Measurement of Allocative and Technical Efficiency in Using Inputs on Paddy Farming in Golakharka, Ilam

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ABSTRACT

Agricultural sector has got the highest priority in each development plan in Nepal. But no significant progress in agricultural productivity has been realized. This paper analyses the production factors that affect production and farming, technical efficiency, and input utilization allocation in paddy farming at Golakharka, Ilam, by using linear regression from the Cobb-Douglas production function. This study is mainly based on primary data. Simple random sampling was used to collect primary data. All necessary input-output data was collected in physical units of measurement like Muri, Pathi, Mana firsthand with the help of a pre-developed questionnaire. Then these were converted into standard units. The population of the study was 1224 households who reside in these selected words from the population, 10 percent (122) from the household area surveyed for this study. The result of this study showed that the regression coefficients of the estimated production function of the first group in cases of local seeds, manure, animal labour, and labour are significant at 1% level and the coefficient is less than unity which indicates that the marginal productivity of inputs decreasing. It means farmers have low allocative efficiency in using agricultural inputs. Similarly, the regression coefficients of the estimated production function of the second group in the case of seeds HYV, manure, are significant at 5 % level of significance. The production elasticity of human labour was found insignificant. The value of R and F is very low in the 1st group and higher in the 2ndgroup. The value of R and F are 0.49 and 3.002 in the first and 0.94 and 19.730 in the second group respectively. Concerned authorities are recommended to increase the allocative and technical efficiency of farmers. External inputs should be provided in the needy time of crop season with sufficient quantity. Training and visit programs should be made effective for the diffusion of external inputs. The credit facility should be provided to the farmers in an appropriate quantity without any delay. Moreover, farmers should apply more external inputs to some extent than the present level.

KEYWORDS: Allocative efficiency, Paddy, Production function, Technical efficiency, Ilam, Nepal

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Introduction

The economy of Nepal is dominated by Agriculture and remittances. Smallholder marginal farmers constitute a majority of the population in rural areas of Nepal (Katuwal, 2020a). Nepal is an economically challenged, subsistence farming nation with over forty percent of GDP contributed by and over seventy percent of the population employed in the agricultural sector. Moreover, this sector supplied about 80 percent of overall industrial raw materials to the industries. Thus, the national goal underlying the economic development of Nepal is still agricultural development which could be materialized if there is a large enough increase in agricultural productivity. Therefore up to date knowledge on farmer's attitudes and their reaction at various stages of progress is of crucial importance for planners in formulating relevant agricultural development policies and programs.

Allocative and technical efficiencies are two such aspects of farmers behaviours which often are sought to be known

while a question is raised by policymakers regarding their attitudes and reactions, in connotation the allocative efficiency of farmers means the rationality in using agricultural inputs, where the technical efficiency means changing the level of production skill of farmers when the new inputs and production techniques are being introduced in the farming system. Pro. Schulz proposed a hypothesis that there were comparatively very few inefficiencies in allocation resources in developing economics. Since then various studies were carried out in various parts of the developing nations and found mixed reactions. Such controversy led the policymakers to retest his hypothesis before drawing any conclusion regarding the farmer's rationality especially

In Nepal, rice is cultivated in three agro-ecological regions (Terai and Inner Terai- 67 to 900;

Mid Hills - 1000 to 1500 masl; and High Hills - 1500 to 3050 masl) and three most important production environments (irrigated, rain-fed lowland, and upland). Nepal is viewed as the centre of origin and diversity for Asian rice. The country has over 1,700 landraces of rice. The rice cultivated in Chhumjul of Jumla (Chhumchour VDC), at an elevation of 3,050 m, the highest place in the world to produce rice (Bhujel et al., 2011).

Paddy ranks the very first among cereal crops with regards to area, production, and livelihood of the people. As the

utmost important staple food of Nepalese people, rice supplies about 40% of this food calorie intake and contributes nearly 20% to the agricultural gross domestic product (AGDP) and almost 7% to GDP (MoA, 2015). Rice in Nepal holds special cultural, spiritual, and traditional values within the community. In Nepalese, rice forms

an integral part of one's life right from the birth rites to the death rites. Annaprasana - the initial rice feeding ceremony is observed on or after the fifth or sixth month of a child's birth. This ritualistic ceremony initiates the formal introduction of solid food for the baby. Dashain (Durga puja), the greatest Hindu festival in Nepal is celebrated immediately after the rice harvesting season. During Dashain, Elders put tika (a blend of rice, yoghurt and vermilion powder) and Jamara (rice seedlings) on the forehead of younger family members to bless them with abundance within the upcoming years. Similarly, during Tihar, sisters put tika on the foreheads of brothers, to make sure their long and safe life. Pinda's are balls of cooked rice with milk offered to ancestors during Hindu funeral rites (Antyesti kriya) and ancestor worship (Shraddha karma) (MoA, 2015).

Paddy, one of the leading food crops, its area of production has decreased by 2.2 percent in the fiscal year 2019/20 in

comparison to that of the fiscal year 2018/19. Due to Unfavourable weather conditions plantation could not take place and a certain area remained Barren thus a certain area under paddy has declined. Production of paddy had increased by 8.9 percent in the previous fiscal year but decreased by 1.1 percent in the current fiscal year. The productivity of paddy production has increased by 1.1 percent in the current fiscal year. Due to the use and availability of improved and hybrid varieties of seeds, longer than average monsoon period, easy availability of chemical fertilizers, and improvements in irrigation technology, the productivity of paddy has remained high so far. The productivity of paddy is high due to the higher seed substitution rate which is 20.5 percent in the fiscal year 2019/20 in comparison to that of the 14.5 percent in the fiscal year 2016/17.(Economic Survey, 2019/20, p. 71). The productivity growth of rice in Nepal in the last 54 years was 1.5% and has not kept up with the population growth rate of 2.3%. Nepal's per capita rice consumption per year in Nepal is 137.5 kg, one of the highest in the world. (Joshi &Upadhaya 2020).

In Nepal, the process of transformation of traditional agriculture has been initiated since 1956, when it launched its first periodic plan, whose highest priority was given to agricultural development was worked out in the plan (Katuwal, 2021). Then onwards agricultural sector got the highest priority in each development plan (Katuwal, 2020b). Simultaneously various agricultural development programs like extension education, the supply of fertilizers and pesticides, credits, etc. Where stated to be launched upon such programmers affected to increases the total irrigated area and consumption of chemical fertilizer to some extent, in a similar way extension services, supply of agricultural tools and implements also increased to the tune of fertilizers. But no significant progress in agricultural productivity has been realized. Nepal has turned back from net food exports to net food importer in four decades in which agricultural development received top priority. The few studies so far carried out previously on this ground could be less relevant by now either because they were carried out before a decade or so on various changes in agriculture have occurred by this period or they suffer from insufficiency coverage and sample size. This study intends to test the allocative and technical efficiency in using agricultural inputs in the llam hill district of Nepal. Here an attempt is made to full fill this gap.

When the economy is in the process of changing from traditional into modern phase. If farmers were rational in allocating resources, any government program aimed at modernizing agriculture could be highly successful. Similarly, the level of technical efficiency would show the real stage of success of any such program which in fact can also be used as feedback for the further implementation of such activities. Hence, Allocation and technical inputs in the Ilam Municipality of Ilam is proposed here.

The efficiency word became a buzzword not only in economics but also in various areas and daily life. Despite its frequent applications, it is a tricky concept. Moreover, there are tricky relationships among efficiency concepts. The full comprehension of the concept depends on the comprehension of the concepts of technical efficiency and allocative efficiency and their relationships.

The general objective of this study is to find out the present situation of agricultural practices and productivity in the study area. The specific objectives are; to find out the allocative efficiency of farmers in using agricultural inputs which they have at their disposal and to find out the technical efficiency of farmers who are using more new varieties of agricultural inputs than those using less and suggest measuring for further increase in efficiency of farmers in using agricultural inputs.

1.1 Relevant Works

Few related studies made by scholars which are related to this study are reviewed here; Banik (1994) has made a study on "Technical Efficiency of irrigated Farm in a village of Bangladesh" and he concluded that 88 out of 99 farms have a technical efficiency of 71 percent or above. Thirteen farms show technical efficiency of 91-100 percent. A very interesting finding is that then out of thirteen most efficient farms belong to the category of small farms. It is also observed that Owner tenant-tenant farms are technically more efficient than owner farms.

Several studies advocate that the strategy for agricultural development should be based on enhancing crop yields, especially for small farmers. There is sufficient empirical evidence that small-scale farms are a source of jobs to the unemployed labour force (Bravo-Ureta & Pinheiro, 1997; Bravo-Ureta & Evenson, 1994). Researchers and policy planners, therefore, have given much attention to the use of new technologies to enhance crop yields and income of households. However, in recent years, the use of agricultural technology is already high. This calls for an increase in productivity through optimal and efficient use of available technologies (Bravo-Ureta & Pinheiro, 1997). In their study of peasant farming in the Dominican Republic, Bravo-Ureta & Pinheiro (1993), using the Cobb-Douglas production frontiers, found that younger, more educated farmers exhibited higher levels of technical efficiency and that, additionally, contract farming, medium-size farms, and being an agrarian reform beneficiary had a positive association with economic and allocative efficiencies. In addition to determining the efficiency levels, for policy formulation purposes, it is also useful to identify the sources of these inefficiencies.

Upadhay (1987) has also made a case study on "Allocation and Technical Efficiency in Using Agricultural Inputs of Nepalese Farmers in Rupandehi District. He has taken land, seed, manure chemical fertilizer, human labour, animal labour, tractor, and irrigation as an independent variable and concluded that with few exceptions, farmers in the Rupendehi District area not only efficient in using agricultural inputs which they have at their disposal but also those who have got a chance to use chemical fertilizer, new varieties of seeds and irrigation facilities are technically advanced than others.

Jayaram, Chandrashekar and Achoth (1992) have made a study in Karnataka, India on the topic "an Economic Analysis of Technical Efficiency in Rice cultivation in Mandya; Some Issued in Resource Pricing." In their study they have taken seed, farmyard manure, Nitrogen, phosphorous, potassium in kg/hectare and plant protection chemicals and total labour employed in Rs/hectare as an independent variable and they found that the existence of glaring over the use of resources in the

production of rich in the study area, which is one of the richly endowed districts of Karnataka with good infrastructural development then they conclude the high output efficiency coupled with the high inefficient use to resources, particularly in the case of small farmers in suggestive of import pricing of resources, which induces non-Judicious use of their resources, such as fertilizes and irrigation, leading to wastage. And finally, they suggest that extension effort should be addressed to the problem of resource conservation explicitly.

Khan and Saeed (2011) conducted the study to measures the productive efficiency of tomato growers in village Akbarpura of District Nowshera in Khyber Pakhtunkhwa (KPK) Province of Northern Pakistan, using household-level data collected from sample farmers selected by multi-stage sampling. The study used a theoretical framework to measure productive efficiency and estimates the Cobb-Douglas frontier production and cost models. They found that technical efficiency indices varied significantly, with the technical efficiency index averaging at 65%. The indices of allocative efficiency also varied widely, with an average of 56 %. There was a wide gap between the highest and lowest economic efficiency indices, with a mean economic efficiency of 35%. The study concluded that farmer education, extension visits, age and access to credit contributed significantly and positively to production efficiencies.

The study of Economies of scale and allocative efficiency of rice farming was conducted in the technical irrigated field at Kabupaten Seram Bagian Barat – SBB (West Seram Regency), Province of Maluku by using linear regression from Cobb-Douglas production function. The result of this study showed that three independent variables have a significant effect on production (Y), that is labor bulk (X6), urea fertilizer (X2) and NPK Pelangi fertilizer (X3) with consecutive elasticity 0,55; 0,19 and 0,11 which means that technical efficiency of this farming has been achieved. Value in return to scale (RTS) with 0,88 showed that increase rate for rice farming at West Seram Regency tend to decrease or decreasing return to scale (DRS), but still within the rational production area. Result in allocative efficiency test toward farming input showed ratio $\frac{mpx_i}{px_i} > 1$, which means allocative efficiency of this farming is still not achieved (Hidayah & Susanto, 2013).

Pradhan, et al (2016) The contracting sugar industries in Odisha are continuously providing technical expertise, proper guidance, close monitoring, supplying crop inputs and procuring produce with remunerative price benefitting both the contracting firms and contracted growers. A study conducted with 80 each of contracted and non-contracted growers revealed that there were no significant developments of the contracted growers in sugarcane cultivation under contract farming. Poor responses were observed towards developments in technological, economical, material possession and farm activities in comparison to socio-cultural aspects. The contracting sugar industry officials essentially need to enrich the knowledge and skill competency of the sugarcane growers along with Liaoning with credit institutions for financial support and input dealers for the timely supply of additional quality inputs enabling the growers for better crop management accelerating production and income leading to their developments.

Shireesha, et al (2016) studied the relationship between profile characteristics of youth in farming and the attitude towards farming is discussed. The results revealed that the computed ‘r’ values of education and exposure to training were positively significant with their attitude towards farming at 0.05 level of significance. Annual income, mass media exposure, decision-making ability, innovativeness, scientific orientation, management orientation, achievement motivation, economic orientation and risk orientation of youth in farming were positively significant with their attitude at 0.01 level of significance. On the other side, the variables like marital status, family type, farm size, material possession and extension contact were found to be non significantly related with the attitude of youth towards farming, whereas age and

farming experience were negatively non-significant with the attitude of youth towards farming at 0.05 level of significance. The multiple regression analysis revealed that, out of the seventeen variables, annual income and economic orientation had shown positive significant contribution with the dependent variable 'attitude of youth towards farming' at 0.01 level, whereas variables like farm size, decision-making ability, innovativeness and achievement motivation had shown positively significant contribution at five per cent level.

Jyothi, Yuma, Sunitha, & Sethi (2017) has made study to find out the participation of tribal women in different farming activities. The data were collected through a structured interview schedule, personally from tribal (SAVARA) woman who was involved in Farming. The results of the study revealed that 63% of the total respondents were participating in farming activities. Maximum involvement of women was seen in activities like cleaning, storage structure with a weighted mean score (1.95) ranking first, followed by manure preparation (1.91) ranking second and seed treatment (1.75) among the farming activities. Less involvement of tribal women was studied in hard activities like ploughing transportation of produce, levelling of the land ethic, as they require high energy and are strenuous.

Zikhali (2018) has presented a paper using a Chamberian lens, the paper discusses poverty in rural Zimbabwe both from an existential perspective as well as in conceptual terms. It recognizes that some assertions made by Chambers do not play out identically at Sivomo where distance and household income have a strong negative correlation ($r = -.553$ (two-tailed), $p < .05$). Assuming such perspectives, the paper makes a modest contribution to the continued call for broad rural development for the millions in the third world. The paper suggests that a more concerted effort be adopted to realize some of the elusive ideals of rural development as outlined by Chambers.

Sreelakshmi (2018) assessed the impact of credit interventions for the promotion of rice farming in Thrissur district India. Percentage analysis, indicator approach and Cobb-Douglas Production Function were employed to analyze the data. The study found the credit interventions to support farmers byways of interest subvention, timely credit etc., and linking of credit with marketing had found to be influencing the net income of farmers positively. The study suggested that the pattern of providing credit by Adat Service Co-operative Bank by way of revolving fund at the commencement of rice cultivation may be replicated by the other two Panchayats, and even other areas wherever not implemented so that farmers can get easy and timely credit and their dependence on private agencies will also be reduced.

Prasidha, and Asokhan (2019) studied the risks in paddy farming. These risks associated with paddy cultivation were categorised as credit, cultivation and marketing (CCM) risks. The study location chosen for the study was Thanjavur, Thiruvarur and Nagapattinam Districts with a sample size of 239 respondents. CCM risks were ranked based on the farmers' response. Further farmers' response on perception statements for each risk was analysed and the respondents were categorised into low, medium-high based on cumulative frequency.

However, the proposed study is different in its methodology and objectives from the above-mentioned studies, this study intends to test the allocative and technical efficiency in using agricultural inputs on paddy farming in Golakharka, Ilam district of Nepal,

II. Research Methodology

Four wards of the Ilam Municipality have been purposively selected for this study. Because these wards of the municipality are intensively advantageous from all government and non-government agricultural extension programmers and it is easily accessible. Also, three wards cover a large part of rural life. The study area is located approximately 800 Mt in the above mean sea level

and covers 2700 hectares of total area. Among the total land area now agriculture is practising in 1293.52 hectares. Rice is the main crop of this area then followed by maize and millet. Rabi crop includes wheat, oilseeds, potato, etc. Socially diversified casts like Chhetris, Tamang, Newar, Brahmin, Rai, Limbu and other occupational casts reside in this area.

2.1. Introduction to the study area: Ilam is the eastern hill district of Nepal which is the adjustment to Darjeeling of India. Its range in altitude from 600 M. to 1600 M. about4100 ft. by diverse climatic conditions and landscapes.

Some Basic Indicators of Ilam Municipality

Area -27.0 sq. km.

Population-17294 in 2057*

Population Growth rate-3.05%

Education- Campus- 1, Secondary school l4, Lower secondary school- 3, primary- 12 Higher secondary-3 Religion- Hindu 84.6%, Buddhist 12.8%, Kirat 2.0%, Others 0.6% Major casts -Chhetri, Newar, Braman, Tamang, Rai-Limbu.

(Source: Ilam Municipality)

The major of rural households are not in a position to produce enough staple food to meet their subsistence requirement this problem can be attributed in general to a "Backward Production System" and lack of intensive farming practices. The study area is surrounded by Mai Khola in the east Puwakholain the west, Sarki and Ujeli Khola in the North and junction of Pouwamai Khola in the south.

2.2 Nature and Source of Data: This study is mainly based on primary data. A field survey has been conducted to collect primary data. All necessary input-output data were collected in physical units of measurement like Muri, Pathi, Mana firsthand with the help of a pre-developed questionnaire. Then there are as converted into standard units. Secondary data has been also used.

Simple random sampling was used to collect primary data. The resident of the 3, 4, 5 and 9 words of the municipality are all farmers. Therefore, the population of the study can be defined as all 1224 household who reside in these words from the population 10 percent (122) from the household area surveyed for this study.

2.3 Method of Analysis:

Technical Efficiency Analysis

The concept of productive efficiency was first introduced by Farrell (1957) who argued that there were two components of efficiency1: technical efficiency (TE) and allocative efficiency (AE). According to Farrell (1957),TE is the ability of a firm to produce the maximum possible output from a given set of inputs or a firm can use the minimum inputs for a given level of output. The former is called input-oriented measures and the latter is known as output-oriented measures of technical efficiency. AE is the ability of a firm to use inputs in optimal proportion, given their respective prices and the production technology. The use of input is allocative efficient if the value of the marginal product is equal to its price."

Technical efficiency could be viewed through its elasticity value. Elasticity value is output change percentage as a result of input change percentage. Regression coefficient in the Cobb-Douglas production function would also show elasticity quantity. If the farmer was producing at areas with an elasticity value of more than one, technical efficiency still hasn't been achieved. Technical efficiency would be achieved if farmers producing at areas with elasticity value between zero until one (O'Neill et al., 2006; Perez et al., 2007).

A variety of functional forms can be used to represent the production activities in an economic endeavour such as linear, log-linear, Cobb-Douglas (log-log), translog, CES, Zellner-Revankar general function or non-linear functions. If closed functions are used, a production function that has the inputs and outputs as components can be used to represent the production activity. On the other hand, if we include the output prices to the closed function we can reach

a revenue function, and if we include the input prices we can reach a cost function.In this way starting from the different representations we can conclude to different concepts such as revenue efficiency, cost efficiency, profit efficiency and scale efficiency.

Efficiency can be defined, in a general sense, as a ratio to approach the optimum level. Economic activities are generally represented by functions. Therefore, the efficiency rate can be defined as the ratio of the observed level to the optimum levels in the functionally represented activities. When we take efficiency into the account as an economical term, we need to address efficiency components, its relationships between the other economical concepts, its measuring and the approach methods to these issues. It is possible to handle the efficiency concept in the classification of technical efficiency and allocative efficiency, and in this classification using the input-oriented approach and output-oriented approach is possible. In such an analysis we can start by presenting the production function on which the efficient and inefficient situations will be determined.

After completion of the field survey, the data will be tabulated. Then for elasticity's of different inputs, the renowned CobbDouglas production function of its log-linear form is to be applied. Because it is easy to manipulate and it is extensively used in the agricultural sector for Input-output analysis. The unrestricted form of Cobb-Douglas production function is;

$Logy_i=LogB_1+B_2Logx_{i2}+B_3Logx_{i3}+B_4Logx_{i4}+B_5Logx_{i5}+B_6Logx_{i6}$……. (1)

Where,

Y = Production of paddy in quintal

B_1= Intercept or shift variable

X_{i2} =Seed in Kilogram

X_{i3} = Manure in Kilogram

X_{i4} =Chemical fertilizer.

X_{i5} =Human labour days in a standard working day of 8 hours

X_{i6} =Animal labour days in the standard working day of 8 hours.

(The subscript refers to cross-section data)

For the elasticity of independent variable the log-linear, Cobb-Douglas production function was estimated by the ordinary least square (OLS) method.

Allocative Efficiency Analysis

Efficiency analysis in production facility utilization was conducted by allocative efficiency testing or price efficiency. Nicholson (1995) and Soekartawi (2002) suggested that production facility utilization allocation could be said efficient if marginal value product for ith input (MVPxi) is equal with its input price (Pxi), it means that production facility allocation has reached an optimal point or has been efficient. Mathematically, allocative efficiency could be written as,

$$MVPx\ i = Pxi$$

$$\frac{Mvpx_i}{px_i} = 1 = i\ k$$

$$\text{MVP } i\ x = \text{MVP } i\ x\ .p\ y$$

$$Mpx_i = b\frac{y}{x}$$

If $i\ k$ =1 means that input utilization has been efficient, $i\ k > 1$ means that input utilization still not efficient and needs to be added, while $i\ k < 1$ means that input utilization is no longer efficient and needs to be reduced. The condition set for allocation efficiency is that the marginal value product of an input is equal to its market price. The marginal product of input $i\ X$ can be obtained by differentiating equation (1) as;

Where MP is marginal of input i', $i\ B$ ' is is the coefficient of elasticity of input I obtained from the estimation of CobbDouglas production function. If Price of input i' is 'p', and price of output y is Py then the required condition is:

$Py\ mp_1 = P_1$

$mp_1 = P_1/Py$

$mp_1 = Y/X_1 = p_1/Py$

$B_1 = P_1/Py\ X_1/y$ ... (ii)

To test differences between the estimated and observed value of "B_j t-statistics is applied.

Test of Technical Efficiency

The intercept of the Cobb-Douglas production function is a shifting parameter i.e. a measure of technical efficiency. Therefore separate production functions will be fitted for a separate group of the farmer who corresponds to the different levels of technology to use. Then the intercept of these functions will be compared to see the difference in their technical level. To test the different t-statistics has been applied with SPSS of ANOVA.

3. Results and Discussions

In this section, characteristics of farmers of the study area andallocative and technical Efficiency in using agricultural inputs on Paddy Farming in Golakharka, Ilam have been discussed.

3.1 Characteristics of Farmers of the Study Area:

The study area has clustered as well as a dispersed settlement. The total population of the study area is 14294. Major ethnic groups are Chhetries 30.64%), Newar (22.07%), Brahmin (14.186), Tamang (12.82%) and Rai Limbu (7.30%). Average family size was 6.50 in the study area. Age and Sex composition directly influence the population growth rate. Similarly, other population parameters such as migration, occupation are also influenced by age composition. Therefore, the age and sex composition of the study area is given here (Table-1).

Table-1 Sample Population Distribution by Age and Sex

Age	Male		Female		Total	
	Number	%	Number	%	Number	%
Below 10 years	67	17.99	87	22.67	154	20.37
10-60	282	75.11	286	69.07	550	72.06
60 above	25	7.00	32	8.26	57	7.57
Total	374	100	387	100	751	100

(Source: Field survey, 2019)

The Overall sex rate is 97.42 in the study area generally, the age group of economically active manpower is considered to be 15 to below 60 years, but in Nepal due to the dominant agro-based economy, it is considered 10 to below 60 years. Thus this percentage of the working population is estimated to be about 72 % and the rest 28% are dependent. Those dependent on active manpower are observed to be involved in various types of households after children, fetching water and cooking the low percentage (7.57%) of old depending indicates short expectancy in the study area.

3.2 Literary and Education of Respondent:

Ilam is considered a forward district in education. Therefore, the literacy level among the respondent is greater than 80 percent in the study area (Table-2).

Table-2Literary and Education of Respondent

Level of Education	No. of Respondent	Percentage
Illiterate	23	18.65
Literate	67	55.25
SLC	19	15.25
Higher	13	10.17

Total	122	100

(Source: Field survey, 2019)

3.3. Occupational structure: Since the Mechi highway passes through the study area, it has access to the external market for vegetables and cash crops. The areas produce a high quantity of ginger and Amliso (raw material of broom) and generate high income (Table-3).

Table-3 Occupational Distribution of the Sampled Households

Main Occupation	No. of Persons	Percentage
Agriculture	424	81.82S
Service	78	13.44
Business	24	2..77
Other	20	1.97
Total	546	100

(Source: Field survey, 2019)

Agriculture employs to a great extent (81.82%) of the economically active population. About 12 percent are employed in the service sector. Similarly, about 5 percent are employed in the business sector. The remaining 2 percent are engaged in other minor activities like carpentry, tailoring, black-Smith and so on. Besides these parts of the population school students and unemployed.

3.4 Landholding Size: The landholding size of Nepalese people is dwindling of the current legal prescription that possession of parents is divided equally among male heirs. If it is extended to female heirs, the pace fragmentation will increase, currently, 0.5 hetaerae in the norm used to distinguish small landowners it is decreasing day by day, here sample households are divided according to the size of holding (Table-4).

Table-4Distribution of Household by Landholding size (in Hectare)

Land Holding Size	Number of Household	Percentage
Below 0.5 ha	45	37.29
5-1 ha	39	32.29
And above	38	30.57
Total	118	100

(Source: Field survey, 2019)

In this study area, small farmers cultivating land size below 0.5hectare are 37 percent, farmers cultivating land size 0.5 to 1 hectare are32 percent and large farmer's landholding size greater than one hector is 30.5percent. About 70 percent of farmers are cultivating less than one hectors. Among 122 households, 4 households were found landless.Agriculture is an extremely labour intensive activity, furthermore, present multiple cropping systems require too much labour in various process or crops and vegetable cultivation. They are preparing fields, weddings, sowing transplanting, farm nurseries, manuring, and harvesting the work is done mainly by hands which demands great patience. Almost the total agro-production is producing through the indigenous manual labour system which mostly includes family members and hired labour. The Parma system is not as popular here as in other parts of the country.

3.5Agricultural services: The government has rendered extension services

through the District Agriculture Development Office and JT, JTA is employed in the study area but they seldom visit the farmers and discuss modern farming methods. Moreover, they rarely motivate to adopt new technology and improve seeds. The majority of farmers keep seeds from bulk harvested grain for next season crop and do not procure from the agriculture input services supply centre.

Sreelakshmi (2018) assessed the impact of credit interventions for the promotion of rice farming in Thrissur district, india. Percentage analysis, indicator approach and Cobb-Douglas Production Function were employed to analyze the data. The study found the credit interventions to support farmers byways of interest subvention, timely credit etc., and linking of credit with marketing had found to be influencing the net income of farmers positively. The study suggested that the pattern of providing credit by Adat Service Co-operative Bank by way of revolving fund at the commencement of rice cultivation may be replicated by the other two Panchayats, and even other areas wherever not implemented so that farmers can get easy and timely credit and their dependence on private agencies will also be reduced.In this study area, an Agriculture Development Bank (ADB) is functioning as the primary source of agriculture credit but the function of ADB is not sufficient and fair. Loans are provided to the large, rich farmer instead of Small needy farmers. Only about 19 percent of farmers have received loan facility from ADB (Table-5).

Table-5Distribution of Agricultural Credit Facility

Credit size (in '000')	Number of households	Percentage
10-19	8	6.78
20-29	6	5.18
30-49	3	2.64
50-69	1	0.85
70-89	3	2.64
90-99	1	0.85
Total	22	100

(Source: Field survey, 2019)

Among the borrower, more than 12 percent have borrowed credit less than Rs. 30 thousand. The loan facility from ADB is not sufficient to transform the Agriculture sector because of the small s1ze of loan. According to the purpose of borrowing more than 50% of farmers have borrowed for ginger, farmer about 25 percent has borrowed for cow farming. Similarly, some farmers have borrowed for the installation of the biogas plant. Among the causes of not borrowing are higher interest rates, administrative inefficiency and lack of security are reported by the farmers.

Agricultural external inputs are always short supply in the needy time. Regarding pesticides, the farmer is using Malathion and matricide. The use of other pesticides is rarely found. Getting loans from the Agriculture Development Bank and commercial banks was a big challenge in Ilam. Agriculture has traditionally been seen as a risk investment by banks and lots of them don't have collateral for accessing credits (Katuwal, 2020c).

Table-6Cause of not Adopting of Modern Farming System

Causes	Frequency	Percentage
Lack of Knowledge	26	20
Not available inappropriate time	73	60
No Credit facility	49	40

Lack of market facility	28	15
Lack of Agricultural inputs	14	10

(Source: Field survey, 2019)

Among the cause of no adoption of the modern farming system completely, many farmers reported not only one came. About 60 percent of farmers reported no agriculture inputs available at an inappropriate time, 40 percent reported no adequate credit facility and 20 percent report reported lack of knowledge. In the study area lack of market facility and the price of inputs are not a significant cause of no adoption (Table-6).

Allocative and Technical Efficiency

To find out the productivity of the external inputs log-linear Cob Douglas production function has been estimated by OLS method for 6 sets of sample data from three words of Ilam Municipality. Separate production function fitted for a separate group of farmers who correspond to the different level of technology to use.

Table-7 Result on Estimation of Cobb-Douglas Production Function by ANOVA Summary

1st Group		2nd Group	
Variable and coefficients statistics		Variable and coefficients statistics	
Intercepts	685.435 (2.338)	Intercepts	-502.131(1.582)
Local Seeds Xi	.317** (0.940)	HYV seeds X_2	.447**(2.582)
Manure X_3	-.273*(-1.734)	Manure X_3	.305** (2.597)
Labour X_5	-.019(-.087)	Fertilizer X_4	.088(.702)
Animal Labour X_6	.338** (1.513)	Human Labour X_5	.429* (2.467)
R	.495	Animal Labour X_6	.051* (367)
R^2	.245	R	. 944
F. Statistics	3.002	R2	.892
		F. Statistics	19.730**

**Significant at 5%

* Significant at 1%

The figure in parentheses is t-values.

The regression coefficients of the estimated production function of FirstGroup in cases of local seeds, manure, animal labour and labour are significant at 1% level and the coefficient is less than unity which indicates that the marginal productivity of inputs decreasing. It means farmers have low alleviative efficiency in using agricultural inputs, similarly, the regression coefficients of the estimated production function of the 2nd group in the case of seeds HYV, manure, are significant at a 5 % level of significance. The production elasticity of human labour is found insignificant. The value of R and F is very low in 1" group and higher in 2group. Similarly t- values are higher in 2 groups. The value of R is 0.49 in 1" and 0.94 in 2 groups. The value of F is3.002 in 1 and 19.730 in second. This indicates there is no goodness of fit between the dependent variable and explanatory variables in the T group regarding the 2nd group. It indicates the technical efficiency of

farmers who are using more new varieties of agricultural inputs than those using less.

4. Conclusion

In the study area, various organizations are providing agricultural services to the farmers to transform agriculture and increase the productivity of the inputs used. Accordingly, farmers are adopting external inputs. Now they are applying chemical fertilizer in the minimum amount and productivity is also low (1.5ton/ha). In the case of improving seeds, most of the farmers do not purchase to improve seeds of new variety every year from dealers. The pesticide is not significant. The irrigation facility is essential for paddy farming. All of the agricultural land for paddy farming is irrigated. Regarding agricultural credit, only 19 percent of farmers have received a credit facility of a very small size. Mean credit is RS. 2409.00 From the analysis of the Cobb-Douglas production function, the hypothesis that the farmers of the study area are

efficient in allocating/using agricultural inputs that they have at their disposal is validated except in the case of human labour the regression coefficient of labour is not significant. This is because of unemployment manpower remained in the agriculture sector, similarly in the second group regression coefficient of chemical fertilizer is not significant. This is because of the low and inappropriate use of chemical fertilizer in the study area. The four variables of group 1st explain 49 percent and 2nd group 94 percent variation in output. Therefore, in conclusion, we can say that if there increase in improve seeds and manure, paddy production increase withholding other inputs constant at their geometric means level. From the analysis of Cobb-Douglas production function the second hypothesis that farmers using more or new

varieties of inputs are technically efficient. Then those using less are validated except fertilizer. This is because of the low and the appropriate use of fertilizer in the study area, the regression coefficient of local seeds (317) is less than HYV seeds, 447, the coefficient of manure in the 1stgroup (-0.25) is less than the second group (0.305). The coefficient of labour in the 1stgroup (-01) is less than the 2nd group (42). R is less in 1 group 49 percent than the second group94 percent. F statistics are also significant inthe 2ndgroup thatis using more new varieties of inputs. In conclusion, we can say who is using more new varieties of agricultural inputs are a technically efficient farmer.

External inputs should be provided in the needy time of crop season with sufficient quantity. Training and visit programs should be made effective for the diffusion of external inputs. The credit facility should be provided to the farmers in an appropriate quantity without any delay. Farmers should apply more external inputs to some extent than the present level. An appropriate price policy of inputs should be adopted by the government. The study recommends that the Govt. of Nepal should invest more in extension education has a direct relationship with efficiency. Therefore, the government should strengthen the extension services of its Agriculture Department so that farmers have easy access to it. This may help them in increasing farm output and net profits. As rice is an important staple food crop in Nepal such measures would ultimately encourage the farmers to undertake rice cultivation and the country becomes self-sufficient in rice production, once again, and that could lead the country to achieve sustainable food security.

References

Adams, M. E. (1994). *Agricultural Extension in Developing Countries*. London: Long Man Group Ltd.

Banik, A. (1994). Technical efficiency of irrigated farms in the village of Bangladesh. *Indian Journal of Agricultural Economics*, *49*(1), 70-79.

Bhujel, R. B., Mahat, P.M. and Rana, C. B. (2011). *Jumla ma dhan kheti* (Paddy farming in Jumla). Jumla: Agricultural Research Station.

Bravo-Ureta, B. E., & Evenson, R. E. (1994). Efficiency in agricultural production: the case of peasant farmers in eastern

Paraguay. *Agricultural economics*, *10*(1), 27-37.

Bravo-Ureta, B. E., & Pinheiro, A. E. (1993). Efficiency analysis of developing country agriculture: a review of the frontier function literature. *Agricultural and resource economics Review*, *22*(1), 88-101.

Bravo Ureta, B. E., & Pinheiro, A. E. (1997). Technical, economic, and allocative efficiency in peasant farming: evidence from the Dominican Republic. *The developing economies*, *35*(1), 48-67.

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society: Series A (General)*, *120*(3), 253-281.

Hidayah, I., & Susanto, A. N. (2013). Economies of scale and allocative efficiency of rice farming at West Seram Regency, Maluku Province, Indonesia. *Asian economic and financial review*, *3*(5), 624.

Jayaram, G.S., Chandrashekar, M. and Lalith, A. (1992). An economic analysis of technical efficiency in rice cultivation Mandya: Some issued in resource pricing. *Indian Journal of Agricultural Economics. 47*(4) 65-75.

Joshi K. D. & Upadhaya, S. (2020, June). The rise of rice in Nepal:Rice self-sufficiency is key to Nepal's economic development, but how to go about it? *Nepali Times.* Retrieved from https://www.nepalitimes.com/banner/the-rise-ofrice-in-nepal

Jyothi, Y., Sunitha, N., & Sethi, N. (2017). A participatory outline of tribal women of Andhra Pradesh in farming activities. *International Journal of Agricultural Science and Research* (IJASR). *7*(5) 421-424.

Katuwal, N. (2020a). Motivational factors influencing a conversion for organic tea farming in Nepal. *International Journal of Current Research and Thought. (IJCRT). DOI: http://doi. one/10.1729/Journal, 25079.*

Katuwal, N., (2020 b).Development practices in Nepal: A historical, perspective. *International Journal of Science and Research (IJSR).* DOI: 10.21275/SR201127093158

Katuwal, N., (2020 c).Factors influencing small farmers' participation in the extension of tea farming: a case of Ilam, Nepal. *EPRA International Journal of Agriculture and Rural Economic Research (ARER). 8*(6), *33-41*.DOI: https://doi.org/10.36713/epra6009

Katuwal, N., (2021).Contribution of remittance to rural Economy in Nepal. *International Advanced Research Journal in Science, Engineering and Technology (IARJSET).7*(8), 13-18. *DOI: 10.17148/IARJSET.2021.8103*

Khan, H. (2012). Measurement of technical, allocative and economic efficiency of tomato farms in Northern Pakistan. *Journal of Agricultural Science and Technology. B, 2*(10B), 1080.

MoA, (2015). *Rice varietal mapping in Nepal: implication for development and adoption.* Kathmandu: Author.

Nicholson, W. (1995). *Macro-economy theory: Basic principles and expansion (5th Eds.)*. Jakarta: Rajawali Press.

O'Neill, S., Matthews, A., & Leavy, A. (2006). *Farm technical efficiency and extension*. Dublin: Department of Economics, Trinity College.

Pérez, J. P., Gil, J. M., & Sierra, I. (2007). Technical efficiency of meat sheep production systems in Spain. *Small Ruminant Research*, *69*(1-3), 237-241.

Pradhan, B., et al. (2016). Contract farming in sugarcane cultivation and developments of the growers. *IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS) 4*(12) 1-6.

Prasidha, P R, & M. Asokhan. (2019). The perception of Cauvery delta farmers

towards credit, cultivation and marketing risks in paddy farming. *International Journal of Educational Science and Research (IJESR) 9*(4) 1-6.

Shireesha, K., et al. "Correlates of Profile and Attitude of youth towards Farming." International Journal of Agricultural Science and Research (IJASR) 7.1 (2016): 43-52.

Soekartawi R. (2002). *Production economy theory with discussion emphasis on Cobb-Douglas function analysis (3rd Eds).* Jakarta: Rajawali Press.

Sreelakshmi, C. C. (2018). Impact of credit interventions for promotion of rice farming in thrissur district. *International Journal of Applied and Natural Sciences (IJANS).* 7(1) 17-26.

Upadhya, S. R. (1986). Allocative and technical efficiency in using agricultural inputs: A case study of Nepalese farmers in Rupandehi district. *The Economic Journal of Nepal.* 10(2), 35-44.

Zikhali, W. (2018) Putting the last first: Using the chamberian lenses to explore poverty at Sivomo village, Nkayi district, Zimbabwe. *International Journal of Humanities and Social Sciences (IJHSS) 7*(4) 55-66.