

## Factors Affecting on Adoption to Factory Automation in Low Country Tea Manufacturing Process

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### Introduction

The legacy of Sri Lankan tea industry shows that Sri Lanka is one of the oldest tea producing countries in the world. The tea produced in this country is popularly known as “Ceylon Tea” and ranks among the best available teas in the international trade. Over the years, the word Ceylon has become synonymous with quality tea.

Sri Lanka’s tea cultivators and manufacturers are the custodians of the traditional, orthodox method of black tea producers. This method is still agreed by most experts to produce the best black tea. Even with the technological improvements introduced to the tea industry over the last thirty or forty years, the orthodox method is relatively slow and labour-intensive method. In tea industry worker productivity plays an important role (Mohamed and Zoysa, 2006). Arising the worker shortage and Lower efficiency of workers in recent time Sri Lanka tea industry has faced several problems. Labour availability in the tea industry has declined by 50 % from the 1980s. Other than, the wage rate has catapulted from Rs 290/- five-years back to Rs 620/- as at 2013 which is an increase of 114%. But the net sales prices from the auctions reveal that in 2008 the average was at Rs 310/- per kg and today the prices are at around 400/- which reflects only a 29% increase. Therefore cost of production has increased significantly. Automation of tea processing, is a best solution to minimize over-dependence on workers and improve efficiency of the stages in manufacturing process. Automated tea processing systems able to convert the tea processing industry with state of the art material moving conveyor systems and other automation facilities. This has successfully improved the quality and quantity of the tea output from the tea production process. Even though it gains more benefits to the industry only a few have modernized to a notable degree (Kodithuwakku and Priyanath, 2007).

But there are no studies that help to identify the current situation of adoption of factory automations in Sri Lankan tea industry. Therefore this study aimed to determine the factors that influence the adoption to factory automation in tea manufacturing.

### Methodology

The study was carried out in low country where high numbers of registered tea factories are available in Sri Lanka. The population of the study was all registered tea factories situated in low country. Fifty tea factories were drawn to the sample from Galle, Matara and Rathnapuara districts using stratified sampling technique and data was collected by means of structured questionnaires. The questionnaire was formulated to identify factors affect on adoption to factory automation in tea manufacturing and preliminary factors were recognized through literature review. Qualitative data was collected with the aid of five point likert scale (Highly agreed- 5, Agreed- 4, About 50/50 either way- 3, Disagreed- 2, Highly disagreed- 1). Collected data was analyzed using SPSS software. Ordinal logistic regression was used to find out the relationship between the adoption level and explanatory variables.

### Empirical model

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \epsilon$   
Where  $\beta_0$  to  $\beta_{10}$  = coefficient and  $\epsilon$  = error term (Table 1)

Table1. Descriptive of variables for empirical model

Notation	Description	Remarks
Y	Adoption for automation	Fully = 3 , Semi = 2 Manual = 1
X <sub>1</sub>	Production capacity	Kg/ day
X <sub>2</sub>	Attitude	Attitude index
X <sub>3</sub>	Company ownership	company = 1, Otherwise = 0
X <sub>4</sub>	Government	government = 1,Otherwise = 0
X <sub>5</sub>	Leaf Source	If own teas = 1,Otherwise = 0
X <sub>7</sub>	Quality certifications	If certification =1,Otherwise=0
X <sub>8</sub>	Experience of manager or owner	Working years
X <sub>9</sub>	Labor shortage	If yes = 1, Otherwise = 0
X <sub>10</sub>	Knowledge (awareness) about technology	If good =1, Moderate=2, Bad=3

### Result and Discussion

According to table 2, the resulted “p” values in the ordered logistic estimation, the adoption of factory automation in tea manufacturing was significantly determined by production capacity of the factory, attitude of the manager or owner, experience of the manager, quality certificates, private owned tea factories and good knowledge regarding automation at 5% significant level. According to the analysis there was no significant relationship between leaf sources, company and government owned tea factories and moderate level knowledge managers at any significant level. Based on the statistically significant coefficients, quality certificates were an important determinant to adoption to factory automation, but the effect is negative. That means decreasing affinity to adapt to automation is increased by no availability of quality certificates for particular tea factory. Effects of the production capacity of the factory, attitude of the manager, experience of the manager were given positive effect. This means increasing affinity to adapt automation is increased by those variables while given all of the other variables in the model are held constant. And also model explains up to 78.8 % of variation of adoption to factory automation in tea manufacturing. This means the portion of the total variation in the independent variable is explained by the variation in the independent variables.

Table 2. Results of the ordinal logistic regression

Variable	Estimated coefficient	Sig. value
Level = fully	39.793	0.001**
Level = Manual	34.762	0.001**
Capacity	0.0001	0.014**
Attitude	0.815	0.006**
Experience	0.355	0.010**
Ownership1(Company)	-0.878	0.703
Ownership2(Private)	2.595	0.019**
Bought leaves	2.459	0.186
Labor shortage	1.376	0.254
Quality certificates(No)	-11.628	0.000**
Knowledge		
Good	3.798	0.02**

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Moderate	2.269	0.202
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\*\* Significant at  $p = 0.05$ ,  $R^2 = 78.8\%$

### Conclusion

The adoption of factory automation is significantly determined by production capacity, attitude of the manager, experience of the manager, private owned tea factories, quality certificates and knowledge on automation.

### References

Kodithuwakku, S., Priyanath, H.M.S., 2007. Reasons for the Improvement of labor productivity in tea plantations after privatization with special reference to the estate laborers in the Ratnapura district. Sabaragamuwa University of Sri Lanka, 2-11.

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