed and truncations (at zero) of the normal distribution or half-normal (Kumbhakar, Soumandra, & Thomas, 1991).

Ui is a one sided $(U \geq 0)$ efficiency component that captures the technical efficiency of farmers. It measure the shortfall in output Y from its maximum value given by the stochastic frontier $Y = f(X_i\beta) + V_i$

5.1 Empirical model

In previous literature, different types of production functions have been adopted to discuss the frontier analysis. Among empirical literature, the most commonly applied production function is Cobb-Douglas (CD) production function and the transcendental Logarithm (TL) production functions (Baten et al., 2009, Battese & Corra, 1977, Hassan & Ahmad, 2005, Kachroo, Sharma, & Kachroo, 2010). The parameters of inefficiency model were produced with two-step approach Finally Cob-Douglas and translog production functions can be written with natural logarithms as follows:

The empirical model for Cobb-Douglas function forms is given by; $InY_i = \beta_0 + \sum_{j=1}^{6} \beta_{ij} InX_{ij} + V_i - U_i$,

The empirical model for translog functional form is given by;

$$InY_i = \beta_0 + \sum_{i=1}^{6} \beta i.InXi + \frac{1}{2}\sum_{i=1}^{6}\sum_{j=1}^{6} \beta_{ij}.InX_{ij}InX_{ij} + \sum_{i=1}^{6}\sum_{i \succ j}^{6} \beta_{ij} InX_{ij} InX_{ij} + V_{ij} - U_{ij}$$

Where; Y = Net value of output (Rs/Month), X1= value of fixed capital (Rs.)
X2 = Skilled labour (Man-days/Month), X3 = Unskilled labour (Man-days/Month),
X4 = Cost of raw Materials (Rs/Month), X5 = Recurrent Expenditure (Rs/Month)
X6 = Amount of Credit Taken from Formal-sources within last 12 months

V_i = Random error, U_i = Technical inefficiency term (half-normal for Cobb-Douglas and truncate normal for translog production function).

Variables for Inefficiency Model α_1 = Experiences in Furniture Industry (years)

α_2 = Education (Years), α_3 = Skill Trainings (Dummy, 1 =Yes, 0= No),

α_4 = Availability of own Marketing Outlet(s) (Dummy; 1=Yes, 0= Not)

α_5 = Other Income Sources (Dummy; 1= Yes, 0=No)

α_6 = Usage of New Equipment (1= Yes, 0 = No)

α_7 = Contact with Government Supportive Agencies (Dummy; 1= good, 0= Otherwise)

α_8 = Type of output (Dummy; Final product= 1, Semifinal= 0)

The stochastic frontier model was estimated using the FRONTIER 4.1 and the parameters of inefficiency model were estimated with TOBIT regression with the help of LIMDEP software packages.

5.2 Output – Input Elasticities

However, since first-order coefficients of traslog production functions are not very informative unlike Cobb-Douglas coefficients, it cannot use directly for as output elasticity of respective factor. Awudu and Eberlin (2001) have applied partial derivative process with the support of estimated coefficients in production function to measure input-output elasticity. In the study, researcher applied Awudu and Eberlin methods which have been established as follows;

$$LnOutput = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_1^2 + \beta_8 X_2^2 + \beta_9 X_3^2 + \beta_{10} X_4^2 + \beta_{11} X_5^2 + \beta_{12} X_6^2$$
$$\beta_{13} X_1 X_2 + \beta_{14} X_1 X_3 + \beta_{15} X_1 X_4 + \beta_{16} X_1 X_5 + \beta_{17} X_1 X_6 + \beta_{18} X_2 X_3 + \beta_{19} X_2 X_4 + \beta_{20} X_2 X_5 + \beta_{21} X_2 X_6 + \beta_{22} X_3 X$$
$$\beta_{23} X_3 X_5 + \beta_{24} X_3 X_6 + \beta_{25} X_4 X_5 + \beta_{26} X_4 X_6 + \beta_{27} X_5 X_6 .$$

Elasticity for $X_1 = \frac{1}{Output} * \frac{\partial Output}{\partial X_1} = \frac{\beta_1}{X_1} + \frac{2\beta_7}{X_1} + \frac{\beta_{13}}{X_1} + \frac{\beta_{14}}{X_1} + \frac{\beta_{15}}{X_1} + \frac{\beta_{16}}{X_1} + \frac{\beta_{17}}{X_1}$

The slope is calculated as follows: $\frac{\partial Output}{\partial X_1} = (\beta_1 + 2\beta_7 + \beta_{13} + \beta_{14} + \beta_{15} + \beta_{16} + \beta_{17}) * \frac{Output}{X_1}$

The equation below show the calculation of elasticities evaluated at the mean

$(\beta_1 + 2\beta_7 + \beta_{13} + \beta_{14} + \beta_{15} + \beta_{16} + \beta_{17}) \times \frac{yield}{X_1} \times \frac{X_1}{Yield}$, thus:

$E_{x1} = (\beta_1 + 2\beta_7 + \beta_{13} + \beta_{14} + \beta_{15} + \beta_{16} + \beta_{17})$. Similar approach applied for measuring input elasticities of other inputs such as: family labour, hired labour, fertilizer, machinery and access to water index. Following table shows the results of the input elasticities for each input in the traslog stochastic frontier production function

5.3 Hypothesis Testing

Likelihood ratio test (LRTs) have been used to compare two nested models. Asymptotically the test statistics is distributed as a chi-squared random variable with degree of freedom equal to the difference in the number of parameters between the models. Null hypotheses of interest are tested using the generalized likelihood ratio. The generalized likelihood-ratio statistic λ given by:

$$\lambda = -2In\left[L(H_0)/L(H_1)\right] = -2\left[InL(H_0) - InL(H_1)\right]$$

Where $L(H_0)$ is the value of the likelihood function for the frontier modal, in which parameters restrictions specified by the null hypotheses, H_0 is imposed; and L (H_1) is the value of the likelihood function for the general frontier model. If the null hypotheses is true , then λ has approximately a chi-square (or mixed square) distribution with degree of freedom equal to the differences between the parameter estimated under H_0 and H_1 respectively.

6. Study Area and Sampling Framework

In Sri Lanka, 19.2% of total SMEs fall under this specific wood and furniture industry category. There are 19,200 furniture manufacturing establishment in Sri Lanka. Out of that 35.8% establishment are located in western province. Within the western province, more than 50% of furniture and other wood product manufacturing establishment are concentrated in Colombo district. Moratuwa is well known furniture making cluster in Colombo district and there are 39 Grama Niladari (GN) divisions under Moratuwa divisional secretariat. There are 2,468 furniture manufacturing establishment functioning within Moratuwa divisional secretariat. Out of that 48% establishment are locating under Moratuwa east, Moratuwa west, Villorawattha East and Villorawattha West GN divisions. Thus, these four divisions were considered as main cluster of this study. Finally based on Morgan sampling procedures, this study randomly selected 335 small scales (Less than 5furniture establishments within identified cluster.

7. Findings

Table one show the descriptive statistics of main variables which have used for frontier production functions in the study.

Table 01: Descriptive Statistics of Main Variables

Variables	Descriptions	Mean	Std. deviation
Gross Value of Output	Rs. per Month	256,860.00	122,346.00
Value of Fixed Capital(Excluding Land and Buildings)	Rs.	128,880.00	98,756.00
Skill Labour Employed	Man-days per Month	56.00	43.50
Un-Skill Labour Employed	Man-days per Month	34.50	21.60
Cost of Raw Materials	Rs. per Month	86.225.00	25,560.00
Recurrent Expenditure (Excluding man Power)	Rs. Per Month	12,560.00	7,825.00
Amount of Credit Taken from Formal-sources within last 12 months	Re.	32,656.00	28,365.00

Source: Author's computation based on Field Survey, 2012.

7.1 Hypothesis Testing

A serious of tested were done to test the specification of functional form, distributional pattern of inefficiency term and availability of technical efficiency in the data set and results are summarized in table 2. These were tested through imposing restrictions on the model and using the generalized likelihood ratio statistics. At the first step researcher hypothesized that the average Cobb-Douglas functions adequately represents the production structure of the furniture industry. However this hypothesis ($\gamma = 0,$) was strongly rejected at 0.05 significant level. By second hypothesis researcher attempted to identify the best stochastic frontier among Cobb-Douglas and Traslog functions. According to LR test, frontier traslog function was recommended as best function to represent data set by rejecting null hypothesis at 95% probability. Finally study test the distributional pattern of technical inefficient term U_i by imposing the restriction of $\mu = 0$, indicating that the inefficient term is half-normal distribution. While, null hypothesis rejected at 5% significant level and proposed truncated normal distribution for inefficient term. Observing that entire hypothesis this study has selected traslog production stochastic frontier production function with truncated normal distribution for inefficiency term.

Table 2: Log likelihood Ratio Test

Null Hypothesis	Log likelihood	LR Statistics	Critical Value	Decision
$H_0: \gamma = 0$, Average CD = Frontier CD	56.48 90.94	68.92	7.05** $\chi^2_{(0.05)}$	Reject H_0
H_0: Frontier CD = Frontier TL	90.94 135.29	88.7	33.92 $\chi^2_{(0.05)}$	Reject H_0
$H_0: \mu = 0$	119.36 135.29	31.86	10.83 $\chi^2_{(0.001)}$	Reject H_0

Note: **The critical values are taken from table of Kodde and Palm (1986). The null hypothesis which includes the restriction that γ is zero does not have a chi-square distribution, and since the alternative hypothesis is that 0<γ> the test has asymptotic distribution.

7.2 Stochastic Frontier Production Functions

The estimated parameters of the traslog production frontier and Cobb-Douglas are presented in table 3. However, since the study used only traslog coefficients for further analysis since Cobb-Douglas were rejected by previous hypothesis testing. The γ is the percentage of the variance of –firm specific technical inefficiency (U_1) to the total variance of output. Since γ is closed to 1 (0.98) suggested that the technical inefficiency is existing with furniture industry in Sri Lanka. The value is 0.98 means that the variation of the output due to technical inefficiency and frontier output is dominated by technical inefficiency. Further λ is ratio of the variance of firm-specific technical inefficiency (U_1) to the variance of random error (V_1). Besides, the value for σ is positive indicate that the observed output deviate from frontier output and also average response functions were nor right production function for study the structure of furniture industry in Sri Lanka.

7.3 First-order Parameters of Stochastic Translog Function

The first order parameters of traslog stochastic frontierβ_j have the predicted (positive) sign reflect the conventional direct relationship between inputs and output. Unless recurrent expenditure, all other variables were strongly significant at 99% probability level. The bordered Hessian Matrix of the first and second order partial derivatives is negative semi-definite reflecting that all regularity conditions such as; positive and diminishing marginal product are valid at the point of approximation (i.e., sample mean).

7.4 Input Elasticities

Table 3 shows results of the input elasticities for each input in the traslog stochastic production function. A one percent increase in the skill labour, gross value of output increase by 3.44 (t=3.2) ceteris paribus. While, as un-skilled labour increase by one percent value of output increase only by 0.86 (t=2.6) ceteris paribus. Among selected variable, highest response variable to gross output was fixed capital since its input elasticity is 3.6 (t=3.5). A one percent increase in cost of raw material and recurrent expenditure, the value of gross output increase by 1.82 (t=2.4) and 0.95 (0.026) respectively subject to other variable keeping constant.

Table 3: Input Elasticity

Variables	Input Elasticity
Value of Fixed Capital(X1)	3.62
Skilled Labour Employed (X2)	3.44
Un-Skilled Labour Employed (X3)	0.866
Cost of Raw Materials (X4)	1.82
Recurrent Expenditure (X5)	0.965
Formal Credit (X6)	2.784

7.5 Frequency Distribution of Technical Efficiency

The results of the frequency distribution of technical efficiency of selected furniture producers are presented in Table 5. The study reveals technical efficiency (TE) of selected firms ranging from 23.7 percent to 99.9 percent, with an average of 69.5 percent. The results suggested that, on average the industry output can further increased by 30.5 percent without increasing the level of input. Beside it indicates that the average farmer in the sample could save 30..5 percent (i.e., 1-{69.5/99.97}) of cost and the most technically inefficiency firm can 76.3% cost saving compare with the TE level of his most efficient counterpart. In addition, around 4.8 percent firms are reflecting very poor TE and 38% firms are keeping excellent record in TE (more than 80%).

Table 4: Frequency Distribution of Technical Efficiency

Range of Technical Efficiency	No of Firms	Percentage (%)
Below 30	16	4.8
31-50	131	39.0
51-70	10	3.0
71-80	49	15.0
81-90	81	24.0
91-100	48	14.0
Maximum TE = 99.97% Minimum TE = 23.67% Mean TE = 69.5%		

Source: Author's Computation.

Table 5: Translog and Cobb – Douglas Stochastic Frontier Production Functions

Variables	Parameters	Traslog		Cobb-Douglas	
		Coefficients	T-Ratio	Coefficients	T-Ratio
Constant	β_0	5.776 †	5.693	0.609	2.827 †
Value of Fixed Capital (X1)	β_1	3.369 †	3.554	0.403	9.755 †
Skill Labour (X2)	β_2	3.217 †	3.225	0.463	4.396 †
Un-Skill Labour (X3)	β_3	1.303 †	2.623	0.067	2.664 †
Cost of Raw Materials (X4)	β_4	2.181 †	2.424	0.396	8.268 †
Recurrent Expenditure (X5)	β_5	0.739	0.026	0.012	1.597
Formal Credit (X6)	β_6	3.207 †	3.272	0.406	6.540 †
Ln-$(X1)^2$	β_7	0.347 †	3.068		
Ln-$(X2)^2$	β_8	0.350 †	3.124		
Ln-$(X3)^2$	β_9	-0.073	-1.359		
Ln-$(X4)^2$	β_{10}	0.282	1.510		
Ln-$(X5)^2$	β_{11}	0.193 †	3.203 †		
Ln-$(X6)^2$	β_{12}	-0.065	0.959		
(X1)*(X2)	β_{13}	-0.379	-2.077		
(X1)*(X3)	β_{14}	-0.142	0.952		
(X1)*(X4)	β_{15}	-0.089	-0.428		
(X1)*(X5)	β_{16}	0.132	-0.797		
(X1)*(X6)	β_{17}	0.036	0.260		
(X2)*(X3)	β_{18}	0.318 †	2.826 †		
(X2)*(X4)	β_{19}	-0.391	2.255		
(X2)*(X5)	β_{20}	-0.089	-0.621		
(X2)*(X6)	β_{21}	0.064	0.338		
(X3)*(X4)	β_{22}	0.083	0.588		
(X3)*(X5)	β_{23}	-0.294 †	-2.961 †		
(X3)*(X6)	β_{24}	-0.256	-1.795		

(X4)*(X5)	β_{25}	-0.151	-0.619		
(X4)*(X6)	β_{26}	-0.379	-1.807		
(X5)*(X6)	β_{27}	0.242	1.840		
Sigma Square	σ^2	0.213 †	6.257 †	0.077	8.583
Log Likelihood Function		135.288		90.94	
Sigma	σ	0.461		0.277	
Sigma-Squared (u)	σ_u^2	0.212		0.074	
Sigma-Squared (v)	σ_v^2	0.001		0.003	
Lamda (σ_u / σ_v)	λ	14.569		4.945	
Gamma	γ	0.994 †	277.196 †	0.963	61.912
Mu	μ	-0.929 †	-6.384 †	68.916	
LR test of the one-sided error		123.678		83.77%	
Mean Efficiency					

Note : † , † † , Significant at 1% and 5% respectively.

7.6 Factors Effecting Technical Efficiency

The censored regression or Tobit model was applied to determine the impact of socio-economic and managerial capabilities on technical efficiency in furniture industry in Sri Lanka. For this model, TE of each firm considered as dependent variable and 8 explanatory variables which were reflecting the managerial capabilities and socio-economic status of producers were selected. The results of the Tobit function was performed in table 6. All selected variables are positively associated with TE and unless α_7 all other variables were significant at 0.01 level. Among education and Experiences, the experience in furniture industry have acquired the big share of Tobit function indicating that experience can more influence on TE rather than education. Since all other variables are Dummy variable, researcher measured exponentiated value of respective parameter for better interpretation. The exponentiated coefficients are the best means of interpreting the impact of the dummy variable (Joseph F, Black, Barry, & Rolph E, 2010). The exponentiated coefficient of α_3 is 1.22 means that, trained producers have 22 percent higher TE score than untrained producers (1.22-1*100). Similarly, those producers who have own sale outlet for their product, their level of TE is 49% more than the producers who haven't sales outlet. Some producers have extra income sources rather than the furniture industry and such producers were reflected 11% greater technical efficiency of furniture industry than the producers who don't have extra income sources. Contact with supportive agencies directing marginal impact on TE compare to other variables. Producers attitudes on government supportive agencies were not satisfactory level and it was not much influences on TE of furniture industry in Sri Lanka.. Finally, the study found two important variables which have done greater impact on technical efficiency in furniture industry such as: usage of new equipment and type of final output. The producers, those who have produced final product (directly purchase by consumer) in the industry were gained 65% more benefit on technical efficiency than others. Beside, any producer may use new equipment in this industry can enhance their technical efficiency by 53 percent from current level.

Table 6: Inefficiency Model – Censored Regression

Variable	Parameter	Coefficient	T-Ratio	Exp(α)
Experiences in Furniture Industry (Years)	α_1	0.3042	5.712	1.35
Education (Years)	α_2	0.1383	2.510	1.15
Attended Training Courses (Yes=1, No=0)	α_3	0.1992	4.793	1.22
Availability of own Marketing Outlet(s) (1=Y,0=N)	α_4	0.3996	12.145	1.49
Other Income Sources (Yes=1, No=0)	α_5	0.1053	2.995	1.11
Usage of New Equipment's (Yes=1, No=0)	α_6	0.4262	2.768	1.53
Contact with Supportive Agencies (Good=1, OW=0)	α_7	0.0653	1.450	1.07
Type of output (Final =1, Semi-Final =0)	α_8	0.5033	10.318	1.65
Log Likelihood Function		71.904		

Source: Author's computation

8. Conclusions and Recommendations

This study mainly attempted to estimate technical efficiency of small-scale furniture industry in Sri Lanka and identify its determinants. The average technical efficiency of this industry was 69.5% or 30.5% below the potential. Further it was indicated that on average, the firm's output can further increase by 30.5% or cost can reduce by 30.5% without changing existing input level and technology.

The study also examined the relationship between producer's managerial capabilities and socio-economic attributes with technical efficiency of small-scale furniture industry in Sri Lanka. The results revealed that all selected variables were significantly impact on technical efficiency except contact with supportive agencies. If producers can use new equipment and final product they would be able to upgrade their TE more than 50%. Further, by selling their product in their own outlets without middlemen's engagements may further enhanced their efficiency around 50%. Education, experiences and training were also key determinants behind the technical efficiency in furniture industry. However, contact with government supportive agencies is only the factor that has found insignificant impact on TE. Another possible interpretation is that policies are not sufficiently strong or effective in helping in produce more efficiently. Although the government has established number of supportive agencies to support small-scale furniture industry during last decades, still they are functioning below the frontier level due to mismanagement practices of resources and technology.

References

Ali, M., & Byerlee, D. (1991). Economic efficiency of small farmers farmers in a changing World: A survey of Reasont evidence . *Journal of International Development*, 3(1), 1-27.

Baten, M., Abdulbasah, A., & Fatama, K. (2009). Technical Efficiency in Stochastic Frontier Production Model: An Application to the Manufacturing Industry in Bangladesh. *Australian Journal of Basic and Applied Science*, 3(2), 1160-1169.

Battese, G., & Corra, G. (1977). Estimation of production frontior Model: with Application to the Pastoral Zone of Eastern Australia. *Journal of agricultural Economics*, 21, 169-179.

Briec, W., Cavaignac, L., & Kerstens, K. (2010). Directional Measurement of Technical Efficiency of Production: An Axiomatic Approach. Perpignan: School of management, University Perpignan.

Dassanayaka, S. (2007). Brief note on Sri Lankan SMEs, *Paradigm Research Journal*, 10(1), 69-76.

Dassanayaka, S. (2009). A Case Study Based on Sri Lanka and Pakistan: The Development of Informal Sector Small and Medium Scale Enterprises Through Formation of Cluster and Networking . Business Review Journal , 1, 107-122.

Dassanayaka, S., & Sardana, G. (2010). A Research agenda: Small and Medium Scale Enterprises in Informal Sector in Parkistan and Sri Lanka. Euro Asia Journal of Management, 38(2), 85-102.

Farrell, M. (1957). The Measurement of Productive Efficiency . Journal of Royal Statistical Society, Series A, 120, 253-281.

Hassan, S., & Ahmad, B. (2005). Stochastic Frontier Production Function, Application and hypothesis testing. *International Journal of Agriculture and Biology*, 7(3), 427-430.

Joseph F, H., Black, W., Barry, J., & Rolph E, A. (2010). Multivariate Data Analysis (Seventh Edition). Pearson Prentice Hall.

Kachroo, J., Sharma, A., & Kachroo, D. (2010). Technical Efficiency of Dryland and Irrigated Wheat Based on Stochastic Model. *Agricultural Economic Research Review*, 23, 384-390.

Koddle, D., & Palm, F. (1986). Wald Criteria for Jointly Testing Equality and Inequality restriction. *Econometrica*, 54(5), 1243-1248.

Kumbhakar, S., & Lovell, C. K. (2000). Stochastic Frontior Analysis. Cambridge U.K: Cambridge University Press.

Kumbhakar, S., Soumandra, G., & Thomas, J. (1991). A Generalized Production Function Approach to Estimate determinants of Inefficiency in U.S Dairy farm. *Journal of Business and Economic statistics*, 9(3), 279-286.

Lovell, C. (1993). Production Frontier and Production Efficiency. Oxford: Oxford University Press. PP. 3-67.

Lovell, C. (2006). Production frontier and production efficiency, in Mariyono Joko' geographical Distribution of technical efficiency in Indonesian Production During the period of 1977-1994. *Journal Ekonomi Pembangunan*, 11(1), 33-48.

Russel, R. (1985). Measurement of Tehnical Efficiency. *Journal of Economic Theory*, 35(1), 109-126.

Sadoulet, E., & Janvy, D. (1995). Quantitative Development Policy Analysis. Baltimore: John-Hopking University Press.

Shephard, R. (1970). Theory of Cost and Production Function. Princeton: Princeton University Press.