

Assessing the Influence of Labour Scarcity in Tea Plantations in Sri Lanka

H W Shyamalie, B M N C Karunarathna, H M C G Pilapitiya, P T P Lakshani,
I H T Chathuranga and K W N Nadeeshani

*Agricultural Economics Division,
Tea Research Institute of Sri Lanka*

ABSTRACT

Tea industry is a labour intensive industry and worker scarcity is being felt as a major impediment in tea sector. The objectives of this study were (i) to calculate supply and demand gap of the tea plantation workers and severity percentage of each selected estate (ii) to calculate annual labour declining rates in different tea growing regions (iii) to assess the effect of severity of labour scarcity on the productivity and cost of production in tea plantations. Time series data for ten-year period were collected from the estate records and stratified random sampling technique was used to select 66 sample estates. The results showed that compound annual labour declining rates in Up, Mid, Uva and Low-Country were 2.94%, 4.87%, 4.22% and 5.06%, respectively. Monthly severity level of each estate was calculated by using the gap between number of required and available workers. It was revealed that average productivity level declined with the increase of labour scarcity and means productivity difference increases with raise of severity of labour scarcity. There is a strong negative correlation between productivity levels and cost of production. Since these findings highlighted the importance of identifying solutions to worker scarcity, responsible authorities have to take actions either to attract and retain worker in tea plantations or to promote mitigation measures such as adopting labour efficient techniques; *e.g.* mechanization of field practices or employing different farming models or introducing labour bank to this problem for the sustainable tea industry in Sri Lanka.

Keywords: Compound annual worker declining rates, productivity level, severity of labour scarcity

INTRODUCTION

Sri Lanka's overall economic and social development is highly dependent on the growth and development of the tea sector. The contribution of the tea sector (green leaves) to the GDP is 0.7% by 2018 (Central Bank, 2018). Currently, tea is the leading cash crop in Sri Lanka which makes significant contribution to the economy. In the year 2018, the country produced 303.8 million kg of made tea, earning Rs. 231 billion in foreign exchange (Central Bank, 2018). This represents about 11.99% of the total export earnings. About 1.5 million people (about 8% of the total population) derive their livelihoods from the tea industry. Among the plantation economies, a majority belongs to tea sector (88%), with the highest workers per hectare value of 2.87 than it places on rubber and coconut (Ekanayake, 1995).

In tea cultivation, the most labour intensive activity is the harvesting which accounts for about 65-70 percent of the workforce on the estate and 40-45 percent of the total cost of production (COP). Fertilizer application continues to be a manual operation; the worker days involved being almost the same for most of the fields, except the fields with very high productivity. High yielding fields require additional rounds of fertilizer application which, in turn, involve more workers. Technical opinion of weeding is that weeds in the tea fields are to be controlled, not eradicated. Due to Maximum Residue Level (MRL) issues, environmental concerns, health of flora, fauna and human concerns, chemical weed control is advised to be limit, which on the other hand, promotes manual weeding and cultural practices which is laborious and time consuming. Pruning is important for maintaining the tea bush in the right form and height for growing and plucking and it is also a worker intensive activity. Worker requirement differs with the

levels of land and labour productivity and for maintaining one hectare of tea land yielding 1000 kg of made tea required 533 worker days and worker requirement for high yielding fields is gradually increased.

At present, the extent of tea (201,000 hectares) land in Sri Lanka remains unchanged (Central Bank, 2018). However, number of registered workers in plantation sector has been declined by 42% from 304, 405 in 1990 to 161,557 in 2016 (MPI, 1990; MPI, 2016). This implies that the labour scarcity is being felt as a major impediment in tea sector and the degree of labour scarcity in the tea estates decides the sustainability of tea industry as labour availability is the most important inputs in tea cultivation.

The term "labour shortage" means a positive gap between labour demand and supply at current wage levels. In general, most of the literature identifies demand side and supply side factors for labour shortage (Barnow, Schede, and Trutko, 2010, Blank and Stigler, 1957, Trendle, 2008, and Shah and Burke, 2003 for demand side interpretations for labor shortage). Shah and Bruke (2003) identified changes in technology, work organization, shifts in consumer tastes, commodity price changes or demographic shifts as main reasons for change in labor demand. In Sri Lanka considerable changes have taken place both in the estate sector and the macro environment that have influenced the supply and demand situation of workers in tea plantations. Worker supply of the estates is mainly depending on two factors as the availability of workers who are willing to work in the estates in the vicinity and the frequency which they report to work in the estates when work is offered (Dunham *et al.* 1997).

Given the stigma attached to work in the estates, traditional management practices and the harsh working conditions due to the nature of the work, the estate inhabitants, more educated and politicized youth in particular, do not give preference to estate employment (Dunham *et al.* 1997; NIPM, 1998). To aggravate the problem, even the workers who remain in the estates do not report to work regularly when the work is offered. Dharmadasa and Zoysa (2012) studied determinants of labour outmigration from tea plantation sector in Badulla district and found that experience of household head in tea estate work, family size, total income from tea, number of dependents in a family and race affect the migration decision negatively. Prasad (2014) conducted a field survey in Banda and Hamirpur district of Bundelkhand region, Uttar Pradesh and observed four main causes of agricultural labour shortage in the rural areas *i.e.*, rural out-migration, labour bank, disinterest of rural youth in agriculture, and political influence of leader on labour.

Labour shortage of the tea sector affects all the agricultural practices, especially harvesting and it leads to reduce land productivity. As a result of plucker unavailability, plucking round could be extended and reduce tea yield and negatively affect to the leaf standard with high percentage of coarse leaves. Labour scarcity in tea sector affects not only agricultural practices, but also land development programmes such as new planting; replanting; and infilling of vacancies. Prabakar *et al.* (2011) studied immensity of labour scarcity and its impact on agriculture in Cuddalore district of Tamil Nadu and revealed that prevalence of acute labour scarcity affected the productivity levels of almost all crops and is even leading towards the permanent changes in the cropping pattern. Further, the

study has observed a significant difference in the average productivity between the labour-scarcity-affected and unaffected farms. A field survey carried out by Prasad (2014) found that the consequence of labour shortage in agriculture is changes in cropping pattern and land market.

The present study is focused to assess the influence of labour shortage on tea plantations (Tea plantations with extent of cultivation greater than 50 acres were considered as large tea plantations) in Sri Lanka. Main objectives of this study were to calculate supply demand gap of the tea plantation workers and severity percentage of each selected estate, to calculate annual labour declining rates in different tea growing regions and to assess the effect of severity of labour scarcity on the productivity and cost of production in tea plantations.

MATERIALS AND METHODS

Sampling procedure

The study was undertaken in corporate sector tea estates representing all Up, Mid, Uva and Low-Country region in Sri Lanka. Stratified Random Sampling technique was used to select sample estates, which are facing a problem of labour shortage and total number of 66 estates in Up (30), Mid (12), Uva (12) and Low-Country (12) were covered in this study (Table 1)

Table 1. Sampling procedure

Region	Total number of estates	Sample
Up	128	30
Mid	51	12
Low	49	12
Uva	55	12
Total	283	66

Collection of data

The study was based on secondary data obtained from the estate records for ten-year period, from year 2006 to 2016. The monthly progress reports and financial accounts of each tea estate were used as data sources. Data were collected on changes of annual workforce, yield in terms of made tea

(kg/ha/yr), tea extent (ha), monthly worker availability (worker/ha), type of tea, use of mechanical devices and other worker deployment models, monthly worker requirement and cost of production (COP) from each selected estate.

Analytical procedure

Compound annual labour declining rate

Compound annual labour declining rate was calculated by using following equation for the ten-year period of time.

$$\text{Compound Annual Declining Rate} = \left\{ \left(\frac{\text{Starting Value}}{\text{End Value}} \right)^{1/t} - 1 \right\} \times 100$$

Where,

t = number of years

Supply - Demand Gap Analysis and calculating labour severity percentage

For the easiness of analysis, results were categorized into four groups namely, severe (worker availability is lesser than 50% of the requirement), average (worker availability is 50 – 75%), low (worker availability is 75-100 %

of requirement) and excess (worker availability exceeds requirement).

Percentage of severity was calculated by using the following formula.

$$\text{Severity (\%)} = \frac{\text{Demand supply gap} = \text{worker requirement} - \text{worker availability}}{\text{Total worker requirement}} \times 100$$

The demand supply gap was assessed by considering the monthly available man days in each estate (supply of worker) and the monthly worker requirement (demand for worker).

Regression analysis

Multiple regression model was employed to determine the relationship between land productivity and field characteristics and input use.

Descriptive analysis

Descriptive analysis was used to calculate mean productivity level in each severity group and the general information of the sample estates.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e$$

Where,

Y = average productivity (kg/ha/yr)

X_j = field characteristics and input use of i^{th} estate

$j = 1, 2, 3, 4, 5,$

X_1 – Extent in bearing (ha)

X_2 – Labour availability (No. of worker days)

X_3 – Type of tea (Dummy variable, If VP=1, otherwise =0)

X_4 – Use of mechanical devices (Dummy variable, if use=1, otherwise=0)

X_5 – Practice alternative worker deployment models (AWDM) (Dummy variable, if practice=1, otherwise=0)

β_i 's- Unknown parameters to be estimated

e- Error term

Pearson correlation

Pearson correlation was used to identify correlation between productivity level and cost of production

Pair wise comparison

Pair wise comparison was done to compare the productivity changes of estates affected by labour scarcity with respect to estates not affected by worker scarcity.

RESULTS AND DISCUSSION

Characteristics of sample estate

Average productivity, extent in bearing and use of mechanical devices and alternative worker deployment models were analysed and given in table 2, 3 and 4.

Table 2. Average land productivity of sample estates

Yield category	Number of estates	As %
> 1000	28	42
1001-1600	26	39
<1600	12	18
Total	66	100

Average productivity of 28 sampled estates (42% of the sampled estates) was below 1000 kg/ha/year. However, 18% of the sampled estates belonged to productivity category of above 1600 kg/ha/yr.

Table 3. Extent in bearing of sample tea estates

Extent in bearing (ha)	Number of estates	As %
>150	20	30
150 - 250	22	33
< 250	24	36
Total	66	100

Extent in bearing of sample estates were grouped in to three categories and approximately one third of the estates were categorized in to each group (table 2).

Table 4. Use of mechanical devices and alternative worker deployment models

Techniques	No. of estates	As %
Use of mechanical devices	20	30
Use of alternative worker deployment models	17	26
Total	66	100

Information on use of mechanical devices and alternative worker deployment models is also gathered and presented in table 4. Of the total sample estates, 20 estates used mechanical devices, while 17 estates have adopted different alternative worker deployment models (Table 4).

The data presented in figure 1 showed a gradual decline of average workforce in Up, Mid, Uva and Low-Country over the period of time.

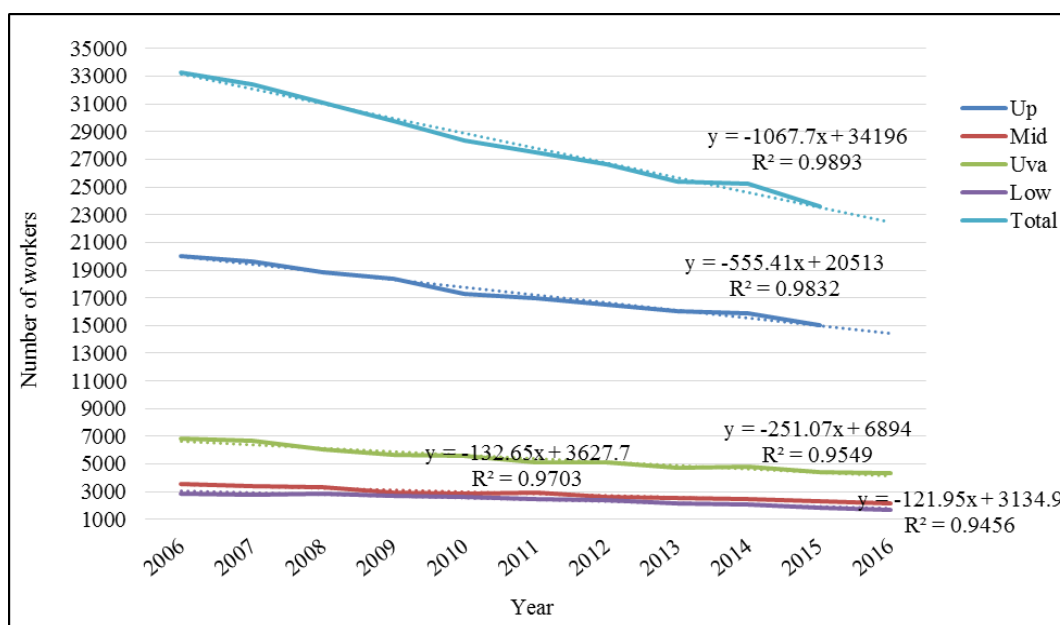


Figure 1. Annual variation of workforce in different tea growing regions

The rate of change in labour per unit change in year was highest in the Up-Country while the lowest value can be observed in the Low-Country.

Table 5 represents the compound annual workforce declining rates in all tea growing regions over the last 10 years period of time.

It was revealed that the highest compound annual declining rate was observed in the Low-Country and it was 5.06%. The lowest value was recorded in the Up-Country as 2.94% and declining rates in Mid-Country and Uva region were 4.87% and 4.22%, respectively.

Table 5. Compound annual labour declining rate (%)

Region	Worker availability		Annual labour declining rate (%)
	2006	2015	
Up	20029	14994	2.94
Mid	3523	2334	4.87
Uva	6812	4430	4.22
Low	2891	1824	5.06

Table 6. Mean productivity levels of estates under different labour severity levels
(kg of made tea/ha/month)

Severity level category	Mean monthly productivity
Adequate/excess	118.27
Less (worker availability is higher than 75% of requirement)	115.56
Average (worker availability is 50-75 % of requirement)	101.06
Severe (worker availability is less than 50% of the requirement)	92.65

Severity of worker shortage in tea plantations was studied by collecting secondary data from the estate records. The gap between required number of workers and available number of workers was used to calculate the monthly severity level of

each estate. Estates were categorized in to four groups based on its severity of worker shortage. Mean productivity level in each severity level was calculated and data presented in Table 6. It clearly shows that mean monthly productivity level declined with the increase of worker scarcity.

Table 7. Results of regression analysis

Variables	Standardized coefficient	Std. error	T value	Significance
(Constant)	155.27	275.85	0.56	0.577
Extent	1.405*	764	1.84	0.074
Labour availability	0.008	0.007	1.18	0.248
Type of tea	579.31**	163.55	3.54	0.001
Use mechanical devices	249.19	178.17	1.40	0.171
AWDM	469.80*	183.94	2.55	0.015

* and ** denote, coefficients are significant at 1% and 5% probability level, respectively

Coefficient of determination (R^2) was 0.50, that means approximately half of the observed variation can be explained by the model. Results obtained from multiple regression analysis imply that labour availability is a positive factor for productivity of the estate. In addition, extent in bearing, VP tea and practice alternative worker deployment models are significant positive

factors of estate productivity. However, use of mechanical devices was a positive non-significant factor of the productivity. The estates used mechanical devices for small extent during few months of the year. This may be the reason for the above results.

A Pairwise comparison was conducted to compare the productivity changes of estates affected by worker scarcity with respect to estates not affected by worker scarcity.

Table 8. Mean difference of productivity levels between labour scarcity affected and not affected estates (kg of made tea/ha/month).

Severity level category (a)	Severity level category (b)	Mean Difference of productivity (a-b)	Change as %
Adequate/excess	Less (worker availability is higher than 75% of requirement)	2.71	2.29
	Average (worker availability is 50-75 % of requirement)	17.21	14.55
	Severe (worker availability is less than 50% of the requirement)	25.61	21.66

Table 8 shows the mean difference of productivity levels and percentage value of mean productivity differences between labour scarcity affected estates with respect

to labour scarcity not affected estates. The results confirmed that mean difference of productivity increase with raise of severity of labour scarcity.

Table 9. Correlation between productivity level and cost of production

Region		Productivity (Kg/ha)
COP (Rs/Kg) (Deflated value)	Up-Country	Pearson Correlation
		Sig. (2-tailed)
	Mid-Country	Pearson Correlation
		Sig. (2-tailed)
	Uva	Pearson Correlation
		Sig. (2-tailed)
	Low-Country	Pearson Correlation
		Sig. (2-tailed)

** denotes, coefficients are significant at 1% probability level.

Pearson correlation was computed to identify correlation between productivity level and cost of production. It was revealed from the analysis that there is a strong negative correlation between productivity levels and cost of production (Table 9), which means reduction of productivity levels directly affect to increase the cost of production in tea plantations. According to results, worker shortage directly affects to reduce tea land productivity, which leads to increase cost of production. Finally, it can be stated that

worker scarcity in tea plantations not only affect productivity levels, but also cost of production which leads to lower the profit margin of tea estates.

CONCLUSIONS

According to the results, the highest compound annual labour declining rate was observed in the Low-Country and the lowest rate was in the Up-Country. Extent, VP tea and practicing AWDM were the significant positive factors of land productivity of sample estates, whereas labour availability and use of mechanical devices were the positive non-

significant factors. Moreover, results indicate that mean productivity levels were declined with the increase of labour scarcity. It was also discovered from the analysis that there is a strong negative correlation between productivity levels and cost of production, which means decrease of productivity cause to increase the cost of production in tea plantations, finally to lower the profit margin of tea estates.

Above findings highlighted influence of labour scarcity on large scale tea plantations in Sri Lanka and the importance of identifying solutions to overcome worker scarcity in large tea plantations. The farmers have adopted various strategies to overcome labour shortage in agriculture such as use of family labour, increased use of machinery, hired labour from outside the village and practiced alternative worker deployment models. Prasad (2014) also reported that mechanization in agriculture is the best alternative for labour shortage but it has some limitation such as costly, high maintenance charges, *etc.* Further, he found that labour bank in rural areas and involvement of it in agriculture is the best strategy to overcome labour shortage in agriculture.

The responsible authorities have to promote mitigation measures such as promoting mechanization of field practices, employing different worker deployment models, increasing efficiency of existing workforce, establishing labour bank *etc.* to overcome this problem. In addition, responsible parties have to take actions to retain and attract workers in tea plantations for the sustainability of tea industry in Sri Lanka.

REFERENCES

- Barnow B S, Schede J and Trutko J W 2010 Occupational Labour Shortages: Concepts, Consequences, and Cures. Report prepared for Alfred P. Sloan Foundation.
- Blank D M and Stigler G J 1957 The demand and supply of scientific personnel. New York, National Bureau of Economic Research.
- Central Bank 2018 Annual Report Central Bank of Sri Lanka
- Dharmadasa R A P I S and De Zoysa M 2012 The Determinants of Labour Outmigration in Tea Plantation Sector in Badulla District. *In: Proceedings of Jaffna University International Research Conference (JUICE-2012)*, pp. 1-8. March 2014, Sri Lanka
- Dunham D M, Arunatilake N and Perera R 1997 The Labour situation on Sri Lanka Tea Estates - a view to 2005. Institute of Policy studies of Victoria University of Welling. 13.
- Ekanayake A 1995 Future Prospects and Threats. *Economic Review*. 21 (6), September, 1995.
- MPI 1990 Statistical Information on Planation Crops. Ministry of Plantation Industries of Sri Lanka
- MPI 2016 Statistical Information on Planation Crops. Ministry of Plantation Industries of Sri Lanka
- NIPM 1998 Managing Social Change in Plantations, National Institute of Plantation Management, Athurugiriya
- Prabakara C, Sita Devia K and Selvamb S 2011 Labour Scarcity – Its Immensity and Impact on Agriculture. *Agric. Econ. Res. Rev.* Vol. 24, 373-380.

Prasad S 2014 MGNREGA: A strategy to overcome labour shortage in agriculture Int. J. Agr. Ext. 02(01) 2014. 57-64.

Shah C and Bruke G 2003 Skills Shortages: concepts, measurement and implications. Working Paper No. 52. Centre for the

Economics of Education and Training. Monash University. Victoria, Australia.

Trendle B 2008 Skill and Labour Shortages - definition, cause and implications. Working Paper No. 54. Department of Education, Training and the Arts, Government of Queensland. Brisbane, Australia.