

## Productivity Variation among Tea Small Holders in Uva Region, Sri Lanka

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### ABSTRACT

Sri Lanka is a leader in the world tea market as well as tea industry is a major contributor to the Gross Domestic Production (GDP) in the country. Tea small holders (TSHs) play a major role in tea sector accounting 70% of the total tea production. However the productivity varies among tea smallholders and there is a productivity gap between growers. Variation in productivity may directly affect on total tea production, unit cost of production and the profitability of the growers. The study was undertaken to examine the productivity variation among TSH's and to identify factors affecting on production efficiency. Badulla district in Uva region was selected for study and 116 smallholders were randomly selected covering all Tea Inspector (TI) regions from three District secretariats divisions. The study was based on primary and secondary data and pre-tested questionnaire was used to collect data. The study revealed that productivity of the small holders in Uva province was highly varied from 526-28968kg/ha/year. According to the Cobb-douglas production function, stochastic frontier model and the inefficiency model, the labour used, amount of fertilizer, Zinc cost, land, type of tea, experience and health condition of farmer and the intercropping were the major contributory factors for productivity variation. The mean technical efficiency of farmers was 52.65%. Optimum utilization of the land and labor resources, aware the smallholders on TRI recommendations and good agricultural practices like fertilizer and Zinc (Zn) application, introducing labour saving techniques would be the better strategies to minimize the productivity variation and improve the production efficiency of tea small holders in Uva province.

**KEYWORDS:** Cost of production, Productivity variation, Tea small holders, Technical efficiency

### INTRODUCTION

Tea is grown as one of the main export crops in Sri Lanka over the last three decades. It contributes significantly to the Gross Domestic Products (1%), total export earnings (12%) (Anon, 2011) and provides direct and indirect employment to over one million people which is 13% of the country's total labour force. Tea covers 12% of cultivated lands with agricultural crops representing different agro-ecological regions in Sri Lanka (Department of National Planning, 2010).

Tea plantations are categorized in to two major production sectors, the estate sector and the small holding sector. Tea small holding is defined by statute as having an area of less than 20 hectares in tea cultivation. Estate sector consists of state own estates (JEDB and SLSPC) and estates own by management companies. According to Ministry of Plantation Industries, in year 2011, extent of tea smallholding sector is 120,009 ha (59% of total extent). However, more than 80 % of tea small holders in Sri Lanka hold less than 0.2 ha of tea land (FAO, 2011). About 400,000 smallholders contribute 70% of the national tea production and the tea smallholding sector has become a central force in maintaining the tea economy of Sri Lanka (FAO, 2011).

However, today Sri Lankan tea industry is facing many challenges and among them low productivity, high cost of production and worker scarcity are crucial ones. Land productivity of tea sector in Sri Lanka is reported to be less than that of many other tea growing countries (eg. India, Kenya, Japan etc). Productivity of made tea of smallholdings is 1,974 kg/ha and tea production is 230 million kg and its contributed 69% of the total tea production (Sri Lanka Tea Board, 2011).

Even though, several programs (subsidy schemes for new planting, replanting, infilling & fertilizers and the extension services) were implemented to develop the tea small holdings sector, it can be noted that cumulative growth rates of productivity in small holdings were negative (-0.45%) during last decades. The productivity of tea small holdings varies from about 1000 to 2500 kg/ha/year in tea growing regions. Of these regions, the lower productivity levels are recorded in Kandy, Matale, NuwaraEliya and Badulla districts that comes under mid country, Up country and Uva Regions (Ministry of Plantation Industries, 2011).

Not only that but also, the productivity varies among tea small holders and there is a productivity gap between growers in same agro-climatic region. Basnayake and

Gunaratne, (2002) studied that the yield tends to vary approximately from 500 kg/ha of made tea to well over 5,000 kg/ha of made tea in the Yatinuwara Secretariat Division. According to Abhayapala, (2012), Extent of land, family labor, hired labor, fertilizer and dolomite were the main contributory factors for yield and age of farmer, education, occupation, type of crop and clone were the main contributory factor for efficiency in mid country wet zone. Further he found that, productivity among the tea small holders in the up country is highly varied (from 180 to 5436 kg/ha/year) due to the factors of family labor, hired labor, amount of fertilizer, chemical cost, health condition and experience of the farmers. Variation in productivity directly affect on total tea production, unit cost of production and the profitability of the growers. Productivity variation would be due to management factors or in other words inefficiency gaps. Therefore, in order to sustain this sector, efficiency and productivity differentials have to be reduced. This can be achieved by having an adequate knowledge and understanding of sources/determinants of the smallholder farmers' productivity variations. Understanding the relationship between productivity, policy indicators and farm-specific practices would provide information to design programs that can improve production potential among tea small holders.

Further, detail studies with this nature were not conducted in Uva tea small holdings fields. Keeping the crux of the above background in view, the present study was undertaken to compare productivity variation among the tea small holders, examine contributory factors for productivity variation and suggest appropriate strategies for improving productivity efficiency.

## MATERIALS AND METHODS

### Theoretical Framework

The following models were used to analyze the survey data and find out the factors which mainly contribute for the productivity variation.

Production function (Cobb-Douglas Model)

$$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + v_i - u_i \quad (1)$$

Where,  $\ln$  denotes natural logarithms to base  $e$ ,  $Y$ -output (kg of green leaf/ha/year),  $X_1$ -labor used (man days),  $X_2$ - extent of land (ha),  $X_3$ - fertilizers (kg),  $X_4$ - chemical cost,  $X_5$ -Zinc cost,  $\beta_i$ 's-unknown parameters to be estimated  $v_i$  denote the independently and identically distributed random errors  $N(0, \sigma^2)$ . These are

factors outside the control of the tea smallholder;  $u_i$  represents non negative random variables which are independently and identically distributed as  $N(0, \sigma U^2)$  and account for the inefficiency of productivity.

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + W_i \quad (2)$$

Where,  $Z_1$ - age of the farmer (years)  $Z_2$ - occupation (a dummy variable equal to one if the small holders involve only in tea holding, zero otherwise.)  $Z_3$ -health condition of the operator (value of a dummy variable is one if the smallholder is healthy, zero otherwise),  $Z_4$ - experience (years)  $Z_5$ - type of tea, (a dummy variable equal to one if VP tea is grown, zero otherwise);  $Z_6$ - variable practicing intercropping (a dummy variable equal one if practicing, zero otherwise),  $Z_7$ - education(number of years educated),  $W_i$ - unobservable random variables; and  $\delta_{10}$ - inefficiency parameters to be estimated.

### Location

Uva region consisted of two district; Monaragala and Badulla. Badulla district was selected for the study due to high number of tea smallholdings in the region and Monaragala district was excluded from the study due to the lower share of smallholdings in terms of production and extent. There are three District Secretariats (DS) divisions in Badulla district namely Welimada, Bandarawela and Hali-ela. The elevation of those areas is about 1300m above mean sea level. The average annual rainfall is between 1100-1400 mm and the monthly average temperature is between 15°C and 27°C (Department of Meteorology, 2012).

### Sample Selection

Sixteen Tea Inspector (TI) regions were identified from registered list available in the sub official regions (Bandarawela, Welimada and Hali-ela) of Tea Small Holding Development Authority (TSHDA) in Uva. Bandarawela, Liyangahawela, Ella, Ballaketuwa, Haputhale, Haldumulla (Bandarawela sub official region), Welimada, Boralanda, Loonuwaththa, Bambarapana (Welimada sub official region), Hali-ela, Atampitiya, Wapassawela, Passara, Lunugala and Badulla(Hali-ela sub official region) TI regions were selected for the study. Keeping time & financial constraints in view, sample size was determined at 90% confident level and 116 tea small holders were selected from the total population (29,942 of small holders). Number of small holders from IT regions was

decided according to the total number of small holders in the particular IT region and required sample was randomly selected from each TI region.

#### Data Collection

The study was based on primary and secondary data and the primary data were collected by well-designed pre-tested questionnaire from randomly selected small holders during March and April 2013. Socio-economic and other relevant factors were included in the questioner in order to achieve the objectives. Identified social factors were working experience of small holders, household size, frequency of accessing extension services, education level, usage of family and hired labour, health condition, age of farmers, adaptation of recommended technologies, level of management, and knowledge on tea cultivation. Tea price, cost of production, investment on tea farming were identified as economic factors and general factors were age of tea bushes, area under tea, type of cultivars propagated, pruning cycle and bush density. Secondary data were collected from various published and unpublished documents.

#### Data Analysis

Both qualitative and quantitative data analysis techniques were used to analyze the data. Cobb Douglas production function and the stochastic production frontier were used to identify productivity variation among small holders and to determine the factors affected

to the productivity variation with the help of STATA 11 package.

## RESULTS AND DISCUSSION

### Descriptive Statistics

Findings of the survey showed that age range of the small holders was 28 to 83 years. Majority belonged to 40-59 age category and it's accounted for 52.90% of the sample. About 35% of the sample had completed up to O/L and 23% of the sample completed the secondary education. Few small holders in the sample were not schooling (1.7%). Majority of the small holders (76%) were male. Experience of the farmers varied from 3 to 60 years and average experience of farmers was 20 years. Annual income from tea farming varied from Rs. 7926 to Rs. 568,808 in Uva region and average annual income was Rs. 123,050.

The study found that the productivity among the tea small holders in the Uva province was highly varied from 526.11 to 28968.16 kg green leaf/ha/year. Among the small holders, about 53.44% of holders produced less than 5000kg green leaf/ha/year while 13.79% of holders produced more than 10000 kg of green leaf/ha/year. The average green leaf output was 6140 kg/ha/year. Small holders used both family and hired labour. The average number of family labor and hired labor used by small holder was 382 and 353 man days/ha/year, respectively (Table 1).

It was revealed from the Cobb-Douglas model that labor used, land extent, amount of fertilizer and Zinc (Zn) cost had significant positive impacts on tea production of small holders in Uva region.

**Table 1. Summary statistics of variables in the stochastic frontier production functions**

| Variables                           | Sample mean | Standard deviation | Minimum value | Maximum value |
|-------------------------------------|-------------|--------------------|---------------|---------------|
| Output (green leaf – kg/ha/yr)      | 6140        | 5439               | 526           | 28968         |
| Family labour used (man days/ha/yr) | 382         | 644                | 0             | 5237          |
| Hired labour used (man days/ha/yr)  | 353         | 723                | 0             | 7024          |
| Extent of land (ha)                 | 0.44        | 0.42               | 0.05          | 2.83          |
| Quantity of fertilizer (kg/ha/yr)   | 1225        | 701                | 0             | 3952          |
| Chemicals cost (Rs/ha/yr)           | 2734        | 4584               | 0             | 34580         |
| Zinc (Zn) cost (Rs/ha/yr)           | 247         | 380                | 0             | 1921          |
| Age of famers (years)               | 56          | 11                 | 28            | 83            |
| Experience (years)                  | 20          | 13                 | 3             | 60            |
| Education (years)                   | 10          | 4                  | 0             | 17            |

**Table 2. Parameter estimates of the production function (cobb-douglas model)**

| Variables              | Parameters | Co-efficient | Standard Error | P Value |
|------------------------|------------|--------------|----------------|---------|
| Constant               | $\beta_0$  | 6.489863*    | 0.3679         | 0.000   |
| Labor used             | $\beta_1$  | 0.0478027*   | 0.0222         | 0.034   |
| Extent of land         | $\beta_2$  | 0.9629415*   | 0.0911         | 0.000   |
| Quantity of fertilizer | $\beta_3$  | 0.162217*    | 0.0566         | 0.005   |
| Chemical cost          | $\beta_4$  | -0.031168**  | 0.0176         | 0.080   |
| Zinc cost              | $\beta_5$  | 0.1055786*   | 0.0263         | 0.000   |
| $\sigma^2$             |            | 0.888        |                |         |
| $\Gamma$               |            | 0.780        |                |         |
| Log-likelihood         |            | -113.56      |                |         |
| LR-Test                |            | 8.76         |                |         |

\*, \*\*, Significant at 5% and 10% probability level

**Table 3. Determinants of production inefficiency**

| Variables     | Parameters | Co-efficient | Standard Error | P Value |
|---------------|------------|--------------|----------------|---------|
| Constant      | $\delta_0$ | 0.7129*      | 0.1119         | 0.000   |
| Age           | $\delta_1$ | 0.0023       | 0.0014         | 0.100   |
| occupation    | $\delta_2$ | 0.0042       | 0.0266         | 0.873   |
| Health        | $\delta_3$ | -0.1363*     | 0.0383         | 0.000   |
| experience    | $\delta_4$ | -0.0025*     | 0.0012         | 0.043   |
| Type of tea   | $\delta_5$ | -0.2967*     | 0.0393         | 0.000   |
| Intercropping | $\delta_6$ | -0.1472*     | 0.0288         | 0.000   |
| Education     | $\delta_7$ | 0.0115*      | 0.0041         | 0.006   |

\*, Significant at 5% probability level

**Table 4. Problems faced by tea small holders**

| Constraint                           | Percentage |       |
|--------------------------------------|------------|-------|
|                                      | Yes        | No    |
| Lack of knowledge                    | 39.65      | 60.34 |
| No institutes to get knowledge       | 12.07      | 87.37 |
| Lack of suitable land                | 33.62      | 66.37 |
| Labor shortage                       | 43.10      | 56.89 |
| Increasing COP                       | 39.65      | 60.34 |
| Lack of infrastructure facilities    | 32.75      | 67.24 |
| Problem of receiving raw materials   | 35.34      | 64.65 |
| Low price for the green leaves       | 84.48      | 15.51 |
| Problems in green leaf selling       | 6.03       | 93.96 |
| Difficult to compete with estate     | 5.17       | 94.82 |
| Difficulties on getting of loans     | 20.68      | 79.31 |
| No organization to get of loans      | 18.96      | 81.03 |
| Difficulties in transport facilities | 20.68      | 79.31 |

The calculated co-efficient for labor used, land extent, amount of fertilizer and Zinc cost showed 0.047802, 0.9629415, 0.162217 and 0.1055786, respectively. It explained that the increment of inputs like labor force, land extent, amount of fertilizer and Zn cost gives the positive impact to the final output. The co-efficient for the chemical cost showed negative value of 0.031168 and it is significant at 10% probability level (Table 2). Chemical cost showed a significant positive value according to the findings of up country survey results (2012) while mid country results (2002) were not significant value. The mean value of technical efficiency in the tea small holdings under the study area was found to be as 52.65% according to the results of frontier programme and it revealed that the output could be increased by 47.35% when all

farmers achieved technical efficiency level of the best farmer. The technical efficiencies of tea small holdings in Uvaregion varied from 17.09% to 99.71%.

According to the results of inefficiency model displayed in the (Table 3), the coefficient of health condition and experience of smallholder, type of tea and intercropping showed negative significant values and it indicated that the healthy, experienced farmers and small holders who use vegetative propagated (VP) tea were found to be more efficient than others. According to the findings of up country (2012) and mid country (2002) the age and the education level also showed significant negative values.

The problems faced by the tea small holders in Uva region were also studied and presented in (Table 4). Low price received for

the green leaves was a major constrain for majority of farmers (84% of sample). Lack of knowledge, lack of suitable lands for cultivation, labour shortage, lack of awareness, lack of infrastructural facilities, difficulties in receiving raw materials and high cost of production were also highlighted as hindrances for small holders in study area.

#### CONCLUSIONS

The results revealed that productivity among tea small holders in Uva region is highly varied (from 526.11 to 28968.16 (kg/ha/year). Labor used, amount of fertilizer, Zinc cost, cultivated land, health condition & experience of the small holders, type of tea and the intercropping were identified as the contributory factors for productivity variation among tea small holders in Uva region. Also the efficiency of small holders varied from 17.09% to 99.71%. Optimum utilization of the land and labor resources, aware the small holders on TRI recommendations and good agricultural practices like fertilizer and Zinc application, introducing labour saving techniques like mechanization of appropriate agricultural practices would be the better strategies to minimize the productivity variation and improve the production efficiency of tea small holders in Uva province.

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