THATTUMARU - KATTIMARU AND PRODUCTIVITY

An Assessment of Traditional Tenurial Systems in The Wet Zone

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FOREWORD

Although the Dry Zone produces the bulk of paddy, Wet Zone production constitutes an important buffer in the context of household food security. In this region the rotational tenurial systems widely referred to as *Thattumaru–Kattimaru* have evolved over time as a remedy for fragmentation and a system of ensuring equity. Declining productivity and abandonment have however raised questions regarding relevance even though these arrangements were certainly appropriate to the social, economic and technical context of an earlier era. All the more reason for a revisitation to assess productivity levels of these systems.

The study examined the argument that *Thattumaru – Kattimaru* tenurial systems are not appropriate and the claim that they negatively impact long term sustainability of the lands. It was found that while landowners are in favour of tenurial reforms the absence of an appropriate institutional mechanism to resolve such issues was a key factor in its persistence.

The information gathered and the consequent analysis provides the basis for the policy recommendations offered in this report which, if considered and implemented could go a long way in addressing the complications associated with the *Thattumaru - Katiimaru* tenurial systems.

Malinda Seneviratne
Director/CEO

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EXECUTIVE SUMMARY

Thattumaru and *Kattimaru* is a land tenure system that is more commonly concentrated in the low and mid-country wet zone paddy lands. Even though the original features are slowly waning it still survives most persistently in areas where land is limited, and agriculture remains the predominant occupation. The primary objective of this research was to examine to what extent rotational land tenure (*Thattumaru* and *Kattimaru* land tenure system) has affected the wet zone paddy cultivation and to suggest possible remedies to overcome issues associated with it.

The research has used data collected from different sources including secondary data available in the literature, farmer group discussions, key informant interviews and a questionnaire survey. Field level information was collected from eight Agrarian Services Centre (ASC) areas in three districts of Kalutara, Galle and Ratnapura where *Thattumaru* and *Kattimaru* tenure is prominent. The total of 147 farmers who have cultivated *Thattumaru – Kattimaru* land in 2018/2019 *maha* and 2019 *yala* season was selected randomly for the field survey.

Analysis of demographic features reveal that the majority of the farmers who are cultivating *Thattumaru – Kattimaru* lands are above the age of 60 years, indicating that a high proportion of the younger generation are not attracted to the paddy cultivation in rotational tenure lands. Although the majority of nearly 40 percent of the farmers depend on agriculture as their primary income source, paddy income is not the primary contributor towards the total family income. The main reason paddy cultivation does not rank as number one in the agricultural income is the rotational nature of cultivation, small land size and inadequate marketable surplus. The farmers receive a larger portion of agricultural income mainly from tea and rubber cultivation.

Study findings indicate that cost of production is comparatively high in all three studied districts, with highest values recorded from Ratnapura district followed by Galle and Kalutara districts. Labour cost represents over 50 percent of the total cost in all locations and this is mainly due to inability to use machinery in the paddy field due to marshy nature of lands and lack of availability of the machines. Therefore, this study strongly recommends investigating the possibility of introducing suitable machinery to suit the wet zone and ways and means to increase the availability of machinery to make paddy farming a more viable venture in the future. The unit cost of

cultivation in Galle district is Rs. 38.57 whilst in Kalutara and Ratnapura districts the cost is Rs. 44.82 and Rs. 50.74 respectively by excluding costs of farmer own inputs.

Results of the efficiency analysis reveal that inefficiencies do exist in paddy production and estimated production loss due to inefficiencies is 45 percent. Seed paddy usage has a positive and significant relationship to the final production indicating the possibility of increasing yield by adding the correct quantity of seeds. Land extents under cultivation and family labor have negative but significant relationship to the final yield, indicating the possibility of reducing the family labour. Increasing land may reduce the yield mainly due to inefficient input usage and lack of managerial competencies.

Research found that the original features of the *Thattumaru – Kattimaru* system are fading away with time. Further, as the next generation moves to urban areas in search of better job opportunities and due to a small share of the rotational land, cultivation rights are left to lapse and eventually neglecting land ownership. Study divulges that farmers have identified a number of social, economic, and cultural reasons associated with rotational tenure system that is detrimental to the future of the paddy cultivation in these lands. Almost all the shareholders have the understanding that this system is not sustainable in the present context and they are in favour of a change in this rotational tenure system.

With this evidence, research recommends to establish a new institutional set or to strengthen existing systems to resolve the disputes associated with rotational tenure systems and convert it to a more viable and sustainable system in the present social, economic and cultural context. It also suggests formulating policy actions to consolidate lands at local level.

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LIST OF ABBREVIATIONS

ARPA	-	Agriculture Research Production Assistant
ASC	-	Agrarian Services Center
CES	-	Constant Elasticity of Substitution
COP	-	Cost of Production
DAD	-	Department of Agrarian Development
DOA	-	Department of Agriculture
FAO	-	Food and Agriculture Organization
FO	-	Farmer Organization
HARTI	-	Hector Kobbekaduwa Agrarian Research and Training Institute
LCWZ	-	Low Country Wet Zone
MLE	-	Maximum Livelihood Estimation
SFA	-	Stochastic Frontier Analysis

GLOSSARY

Thattumaru - the right to cultivate a piece of paddy land which is shared among two or more persons in an annual rotation. Instead of physically dividing the land, the person with cultivation rights takes turns to cultivate the land each year.

Kattimaru - land is subdivided at the death or retirement of its owner among his heirs, but each heir inherits instead of permanent ownership rights to a particular land plot, the right to cultivate in turn each of the plots into which the estate has been divided

Karamaru – is where operating both Thattumaru and Kattimaru jointly in a single case

CHAPTER ONE

Introduction

1.1 Background

Land use which refers to the purpose the land serves vary among economic, social, and cultural perspectives. It also displays strong spatial and temporal variability. Land use in Sri Lanka which has a long history of civilization shows significant changes over time. During the early stage of Sri Lankan history, when there was plenty of land to meet the requirements of the smaller population, land use was determined by individuals or respective communities based on their self-sufficient economy. Under such circumstances, the impact on the environment by a certain type of land use system was negligible due to minimal human interference.

Over time with population increase, land became scarce. This paved a path to develop individual land rights and mechanisms and enforce such rights in the rural areas. With time producing more food from shrinking cultivable land was a challenge. This made traditional methods of cultivation such as shifting cultivation or adoption of long fallow periods to improve soil fertility fade away from the agricultural societies (Feder, 1988). With the introduction of Green Revolution technologies to Sri Lanka in early 1960s crop intensification technologies were introduced to increase farm productivity and input use efficiency. Fertility restoring technologies which came into practice permitted farmers to cultivate the same land continuously as it was able to maintain the required fertility levels by compensating the nutrient loss caused by continuous exploitation of the land. Since such technologies require investment of both capital and effort, the cultivator should have an investment incentive. For the cultivator, this incentive is enhanced when they possess the right to cultivate continuously, and they have the authority to transfer a given tract of land by will or by sale. This authority should not only be fixed by social custom but also by an effective state-enforced legal system (Place & Hazell, 1993). Thus, population growth and agricultural progress are typically accompanied by mechanisms to enforce land rights. An almost universal mechanism is a unified system of land registration and documentation whereby the state provides the landowner with proof that a given well-defined tract of land does indeed belong to him. If the registration system is effective, and if the state can protect the owner from encroachment or false challenges to his ownership, such a mechanism does indeed enhance security (Feder, 1988).

Sri Lanka has a unique land use, land tenure and regulation system which has evolved over the time. Of the total surface area of 6.57 million ha, almost 83 percent of the land is owned by the state and the remaining 17 percent is privately owned according to the data available at the Land Commissioner General's Department of Sri Lanka. Over 2 million ha are under agricultural usage of which 1.38 million ha are state-owned agricultural land. They are farmed by private farmers under varying tenure arrangements. Privately owned agricultural lands comprise 0.88 million ha and they are largely located in the Wet Zone of the country (Weerahewa et al, 2021).

The administration and management of agricultural lands in Sri Lanka is governed by a number of different operational laws, and Institutions. Different user and transfer rights have been given to recipients of land settlement schemes administered by the government agencies in terms of land grants and permits. Apart from these, there are varieties of informal arrangements to own, manage and access agricultural lands in rural settings often disregarding regulations. They include various rotational tenure systems (such as *Thattumaru* and *Kattimaru*), share tenancy arrangements, and ownership rights acquired through long term use

At present with an estimated population of nearly 22 million (Central Bank, 2020) the per capita arable land area is about 0.15 ha. This indicates the heavy pressure on agricultural lands. Such unbearable pressure created on land due to population growth over the generations in the wet zone of Sri Lanka has led to development of traditional agricultural land tenure systems called *Thattumaru* and *Kattimaru* (rotational land tenure system). Under this traditional method of land tenure, the lands are not divided but held jointly by several owners, each of whom takes over a small area in rotation depending on his share in the joint holding (Raza, 1970). This system of tenure mostly prevails in the wet zone districts like Ratnapura, Kegalle, Galle, Kalutara and Matara districts.

The principle behind *Thattumaru* is that rights to cultivate a piece of paddy land are shared among two or more persons in an annual rotation. Instead of physically dividing the land, the persons with cultivation rights take turns to cultivate the land each year. In the case of *Kattimaru* tenure land is subdivided at the death or retirement of its owner among his heirs, instead of permanent ownership rights to a particular land plot, each heir has the right to cultivate in turn each of the plots into which the estate has been divided.

In addition, a more complex system of rotational tenure called *Karamaru* exists where both *Thattumaru* and *Kattimaru* are jointly operated in a single case. It is difficult to understand and explain the operating system of *Karamaru* as it is a combination of *Thattumaru* and *Kattimaru*. The basic idea of *Thattumaru* and *Kattimaru* system was to avoid over-fragmentation while maintaining a high degree of equity. The original nature of the systems has changed as land productivity has drastically reduced due to changing environmental and socio-economic conditions (Moor & Wickremasinghe, 1978).

The major drawback identified in the rotational agricultural system at present is low land productivity and subsequent abandonment of paddy lands. Weerawardena & Collonnege (1971) highlighted that *Thattumaru* and *Kattimaru* system of land tenure makes implementing legislative provisions difficult by creating obstacles in security of tenancy rights and preparation, and revision of the paddy lands registry, operation of the irrigation ordinance and crop insurance act. In addition, over fragmentation and co-ownership of paddy land parcels has created several other disadvantages such as low irrigation efficiency, low labour efficiency, and problem of accessibility, land protection and land insecurity, limited period of operation and finally all these have led to abandonment of the land (Raza, 1970; Weerawardena & Collonnege, 1971; Moore & Wickramasinghe, 1978; Witharana, 2014).

The Department of Agrarian Development (DAD) has made several attempts in the past to address the issue mentioned above with what they learnt by undertaking several pilot studies. However, now it is obvious that simple land rearrangement will not provide a sustainable solution for this specific problem. The real challenge is to maintain the sustainability and productivity of these rotational tenure lands by overcoming the problem of over-fragmentation and co-ownership while safeguarding the underlying principles such as equity, water use efficiency and land productivity.

Obviously, any land tenure system without legal and titles prevents investment for permanent improvement of the land. Even temporary improvements such as the use of fertilizers which would produce benefits which will benefit not only the crops grown in a particular season but would be carried over to the crops grown in the next season or year, will not happen in such a circumstance. This situation is somewhat analogous to tenancy in so far as security of the tenure is concerned. Permanent

improvements of land would be facilitated on tenancy holdings if the tenant was given a secure right to land (Raza, 1970; Place & Otsuka, 2001; Chirwa, E., 2008).

With this background this study assumes that land insecurity, uncertainty, low land value, low labour efficiency and limited period of operation have led to control or reduction of the usage of inputs. Subsequently, this has resulted in a significantly reduced output. In such circumstances, the operation and maintenance of paddy fields and associated irrigation systems are also affected, and the sustainability of these systems is also threatened.

1.2 Rationale of the Study

Traditional land tenure systems have been developed in old private lands with the underlying principle of maintaining equity and the purpose of high land productivity. A similar type of rotational land tenure system to *Thattumaru* and *Kattimaru* also prevails in the dry zone of Sri Lanka as well but with the widespread extent of resettled lands, the dominance of rotational land tenure system in the dry zone has decreased. In the wet zone *Thattumaru-Kattimaru* is concentrated in the low and mid-country wet zone paddy lands and widely practiced in Southern and Sabaragamuwa Provinces (Witharana, 2014).

The sustainability of this land use pattern under the current socio-economic conditions has not been researched detail. However, the few pieces of detailed, case study- based research that have been conducted have generated strong and conflicting views about the value of the system. In part, this dispute arises because each case study has focused on a single village (Moore & Wickramasinghe, 1978). The nature and the consequences of the *Thattumaru — Kattimaru* system differs widely from one area to another. Therefore, conclusions based on case studies may be specific to the study site and difficult to generalize. Therefore, the focus of this study is to examine the impacts of *Thattumaru* and *Kattimaru* tenure systems on the productivity aspects of the paddy lands in the present social and economic setting in wet zone of Sri Lanka. Since a considerable percentage of land comes under this category, there is a need to highlight the extent of this problem while seeking possible solutions to overcome the problems confronted.

Many research studies conducted related to the factors that contribute to the gap in agricultural production tended to show that those factors broadly can be categorized into four main groups as economic, technological, socio-cultural, and political. Economic factors include marketing, credit and insurance, supply of inputs and efficient allocation of limited resources (FAO, 2017). Breeding of new varieties, introduction of efficient methods of cultivation are the technological factors. The socio-cultural aspects include farmers' attitude and response towards change, tenure, and ownership patterns prevailed in the society and many other institutional aspects. Economic policies, infrastructure, extension, and other services related factors considered as political (ibid).

Therefore, it is important to identify what are the factors that lead to less competitive performance of these rotational tenure paddy lands in the wet zone of Sri Lanka. Results derived from the economic analysis can be used to make relevant resource adjustment recommendations and combining it with social factors help to form a basis for policy directives to improve the performance of wet zone paddy cultivation.

1.3 Objectives

General objective of this study is to analyze the impact of *Thattumaru* and *Kattimaru* tenure system on the agricultural productivity aspects of paddy cultivation in low country wet zone areas of Sri Lanka.

Specific objectives of the study are;

- To identify the characteristic features of *Thattumaru* and *Kattimaru* tenure system
- To determine the paddy production performance and resource use efficiency in the rotational land tenure system
- To trace the attitude of the peasantry towards this system in the existing agricultural/agrarian set up
- To seek remedial measures leading to the solution of the productivity problem associated with the particular land tenure system

CHAPTER TWO

Methodology

2.1 Study Location and Sample

Based on the data available in the DAD three main districts where the *Thattumaru* and *Kattimaru* land tenure system is more predominant; Ratnapura, Kalutara, and Galle located in the Wet Zone of the country were selected as the study areas of the research. Selected ASC centers in each district and sample size are listed in Table 2.1

Table 2.1 Distribution of Sample

District	ASC	Sample size
Kalutara	Millaniya	21
	Kananvila	32
Ratnapura	Kuruvita	28
	Pelmadulla	19
	Nivithigala	13
Galle	Gonadeniya	10
	Yakkalamulla	17
	Pinikahana	07
Total		147

2.2 Data

The following techniques were used to collect primary and secondary data for the study.

Review of literature: The available published and unpublished literature on the subject was reviewed to understand the *Thattumaru* and *Kattimaru* land tenure system and related issues. From the review, a checklist was prepared to formulate the questionnaire for the sample survey and the interview guides for rapid assessment.

Key informant interviews: Key informant interviews were conducted among the officers of the selected Agrarian Services Centers (ASC) and Farmer Organization (FO) leaders.

Sample survey: Basically, three districts, Ratnapura, Kalutara and Galle were selected for the study considering the high prevalence of the *Thattumaru* and *Katimaru* tenurial system. Within districts, ASCs were chosen based on the documents compiled by the Department of Agrarian Development (DAD) on land extent under each tenure arrangement. A final Agrarian Research and Production Assistant (ARPA) area to implement the survey was selected with the consultation of the officials of respective ASC. From each district fifty farmers who have cultivated *Thattumaru* and *Kattimaru* land plot in the nearest cultivation year (2018/2019 *maha* and 2019 *yala* seasons) were randomly selected for the survey.

Rapid appraisal: Also rapid appraisal method of information collection was employed for the villages of same selected ASC areas to assess the consequences of *Thattumaru* and *Kattimaru* land tenure systems on farm production, factors limiting the production performance, farmer perception and suggestions for increasing the sustainability of the system.

2.3 Data Analysis

Tabular and descriptive analysis was used to examine different socio-economic features of the sample farmers and institutional factors affecting paddy production. An econometric model was used to assess the farmer level production efficiencies and causes of inefficiencies.

2.3.1 Theoretical Background of Efficiency Estimation

Efficiency of a production unit can be defined as effective use of variable resources for profit maximization under the best production technology available. From an applied perspective, measuring efficiency is important because this is the first step in a process that might lead to substantial resource savings that have implications for both policy formulations and management. Efficiency and inefficiency can be measured by using different functions such as, technique, cost, revenue, and profit. Technical efficiency refers to a farm's ability to achieve the maximum output for a given set of inputs and technology. Production functions are widely used to analyze efficiency in terms of output for a given level of inputs. In most microeconomic analysis, production functions are estimated under the assumption that producers are rational in maximizing their profit and operate within their production frontiers. However, Farrell (1957), Aigner et al (1977), Meeusen and Van den Broeck (1977), and Battese and Coelli (1995) support the view that producers differ in the measured output that

they produce from a given bundle of measured input, or alternatively, in the input requirements to produce a given output.

Stochastic Frontier Analysis (SFA) acknowledges such efficiency differences among farmers. Producers operating on their production frontier are referred to as technically efficient and vice versa. Stochastic Frontier Production functions have been used extensively in the past two decades to analyze technical efficiency. The original models of Aigner et al (1977) and Meeusen and Van den Broeck (1977) have been modified and extended in many ways. One development has been to express inefficiency as an explicit function of farm-specific variables. Such a model can be estimated in a two-stage technique, where the Stochastic Frontier is obtained first, and the predicted efficiencies are then regressed upon the farm-specific variables. Battese and Coelli (1995) proposed a simultaneous estimation procedure that has the advantage of providing consistent and efficient estimates. The results of the technical efficiency studies are used to estimate the effects of various factors on inefficiency. These may be estimated using either a one-step or two-step process. In the two-step procedure, the production frontier is first estimated, and the technical efficiency of each firm is derived. These are subsequently regressed against a set of variables, which are hypothesized to influence the firm's efficiency. This approach has been adopted in a range of studies.

A problem with the two-stage procedure is the lack of consistency in assumptions about the distribution of the inefficiencies. In the first stage, inefficiencies are assumed to be independently and identically distributed to estimate their values. However, in the second stage, estimated inefficiencies are assumed a function of a number of firm-specific factors, and hence are not identically distributed (Coelli et al, 1996). Kumbhakar, Ghosh and McGuckin (1991) estimated the parameters in one step to overcome this inconsistency. The inefficiency effects were defined as a function of the firm-specific factors (as in the two-stage approach) but were incorporated directly into the MLE. Battese and Coelli (1995) also suggested a one-step estimating procedure. In this study we used the SFA specification proposed by Battese and Coelli (1995), in which technical inefficiency was estimated from the frontier and simultaneously explained by a set of variables representative of the farms' characteristics.

2.3.2 Model Specification

A variety of mathematical research models have been developed and used in quantitative research in the microeconomics of farm production. But the choice of functional form in an empirical analysis is crucial because it makes a significant effect on the results. Parametric frontier approach assumes functional form on the production function and makes assumptions about the data. The most common functional forms include the Cobb-Douglas, Constant Elasticity of Substitution (CES) and translog production functions. Deterministic frontiers assume that all the deviations from the frontier are a result of firms' inefficiency, while Stochastic frontiers assume that part of the deviation from the frontier is due to random events (reflecting measurement errors and statistical noise) and part is due to farm specific inefficiency (Forsund et al. 1980; Battese and Coelli et al., 1998).

Stochastic frontier function can be expressed as;

$$y_i = f(x_i, \beta) + \varepsilon_i$$
$$\varepsilon_i = v_i - u_i; \qquad i = 1,2, \ldots., N \quad (1)$$

Where, Y_i is production of the i^{th} farm, x_i is vector of inputs of production of the i^{th} farm, β is a vector of unknown parameter to be estimated. ε_i is the composed error term consist of two independent elements u and v. v_i is the error term of i^{th} producer for all possible random variation in output due to factors outside the farmer's control such as weather and pest and diseases. It is assumed that distributer normally, identically and independently with 0 mean and σ_v^2 variance, N (0, σ_v^2). u_i is a non-negative error term denoting inefficiency of the i^{th} producer, which Aigner et al., (1977) assume having either half normal or exponential distribution. In this study the distribution of u_i is assumed as half-normal and identical, N (0, σ_u^2).

Equation (1) specifies the Stochastic frontier production function in terms of the original production values. The technical inefficiency effect, U_i, in the Stochastic frontier model (1) can be specified as:

$$u_i = z_i\delta + w_i \qquad (2)$$

Where, z_i - vector of explanatory variables associated with technical inefficiency of production δ - vector of unknown coefficients to be estimated and W_i is random variable, defined by the truncation of the normal distribution with zero mean and variance σ^2.

2.3.3 Maximum Likelihood Estimation

Stochastic frontier functions can be estimated using the maximum likelihood method. According to Battese and Corra (1977) the variance ratio parameter (γ), which relates the variability of u_i (σ_u^2) to total variability can be calculated as follows;

$$\gamma = \frac{\sigma_u^2}{\sigma^2}$$

Where, $\sigma^2 = \sigma_u^2 + \sigma_v^2 \qquad (3)$

So that, $0 \leq \gamma \leq 1$

In the case of $\sigma_v^2 = 0$, γ would be equal to 1 and all the differences in the producer yield and efficient yield is a result of management factors under the control of the producer. In the case of $\sigma_u^2 = 0$, γ would be equal to 0, which means all the differences between farmer's yield and efficient yield is due to factors that the producer has no control over.

Hypothesis Testing

$$H_0; \qquad \sigma^2 = 0$$
$$H_1; \qquad \sigma^2 > 0$$

Where, γ statistics is used for hypothesis testing. If likelihood ratio (LR) > χ^2, null hypothesis (H_0) is rejected. It means that there are inefficiencies and the function could be estimated using Maximum Likelihood Methods. If H_0 is not rejected, the Ordinary Least Square Method gives the best estimation of the function.

Estimation Procedure

The Stochastic frontier production function of Cobb-Douglas type is defined in logarithmic form as;

$$\ln Y = \beta_0 + \beta_1 \ lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + (v_i - u_i) \quad (4)$$

The Stochastic frontier production, defined in equation (4), is a linearized approximation of a Cobb-Douglas production function. In the Stochastic frontier,

Y =Paddy output (kg/ac)

X_1 = Land size (ac)

X_2 =Quantity of seed (kg/ac)

X_3 = Quantity of fertilizer (kg/ac)

X_4 =Family labour (man-days)

X_5 =Hired labour (man-days)

2.3.4 Causes of Inefficiency

The level of efficiency differs from farm to farm, and it depends on both farm and farmer characteristics. The inefficiency estimates coming from the frontier production function implies the contribution of farmer related exogenous variables on inefficient usage of inputs. Depending on the co-efficient calculated for these exogenous variables, the inferences could be drawn. Negative co-efficient of an inefficient variable implies the reduction of inefficiency with the presence of the respective exogenous variable.

The inefficiency variables considered in this analysis are;

Age of the farmer (years)
Education level (years)
Dummy variable for type of primary employment (Agriculture =1; otherwise=0)
District 1 dummy variable (If district is Galle = 1; otherwise = 0)
District 2 dummy variable (If district is Ratnapura = 1; otherwise = 0)
Type of involvement in paddy farming (Full time =1; otherwise = 0)
Thattumaru - Kattimaru rotation in years

2.3.5 Cost of Production Calculation

The cost of cultivation for rotational tenure farmers were calculated separately for the three districts. Average costs were calculated for important cultural practices and the production process was synthesized by including the most prominent cultural practices in the model. Cost items were divided into three main components; labour, machinery, and materials. Power cost included the cost of draught power for land preparation and harvesting, while material cost included seed, fertilizer, and pesticides. Costs and returns were calculated with and without cost of family labour.

In the analysis all costs and returns were computed for an acre of cultivated extent and imputed wage rate for family labour was considered as same as hired wage rate for respective operations.

In addition to details of cost components, different analytical indicators, namely, profit, return to labour, return to capital, per unit cost and break even yield, were also calculated to make an explicit picture of cost of production related information associated with paddy production under rotational land tenure. Equations used to calculate different indicators are given below.

I. Profit including imputed costs = Gross return – Cost of cultivation including imputed cost
II. Profit excluding imputed costs = Gross return - Cost of cultivation excluding imputed cost
III. Return to labour = (Profit excluding imputed cost + Cost of hired labour) / man days
IV. Return to capital = Gross return / Cost of cultivation excluding Imputed cost
V. Per unit cost including imputed cost = Cost of cultivation including imputed cost /Average yield
VI. Per unit cost excluding imputed cost = Cost of cultivation excluding imputed cost/ Average yield
VII. Break even yield including imputed cost= Cost of cultivation including imputed cost imputed cost / Farm-gate price
VIII. Break even yield excluding imputed cost = Cost of cultivation excluding imputed cost imputed cost /Farm-gate price

CHAPTER THREE

Socio Economic and Production Features of *Thattumaru* and *Kattimaru* Tenure Farmers

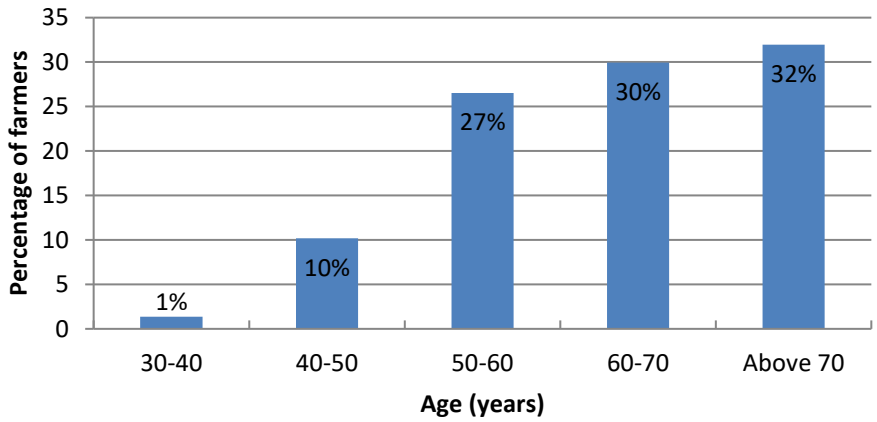
Individual households being the most crucial decision making unit in resource allocation and production of the household economy, this chapter attempts to review the basic demographic and cost of production features of the rotational tenure lands of the wet zone paddy farmers. This chapter consists of two important sub-sections namely socio-economic characteristics of the respondent farmers and composition of cost of paddy cultivation under rotational tenure lands in selected three districts, Kalutara, Galle and Ratnapura.

3.1 Demographic Characteristics of the Rotational Tenure Farmers

This subsection summarizes the demographic characteristics of the sample farmers; age, educational level, income, household size and employment profile to try and understand the major issues arising due to changing settings of households' social and economic conditions with special reference to land tenure system in the wet zone paddy lands.

3.1.1 Age Distribution of Paddy Farmers

The findings indicate that, majority of the sample rotational tenure farmers (62%) are above 60 years of age highlighting less involvement of youth in farming activities (Figure 3.1). However, this is not a phenomenon restricted to rotational tenure; a similar pattern could be identified under other tenurial arrangements in all districts in wet zone (Wijesinghe & Wijesinghe, 2015). Only one percent of the total number of farmers is represented by youth below 40 years of age. Remarkably, the highest number of farmers (32%) is above 70 years of age indicating that younger generations are not attracted by paddy cultivation under rotational land ownership. This situation is common in all three study districts.

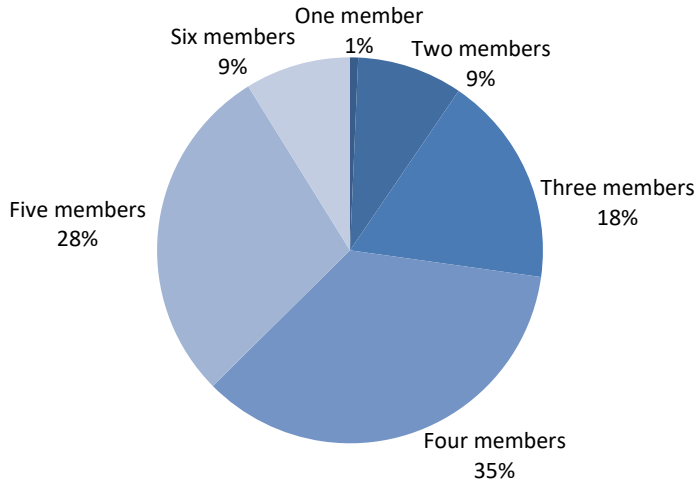


Source: HARTI survey data, 2019

Figure 3.1: Age Distribution of the Household Head

3.1.2 Family Composition

Average family size of the sample households is 4.1 and sample families were categorized into six groups based on the household size. As illustrated in Figure 3.2, 20 percent of the households have 1-3 members in their families. Thirty-five percent of the total number of families consisted of four members while families with more than five members accounted for 37 percent of the total sample families indicating that the majority of farmer families comprised fairly of larger family units.



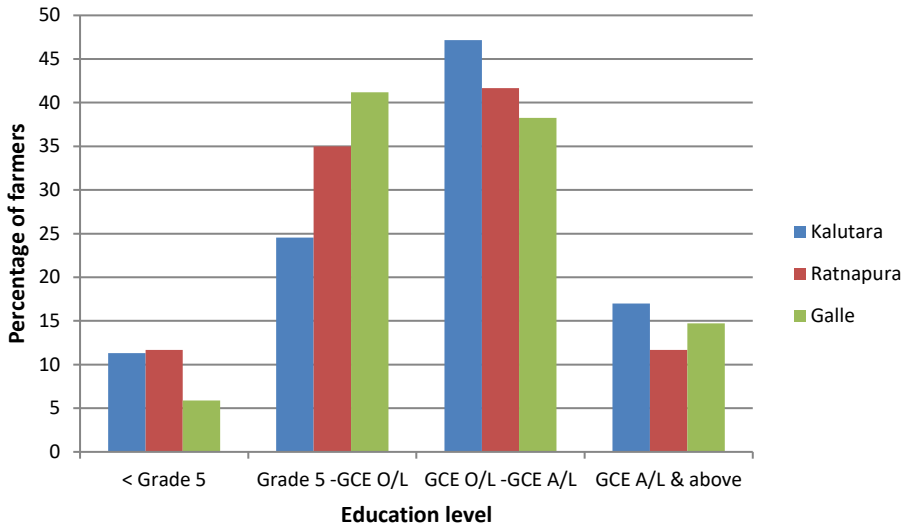
Source: HARTI survey data, 2019

Figure 3.2: Number of Family Members in the Households

Almost all the paddy lands in the wet zone are old lands (Purana Kumburu) inheritance coming from ancestors, therefore, parents would like to transfer not only the ownership of land to their heirs but the genealogy. Therefore, large family size implies the expanding number of inheritors for the limited number of agricultural lands available in the wet zone. This could be taken as a portent of possibility of escalating future land disputes. Conversely, regulations have been implemented in settlement lands to prevent over fragmentation (Samarasinha & Aheeyar, 2013; Chandrasiri, 2010) therefore it is important to have institutional mechanism to avoid land distribution related issues when traditional systems are not properly functioning (Weerahewa et al, 2021).

3.1.3 Education Level of the Sample Farmers

The education status of the sample household farmers illustrates that all the farmer household heads had attended formal education and only 10 percent of the sample farmers had been limited to primary education. In the total sample about 43 percent had been able to qualify for G.C.E. O/L and followed through to G.C.E Advanced level while another 14 percent of them have qualified G.C.E. advanced level and above. District wise distribution of the education level of household heads is illustrated in Figure 3.3. The majority of members living in these areas, especially the younger generation, meet higher education qualifications, opening up avenues for them to pursue other non-agricultural jobs in the job market. This has further influenced them to move away from non-economic, rotational agricultural lands.

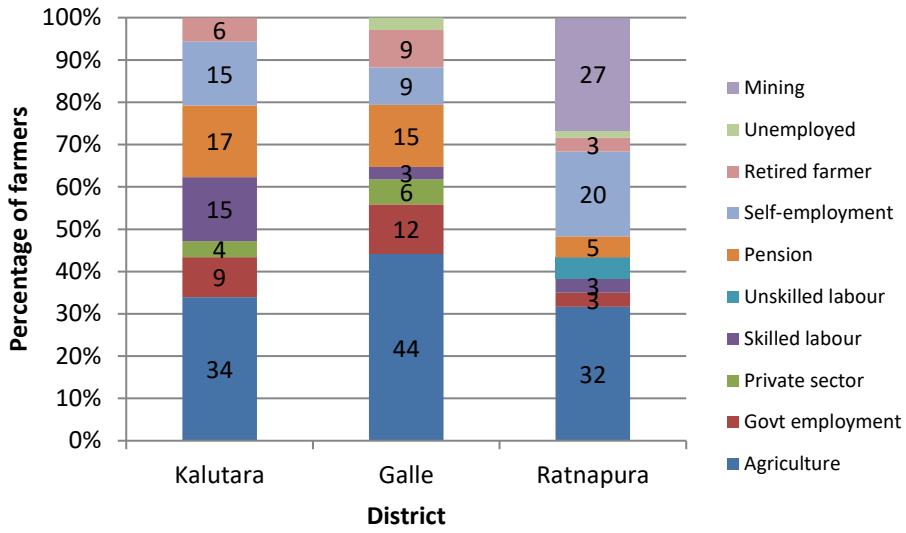


Source: HARTI survey data, 2019

Figure 3.3: Level of Education of the Household Head

3.1.4 Primary Income Source of the Sample Farmers

Agriculture related activities can be identified as one of the most common income sources in all three districts with percentage share above 30 percent. Agriculture is the main income source for 34 percent in Kalutara district, 44 percent in Galle district and 32 percent in Ratnapura district. It is also important to highlight that unlike in dry zone most of the households in the selected three districts have their own plot of plantation crops such as tea, rubber cinnamon etc., hence their main agricultural income is from plantation crops not from paddy. Figure 3.4 illustrates the main income source of the sample rotational tenure farmers in three selected districts.



Source: HARTI survey data, 2019

Figure 3.4: Primary Employment of the Sample Farmers

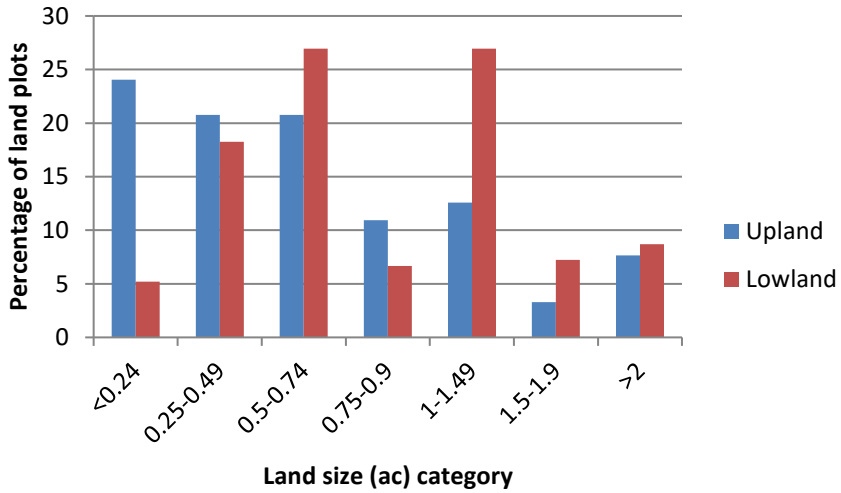
Compared to the dry zone, the wet zone farmers have greater off farm employment opportunities therefore a majority of them seek employment in other sectors. The distribution of non-agricultural activities among the sample farmers of the study can be categorized into government and private sector. Income can be either self-employment activities maintaining boutiques, pensions, government, employment and gem mining. In Kalutara and Galle districts the primary income source of the second large group of farmers is their pension.

At the same time in Ratnapura district 27 percent of the farmers were involved in gem mining as Ratnapura region was the first locality to mine sapphire in Sri Lanka. During the field visits it was observed that almost all the farmers are involved directly or indirectly in gem mining related activities as their priority source of income generation. The value of land has increased due to mining of gems and in addition lands that are not regularly cultivated are encroached on by miners. Though most of these lands are categorized under paddy land, they are not cultivated in either season and left abandoned even though they are suited for agriculture. The main reason being that gem mining is a more lucrative income source. Sri Lankan gem mines are not land intensive, a gem mine would need a maximum of 10 –15 perches of land, which are mostly found in the middle of a paddy field, and can co-exist with paddy farming (Alawattage, 2011).

3.1.5 Land Use Pattern and Ownership of Paddy Lands in the Cultivation Year 2019

Land size

One of the main characteristics of wet zone farming is farmers' possession of small land holdings and this is the main reason behind the development of a rotational land tenure system in the wet zone. As illustrated in Figure 3.5 more than 70 percent of the uplands are less than one acre in size. Since wet zone have favorable environmental conditions for plantation crops such as tea and rubber, most of the farmers have land plots cultivated with these crops.



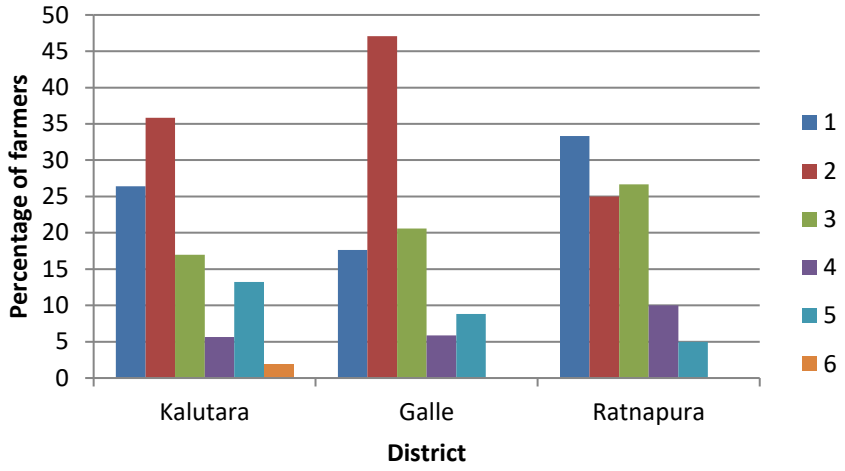
Source: HARTI survey data, 2019

Figure 3.5: Land Size Distribution of Rotational Tenure Lands

When it comes to lowlands, only 23 percent of the land plots are less than 0.5ac while 27 percent of the land plots are 0.5 – 0.74ac and 1 – 1.49ac in extent. Percentage of paddy lands above 2ac of extent is less than 10 percent. It follows that more than 43 percent of the lowlands in the sample area was larger than one acre. Compared to other low land paddy cultivation areas located in dry zone and even other areas in the wet zone these extents are larger in size. This might be due to prevalence of *Thattumaru* and *Kattimaru* tenure systems which prevent over-fragmentation.

As illustrated in Figure 3.6 irrespective of the district, the majority of the farmers have owned more than one plot of paddy land under different tenurial arrangements. In Ratnapura district 33 percent of the sample

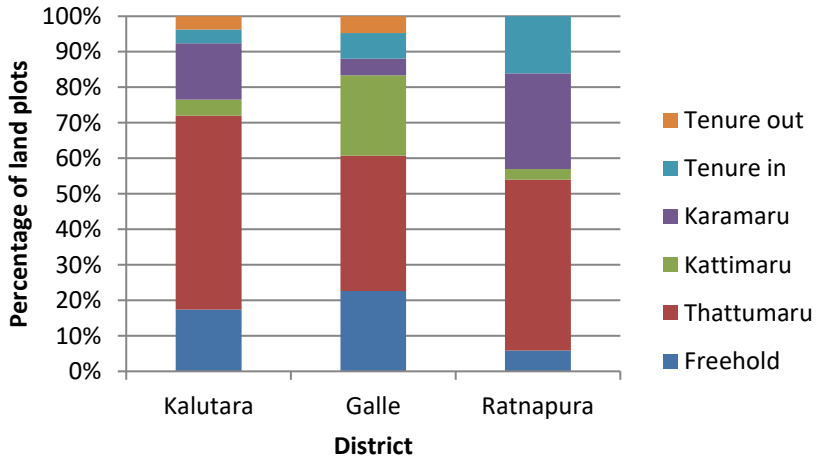
farmers have one plot of paddy land while in Kalutara and Galle districts this number is 26 percent and 18 percent respectively.



Source: HARTI survey data, 2019

Figure 3.6: Number of Paddy Land Plots Owned by Sample Farmers

Even though most of the sample farmers have more than one plot of land under their custody, the majority of the paddy land plots were under at least one of rotation tenure arrangements such as *Thattumaru*, *Kattimaru* or *Karamaru* irrespective of the district (Figure 3.7).



Source: HARTI survey data, 2019

Figure 3.7: Ownership Status of the Paddy Lands

CHAPTER FOUR

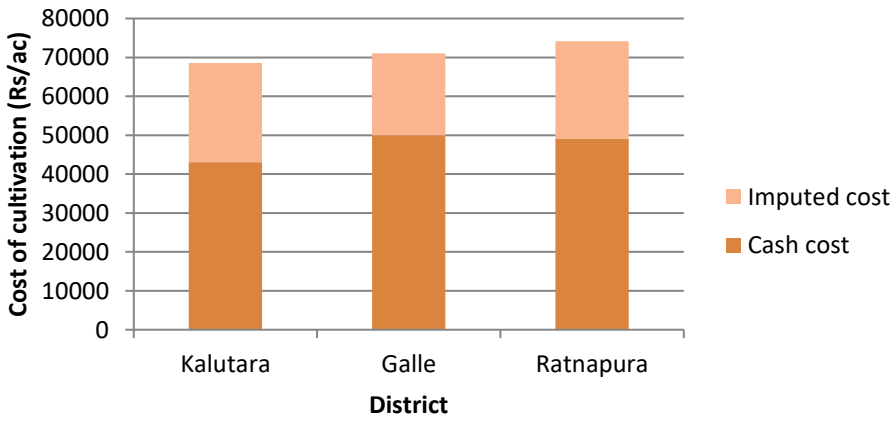
Cost of Production and Resource Use Efficiency

This chapter depicts the analysis of the cost of cultivation, returns in paddy farming and production efficiency of paddy cultivation under rotational land tenure in three surveyed districts, of Ratnapura, Galle and Kalutara. The first section describes the cost of cultivation and returns of cultivation including input wise distribution of cost components. The second part of the chapter represents the production efficiency results derived from Stochastic frontier production function.

4.1 Cost of Cultivation and Returns in Paddy Farming

4.1.1 Total Cost of Cultivation

This section discusses the results of cost of cultivation of paddy in 2019 *yala* season and 2018/19 *maha* season in rotational paddy lands in surveyed districts. Majority of the sample farmers had cultivated only one season per year and for 70 percent of the farmers it was *maha* season. Total cost of production consisted of farmer owned and purchased inputs; seeds, machinery, fertilizer, pesticide and, labour associated with different activities of paddy production.



Source: HARTI survey data, 2019

Figure 4.1: Cost of Cultivation of Paddy in Rotational Tenure Lands in Selected Districts

The breakdown of the average cost of cultivation per acre of land according to cash cost and imputed cost for Kalutara, Galle and Ratnapura districts are graphically illustrated in Figure 4.1.

The highest cost of production of Rs. 74,183 was recorded from Ratnapura district and of Rs. 25,021 was incurred on opportunity cost of farm family owned inputs. The total cost of cultivation was Rs. 71,041 in Galle district of which Rs. 21,043 was incurred on imputed cost. The least cost of cultivation per acre of paddy land of Rs. 68,603 was recorded in Kalutara district of which Rs. 40,076 was incurred as cash cost while the remaining Rs. 25,527 was imputed as opportunity cost. The percentage share of cash cost component to the total cost was more than 62 percent in all three districts. Primary data used to calculate cost of cultivation displays that the main contributor to the difference between costs of cultivation is variations in machinery and labour days usage. Farmers were involved in non-agricultural activities such as gem mining in Ratnapura and cinnamon industry in Galle district. Therefore, they have given priority to non-agricultural activities rather than to paddy cultivation. On the other hand labour has become comparatively expensive in the said two districts due to the same reason.

Table 4.1 depicts the variation in cost of cultivation with scale of operation in rotational tenure paddy lands in wet zone of Sri Lanka. Results clearly indicate that there are economies of scale in paddy production as cost of cultivation of acre of land declines with the increase of land extent. As indicated in the table, the majority of the farmers (54%) cultivate less than one acre of land which is a characteristic feature of wet zone lands (Wijesinghe & Wijesinghe 2015). Results clearly show that minimum production cost was recorded by farmers who are cultivating land extent greater than two acres.

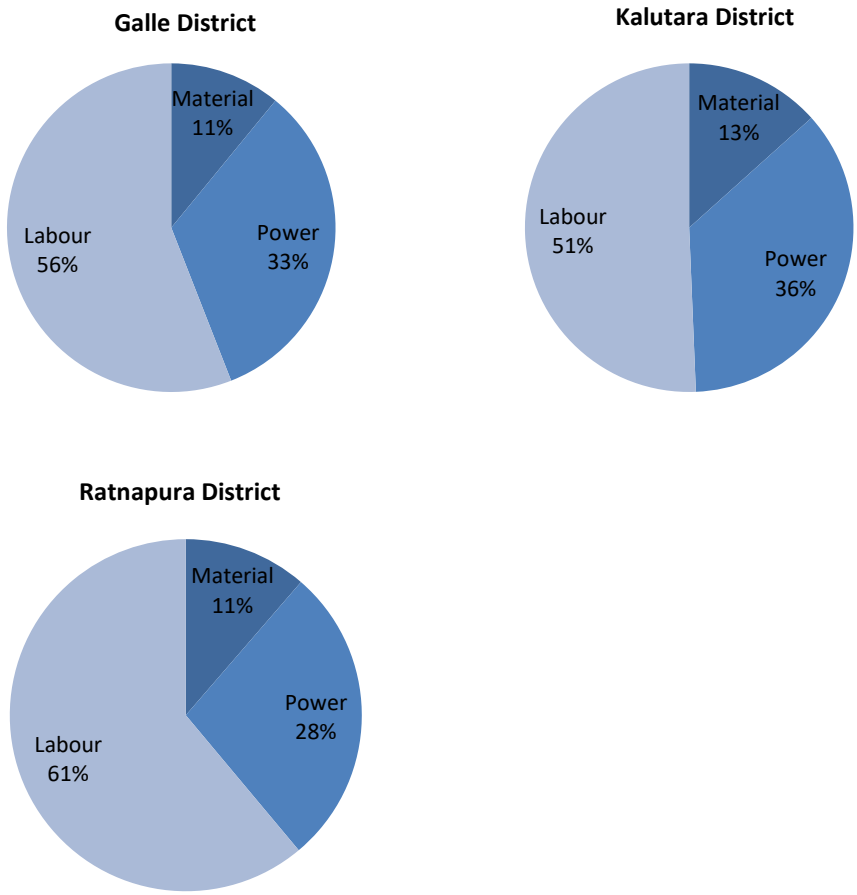
Table 4.1: Cost of Cultivation Paddy by Land Size in Rotational Tenure System (Rs/ac)

Land size	<0.5 ac	0.5-1ac	1-2ac	>2ac
% of farmers	12	41	42	5
Average COP excluding imputed cost (Rs/ac)	56526.54	52277.76	40823.42	31775.33
Average COP including imputed cost (Rs/ac)	127074.5	76987.09	53790.52	45032.95

Source: HARTI survey data, 2019

4.1.2 Cost Structure

Total cost of production can be categorized into three main input components as labour, machinery, and material. Labour cost component included all types of labour used in the cultivation process such as family, hired and exchange labour. Machinery cost mainly comprises all costs associated with different machineries used in the cultivation activities of ploughing, pesticide application, harvesting, threshing, and winnowing and it is stated here as power. All other costs used to acquire seeds, fertilizers, and pesticides are under the material cost component. Figure 4.2 illustrates the percentage share of major cost components to the total cost of cultivation in rotational tenure lands in selected districts.

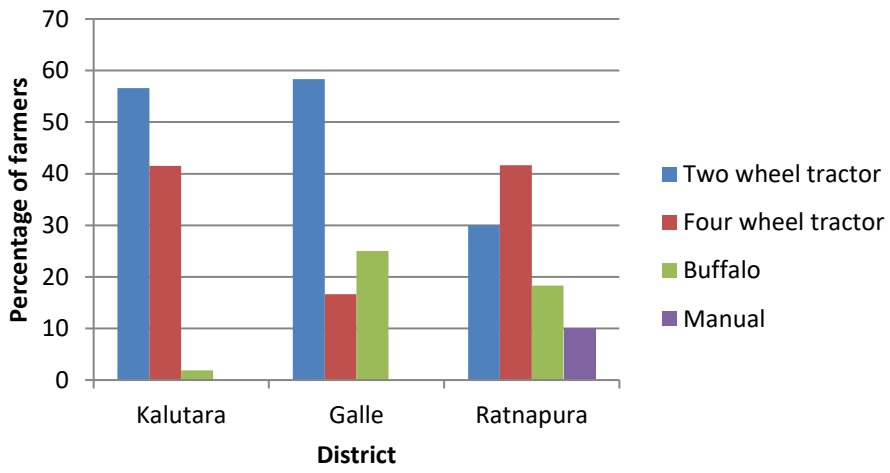


Source: HARTI survey data, 2019

Figure 4.2: Percentage Share of Major Cost Components to the Total Cost of Cultivation

As shown in Figure 4.2, labour share is the most predominant cost component in all three studied districts. Ratnapura district has the highest percentage share of 61 percent followed by 56 percent in Galle district and 51 percent in Kalutara district. Unlike in dry zone paddy cultivation labour usage is high in wet zone mainly due to the small plot size and inherent marshy nature of the lands. Labour usage is high in Ratnapura district starting from land preparation to harvesting of the surveyed farmers 10 percent had not used any machinery in the cultivation process. In Ratnapura and Galle districts only around 30 percent of farmers used a combine harvester for harvesting while this value is nearly 72 percent in Kalutara district. Nature of the land, small plot size, unavailability of suitable machinery and higher cost associated with machinery are the main reasons for less mechanization in selected study locations. Since they are subsistence farmers mainly producing for the purpose of household food security with poor yields, they are reluctant to spend on machinery.

Further, there were some extreme variations in labour usage when farmers had to use manpower for almost all the activities. Average labour usage per acre is around 22 man days. This was identified as one of the major constraints that hinder the continuous cultivation of paddy lands in wet zone. These trigger farmers to avoid cultivating their respective turn ultimately leading to paddy land abandonment. Generally, machinery cost share is around 30 percent of the total cultivation cost and material cost is about 10 percent of the total cost irrespective of the district.



Source: HARTI survey data, 2019

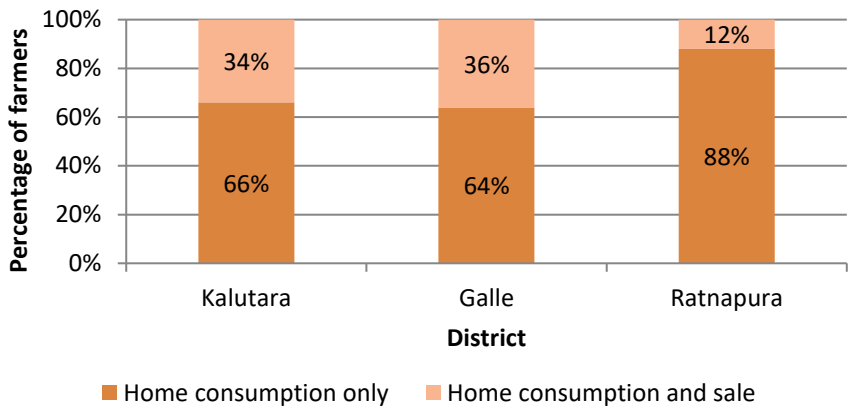
Figure 4.3: Type of Machinery Used in Land Preparation

The Figure 4.3 illustrates the type of machinery used by sample farmers in wet zone. More than 50 percent of the farmers in Kalutara and Galle district used two-wheel tractors for their land preparation. While in Ratnapura district 42 percent of the farmers used four-wheel tractors and another 30 percent of them used two-wheel tractors. While land preparation in most areas of the country is mechanized in Ratnapura area there is a use of manual labour and buffaloes for land preparation. It is important to highlight that 10 percent of the sample farmers in Ratnapura district did their land preparation totally using manual power. Many paddy lands of the low country wet zone in particular the part of the country where rotational tenure is most common, is characterized by low-lying ill drained fields bog and half bog soils comprising several feet of soft mud (hal kumburu). The land preparation and harvesting of these fields is a very laborious and unpleasant task for farmers since they have to work a foot deep in mud as machinery cannot be used in the fields.

In the breakdown of the material cost irrespective of the district nearly 50 percent of the material cost has been spent for seeds. Irrespective of the district, more than 70 percent of the farmers in the sample purchased DOA certified seeds from ASCs or seeds produced by the private companies from the open market. While the share of total cost incurred for pest and disease control was 30 percent and remaining 20 percent goes for fertilization of soil. Almost all the farmers have tended to use synthetic fertilizers which were provided through fertilizer subsidy scheme.

4.1.3 Unit Cost of Production, Yield and Returns

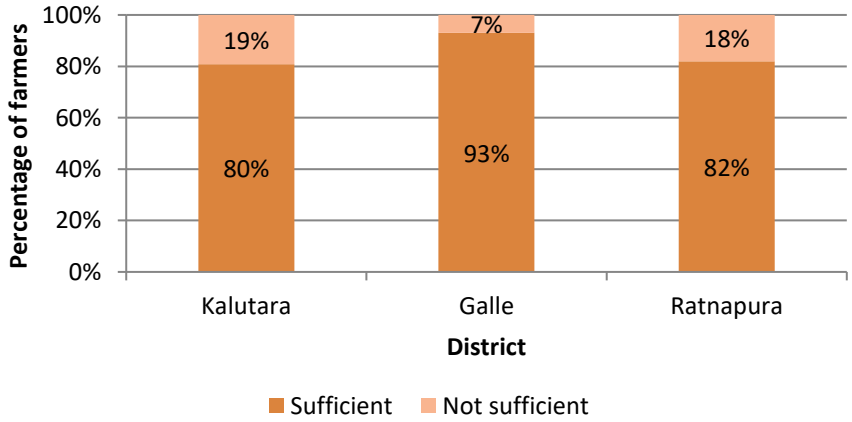
Unlike in dry zone, most of the farmers in wet zone cultivate paddy with the primary objective of household food security. According to the survey findings, the sole purpose of 88 percent of the farmers in Ratnapura district cultivating their rotational tenure paddy land is for home consumption. In Kalutara and Galle district 66 percent and 64 percent of the farmers respectively cultivate only for home consumption, while the rest of the farmers sell part of their production (Figure 4.4).



Source: HARTI survey data, 2019

Figure 4.4: Main Purpose of Paddy Cultivation

Even though the majority of the farmers cultivate their land with the purpose of getting their staple food, Figure 4.5 illustrates that, 19 percent, 18 percent and 7 percent of the farmers respectively in Kalutara, Ratnapura and Galle districts were not able to get a production that is sufficient for consumption throughout the year. This is mainly because more than 90 percent of the farmers in these areas cultivate only one season in a year and poor yield potential due to the soil and agronomic conditions prevailing in many of those areas (Jayawardena et al, 1983; Dhanapala 2010).



Source: HARTI survey data, 2019

Figure 4.5: Sufficiency of Own Produced Rice for Year around Consumption

Table 4.2 depicts the calculated unit cost, breakeven yield, net returns, return to labour, return to capital and yield for the rotational tenure farmers

in Kalutara, Galle and Ratnapura districts. Cost of production of a kilogram of paddy in selected rotational tenure farmers is high compared to the national average of rainfed paddy cultivation of Rs. 32.38 including farmer own inputs and Rs. 24.19 by excluding farmer own inputs (DOA, 2020).

The lowest unit cost of production excluding imputed costs of Rs. 38.57 was reported from Galle district followed by Rs. 44.82 and Rs. 50.74 in Kalutara and Ratnapura districts respectively. When it includes farmer own inputs, mainly the labour cost, unit cost of production is much higher in study locations as shown in the Table 4.2. Ratnapura district reported the highest calculated value of Rs. 75.43, followed by Rs. 71.19 in Kalutara district and Rs. 55.33 in Galle district.

Almost all the farmers commented that even though paddy cultivation is not profitable in monetary terms, they continue to cultivate so that they can secure their ownership in rotation of cultivation and to produce their own rice. During farmer discussions, in almost all the study locations, farmers reveal that they are keen to cultivate in their respective turns because of the high market price of rice.

Table 4.2: Unit Cost, Break Even Yield, Net Returns, Return to Labour, Return to Capital and Yield

	Kalutara		Galle		Ratnapura	
	1	2	1	2	1	2
Unit cost (Rs/kg)	44.82	71.19	38.57	55.33	50.74	75.43
Break even yield (kg/ac)	861.53	1372.06	999.96	1420.82	983.23	1483.65
Net returns (Rs/ac)	9809.35	-15717.33	21249.91	206.60	3131.77	-21889.27
Return to labour (Rs)		1680.45		2502.39		1087.59
Return to capital (Rs)		1.38		1.57		1.16
Yield (kg)		1058		1425		1046

Note: 1. Excluding cost of farmer own inputs 2. Including cost of farmer own inputs
Source: HARTI survey data, 2019

Average yield of studied districts are given in Table 4.2. Calculated average yields for Kalutara, Galle and Ratnapura districts were comparatively less than the rainfed average yields calculated by the Department of Census and Statistics (Department of Census and Statistics, 2021).

Break even yield is the yield that is required to cover the cost of production. In other words it enables one to understand the minimum yield needed to earn a return on the investment. All three districts reported lower break even yield than average yield when farmer own inputs were omitted. But by including farmer own inputs farmers have to obtain a higher level of yield to get a positive return on their investment.

As clearly shown in Table 4.2, because of lower yields and high cost of production net returns were not attractive for the farmers in almost all three districts. Farmers were able to get a small profit without costing their own inputs. However, Galle district farmers show a small but net profit even including family labour. Further, farmers were able to receive at least this level of returns because of good market prices and subsidized fertilizers. Calculations related to all three districts show return to capital and return to labour greater than one, these values are far below when compared to district figures (DOA, 2020).

4.2 Resource Use Efficiency in Rotational Tenure Paddy Lands in Wet Zone

4.2.1 Input Output Relationship

Individual farm level efficiency was estimated for Kalutara, Galle and Ratnapura districts. Cultivation data for the nearest cultivation season at the time of data collection was considered for the analysis. The summary results of the analysis are shown in Table 4.3.

The results in Table 4.3 show that γ value for two districts are significantly different from zero, hence the null hypothesis γ = 0 was rejected at the 1 percent significance level. Thus, it can be concluded that technical inefficiencies do exist in paddy cultivation in Thattumaru and Kattimaru lands in selected districts of wet zone. According to the 1% significance, 99 percent of the random variation in paddy production was explained by the model. The observed variations in production efficiency among paddy farmers were mainly due to differences in farm practices of sample farmers rather than random factors that are not within the control of farmers. One-sided LR tests of γ = 0 provide statistics of 25.726 for the models and that exceeds the chi-square critical value at five per cent. Hence, the Stochastic frontier model does appear to be a significant improvement over an average production function.

Table 4.3: Summary Statistics and Estimated Coefficients of the Frontier Analysis

Parameter	Coefficient	SE	t-ratio
$\sigma^2 = \sigma_u^2 + \sigma_v^2$	0.131	0.019	6.67*
$\gamma = \sigma_u^2 / \sigma^2$	0.99	0.19E-05	0.53 E+06*
Log likelihood	- 33.059		
LR test	25.726		
Variables in the production function			
Seeds	0.606	0.048	12.559*
Fertilizer	0.017	0.094	0.184
Hired labour	0.008	0.013	0.622
Family labour	-0.059	0.031	-1.910***
Land	-0.131	0.065	-2.000**
Determinants of the inefficiency			
District1 dummy	-0.431	0.139	-3.091*
District 2 dummy	0.056	0.097	0.573
Age	0.006	0.004	1.720***
Education	1.290	0.017	0.740
Primary employment	0.009	0.117	0.079
Involvement in paddy cultivation	-0.074	0.098	-0.757
Thattumaru - Kattimaru rotation	-0.009	0.022	-0.424

*significant at 1% level, **significant at 5% level, significant at 10% level

Source: HARTI survey data, 2019

Estimated coefficient for the variable representing seed quantity used was positive and significant at one percent significant level by implying that by keeping all other variables constant, 10 percent increase in quantity of seeds used will increase the paddy yield by approximately 6.06 percent on an average. Seed quantity and quality are major factors that contribute to the ultimate yield. Though almost all the farmers' practice broadcasting as a labour saving technique, it leads to higher loss of seeds before germination due to damage caused by pests, mainly the birds. Further, farmers reiterate that damage by bird increases at planting stage.

More than 99 percent of the farmers used synthetic fertilizers provided through the government fertilizer subsidy scheme. Fertilizer quantity showed a positive impact on the yield, but this relationship is not statistically significant. Yet again, hired labour man days used for cultivation practices shows negative but not statistically significant relationship to the yield.

The variable family labour shows negative and a statistically significant relationship to the paddy production. By keeping all other variables

constant, 10 percent increase of the family labour will reduce the paddy yield approximately 5.89 percent on an average. This is an indication of the overuse of family labour in paddy production in the study area. Remarkably, extent under cultivation shows negative and significant relationship to the paddy production in rotational tenure paddy lands in wet zone.

According to the estimated results one percent increase of land area under cultivation would lead to an approximately 0.131 percent reduction in paddy yield on an average. This finding explains that with increasing extent farmers would face difficulties in management practices, especially with poor level of mechanization and high cost of labour. This point is established by the positive and significant relationship between machinery cost and paddy production. Wijetunga (2011) from a study on this subject has also suggested that labour saving mechanisms should be introduced in paddy cultivation as a solution to the problem of labour shortage and accompanying high wage rates. This was further highlighted by Wijesinghe and Wijesinghe (2015) by mentioning that the degree of mechanization has a positive correlation with production and therefore mechanization when and where appropriate would enhance the paddy yield in the low country wet zone region.

4.2.2 Determinants of the Inefficiencies

Socio-economic factors, farm characteristics, environmental factors and non-physical factors are likely to affect the efficiency of agricultural production (Kumbhakar et al 1991). Results of the maximum likelihood estimation of the inefficiency model are summarized in Table 4.3. According to estimated coefficients dummy variables representing district Galle and age are the only included factors that affect the level of inefficiency persisting in the paddy production in study location.

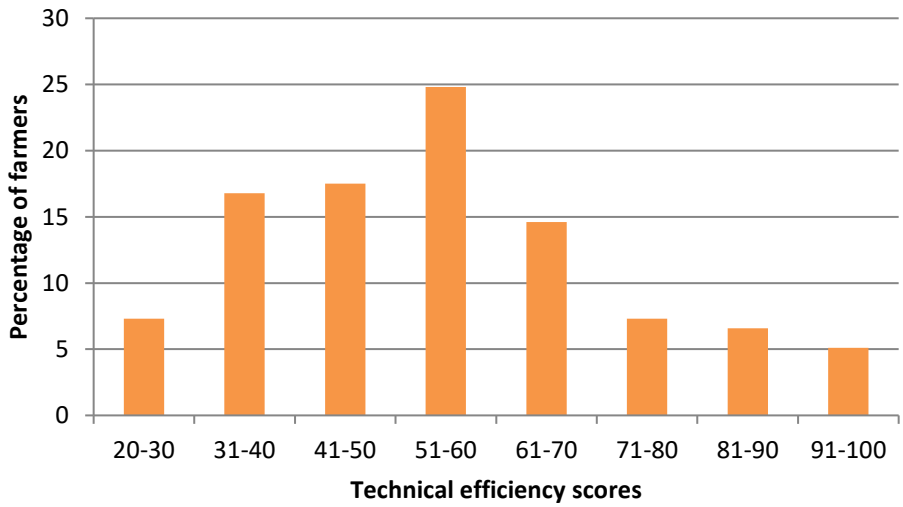
Significant relationship and positive sign of age variable indicate that young farmers are more efficient than the older farmers, which implies that younger farmers are more efficient in input usage and management practices related to paddy cultivation.

The Dummy variable representing Galle district has negative signs and significant relationship in inefficiency models, and it implies that the Galle district farmers are more efficient than the Kalutara and Ratnapura district farmers. This result reassures the estimated cost of cultivation results discussed in section 4.1. Galle district farmers have the highest yield and low cost of production compared to other two districts. Choosing the most

appropriate rice variety for the season and soil is said to enhance the efficiency of resource use in paddy farming. Use of paddy varieties of 3.5 months such as BG 358, BG 350, BG 360, LD 355, LD 356, AT 362 and BW 361 have shown a higher yielding capacity in the LCWZ than using 3 months varieties such as BG 300, BW 272-6B (Wijesinghe and Wijesinghe, 2015).

4.2.3 Technical Efficiency in *Thattumaru* – *Kattumaru* Tenure Paddy Lands in Wet Zone

Individual property rights also affect efficiency directly since efficiency required for land development and maintenance are related to land ownership-tenure ship (Wijesinghe & Wijesinghe, 2015). The mean technical efficiency of *Thattumaru*- kattumaru land tenure paddy farmers was estimated as 55 percent which indicates that the average paddy farmers cultivated in rotational tenure paddy lands in selected three districts produced 55 percent of the maximum attainable output for a given input level. In other words, there is an average of 45 percent of production lost due to inefficiency.



Source: HARTI survey data, 2019

Figure 4.6: Distribution of Farmers' Technical Efficiency Indices

Even though the mean technical efficiency of the selected farmers under rotational land tenure was 55 percent, the value ranges from 22 percent to 100 percent. This shows a wider difference in the individual farms' efficiency level. Therefore, the mean technical efficiency level may not indicate the actual picture of the distribution of individual farm efficiency levels. Figure

4.6 illustrates the frequency distribution of individual farms' technical efficiencies.

4.2.4 Returns to Scale

The summation of estimated production coefficients (β_i) indicates the return to scale. The return to scale of paddy cultivation in rotational tenure paddy lands was found around 0.441 which indicates the diminishing return to scale. It means paddy farmers allocated their resources in the rational stage of production (Stage-II) where a lower amount of return would be added to the gross return by using each additional unit of input to the paddy cultivation.

Agricultural policies tend to focus more on fostering productivity through technological change than through better use of the existing technology. However, rebalancing the focus of agricultural policies towards improving efficiency is necessary in the context of limited availability of natural resources, such as land and water, and given the necessity to limit the environmental footprint of agricultural production. Equivalent physical productivity gains and perhaps even larger economic gains may be expected from better use of existing technology than from shifting to new technology.

CHAPTER FIVE

Socio-cultural Perspective of the Rotational Land Tenure System

Land is a fundamental factor of production in the agricultural sector. It has an essential role to play in increasing as well as sustaining agricultural production and the livelihood of most subsistence farmers. The extent to which this role operates is determined in part by methods of land acquisition and arrangements for the ownership and use of land. 'Land tenure' means the type of right or ownership and use of land. The tenurial systems have been changing from time to time in Sri Lanka (Weerahewa et al, 2021). The validity and continuity of rotational land tenure as a solution to over fragmentation and to ensure equity among heirs has become questionable in present socio economic and cultural context. Therefore, the following chapter discusses the rotational land tenure in socio- cultural perspective of the people belonging to the system.

Since *Thattumaru-Kattimaru* is a regional phenomenon it differs widely from one area to another. Therefore, this chapter presents the issues and suggestions made by a group of farmers in the eight selected ASC locations. The issues and suggestions coming from the farmer discussions are included as common facts.

5.1 Present Situation and Issues of the *Thattumaru – Kattimaru* Land Tenure System

Thattumaru – Kattimaru land tenure system accommodates considerable variations in inheritance and performance over both time and space. Since those in the wet zone have had more nonagricultural employment opportunities to earn a decent living, most of the heirs have moved away from agriculture. Only one or two members of a family are engaged in agriculture related activities. While other members are aware of their right to land they claim their rights if they are engaged in other jobs. If all heirs, or even all male heirs, had normally inherited a share of each piece of land owned by their ancestors, the general level of complexity of the system would be far greater. Table 4.1 shows how often cultivation rotation to a particular land plot based on the survey results. In all three districts farmers get their turn to cultivate in two to three years and this implies land rotation takes place only between two to three heirs. Most of the heirs do not have

an interest in their right to land mainly because of low profitability of the lands.

Table 5.1: Length of the Rotation in Years Based on the Land Plot

Rotation in years	Percentage of lands		
	Kalutara (N=53)	Galle (N=34)	Ratnapura(N=60)
0	11	12	2
1	22	39	35
2	20	12	18
3	10	7	7
4	18	25	15
5	5	2	7
6	8	0	2
8	0	0	6
>8	6	3	7

Source: HARTI survey data, 2019

At present a considerable amount of land under *Thattumaru-Kattimaru* is cultivated by tenants and this has helped to simplify the actual operation of the system, since two or more owners lease out their shares to a single tenant. This is indeed inevitable once shares become very small, since the areas which individuals are entitled to cultivate often become unreasonably small. But it is also important to highlight that even most of the heirs forgo the right to cultivate because it is uneconomical to cultivate a small share of land, but they are more zealous on their ownership rights.

Due to more nonagricultural employment opportunities to earn a decent living in the wet zone, most of the heirs have moved away from agriculture. This has resulted in agricultural production being left increasingly to those who have no other choice in life; the elderly or infirm and those who are too poor to invest in agricultural investments which are needed to make existing land viable. Many of the paddy lands in the wet zone will be forced to withdraw from agricultural production because of various reasons such as age or illness of existing land owners and as many of their heirs have no interest in agriculture and the many disputes and the ambiguous nature of the land titles.

All three types of rotational tenures, *Thattumaru*, *Kattimaru* and *Karamaru* prevail in all three districts, but the most prominent system is *Thattumaru*. Combination of all three types of ownership makes the system more complex. As a result, the owners as well as the cultivated land plot change from season to season. Some farmers have the opportunity to cultivate one plot of land every two to three years or secure their rotation after a couple of seasons. This land tenure system is not properly documented in a legal register at present. Officials of the ASC claim that some of the old farmers have documented and maintained their *Thattumaru –Kattimaru* rotation sequence, however it is complicated to understand the system of rotation without prior - knowledge on how the system works. When the *vel vidhane* system and Cultivation Committees were operating in the country there was documentation of most of the lands under rotational tenure. But with subsequent abolition of those committees there was no update or continuation of rotational tenure records. As the youth is not involved and moving away from agriculture, these ambiguities will be exacerbated in the future and the problem will become unsolvable. Therefore, urgent institutional intervention is needed to resolve this issue.

Under such circumstances the Agrarian Development Act No. 46 of 2000 amended by Agrarian Development (Amendment) Act No. 46 of 2011, proposed to establish an Agrarian Development Councils at ASCs to cater to the issues related to purpose of paddy lands, issues related tenure, minor irrigations, agricultural land registers, agro road and re-cultivation of abounded paddy lands etc. One of the main responsibilities of every Agrarian Development Council is to prepare, amend and maintain a register of the agricultural lands within its area of authority and it has to be inspected and certified once in every three years (DAD Act, 2011).

Those who have established proper non-agricultural income sources and no interest to continue in agriculture are willing to sell their share but there is a lack or non-existence of a formal land market for rotational tenure lands in the country. Problems have arisen due to the fact that a large number of heirs who have no close relationship with each other have shares in one small plot of land and sometimes shareholders have sold their shares to outsiders without the knowledge of the other parties which has aggravated the situation in the tenure system.

Since most of the paddy lands in studied areas have the bog and half bog soils with very poor drainage properties farmers have issues with agronomic practices and water management. In all discussions held in different ASCs farmers requested to rehabilitate their canals because they could not

cultivate due to inability of water management. Considerable investment of labour and capital is needed for channel and bund clearing, land levelling and other infrastructural works. Even though FOs were established in these areas, unlike in dry zone they are not functioning properly. Collective action of farmers is not visible in these areas because paddy farming is only at subsistence level. But the underlying reason for poor infrastructure is due to the rotational nature of the ownership, none of the possessor is willing to make long term investment to improve the productivity and sustainable use of the land. Moore & Wickremasinghe (1978) based on the findings of a case study also comment that *Thattumaru* – *Kattimaru* tenure system is no longer appropriate to the present context because it inhibits investment activities which are needed to sustain the system. Therefore, there is a strong need of promoting collective action among farming communities via strengthening and mobilizing FOs.

Further, the issue of paddy lands abandonment by shareholders was highlighted in the discussions. Sometimes farmers do not cultivate the land plot in their respective turn. Some of the reasons are failing to remember the cultivation turn by the respective farmers, especially when the cycle is too long and infrequent cultivation rotation or in certain instances farmers' avoid the cultivation purposely. When a land is abandoned for a year, the farmer in the next turn has to invest more money for clearing the land and making bunds. This may be uneconomical because he also gets a chance to cultivate only two seasons related to his rotation even with additional cost. If the land is left fallow and this continues for two to three years it leads to a complete abandonment of the land.

Conflicts arise when shareholders attempt to cultivate more than their due or cultivate more land area than they are entitled, changing the land plot in *Kattimaru* tenure, or cultivating out of their turn. As commented by the Divisional Officers in the ASCs, these kinds of conflicts are more common in the beginning of each cultivation season in all three districts. Field level officers also faced difficulties in solving these disputes because of lack of proper records to support the cases.

In addition to issues of ownership status, farmers have to struggle with other technical issues in their respective cultivation rotation. One of the main constraints highlighted by farmers was lack of availability of suitable machinery that can be used under poor drainage conditions prevailing in most of the wet zone paddy lands. Owing to this fact, farmers have to employ additional manpower, which is scarce. Ultimately increasing cost of cultivation has led farmers to move away from paddy production.

5.3 Suggestions Made by Rotational Tenure Farmers to Address the Issues Related to Thattumara – *Kattimaru* Land Ownership

1. Those who have no interest in agriculture and relatively less or no concern to preserve their rotational land ownership can sell their share of land to those who are likely to make a living on agricultural activities. If such an environment could be facilitated through proper institutional setup, it is relatively easy for those who wish to purchase or otherwise consolidate shares and eventually achieve a legal simple freehold land title for their land.
2. It is utmost important to prepare a Paddy Land Registry through a census to document all the lands and respective owners and solve the issues related to ownership
3. Farmers request to allocate permanent land plots to each farmer or at least to the farmers who are engaged in paddy cultivation.
4. Provide opportunities to cultivate abandoned paddy lands to farmers who are willing to cultivate under proper legal and institutional support.
5. Impose suitable rules and regulation to ensure continuous cultivation of the lands.
6. Maintenance of canals and bunds make mandatory for all farmers and imposition of fines for non-compliance

Agrarian Development Act has made provisions to establish a Land Bank entrusted with the possession of certain agricultural lands, with the purpose of; granting of such agricultural lands to cultivators who can improve agricultural productivity of such lands ; enabling agricultural lands which are not satisfactorily cultivated to be cultivated according to the provisions of this Act; the provision of financial assistance to tenant cultivators to purchase the ownership of the paddy land in respect of which they are the tenant cultivators; and enabling owners of paddy lands to purchase the right of cultivation of such paddy lands, by the granting of monetary assistance (DAD, 2011). By enacting the provisions given in the Agrarian Development Act can resolve many of the issues related to rotational tenure as well.

CHAPTER SIX

Findings and Recommendations

6.1 Major Findings

1. Even though *Thattumaru - Kattimaru* system of cultivation still persist in wet zone paddy lands, its original features are fading away with time

2. Average family sizes of the rotational tenure farmer are 4.1, with around 47% of the households having more than five members.

3. Majority of the sample rotational tenure farmers (62%) are above 60 years of age highlighting less involvement of youth in paddy farming under rotational tenure.

4. All the farmers in study locations have relatively high levels of education, non-agricultural employment, and part time paddy farming.

5. Agriculture is the primary source of income for the majority of the farmers, but agriculture based on paddy is not the main contributor to the total agricultural income for most of them due to small land holdings, rotational nature of cultivation and lack of marketable surplus from paddy farming. Tea, Rubber and Cinnamon cultivation are the main agricultural income sources for the majority of the farmers.

6. Cost of cultivation results in the high cost of cultivation and lower profitability of paddy cultivation in rotational tenure lands in wet zone. The highest cost of cultivation was recorded from Ratnapura district followed by Galle and Kalutara district.

7. Irrespective of the districts (largest share of) more than 50 percent of the total cost of production was incurred by labour component followed by machinery and materials.

8. Main constraints highlighted by the farmers related to machinery use are poor availability of suitable machinery at affordable price in those localities and difficulties to deploy tractors to their paddy fields due to marshy nature of the lands. This is one of the main

reasons behind high cost of cultivation in study locations and ultimately abundance of the land.

9. Because of lower yields and high cost of production, net returns of paddy were less attractive for the farmers in all three districts.

10. Production function analysis shows that technical inefficiencies do exist in paddy cultivation in rotational tenure lands in all Kalutara, Galle and Ratnapura districts. Inefficiency in paddy farming under rotational tenure causes production loss of 45 percent.

11. Estimated coefficients related to production process shows increased usage of seed paddy would increase the yield. Negative and significant relationship with family labour to the yield indicates the possibility of reduced use of family labour. Further, cultivation of larger land extents shows reduction in the yield.

12. Results of the discussions held with rotational tenure farmers revealed the present status of the *Thattumaru* – *Kattimaru* and the issues they are confronting.

13. High level of education, urbanization, small land share, availability of lucrative income sources and ambiguity of ownership has eased the adherence to shared ownership over the generations.

14. Findings of the study reveal a very strong distaste to continue rotational land tenure for the future due to many socio-economic reasons.

6.2 Conclusions

1. Paddy production in wet zone has played a considerable role in supporting people by way of supporting their livelihoods and providing food security. Therefore, identified barriers in improving productivity and continuous cultivation should be removed for the sustenance of the system.

2. Current level of paddy yield under rotational tenure systems is much lower. There is room to shift existing agricultural system towards more production and profit-oriented farming

3. Existing low levels of yield are mostly due to institutional gaps that could be addressed without increasing cost of production to farmers.

4. The changes in economic and social conditions have rendered the rotational land tenure system not only economically redundant, but positively harmful to sustainable agricultural development in the present context.

5. Building stronger and supportive institutional structure at the ASC level is one of the prerequisites to make rotational tenure lands viable in future. The Agrarian Development Act No. 46 of 2011 has granted the provision to establish required institutional structure to resolve many disputes associated with rotational tenure and taken measures towards enhancing sustainability of the wet zone paddy lands.

6. People in the study locations have identified the issues related to rotational land tenure and they express their reluctance to continue this system in future. Further they are in favour of any tenurial reforms to change this system.

6.3 Recommendations

1. It is recommended to strengthen the existing institutional framework of ASCs or to establish new institutional mechanisms to divide the inheritance, commercialization of shares and to promote sustainable usage of rotational tenure lands by solving disputes. To this end, it is recommended to establish and enforce Agrarian Development Council, Land Bank and Agrarian Tribunals which is proposed in the Agrarian Development Act, at the Agrarian Services Center level.

2. Based on the findings of the study it is strongly suggested to ameliorate the *Thattumaru – Kattimaru* land tenure system for the sustainable use of these lands in future. Some of the possible policy strategies are;
   2.1. Restructure and re allocate fragmented and widely dispersed lands through land consolidation. Even though farmers strongly dislike the prevailing system, they may be reluctant to consolidate their shares as well. Therefore, as an initiation, the government can start from a simplified version of voluntary or individual consolidation based on the results coming from proper case studies in respective locations. Because of that, a suitable model needed to be developed by consulting the prejudiced parties. Further studies are recommended to

develop this strategy and more importantly it might be specific to the locality.

In voluntary group consolidation, consolidation takes place with mutual agreement among shareholders and the process is completely voluntary without any compulsion.

Individual consolidation can take place in an informal process without direct government intervention. Local level government institutes like ASC can promote groups of farmers with interest in consolidation to join and work together to consolidate their lands with mutual agreements. The legal environment required for this has to be provided through the Agrarian Development Act. Since most of the rotational tenure cases in Sri Lanka are highly localized, voluntary consolidation can be suggested as a viable solution.

2.2. Developing a community farming model: maintain the current ownership structure as it is and with the consent of all shareholders one tenant or group of farmers (this can be a Farmer Organization) cultivate the land while the costs and the harvest are shared among the shareholders. Contributions to the costs and rewards can be allocated proportionally to the size of land share.

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