IOSR Journal of Business and Management (IOSR-JBM)
e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 20, Issue 9. Ver. III (September. 2018), PP 64-73
www.iosrjournals.org

Factors Affecting Natural Rubber Production: Case Studyof Small Rubber Farmers In Kalutara District, Sri Lanka

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Abstract: *The study examined the determinants of small rubber production with special reference to Kalutara District, Sri Lanka. Data were collected through structured questionnaires from 389 respondents selected through random sampling technique. Further, in-depth interview were conducted to gather more information relating to the issues faced by rubber farmers. To verify these issues we have interviewed 20 rubber extension officers in the regional office of Rubber Department in Kalutara. The coefficient of the production function was estimated using multiple regression equation. The summary of the demographic characteristics of the respondents showed that majority of the small rubber farmers were ageing since a greater percentage of the rubber famers were above 45 years. None of the respondents was below 20 years and therefore, they have relatively higher experienced in rubber production. Also, the level of education was low among the majority of the respondents and about 20% of total respondents had no formal education while 54% had completed only primary education.*

Results further revealed that variables such as input cost, credit facility, fertilizer subsidiary, land size, experience, hours spent on rubber activities, inter-cropping and number of family members age, are positively related to output while education level is inversely related. However, fertilizer subsidiary, size of the land, farmer's experience and number of labor hours spent on production have significant impact on rubber production. Education level has significant negative impact on rubber production. The negative sign of education implies that majority of the respondent have low level of education and it has negative effect on production. More educated farmers could be easily catch-up new technologies and know-how in relating to the industry. Thus.it will enhance the production. The efficiency analysis showed that farmers in small rubber industry are belongs to stage II of the production function and that factors were efficiently allocated.

Keywords: *Small rubber farmers, production level, KalutaraDistrict, stage II*

Date of Submission: 31-08-2018 Date of acceptance: 15-09-2018

I. Introduction

Rubber is an important agricultural commodity and it is among the three main income earners in the national economy. It has a direct impact on the socio-economic conditions of thousands of people in the country in terms of employment and export earnings.Earnings from exports of merchandise were U$ 10.4 billion in 2013. The contribution of the rubber sector exports were around U$ 1 billion was 10% of the above value. It includes raw rubber, rubber products and rubber-wood based products. Rubber production fallen by 24.4 percent to 98,573 metric tons in 2014 from 130,420 metric tons in 2013.In the global market, the average price of natural rubber per metric ton declined by 30 percent to US dollars 1,956 in 2014 from US dollars 2,795 reported in 2013.In 2015, further, the value added of rubber sub sector recorded a huge negative growth of 12.8 percent in the first quarter of 2015. Despite the decline recorded in rubber export prices, earnings from rubber exports, which declined continuously since 2012, increased by 25.0 percent to US dollars 33 million in 2016, reflecting an increase in export volumes, by 55.8 percent to 16 million kilograms. In termsof GDP in 2015, the rubber sector has accounted for 1.5% and contribution to total exports covers around8% of total national export income (Central Bank Annual Reports 2012-2016).

In 2015, Sri Lanka stood a market share of around 0.7% of the global market for natural rubber as a producer and Sri Lanka ranked in a 14th place as a rubber producer in the world . Meanwhile, the national export income target for 2020 has been set by the Rubber Industry development at U$ 20 billion and the share of the rubber sector in this endeavor is estimated at around U$ 2 billion under normal conditions (Sri Lanka Rubber Industry Development Master Plan 2017 -2026).

In Sri Lanka, most of the land under rubber farming is belongs to small holders, who number about 130,000 families in 2009, scattered in the Low Country Wet and Intermediate Zones. Basically they are the holdings below 20 acres in extent (Department of Rubber Development, 2010).

In 2009, out of a total of 124,300 hectares, 72,719 hectares were belongs to small holders and 51, 581 hectares under the estate sector. However, over the years, there has been a sharp decline in the area which is

under small farmers. For example, in 1990, out of a total of 199,048 hectares, 139,488 hectares were under small growers and only 59,560 were under the big growers or the estate sector (Rubber Development Department, 2010).

According to Master plan (2017-26) rubber farming activities can be identified as downstream and upstream activities. Upstream activities are defined as farming of rubber, processing and marketing which are carried out by small rubber farmers, private estates and plantation Companies. Smallholders are accounted over 72 percent from upstream activities. Further it is estimated that total employment in upstream activities is to be around 200,000 persons of which, around 40% are women. According to performance of these two activities, it is clearly states that the downstream activities indicate significant improvement while upstream activities have contracted over the past years.For a sustainable growth in the sector, it is vital to maintain a balance between the two sectors.

Table 1 presents the data of rubber industry in Sri Lanka from 2010- 2015.Land area for rubber planting was changed slightly during the period of 2010 to 2015. Total production has declined gradually during the period. Rubber production had increased in Sri Lanka till 2011, from 94.7 M.T. in 2004 to 136.9 M.T in 2009 and was 158.2 M.T in 2011, which was a 3.2 percent increase over the figure for 2010.Meantime total exports in terms of metric tons also dropped sharply. Similar to export volume, value of the export also followed the declining trend. Cost of production has increased and local consumption level has changed slightly during this period. Average yield per hectare and rubber price per kilogram also deteriorated in recent years.Rubber prices have fallen from Rs. 403/kg in 2010 to Rs. 289/kg in 2015. Due to drop in rubber prices and increasing cost of production, many rubber small holders have given up rubber farming. Although a steady growth of rubber sector was reported during the last decade (2000-2009), the data reported in recent years shows that performance of the rubber sector has declined.

Table 1 Rubber Sector in Sri Lanka 2010-2015

	Unit	2010	2011	2012	2013	2014	2015
Total extent under rubber	Ha	125,645	128,119	130,415	132,534	133,762	134,409
Total production	M.T. 000	152.95	158.20	152.03	130.41	98.57	88.57
Total exports	M.T. 000	51.50	42.61	37.38	23.58	16.50	10.37
Export value	Rs. Mn	19,256	22,811	15,726	9,194	5,916	3,548
Local consumption	M.T. 000	119.61	128.25	125.69	118.41	116.05	127.42
Cost of production per Kg. of made rubber	Rs.	158.94	188.23	223.69	259.43	282.04	266.41
Rubber price per Kg.	Rs.	403	513	417	377	286	289
Ave. yield per Ha.	Kg.	1,561	1,631	1,531	1,290	930	776

Source: Rubber Development Department, 2015

The global rubber industry grows at about 4 % - 6 % per year and the growth potential for Sri Lanka stands at the higher level. Considering the long history of the rubber industry and the exceptional characteristics accumulated over the years, the government together with private sector has set a high target to increase the share of rubber product earnings by 15 % by the year 2020 (Master Plan 2015-2020).

.The total rubber production of Sri Lanka is about 1.2% of the total global rubber production. Approximately 70% of the said production is consumed by the local producers. Since the world demand for natural rubber is higher than the supply, there is a potential of further increase in the world rubber production (Export Development Board, Sri Lanka 2013).

Given this prime position of rubber production in the Sri Lankan economy and given the fact that domestic supply has not been able to meet up with demand, there is therefore the need to examine what are the factors that affect the rubber production. Therefore, the main objective of the study is to examine the determinants of natural production in Kalutara district in Western province, Sri Lanka.

Objectives of the study

The main objective of the study is to determine the major determinants of natural rubber production of small rubber farmers in Kalutara District, Sri Lanka.

Other objectives of the study

To identify issues of the small rubber farmers

To determine Returns to Scale in rubber production

Theoretical background and Literature Review

Theoretical background

Theory of Production in economics explains the relationship between inputs such as labor, raw material and other inputs like capital, equipment, etc. and output level. It is a process of combining various resources in order to produce goods and services to satisfy utility of people. Production function indicates the physical output of a production process. It is possible to explain in a mathematical form which relates the maximum level of output that can be attained from a given input level.

Simple production function can be expressed as Q = K+ L, where Q is the quantity produced K and L is the amount of capital and amount of labor used in production process respectively.

The other common production function is the Cobb – Douglas production function.

$Q = f(K,L) = AK^aL^b$where 'Q' is output, 'L' the quantity of labor and 'K' the quantity of capital. 'A', 'a' and 'b' arepositive constants.In relation with production function, there are few important concepts, such as Average Product (AP), Marginal Product (MP), Marginal Rate of Substitution (MRS), Returns to Scale and Elasticity of Production. These concepts can be applied to identify the three stages of the production and can be used to determine feasible region for the production. The Cobb – Douglas production can be used to identify all these concepts and can be used to determine returns to scale easily. Returns to scale is depending on the values of 'a' and 'b' (Koutsoyiannis, 2006). In general, the Cobb-Douglas production function is applied in both macro level as well as micro level to estimate the input and output relationships.

II. Literature Review

Number of studies has been paid attention to identify and analyze factors that affect agricultural productivity and also ways to increase agricultural productivity in developed as well as developing countries. According to the theoretical background productivity as well as production is highly depend on capital and labor. Based on this background researchers have identified different inputs which are determine the productivity or production level for a particular industry or product.

Ellis (1993) pointed out that small producers in terms of size of the land are more important than the large producers. And also further this book has highlighted that small farm aremore productive than large farms. Therefore, the author has argued that agricultural development strategy should be focused on the promotion of small farmers rather than large farmers.

Bingenet al., (2003) reported that to achieve agricultural development, the investment in new production techniques and technology was essential. And also it should be supported by a comparable investment in human capital too. Farmers can adopt technology, change ways of doing things and sell their product at the right time, if they have enough information and knowledge. Therefore, it is an important for spending money towards farmers' education (Chowaet al., 2012). Burton (2013) indicated that formal education enriches farmers' concerns about environment and approaches for the sustainability of agriculture sector. At the same time, education enhances and stimulates economic growth by improving the productive capacity of farmers. There is a well-known argument that the increase in knowledge via education is an essential element for economic development (Asfaw, &Admassie, 2004).

Adomi et al., (2003) showed that agricultural production is determined by various household characteristics. They pointed out that the farmer's age level, size of the family and size of the land as important factors which have direct relationship with production level.They considered age of the farmer is a proxy for farmer's experience level.Further, researchers have revealed that farmers are mostly depending on the prior knowledge of farming know-hows in the industry. Hence, there is a positive relationship between farmers' age level and productivity level. On the other hand Moussa et al., (2011) and Burton (2013) argued that older farmers do not have enoughphysical strength to perform their farming activities and reluctant to use new technologies.

Agricultural production mainly is influenced by size of the land. Amsalu et al., (2006) also showed that land is the most important input for any country, if the agriculture industry is dominated in that economy.Imahe&Alabi (2005) investigated the determinants of agriculture productivity in Nigeria. The findings of the study revealed that size of the land, fertilizer distribution and the credit facilities provided by the commercial banks contributed agriculture productivity and output level.

Anyanwu (2009) examined the determinants of agricultural productivity among smallholder farmers in Rivers State. The results indicated that size of the farm land, labor input, age level of the farmer, experience of the farmer and education level contributed significantly on agriculture productivity level. Further, results of the analysis showed that credit facilities also important to improve the productivity level.Goni*et al.,* (2007) examined resource-use efficiency in rice production in the Lake Chad area of Borno state, Nigeria. They found that increase in the level of seed, farm size, and fertilizer will lead to increase in rice output. Abang*et al.,* (2001) also revealed that education was positively related to output level.

Ekbom (1997) estimated relationship between socio-economic, bio-physical factors and agricultural productivity among smallholders in Kenyanhighlands.Results of the analysis showed that farm size, distance, availability of labor and cost of inputs are major contributing factors to the productivity level.

Kamruzzaman& Takeya (2008) pointed out that intercropping is another important factor which determined the productivity of the farm. They argued that when farmers practice intercropping in the land, it improves soil quality and productivity. Farmers expect to enhance harvest of the land by using more crops rather than one crop for their farm land. Guvenc&Yildirim (2006) found that intercropping is practiced by a large extent by farmers in developing countries. Further, Karlidag&Yildirim (2009) showed that intercropping is very important to enhance crop productivity level as well as to reduce the excess demand of food requirements of the world.

Another factor that determines the productivity level is access to credit facilities or agricultural credit. Aggelopoulos et al.,(2011) described that agricultural credit means banking finance for agricultural production, processing, trade of product or financial support for any other activities relating to the agricultural sector. Kwon et al.,(2006) and Pfeiffer et al.,(2009) pointed out that in developing countries the most serious issue for the farmers is lack of enough money for their farming activities. Lacks of credit access, farmers are enforced to spend a considerable amount of money from their income to obtained resources such as fertilizer, seeds and pesticides to their farming. Thus, farmers who have access to credit facility will be provided support for their financial constraints.Wolday (1999) and Mulugeta (2000) showed that farmers who do not have access to credit facilities face a difficulty to adopt new technologies in their farming activities.

.In addition the above factors, the productivity were influenced by government involvement such as guaranteed prices, subsidiaries to the agricultural sectors and credit provided by the government.Aune&Bationo (2008) revealed that to enhance the cotton production in Mali, government has involved in different ways; like introducing policies on credit facilities, input distribution and price legislations.

In summary, it can be seen from the above empirical literature reviews that little research works have been done on the field of agriculture sector and especially for determinants of productivity in rubber industry in Sri Lanka. Therefore, this research work seeks to examine the determinants of natural rubber production in small rubber farmers in Sri Lanka.

III. Data And Variables Of The Study

The top three growers in the rubber industry in Sri Lanka are identified as Kegalle, Kalutara and Ratnapura Districts.The study area was selected based on the size of cultivated land area. It is one of the major rubber growing districts in the country and it being a traditional rubber growing region.And also input and output markets are well established in this District. There are 14 Divisional Secretariat (DS) divisions in the Kalutara district. Three DS in Kalutara district were purposively selected to ensure representative sample size for the study. The three sample areas are Horana, Bulathsinhala and Dodangodain Kalutara district The data used in the study was collected from primary sources. Well-structured questionnaires were used to obtain relevant information from 389 respondents from three areas in Kalutara District. Further focus group discussions and in-depth interviews were conducted with selected households by the researcher and with the 20rubber extension officers in the Regional Offices of Rubber Development Departmentwhich is situated in Kalutara District.

The data were analyzed using frequency distribution, percentage distribution and by employing Multiple Regression Model. To verify the impact of the dependent and independent variables, hypothesis is formed based on previous research findings. The following production function has applied to explore the factors that influence rubber production in the study area.

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon_t$$

Dependent variable (Y)

The dependent variable of the study is the out level of the each farmer in the study in Kilograms (Kg) at time t.

Independent variables

Labor input (X_1)

This refers to the total number of laborhours hired during the production process. The number of allfamily members those who were involved in farm activity was included as laborinput.Therefore, number of labor hours was hypothesized to have apositive impact on rubber production.

Input cost(X_2)
Higher the input cost is an indication of higher level of input. It is expected that higher level of input cost means higher level of output in the production process.

Fertilizer subsidiary ((X_3)
Especially for developing countries to motivate agricultural products fertilizer subsidiary is an important factor. The study is expected that there is a positive relationship between fertilizer subsidiary and output level.

Size ofLand(X_4) (in acres)
This variable is measured in terms of acres. It is also hypothesized that the larger the land size (own and rented cultivated land) of the rubber farmer, the higher the volume of production.

Experience of the farmer(X_5)(Years)
Experience of farmer is measured in terms of years of rubber farming. The variable number of years is associatedwith the learning process of farmers in handling their overall production practices of rubber farming. It is expected to influence positively on production level.

Educational status of the farmer(X_6)(Education level)
Educated farmers are expected to have better exposure to information that enhances rubber production. They are also expected to be innovators in accepting new waysof doing things and have an ability to accumulate knowledge of farm practices. This variable is measured in terms of the number of years of schooling thatis expected to have a positive impact on rubber production.

Family Size (X_7)
It is defined as the totalnumber of members living together during the survey period. Thosehouseholds having alarge number of family members may have large number of family labor and there will be a positive relationship between size of the family and production level.

Credit facilities(X_8)
Capital is the most important and the scarcest input in less developed countries in general and rural areas in particular. Farmers need capital or in other words funds to adopt new technologies to increase productivity of input and efficiency of resources.Therefore, obtaining credit facility to finance their capital input requirements is expected to increase rubber production. It is measured whether farmer obtained a credit facility or not during the survey period.

Inter-cropping (X_9)
In agriculture sector, especially in rubber farming farmers are engaged in inter-cropping during the initial stage of rubber planting. The study is expected that there will be a positive relationship between inter-cropping of the land and production level.

IV. Data Analysis and Discussion

Sample of 389small rubber farmers from the KalutaraDistrict was asked to complete a questionnaire for this study and 20 rubber extension officers in the Regional Offices of Rubber Development Department has interviewed to collect the data relating to rubber farming.The following Tables summarize the demographic characteristics of respondents.

Table 2 Number of Family Members

Number of Members	Frequency	Percent (%)
2	1	0.3
3	11	2.8
4	82	21.1
5	142	36.5
6	101	26.0
7	43	11.1
8	9	2.3
Total	389	100.0

Source: Survey data

Table 2 is presented the number of family members in each family. Majority of the respondents have 5 members in their family while only one respond has two members of their family.

Table 3 Educational Status of Farmers

Educational Status	Frequency	Percent (%)
No formal Education	85	21.9
Primary	208	53.5
Secondary	87	22.4
Above Secondary (Higher)	9	2.3
Total	389	100.0

Source: Survey data

Table 3 shows that majority (53.5%) of farmers in the study area belong to primary education categorywhile 22.4and 2.3% had secondary and higher education respectively. Approximately 22% had no formal education in the study area. This could have negative impact on the adoption of new techniques and ways of doing things of production.

Table 4 Age Distribution of Farmers

Age level (Years)	Frequency	Percent (%)
21 - 35	19	4.9
31-45	99	25.4
46-60	187	48.1
61 - 75	84	21.6
Total	389	100.0

Source: Survey data

Data in Table 4showed that the age of respondents ranges between 21 and 75 years. 48% belongs to 46-60 years age bracket while 21% belongs to 61 – 75 age groups. By implication therefore, about 70% represent by above 46 years. The results of this area show that rubber farmers in the study area are ageing.

Table 5 Years of Experience of Farmers

Number of Years	Frequency	Percent (%)
Less than 5	19	4.9
5 - 10	53	13.6
11- 15	76	19.5
16 - 20	113	29.0
More than 20	128	32.9
Total	389	100.0

Source: Survey data

Table 5 shows the years of experience of farmers. Results indicate that 32.9% of therespondents took on rubber farming as major occupationfor above 20 years of experience. This is expected to havepositive impact on rubber production, all things being equal. The reason behind this expectation is that they can acquire knowledge in order to enhance their production and yield from the farm through experience. Sriyalatha (2018) showed that higher the level of experience lowers the level of formal training for small rubber farmers in Kalutara district. Ashuman capital theory pointed out,theindividuals acquire training through work experience and it leads to increase the production levels.

Table 6 Number of Farmers involve in Inter-Cropping

	Frequency	Percent %
Yes	265	68.1
No	124	31.9
Total	389	100.0

Source: Survey data

Most farmers (68%) in the study area are engage in inter-cropping of different types of crops. Out of 265 rubber farmers, 28.3 and 27 % are growing Banana and vegetables as inter-crops in their rubber land respectively.The study is expected that there will be a positive impact from inter-cropping of the land as well as production level.

Table 7 Types of Inter- Cropping

Types	Frequency	Percent
Pine-Apple	7	1.8
Banana	110	28.3
Pepper	39	10.0
Vegetables	105	27.0
Coffee	4	1.0
Total	265	68.1

Source: Survey data

Table 8 Issues of Rubber Farming

Type of Issue	Frequency	Percent
Labor	35	9.0
Raw materials	7	1.8
Weather	51	13.1
Market	296	76.1
Total	389	100.0

Source: Survey data

Table 8 shows the major issues faced by small rubber farmers in the study area. Among them the most important problem that they faced was market problems especially rubber price and market place for their products. Labor issues are the minor problem for them.

Table 9 Nature of Ownership of the Rubber Land

Type of ownership	Frequency	Percent
Inherited	165	42.4
Purchased	205	52.7
Rented Land	19	4.9
Total	389	100.0

Source: Survey data

Nature of ownership of the rubber land in this study area is presented by Table 9. As per survey data, it shows that considerable number of rubber farmers used lands which are purchased by them.

Table 10 Sources of Labor Supply

Source	Frequency	Percent
Family labor	134	34.4
Hired labor	97	24.9
Both (Family and hired)	158	40.6
Total	389	100.0

Source: Survey data

Majority of the farmers used family labor for their production process. Thus, they do not have many issues on their labor input for their production process.

Results of the production function

The linear regression analysis was employed to identify the determinants of production level of small rubber farmers in KalutaraDistrict in Sri Lanka. Results of the analysis are presented in following Tables. Table 11 shows that value of R square is 0.492 which indicates that around 50% of the variation in the endogenous variables are explained by exogenous variable of this model.

Table 11 Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
.702[a]	.492	.480	.4822	.492	40.803	9	379	.000

Table 12 Overall Significance of the Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	85.402	9	9.489	40.803	.000[b]
	Residual	88.140	379	.233		
	Total	173.542	388			

Table 12 shows that overall significance of the model. F-statistics were carried out to find the overall strength of the model. The value of F-Statistic 40.803 shows that the production equation is highly significant and probability value is significant at 1% significant level.

Table 13 Determinants of Small Rubber Production

Variables		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.671	.207		3.241	.001***
	Laborinput (X_1)	.099	.030	.128	3.272	.001***
	Cost(X_2)	.029	.029	.047	.973	.331
	Fertilizersubsidiary(X_3)	.217	.054	.170	4.042	.000***
	FarmSize(X_4)	.637	.050	.558	12.774	.000***
	Experience(X_5)	.055	.024	.099	2.349	.019**
	EducationLevel(X_6)	-.086	.038	-.094	-2.251	.025**
	Family Size(X_7)	.031	.025	.051	1.243	.215
	Credit Facility(X_8)	.057	.055	.041	1.047	.296
	Inter-cropping(X_9)	.003	.055	.002	.046	.963

*** Significant at 1% level and ** significant at 5% level

The result of the production function analysis is presented in Table 13.The result shows that there is a positive relationship between total production level andinput cost, credit facility, fertilizer subsidiary, farm size, experience level of the farmer, labor hours used in the production process, inter-cropping and number of family members. This suggests thatas more and more of these variables are used, there will be anincrease in total output of rubber. This result is consistent withOjo (2000). On the other hand, result indicates that inverserelationship between output and education level of the rubber farmers. The inverserelationship between rubber production and education level isunexpected. It could be due to one fifth of the respondents had no formal education in this study. This has probably hindered the adoption of new techniques and new ways of doing things of production.Among nine independent variables three variables are significant at 1% significant level and another two variables are significant at 5% level.

Table 14 Elasticity of Production and Return to Scale (RTS)

Variable	Elasticity
Farm Size	0.558
Labor Hours	0.128
Input Cost	0.047
RTS	0.733

Table 14 indicates that the input elasticity of the variables. Farm size, labor hours and input cost have positive coefficient and all values are less than unity elasticity.It is an indication of decreasing returns to scale of the production. Thus, the farmers do their production at stage II of production and further, it indicates that the rubber farmers are in rational stage of production. They used both capital as well as labor at efficiency level.

V. Conclusion

There are numerous factors that contribute for the production level of the rubber farming. This study only focused on some of the factors thatdetermine small rubber production (Natural rubber production) in Kalutara District, Sri Lanka.

Farm size, number of hours spent on rubber related activities and fertilizer subsidiary were significant at 1% whereas education level and experience of the farmer were significant at 5%.This study concluded that the larger the size of rubber land is the best indicator and contributing towards the higher level of production in rubber farming. This result is consistent with the findings of Adomi et al. (2003) and Imahe&Alabi (2005).The second contributor, fertilizer subsidiary also has significant effects on rubber production level. It is consistent with the findings of Imahe&Alabi (2005). Further, number of hours spent on rubber farming and other activities have positive strong effect on production level. This indicates that if farmers are more dedicated towards the rubber farming activities they are able to get higher output. Higher level of experience in rubber farming has positive impact on production level. The positive relationship of farmers experience is in line with the findings of Adomi et al. (2003) and Imahe&Alabi (2005).

The study hypothesized that there will be a positive relationship between education level of the farmers rubber production level. This expectation did not achieve in the study. Education level has significant negative impact on rubber production in this study.One reason for this relationship is that about 20% of the respondents in the industry do not have formal education. The higher the percentage of low education level farmers could have negative impact on the adoption of new production technologies. One reason for this relationship is that about 20% of the respondents in the industry do not have formal education. Generally education is believed to create a positive mental attitude for the acceptance of new practices especially of information-intensive and management-intensive practices(Waller et al., 1998 and Caswell et al., 2001).Further, interviewed results show that when people are getting opportunities for education, they reluctant to engage in traditional industries and

are moving from new industries like appeal industry. Credit facility and family size also have positive insignificant impact on production level. As expected inter-cropping has positive but insignificant impact on production level. Result shows that positive relationship exists between input cost and output level. This implies that as more and more of these variables are used, there will be an enhancement in total production level. These findings are in line with the findings of Ojo (2000).

The R^2value for the regression is 0.492 and this means that 50% of the variations in rubber output are explained by the factor inputs. Also from the F-statistic it can be concluded that the overall regression is significant at 1% significance level.

The efficiency analysis showed that Return to Scale is 0.733. It indicates that farmers in small rubber industry are belongs to stage II of the production function and production inputs were efficiently allocated.

Based on the interview, the following issues have highlighted by the respondents. They clearly pointed out that replanting of the rubber is at the slow rate and new planting programs also not at the sufficient level. Further, they have pointed out that small rubber farmers do not have enough technical know-how of producing quality output. The natural rubber price is always fluctuating and expenditure of input is increasing.

According the empirical findings of the study, it revealed that rubber production level increases as labour hours increases; output could further be enhanced by using large size of land with enough fertilizer and higher level of experience.

Based on the findings of the study, we would like to highlight the following points.

1. Government need to promote and protect smallholder rubber farmers to encourage them to retain in the industry. At the same time need to pay attention to encourage youth generation to engage in the industry. The few number of youth (4.9%) involved in rubber farming could indicate that the future of the small rubber industry is slowdown. The youth are the future growers of the industry, if small rubber supply is to be sustained; there is the need for youth to be motivated to go into rubber production.
2. Government need to enhance institutional support in order to improve the efficiency and productivity of smallholders.
3. Government need to intervene to secure market for rubber output and economic benefits for farmers.

Acknowledgement

This study has been undertaken with the financial support of the University of Sri Jayewardenepura, Sri Lanka under the Research Grant ASP/01/RE/MGT/2015/09.

The researcher is especially indebted to the staff of the Regional office of Rubber Department in Kalutarafor the information they provided and also grateful to the respondent farmers,without whose co-operation the study could not have taken place.

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IOSR Journal of Business and Management (IOSR-JBM) is UGC approved Journal with Sl. No. 4481, Journal no. 46879.

M.A.K. Sriyalatha. " Factors Affecting Natural Rubber Production: Case Studyof Small Rubber Farmers In Kalutara District, Sri Lanka." IOSR Journal of Business and Management (IOSR-JBM) 20.9 (2018): 64-73.