Chapter 4

PROFIT EFFICIENCY OF PADDY FARMING IN SRI LANKA: A CASE OF *HURULUWEWA* COLONIZATION SCHEME IN ANURADHAPURA DISTRICT

R.P.I.R. Prasanna, S.A.U. Niranjala and J.M.G. Lalani
Department of Economics, Faculty of Social Sciences and Humanities, Rajarata University of Sri Lanka, Sri Lanka

1. INTRODUCTION

The modern agricultural colonization schemes were introduced to the dry zone of Sri Lanka with the aim of achieving self-sufficiency in paddy production, and addressing the unemployment problem and pressure of higher population density in some regions of the country (Farmer, 1977; Irangani & Prasanna, 2017). At present, paddy sector occupies 34 percent of the cultivated area of domestic agriculture and provides a livelihood for approximately 1.8 million farmers. About 75percent paddy cultivated area is irrigated, and a majority of the farmers (approximately 70 percent) are smallholders owing less than 1 ha land area (Weerahewa, 2004). Currently, 95percent of national rice requirement is fulfilled by domestic production (Department of Agriculture, Sri Lanka, 2017).

The country managed to increase paddy production dramatically during the last few decades along with technological changes in paddy farming and extending the cultivated area mainly through the agricultural colonization schemes. However, the paddy farmers, particularly in the major colonization schemes, confront some problems. One problem they faced is less capability of deriving a satisfactory profit after spending much for cultivation (World Bank, 2003; Prasanna, 2006; Rupasena & Wijayakumar, 2006; Kikuchi et al., 2006; Rupasena & Naik, 2009). This trend has put the livelihoods of impoverished farmers in jeopardy. As a result, farmers are moving away from paddy farming to alternative crops such as banana, sugarcane, and soybean (Henegedara, 2010).

Cite this chapter: Prasanna, R., Niranjala, S. & Lalani, J., 2021. Profit Efficiency of Paddy Farming in Sri Lanka: A Case of Huruluwewa Colonization Scheme in Anuradhapura District. In: R. Prasanna, ed. *Sustainability of Agriculture Settlement Schemes in Dry Zone of Sri Lanka: Issues, Challenges and Path ahead.* Mihintale: Rajarata University of Sri Lanka, pp. 45-58.

This book chapter is an extended version of the paper published in the Journal of Management Matters, Vol. 4 (2), 2018.

The younger generation, predominantly in the colonization schemes, are less interested in continuing with paddy farming (Sudarshanie, 2014; Thivanka, 2004).

Literature in this subject outlined numerous reasons for less profitability of paddy farming in Sri Lanka; high cost of production, land fragmentation issues, the small size of paddy lands, and marketing-related issues are the highlighted areas (Kikuchi et al., 2006; Rupasena & Wijayakumar, 2006). Using the Domestic Cost Approach, Rafeek and Samaratunga (2000) have pointed out that Sri Lanka does not have comparative advantages in producing paddy. Weerahewa (2002) emphasized that competitiveness in paddy farming could be observed in some areas of irrigated paddy farming, practicing at adequate levels of scale. Due to less profitability of paddy farming, the government has to spend more on subsidy programs such as fertilizer subsidy, intervene to free irrigation water supply and management, and marketing. Thus, the country could achieve self-sufficiency in rice at a high cost to the society (Thiruchelvum, 2005).

Since a more substantial proportion of paddy is produced by major colonization schemes and the majority of paddy farmers are smallholders and resource-poor (Chandrasiri, 2010; Prasanna, 2006), this emerged issue—less profitability of paddy farming— put country's paddy production into a problem and thereby food security at risk. Thus, identification of methods to improve farmers' capacity to enhance the profitability of paddy farming, given the farm-specific output prices, and fixed inputs are of paramount importance to sustain the modern colonization schemes in Sri Lanka.

Thus, this study aims to investigate the level of profit efficiency of paddy farming in the Modern Colonization Schemes (MCS) in Sri Lanka with the intention of identifying existing opportunity to enhance the profitability of paddy farming. To fulfill the above objective, following specific objectives need to be realized: 1) identify the socioeconomic status of smallholder farmers in the MCS, 2) determine the level of profit efficiency of smallholder paddy farms, and 3) identify the determinants of profit inefficiency of smallholder paddy farming in the MCS.

2. LITERATURE REVIEW

Profit efficiency is defined as the ability of a farm to achieve the highest possible profit under given prices of inputs and levels of fixed factors. The profit inefficiency in this context is defined as the loss of profit from not operating on the frontier (Ali, Parikh, & Sha, 1989). The subject of profit efficiency of rice farming is gaining increasing interest among the scholars since rice is the staple food of many countries. This section of the paper attempts to signify the levels of the inefficiency of rice farming in many countries and the factors influencing

the efficiency levels. For instance, age, education level of farmers, irrigation, land size, training attendance, experience, level of agriculture infrastructure, soil fertility, extension services, share of non-agricultural income, amount of fertilizer usage, labour and machinery usage, household size, accessibility to credit, seed type, and price and amount have been highlighted in the literature related to efficiency models of rice farming.

Trong and Napasintuwrong (2015) investigated the profit inefficiency among hybrid rice farmers in Central Vietnam. The study identifies that age, educational level, irrigation, the share of rice income, the share of hybrid rice area, frequency of training attendance about hybrid rice production, hybrid rice production experience, and topography of farm are the leading factors affecting farmer profit inefficiency in hybrid rice production. Further, it revealed that the lowland rice farmers operate production more efficiently than the upland farmers in Central Vietnam. The study reveals the differences among the farmers between lowland and upland in terms of socioeconomic conditions.as reasons for such differences in profit efficiency between lowland and upland in Central Vietnam.

A research work of Rahaman (2003) on profit efficiency of rice farmers in Bangladesh reveals a high level of profit inefficiency in modern rice production. The reasons for high-profit inefficiency in the study area are the inadequacy of infrastructure facilities in agriculture areas, soil fertility, and experience in farming, extension services, tenancy, and the share of non-agricultural income. Kolawole (2006) attempted to derive a statistical measure of profit efficiency of small-scale upland rice farmers in Nigeria and found a negative relationship between the unit cost of fertilizer and profit efficiency, and negative impacts of farmers' age, educational level, farming experience, and household size on profit inefficiency.

Ali et al. (1989) have estimated the level of profit inefficiency in terms of Basmati rice variety in Pakistan Panjab. According to the findings, the farm households' low education level and off-farm employment activities are the socioeconomic factors that negatively affect the profit efficiency. Interestingly, the studies on profit efficiency revealed that the institutional determinants, i.e., credit constraints, water constraints, and the late application of fertilizer, negatively affects profit efficiency, but Abdulai and Huffman (2000) and Magreta et al. (2013) noted a positive relationship between credit facilities and profit efficiency.

Abdulai and Huffman (2000) have examined profit efficiency of rice farming and the relationship between farm and household attributes and profit inefficiency in Northern Ghana. The results indicate that the average level of

profit efficiency is relatively high in the area, but identify a higher variation in efficiency and inefficiency levels of farmers. The results of the inefficiency model disclose that high education level of household heads, access to credit, production specialization, and being located in districts with extension services and better infrastructure facilities are significant determinants positively affecting the profit efficiency. Similar to results of the study of Ali and Flinn (2014), this study also confirms the negative impact of increasing participation in off-farm activities by farmers on profit efficiency. According to Chang et al. (2015), in Taiwan, farmers in the contract farms are more profit efficient than those of the non-contract farms in a comparable operating environment.

According to Magreta et al. (2013), Southern Malavi has an average technical, allocative, and economic efficiency levels of 65percent, 59percent, and 53percent of rice farmers, respectively. This suggests that farmers can further increase the rice production by 35percent. The average economic efficiency level entails that farmers can raise their profitability or rice production by 47percnet by adjusting the input use. Soil fertility status, access to credit, household size, and farmers' experiences were the factors that influence the efficiency levels of smallholder rice farmers.

In the Sri Lankan context, researchers have paid less attention to estimate profit efficiency of paddy production. Abeysekara (1976) has analysed underlying input-output relationships in paddy farming in Sri Lanka and observes that the levels of fertilizer applied, machinery usage, and the amount of labour used help to increase the production level. Thiruchelvam (2005) examined factors of the inefficiency of rice production and issues relating to the cost of production in the districts of Anuradhapura and Polonnaruwa in Sri Lanka and the study reveals the negative association of farm management issues with the production efficiency of rice farming in the study area. Rathnayake and Amaratunge (2016) estimated the technical and allocative efficiency of paddy farming in Sri Lanka and observed that the estimated average technical efficiency of the farmers is 78.3 percnet, suggesting there is a scope of 21.7 percent to increase paddy productivity using present technology. Age, schooling, alcohol consumption, agricultural training, farmers' attitudes, and the distance between the land and the primary water source are significant determinants of technical efficiency. According to the analysis of allocative efficiency, there exists inefficiency in allocating resources, where land and machinery resources are under-utilized while labour is over-utilized.

Gunaratne and Thiruchelvam (2002) estimated the technical efficiency of paddy production in the Rajangana major irrigation scheme and the Elayapattuwa minor irrigation areas in the Anuradhapura district. Results of the study indicate substantial differences in productivity, resource usage, and technical efficiency in

two types of irrigation schemes. The low asset level of the farmers and poor participation in farmer organization activities have significantly influenced the technical efficiency of farmers in Elayapattuwa. It was also evident that part-time farming is associated with a higher level of inefficiency in both study areas.

3. METHODOLOGY OF THE STUDY

3.1 Model specification

Profit efficiency estimates the capacity of a farm to achieve the highest possible profit by considering farm-specific prices and the level of fixed factors. In this study, Stochastic Frontier Analysis (SFA) was used to estimate the profit efficiency of paddy farms in the survey area owing to the capability of the SFA to accommodate random variations in the model. The actual normalized profit function for this study is specified as follows:

$$N(\pi_i) = f(p_i, z_i)\exp(v_i - u_i) - -(1)$$

Where, $N(\pi_i)$ represents the normalized profit of the i^{th} farm, which is measured by dividing the profit by the price of output (price of paddy), p_i represents the price of i^{th}variable inputs divided by output price, and z_i represents fixed factors employed by the i^{th} farm. v_i is assumed to be independently and identically distributed as $N(0, \sigma^2)$. This is associated with various random shocks and measurement errors. u_i is the non-negative random variable (one-sided error term), which associates with farm-specific profit inefficiencies.

In this study, stochastic production frontier model developed by Battest and Coelli (1995) and widely used in efficiency analysis was used to estimate the profit efficiency for each paddy farm. Cobb-Douglas functional form determined the relationship between farm-level normalized profit and specific inputs specified as follows:

$$Ln\ N\ (\pi_i) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + (v_i - u_i) \quad --(2)$$

Where,

$N\ (\pi_i)$ = Normalized profit gained by i^{th} farm
X1 = Farm size (acres)
X2 = Cost of labor (per acre) normalized by unit price of rice
X3 = Cost of fertilizer (per acre) normalized by unit price of rice
X4 = Cost of seeds (per acre) normalized by unit price of rice

X5 = Cost of agrochemical (per acre) normalized by unit price of rice
X6 = Cost of machinery (per acre) normalized by unit price of rice
β_i = Parameters to be estimated
Profit inefficiency model is defined as follows:

$$Ui = \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 - - - (3)$$

Where,
Z1 = Educational level (year of schooling)
Z2 = Household size
Z3 = Years of experience in farming
Z4 = Training in farming (dummy; if yes = 1, otherwise = 0)
Z5 = Extension services (if received = 1, otherwise = 0)
Z6 = Storage time (if more than 4 weeks storage time = 1, otherwise = 0)
α_i are the scalar parameters to be estimated.

3.2 Sample and Data Collection

Empirical data for the study were drawn from a field survey conducted in the HMCS in the Anuradhapura district in January 2018. The field sites were selected considering both right-bank and left-bank of the HMCS due to the differences between the people settled in the area—traditionally lived, and outside people. Six typical Grama Niladari (GN) divisions from both the left-bank and right-bank were selected for the farmer household survey. The survey covered 110 farm households by giving equal probabilities to all farm households to be in the sample. Sampled farmers were interviewed by administering a pre-tested survey questionnaire. The questionnaire was designed to elicit the data on paddy cultivation practices (cost of production, yield, etc.), marketing, and socioeconomic background of the farm households. Also, experienced agricultural officers and selected adult farmers in the area were interviewed to identify the project-specific issues related to the research subject.

4. RESULTS AND DISCUSSION

4.1 Socioeconomic status of the farmers

Socioeconomic profile of the sample revealed that almost all farmers are smallholders with an average farm size of 1.8 acres. Average age of a farmer is 54-years with 32 years of farming experience. It implies that most farmers are in the middle age, economically active, and experienced in farming. But it also indicates that paddy farming is less attractive to the younger persons in the area.

All farmers use their own land for rice cultivation. The average paddy production per acre is 1,429 kg, which is below the national average of 1,743 kg per acre (Department of Agriculture, 2017). The average selling price of paddy in the concerned season of the study was Rs. 39, and only 47 farmers were able to sell their production at this average price. Almost all farmers use chemical fertilizer, pesticides, and weedicides in farming, and only two farmers reported that they use organic fertilizer in paddy farming. The average cost of production and profit of paddy farming in the area are Rs. 59,592 and Rs. 7,194, respectively. Another important parameter of the surveyed sample is the educational level where the majority (53%) has studied until the GCE O/L examination.

4.2 Estimation of Profit Efficiency Model Parameters

The normalized profit function and profit inefficiency model were estimated together, and the results are presented in Table 1. Coefficients of normalized profit model were with the expected sign and were significant at 0.01 level. The coefficient of variable farm size is 0.013 and highly inelastic, indicating 1 percent increase of land size leads to 0.0138inclease increase of per acre profit level of paddy farming.

The land is a limiting factor for the paddy farmers due to land fragmentation issue in colonization schemes and water management problems. Rest of the variables —cost of labor, cost of fertilizer, cost of seeds, cost of agrochemicals, cost of machinery—associated with both sides of production and cost of paddy farming indicating negative impact on profitability. However, coefficients specify the elasticity values are highly inelastic (see Table 1). Farmers mainly purchase chemical fertilizer from private traders in the area, spending the money received from the fertilizer subsidy scheme. However, farmers reported the weaknesses of the fertilizer subsidy scheme, which increased the real cost for farmers in fertilizer application. The results reveal that the average cost of fertilizer application per acre is Rs. 8,151 in the scheme.

Rest of the inputs (seeds, agrochemicals, and machinery) are directly obtained from private traders in the area, and a majority of these inputs and machinery suppliers are participants in the paddy marketing channel in the area. Interviews with farmers and extension officers in the scheme reported that domination of input and agro-machinery supply market by the private traders in the paddy marketing channel weakens the farmers' bargaining power in paddy marketing, as these farmers are resource-poor and smallholders. It indicates the requirement of an alternative mechanism to supply these inputs and machinery.

The frequency distribution of profit efficiency of smallholder paddy farmers is tabulated and presented in Table 2. The average profit efficiency score for

paddy farming in the studied colonization scheme is 61percent, and it implies that remaining 39percent level of profit in paddy farming is achievable by considering the farm-specific prices and fixed inputs. The determinants that affect the level of profit inefficiency in paddy farming in the scheme show that paddy marketing period or storage time—whether paddy production is sold soon after harvesting or not—is the critical factor influencing the profitability of paddy farming in the scheme.

Table 1: Maximum Likelihood Estimates of the stochastic profit frontier model

Variable	Coefficient	p>|z|
Variable in the normalized profit function		
Farm size (acre)	0.0138***	0.000
Cost of labor (per acre)	-0.0153***	0.000
Cost of fertilizer (per acre)	-0.0139***	0.000
Cost of seeds (per acre)	-0.0310***	0.000
Cost of agrochemicals (per acre)	- 0.0047***	0.000
Cost of machinery (per acre)	-0.0416***	0.000
Variable in the inefficiency model		
Educational level	0.0451	0.760
Household size	0.0167	0.898
Experience in Farming	-0.0001	0.858
Training in farming (1 for trained, 0 for otherwise)	1.4544***	0.006
Access to extension services (1 for received, 0 for not received)	-0.0602	0.839
Marketing period (1 for selling paddy after 1 month, 0 for otherwise)	-0.6716**	0.047
Constant	-0.9034	0.165
Log likelihood = -28.880		
Number of observations = 110		
Prob > chi 2 = 0.000		

Note: *, **, and *** represent level significance at 10%, 5% and 1%, respectively.

As harvesting take place at the same period and existence of paddy surplus in the market at the harvesting time, the price of paddy decline significantly during the harvesting period. Analysis displays that 85 farmers (77%) had marketed their paddy production immediately after (less than one month) harvesting. Table 3 presents the reasons for selling output at the harvesting time. It demonstrates that 41.2 percent and 43.5percent of farmers, who sold their output at the harvesting time, have respectively sold their output since they had to repay the loans borrowed for paddy farming, and pay the labor cost, input cost, and machinery cost of paddy farming. No farmers reported that they lack

storage facilities. This indicates that continues insufficient derivation of profit in paddy farming has reduced the farmers into the debt trap. Farmers mostly borrow from the village-level money lenders, who are in the paddy supply chain. It has constricted the bargaining power of the paddy farmers in paddy marketing, and hence, they are compelled to accept the trading terms offered by the rice traders in the area. The majority of large-scale machineries also belong to the traders in the schemes, and thus, farmers have to sell their output to these traders to pay the machinery cost. Therefore, a paddy price stabilization mechanism to the scheme is highly necessary to fulfill the gap between the actual and potential level of profit of paddy farming in the HMCS.

Table 2: Distribution of profit efficiency score

Range	No. of farmers	%
Less than 0.40	13	11.8
0.40-0.60	32	29.1
0.60-0.80	50	45.5
More than 0.80	15	13.6
Mean Score	0.61	

Table 4 presents the distribution of farmers in different profit ranges. The minimum and maximum profit reports by the farmers were Rs. -49,233 and 76,350, respectively. The profit analysis revealed that the mean level of profit of surveyed sample is Rs. 7,159, which is not sufficient to sustain the paddy farming in the scheme. However, there are 22 (20%) farmers who derived a profit over Rs. 20,000, while 36 (32.7%) farmers have reported a negative profit. These findings indicate that paddy farming should be promoted in the land or areas of the scheme having farming supports to derive higher profit. Figure 1, which shows the relationship between farm productivity and per acre normalized profit, clearly illustrates a positive relationship between two variables. This further supports the argument that paddy farming should only be promoted in the areas where the level of productivity is high, as it leads to derive a sufficient level of profit in farming.

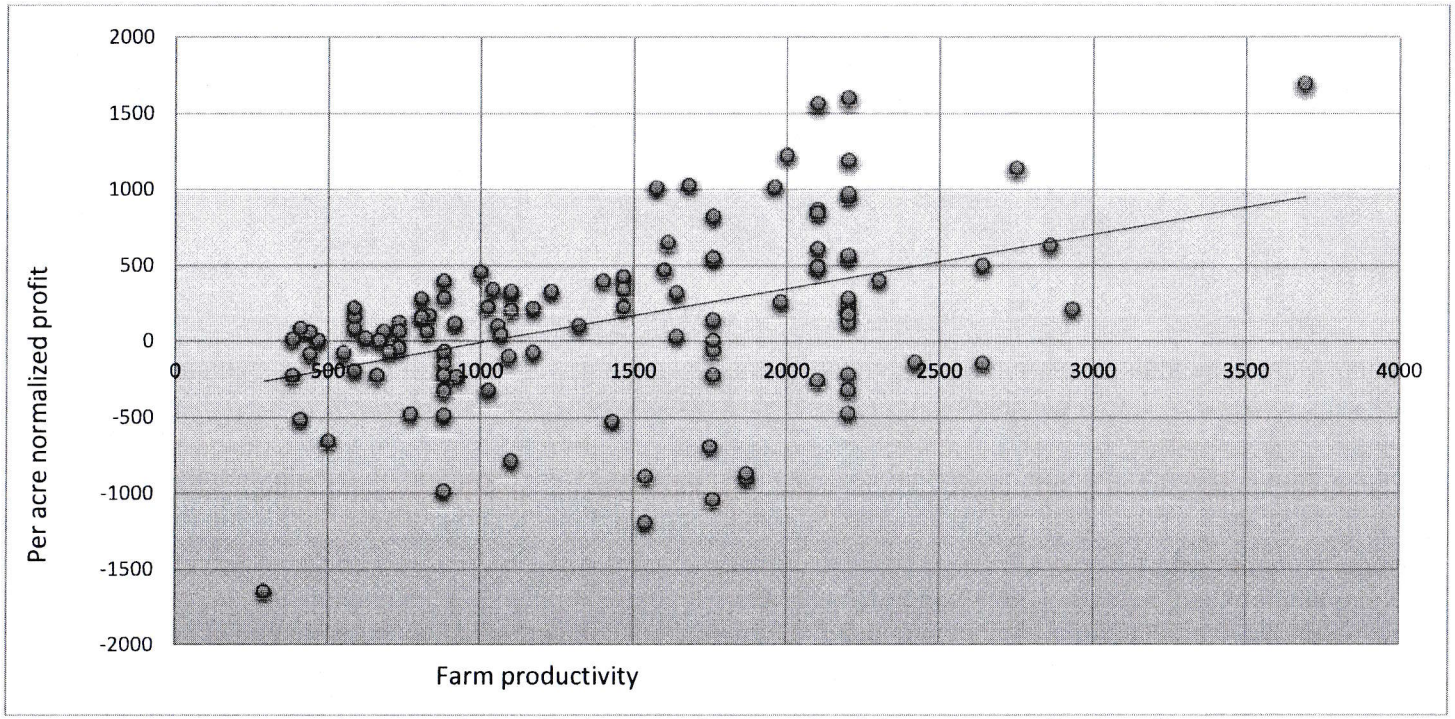

Figure 1: Relationship between farm productivity and normalized profit

Source: Field survey, 2018

Table 3: Reasons for selling output at the harvesting time

Reason	No. of farmers	%
To repay the loan borrowed for the paddy farming	35	41.2
To pay for labor cost, input cost, and machinery cost of paddy farming	37	43.5
To repay the loan borrowed for reasons other than the paddy farming	9	10.6
Emergency needs	2	2.4
Due to risk of pest attacks	2	2.4
Insufficient storage facilities	0	0.0

Source: Field survey, 2018

Table 4: Number of farmers among different profit ranges

Range	No. of farmers	%	Std. Deviation	Min.	Max.
More than Rs. 30,000	15	13.6	12,829	33,826	76,350
Rs. 20,000 – 30,000	7	6.4	3,173	20,220	28,828
Rs. 10,000 – 20,000	20	18.2	2,652	10,012	19,134
Rs. 0 – 10,000	30	27.3	2,714	160	9,108
Less the Rs. 0	36	32.7	12,612	-1,672	-49,233
Mean profit (Rs. 7,159)	110	100	22,920	-49,233	76,350

Source: Authors calculations based on field survey data, 2018

5. CONCLUDING REMARKS

This study aimed to analyze the level of profit efficiency of paddy farming in one of the major modernized colonization schemes, Huruluwewa MCS, in North Central Province, Sri Lanka. The results of the study revealed that the moderate level of mean profit efficiency score of paddy farming in the area indicating the potential of further increasing the level of profitability of paddy farming.

The Inefficiency model revealed that the period that the harvest hold for marketing is critical for the profit level of paddy farming. However, by spending large amount of money, the farmers in the scheme earn very less net income per acre. The higher standard deviation of profit level of paddy farms, and minimum

and maximum profit levels signified that a group of farmers earn a higher profit while a group loses the profitability.

Based on these findings, following two concluding points were made to sustain the modernized colonization schemes in Sri Lanka: First, it is essential to further strengthen the paddy market price or a guaranteed price of paddy stabilization mechanism. As farmers are selling the harvest at the harvesting time due to debt problem and lack of finance to cover the main variable cost items of the paddy farming, particularly at the harvesting time, a formal credit institution-initiated special credit scheme is required with coordination of village-level agricultural officers to address the financial shortage of farmers. Further, extending the functions of farmer organizations to input and output marketing of paddy farming and credits functions may help to strengthen the power of paddy farmers in paddy marketing, and reduce the cost of production of paddy farming. Second, as paddy farming does not support the majority of farmers to earn a sufficient profit, paddy farming should only be promoted in the areas where farmers can derive high profits, while rest of the paddy farming area should be converted to other profitable alternative crops.

References

Abdulai, A., & Huffman, W. (2000). Structural Adjustment and Economic Efficiency of Rice Farmers in Nothern Ghana. *Economic Development and Cultural Change , 48*(3), 504-519.

Abeysekara, W. (1972). *A Production Function Analysis of Paddy Farming in Sri Lanka.* Vancouver: The University of British Colombia.

Ali, M., Parikh, A., & Sha, M. (1989). Profit Efficiency Among Bashmathi Rice Producers in Pakistan Punjab. *American Journal of Agricultural Economists Association*, 303-310.

Chandrasiri, J. (2010). *Impact of Informal Land Transactions in Settlement Scheemes in Sri Lanka.* Colombo: Hector Kobbekaduwa, Agrarian Research and Trainning Institute.

Chang, C., Chen, C., Tsend, W., & Hu, W. (2015). Estimating the Profit Efficiency of Contract and Non-Contract Rice Farms in Taiwan: A Meta-Frontier and A Cross Frontier Approach Application. California: Western Agricultural Economics Association.

Department of Agriculture, Sri Lanka. (2017). *Agricultural Statistics.*

Farmer, B. (1977). *Green Revolution? Technology and Change in Rice-growing Areas of Tamil Nadu and Sri Lanka.* Boulder: Co: Westview Press.

Gunarathna, R., & Thiruchelvam, S. (2002). Comparative Study on Technical Efficiency of Paddy Production under Major and Minor Irrigation Schemes in Anuradhapura District. *Tropical Agricultural Research*, 14, 341-350.

Irangani, M., & Prasanna, R. (2017). The Fallacy of Underlying Assumptions of Green Revolution Technology in Sri Lanka: A Historical Comparative Analysis . In Q. Vinh, *Sri Lanka: Economic, Political and Social Issues* (pp. 1-30). Washinton DC: Nova Publications .

Kolawole, O. (2006). Determinants of Profit Efficiency among Small Scale Rice Farmers in Nigeria: A Profit Function Approach . *Annual Meeting of International Association of Agricultural Economists* . Gold Coast : International Association of Agricultural Economists .

Magreta, R., Adriss, A., Mapemba, L., & Singo, S. (2013). Economic Efficiency of Rice Production in Smallholder Irrigation Schemes: A Case of Nkhate Irrigation Scheme in Southern Malavi. African Association of Agricultural Economists .

Prasanna, R. (2006). Time to Rethinking Sri Lankan Agricultural Policy: An Analysis of the Sri Lankan Paddy Sector. *Economic Review*, 26-31.

Rafeek, K., & Samaratunga, P. (2000). Trade Liberalization and Its Impact on Rice Sector of Sri Lanka. *Sri Lanka Journal of Agricultural Economics*, 3(1).

Rahman, S. (2003). Profit Efficiency Among Bangladesh Rice Farmers. *Annual Meeting of International Association of Agricultural Economists* . Durban: International Association of Agricultural Economists .

Rathnayake, R., & Amaratunga, S. (2016). An Analysis of Technical and Allocative Efficiency of Paddy Farming: The Case of Mahaweli System H. *Sri Lanka Journal of Economic Research*, 4(1), 35-57.

Rupasena, L., & Naik, A. (2009). Economics of Rice Production and Its Competing Crops . *Sri Lanka Journal of Agrarian Studies* , 15-22.

The World Bank. (2003). *Sri Lanka Promoting Agriculture and Rural Non-Farm Sector Growth.* Washinton DC.: Rural Development Unit, South Asian Region, World bank.

Thiruchelvum, S. (2005). Efficiency of Rice Production and Issues Relating to Cost of Production in the Districts of Anuradhapura and Polonnaruwa. *Journal of National Science Foundation Sri Lanka*, 33(4).

Trong, P., & Napasintuwrong, O. (2015). Profit Efficiency among Hybrid Rice Farmers in Central Vietnam. *Agriculture and Agriculture Science Procedia*, 89-95.

Weerahewa, J. (2004). *Impact of Trade Liberalization and Market Reforms on the Paddy/Rice Sector in Sri Lanka.* Washinton DC: International Food Policy Research Institute .