EFFECTS OF LABOUR MIGRATION ON PRODUCTIVITY AND TECHNICAL EFFICIENCY IN RICE FARMING IN KANCHANPUR, NEPAL

A Thesis

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DECLARATION

I hereby declare that the thesis entitled, "EFFECTS OF LABOUR MIGRATION ON PRODUCTIVITY AND TECHNICAL EFFICIENCY IN RICE FARMING IN KANCHANPUR, NEPAL" submitted to the Department of Economics, Patan Multiple Campus, is entirely my original work prepared under the guidance and supervision of Dr. Bishnu Prasad Sharma, Professor, Department of Economics, Patan Multiple Campus. I have made due acknowledgements to all the ideas and information borrowed from different sources in the course of writing this thesis. The result of this thesis has not been presented or submitted anywhere else for award of any degree or for any other purpose. No part of the contents of this thesis has ever been published in any form before. I shall be solely responsible if any evidence is found against my declaration.

Bina Bhatt

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This thesis entitled "EFFECTS OF LABOUR MIGRATION ON PRODUCTIVITY AND TECHNICAL EFFICIENCY IN RICE FARMING IN KANCHANPUR, NEPAL" has been prepared by Ms. BINA BHATT under my guidance and supervision. I, hereby, recommend it in partial fulfillment of the requirements for the Degree of MASTER OF ARTS in ECONOMICS for final examination.

……..
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LETTER OF APPROVAL

We certify that this thesis entitled, "EFFECTS OF LABOUR MIGRATION ON PRODUCTIVITY AND TECHNICAL EFFICIENCY IN RICE FARMING IN KANCHANPUR, NEPAL" submitted by BINA BHATT to the Department of Economics, Faculty of Humanities and Social Sciences, Patan Multiple Campus, Tribhuvan University, in partial fulfillment of the requirements for the Degree of MASTER OF ARTS in ECONOMICS has been found satisfactory in scope and quality. Therefore, we accept this thesis as a part of the said degree.

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ABSTRACT

Labor migration for employment is one of the most significant economic phenomena in a country like Nepal. However, there is no consensus among past studies on whether smallholder agricultural systems are deteriorated, are reinforced or remain unchanged due to the labour migration for foreign employment and the remittance received. This study aims to examine the effects of labour migration for foreign employment on productivity and technical efficiency of rice farmers applying it to the case of Nepal.

The study is based on primary data obtained through cross sectional single-visit survey of randomly selected representative samples of migrant and non-migrant households during January 2022. Sample for the study consist of 140 households, comprising 67 migrants and 73 non-migrant households. The study employed Cobb-Douglas production function and stochastic production frontier analysis to estimate productivity and technical efficiency respectively. T-test was conducted to see the difference between the socio-economic and farm-related characteristics of migrant and non-migrant households.

The study found that the average yield of rice was lower in the migrant households than that of non-migrant households. The mean value of marginal productivity of land was estimated 0.89 quintal per kattha for migrant households and 1 quintal per kattha for non-migrant households. The mean value of average productivity was estimated 1.33 quintal and 1.43 quintal for migrant and non-migrant households, respectively. Similarly, the estimated mean technical efficiency level was 82 percent for migrant household and 94 percent for non-migrant households. Moreover, the migrant households lagged behind in socio-economic and farm-related characteristics including land holding, access to irrigation, mechanization, education, use of inputs and output compared to non-migrant households.

Based on the findings of the study, it can be concluded that labour migration for foreign employment has negative effect on farm productivity and technical efficiency. There is a need for more in-depth analysis at a greater scale.

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ACRONYMS/ABBREVIATIONS

ADB = Asian Development Bank
AP = Average Productivity
CBS = Central Bureau of Statistics
DEA = Data Envelopment Analysis
Exp = Exponential
FAO = Food and Agricultural Organization
GDP = Gross Domestic Product
HHs = Households
LR = Likelihood Ratio
Max. = Maximum
Min. = Minimum
MP = Marginal Productivity
MPRA = Munich Personal RePEc Archive
N = No
No. = Number
n = Sample Size
OLS = Ordinary Least Square
S. D. = Standard Deviation
SFA = Stochastic Frontier Analysis
Std. = Standard
TE = Technical Efficiency
Y = Yes

CHAPTER I

INTRODUCTION

1.1 Background of the study

Labor migration for employment is one of the most significant economic phenomena with more than one third of households in Nepal having a family member migrated for foreign employment abroad, the largest among South Asian countries (Bossaive & Denisova, 2018). Migrant workers' remittance income has emerged as one of the most important components in the Nepalese economy, influencing not only household consumption and investment patterns, but also the overall economic structure and dynamic (Tuladhar, Sapkota & Adhikari, 2014) which in turn has a profound effect on agriculture productivity and technical efficiency.

Conventionally, international migration is understood to occur mainly because of economic imbalances in development between home and host countries. Migration is induced by both; push and pull factors. Push, on account of population growth, high rate of poverty, food insecurity and low level of agricultural and industrial development. The pull factors are globalization and openness of economies and comparatively handsome wage packets (Ojha, 2015).

Although, Nepal is predominantly an agrarian economy employing 60.4% of the country's population and contributing 25.8% to GDP (MOF, 2020), it is still a subsistence activity. The agricultural sector suffers from low productivity due to lack of timely availability of fertilizer, constraints of credit, labour and insurance. Subsistence-oriented farming, together with declining farm sizes, makes it difficult for farming households to meet their basic requirements. The stagnating industrial sector does not provide sufficient opportunities for the rural population to earn a living in Nepal either. Hence, rural farming households are increasingly looking for opportunities away from the agriculture sector and relying on labour migration as a livelihood strategy to meet their

basic requirements and enhance their income levels (Maharjan, Bauer & Knerr, 2013). Nepalese economy is now changing from agriculture based to the remittance based as majority of active working population is in foreign employment. Seasonal migration to urban centers within the country and to neighboring cities of India may not be bad, as this sort of migration supplements the income of the farmers and the farmers are back during their own farming season. But an absence for more than six months in a year results in labour shortages for even normal farming activities (Ojha, 2015). Numerous studies have been conducted to investigate whether migration will improve or worsen conditions in these farm households and their communities in the long- run, however there is no consensus in the findings.

While some argue that migration can reduce farm labour and subsequently lower agricultural production, others point out that migration can address the critical problem of under-employment faced by many, and, hence, not necessarily lead to a reduction in farm labour input. It is also argued that remittances from migrant workers can be used for productivity enhancing agricultural inputs to offset any labour losses, resulting in higher yield. However, when remittances are not invested in farming, the net impact of migration on farm production can be negative. Further, with the increasing remittance income farm household may choose to escape from the low productivity subsistence farming which may pose a serious problem in maintaining or enhancing domestic agricultural production and households' food security.

Labour migrates to different destinations with or without intention to return to the country of origin. This study focuses on transnational migration, defined here as international migration in which migrants maintain their family ties across borders, for instance, through making regular visits, sending remittances, or having plans to return (Levitt & Jaworsky, 2007) rather than the labour force migrating for permanent settlement to other countries. For the purpose of this study, international labour migration to India and elsewhere has been studied to explore its impact on productivity and technical efficiency.

With the labour migration for foreign employment, farm households' remittance income is increased. Increased income can be invested in irrigation, improved seeds, fertilizer and pesticide. However, using more and better inputs leads to higher production cost, which means farmers has to produce more to cover cost. In other words, productivity of each input should be increased. And to be more productive, farmers have to be more efficient.

Productivity is usually defined as the relationship between the quantity of the product obtained (output) and the volume of one or more factors (inputs) required for its production. Technical efficiency (TE) refers to the ability of the farm to attain the highest level of output, given a set of inputs. Productivity measures how much output can be produced out of given amounts of resources while technical efficiency reflects "how well" a farm is able to combine the different inputs and factors of production into the production process to produce a maximum amount of output. If a farm produces the same quantity of output with fewer resources or more output with the same amounts of resources, it is more productive. However, it is not necessarily more technically efficient, because this increase in productivity may be the result of the availability of better inputs (that is, technological change), for example in the form of improved seed varieties or more powerful fertilizers or pesticides, and not to a better use or combination of the existing inputs. The definition of technical efficiency is based on the concept of production frontier, which represents the maximum output allowed by the technology. This frontier varies across countries and regions because the technology is different, in the sense that the production conditions, such as soil types, rainfall, sunlight intensity or availability of qualified workforce, also vary (Food and Agriculture Organization, 2018).

A farm is said to be technically inefficient if it does not produce the maximum level of output that can be expected given the resources available. An increase in technical efficiency, or a reduction in technical inefficiency, raises productivity as more output can be produced from the same set of resources. Technical efficiency is only one of the sources of productivity growth and, therefore, should not be confused with productivity itself (Grosskopf, 2002).

1.2 Statement of the problem

Labour migration for foreign employment is one of the major socio-economic phenomena of Nepal. The effect of labour migration for foreign employment on farm households is twofold. first, it creates shortage of labour for agricultural activities and lower agriculture productivity and production in the long run (Ojha, 2015), second, it provides households with remittance income which may be used for purchasing productivity enhancing agricultural inputs and technology to offset the loss of labour shortage, resulting the higher yield (Stark, 1980)

Although, many researchers have carried out a number of empirical studies to investigate the impact of labour migration on agricultural productivity and technical efficiency, there is no consensus on whether smallholder agricultural productivity is improved, deteriorated or remain unchanged through migration and the remittance received. (Khanal, 2013; Tuladhar, Sapkota & Adhikari, 2014; Anuja et al., 2020) show negative impact of out-migration on farm production, while (Dharmadasha & Wijethilaka, 2014; K. C. et al., 2022) show the positive impact, however, studies of (Mccarthy et el., 2009; Jokinen, 2018) show no impact of out-migration on farm production. These studies suggest that the effect of migration and remittance varies across countries and communities depending on the contextual characteristics of origin communities and their potential for agricultural improvement.

Several studies have been carried out in Nepal as well to identify the impact of remittance on Nepalese economy. However, there is dearth of studies that empirically investigate the impact of labour migration specifically on productivity and technical efficiency. Therefore, this study is necessary to examine the effect of labour migration for foreign employment on agricultural productivity and technical efficiency.

1.3 Research questions

The purpose of this thesis is to empirically answer the following questions:

1. What are the socio-economic and farm-related characteristics of migrant and non-migrant household?
2. What are the effects of labour migration for foreign employment on rice productivity and technical efficiency of farm households?

1.4 Objectives

General objective of the study is to examine the impacts of labour migration for foreign employment on agricultural production. The specific objectives of the study are as follows:

1. To analyze the socio- economic and farm-related characteristics of migrant and non-migrant households in the study area.
2. To analyze the impact of labour migration on rice productivity and technical efficiency of farm households.

1.5 Hypothesis

Based on the extensive literature review and research questions the following hypotheses are formulated:

1. H0: There is no difference between the socio-economic and farm-related characteristics of migrant and non-migrant households.
   H1: There is a difference between the socio-economic and farm-related characteristics of migrant and non-migrant households.

2. H0: There is no difference between the rice productivity and technical efficiency of migrant and non-migrant households.
   H1: Migrant households are less productive and less efficient than non-migrant households.

1.6 Significance of the study

This study is important as it produces detailed information about the differences in productivity and technical efficiency in rice farming between the households with or without the labour migrated for foreign employment. This study also analyzes the factors affecting rice productivity and technical efficiency. As existing literature suggest that the impact of labour migration for foreign employment on agricultural productivity and efficiency varies across the countries and communities (Khanal, 2013; Jokinen, 2018; Anuja et al., 2020; K. C. et al., 2022), this study will be useful to understand the location specific agricultural dynamics resulted by labour migration for foreign employment.

1.7 Limitations of the study

It is an overview study of Kanchanpur district. The intention of the study is not to provide an in-depth analysis of a broad sample but rather to inform understanding of the effects of labour migration for foreign employment at household level. Therefore, it cannot be the representation of the country as a whole. The study is based on primary data collected from household survey. Therefore, the reliability of the study depends upon the accuracy of the information provided by the respondents. This study focuses only on the effects of labour migration for foreign employment in rice productivity and technical efficiency. Thus, this study is not able to show how labour migration has affected other aspects of migrant households such as health, education, living standard, wealth accumulation and human capital development. An answer to these questions would require further research.

1.8 Outline of the study

This study is divided into five chapters. Chapter one presents the background information and justifies the research problems. This covers the objectives of the study, importance of the study, significance of the study and limitations of the study. Chapter two reviews available literature related to the study. Here different literature on effects of labour migration for foreign employment on agricultural productivity and technical efficiency are reviewed from national and international experiences. This chapter identifies research

gap on the proposed topic based on literatures. Chapter three discusses research methodology of the study. It elaborates on sampling design, sources of data and data collection methods. Chapter four focuses on data presentation and analysis. The final chapter five ends with summary and conclusion of the research.

CHAPTER II

REVIEW OF LITERATURE

2.1 Introduction

This chapter includes a review of literature on the labour migration and its impact on farm production from national and international experiences and concludes with a research gap. There have been numerous studies on this topic which suggest that effects of labour migration for foreign employment vary across countries and communities depending on the contextual characteristics of origin communities and their potential for agricultural improvement. Thus, this section provides an insight to the research question and will provide a guideline for the entire upcoming sections.

2.2 Review of literature

Msuya & Ashimogo (2005) estimated and compared the level of technical efficiency of sugarcane outgrower and non-outgrower farmers in Tanzania using the Cobb-Douglas production frontier assumed to have a truncated normal distribution. Technical efficiency of outgrower and non-outgrower were 76.43 percent and 80.65 percent respectively. This indicates that there is a scope of further increasing the output of out-growers and non-out growers by 23.57 percent and 19.35 percent respectively without increasing the levels of inputs used. The results showed significant positive relationships between age, education, and experience with technical efficiency.

(McCarthy et al., 2009). suggest that smallholder farmers may choose not to invest remittances in agricultural inputs. Although rural families with migrant household members commonly have a higher income level than non-migrant households, they do not necessarily have higher agricultural incomes. While agriculture is not abandoned, it often becomes a secondary income source (McCarthy et al., 2009).

Adaku (2013) reported that households whose members opted for seasonal migration had significantly low farm production compared to non-migrant households in Ghana. Another study by Iheke, Nwaru & Onyenweaku (2013) examined the impact of migrant remittances on the technical efficiency of smallholder arable crop farm households in South Eastern Nigeria. The study employed stochastic frontier production function analysis in a single stage maximum likelihood estimation method and z -test statistics. Using primary data collected from 120 respondents comprising 60 migrants' remittance receiving households and 60 non receiving households, they found that the non-remittance receiving households were more technically efficient than the remittance receiving households in the use of farm resources. The study estimated the mean technical efficiency at 42 percent and 53 percent for remittance receiving and non-receiving households respectively. The results of data analyzed showed that household size, education, farming experience, and farm size were the significant determinants of technical efficiency of the remittance receiving households; while age, years of education and farm size were the significant determinants of technical efficiency of the non-remittance receiving households.

Likewise, Khanal (2013) analyzed how the family labour out-migration affects technical efficiency of rice farmers in Tanahu, Nepal and suggested that technical efficiency of households with no migrants was significantly higher (78%) compared to households with both international (68%) and internal (66%) migrants. Study found that education level, livestock holding and participation in agricultural related organization had positive effect on production while age and migrants' status had negative impact. Moreover, although migration provides houses with remittance income, it does not improve the technical efficiency.

In a study conducted by Maharjan, Bauer & Knerr (2013) on migration of labour and its impact on farm production in Nepal, the authors have identified quite dissimilar impact of migration on agricultural production in two districts. The impact of family labour loss is significant in Syanja but less so in Baitadi. In both districts, the use of purchased agriculture inputs is not significantly influenced by household migration status. The

results indicate that when remittance is relatively high, farmers do not invest in low-productivity subsistence crop farming and livestock, and prefer the nonfarm sector or use remittances for more leisure and consumption goods. However, when remittances are low, farm households use the extra funds to supplement income from their subsistence farming to meet their basic food and non-food requirements, and also to expand their livestock activity as it is more profitable than subsistence cereal farming. Whenever remittances are high enough to substitute income from subsistence farming, the farm households are more likely to neglect farming than be engaged in commercial farming.

A study by Dharmadasa & Wijethilaka (2014) found positive and significant effect of migration and remittance on the technical efficiency of tea production in Sri Lanka. The effect of migration and remittance was analyzed using a sample of 200 tea smallholders. Utilizing stochastic production frontier, the study estimated technical efficiency of 77 percent and 62 percent for migrant and non-migrant smallholders, respectively. The inefficiency model suggests that the amount of remittance sent and the education level of migrants have significant effect on decreasing inefficiency while duration of migration and age of migrants significantly increases inefficiency.

Tuladhar, Sapkota & Adhikari (2014) pointed out two important trends of migration and remittance on agriculture in Nepal: (1) migration adversely affects agricultural yields by inducing a labour shortage in the sector, and (2) there is no improvement in agricultural productivity of remittance receiving households despite increased household incomes, because such incomes are not invested on productivity enhancing agricultural capital goods and inputs.

In a study of impact of migration in agriculture and food security in South Asia, Ojha (2015) have identified that there is a two-way relation between agricultural productivity and labour migration. On the one hand, the migration of the workforce may initially lead to reduced disguised unemployment in the agricultural sector in the short run, resulting in increased productivity due to the withdrawal of excess labour. But the results may show a fall in the longer run due to shortages of labour. The fall in productivity may

subsequently trigger an outward flow of migrant workers, leading to a vicious cycle of external dependency and food insecurity.

Jokinen (2018) investigated two agricultural communities in Bolivia and found weak and mixed migration induced change in agriculture. The study showed that transitional migration does not necessarily result in the abandonment of agricultural activities even if the space is already being pressurized by rapid urbanization and internal in-migration. The author observed that migration-induced labour losses are compensated through labour- saving adaptive activities, and remittances are occasionally used for agricultural input. On very rare occasions, households with agronomic knowledge have been able to substantially improve their agricultural production as a result of migration, indicating that technical guidance for agricultural families with access to remittances could improve their productivity. In general, however, the migrant households strive to maintain their farming practices for subsistence and as a part-time economic activity in addition to other income sources.

KC & Race (2020) analyzed how out migration affects land management practices in the context of rapidly changing rural communities in middle hills of Nepal. The result found that the underutilization of farmland was prominent phenomenon than land abandonment, with rural communities moving to less intensive farming. Also, the increasing underutilization of farmland is not just occurring among migrant households but among non-migrant households too. Farmers were found to be moving towards less intensive farming practices, such as planting fodder and timber trees, grasses, and cash crops, rather than regularly cultivating land for annual crops. The study prescribed that the government needs to quickly develop an integrated national agricultural and rural development policy that attracts and encourages a new generation of farmers and investment to revitalize this vital sector of the country.

Pradhan & Raut (2019) estimated technical efficiency of poultry farming in Nepal using secondary data obtained from Nepal commercial Poultry Survey 2015.The study estimated technical efficiency range between 89 and 92 percent depending on the

distributional assumption. Study utilizes stochastic Cobb-Douglas production frontier and did not find any significant effect of trained farmer and credit on production.

Likewise, Anuja et al., (2020) examined the pattern and implications of labour migration on technical efficiency of farm households. The authors have identified that the average yield of selected crops was higher in the non-migrant households than that of migrant households in Bundelkhand, India. Although the yield was higher for non-migrant households, there was no variation in the input use intensity between the two categories. The study also suggested that timely availability of labour for farm operations by non-migrant farmers throughout the cropping season could be the reason for better performance of non-migrant households. However, K.C. et al., (2022) suggest that the rice productivity of migrant households was higher compared to non-migrant households in Chitwan, Nepal.

2.3 Research gap

Although several studies have conducted in Nepal to analyze the impact of labour migration and remittance on Nepalese economy, only limited research have focused on its impact on agricultural productivity and technical efficiency. In addition, previous studies suggest that the effect of labour migration on agricultural productivity and technical efficiency varies across countries and communities. Existing studies have been concentrated mostly on the hilly regions of Nepal (see for example; K.C. & Race, 2020, Maharjan, Bauer & Knerr, 2013) where farmland is categorized as khet (relatively productive and usually irrigated farmland), bari (farmland less productive than khet) and khar bari (least productive farmland, traditionally growing khar grass that is typically used for roof thatching and feed for livestock). So, these studies are not relevant in the terai region where agricultural land is more productive, fully used for crop production instead of grass and cattle rearing and where labor losses of the households can be substituted for machines. Therefore, this study attempts to fill the gap by specifically analyzing the effects of labour migration on rice productivity and technical efficiency in the plains of Terai.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Introduction

The study is based on the primary data collected from household survey conducted in Kanchanpur district of Sudurpaschim province, Nepal. The sample consists of 140 farm households in total, comprising 67 migrant and 73 non-migrant households. In order to see the differences in socio-economic characteristics 67 migrant and 73 non-migrant households were taken. However, only 126 households were taken for estimating productivity and technical efficiency comprising 63 migrant and 63 non-migrant households due to unavailability of data related to inputs and output from some respondents. Migrant households are those households whose family member/s in foreign employment while non-migrant households are those with no family member migrated for foreign employment. The study employs a non-probability, purposive sampling technique to select study area and a simple random sampling to select respondent households. Households were directly interviewed using semi-structured questionnaire to collect required data. The study employs stochastic production frontier with Cobb-Douglas functional form to measure farm level technical efficiency scores. Data on single output (rice) and multiple inputs to produce that output are used to measure technical efficiency and productivity. Data related to socio-economic and farm-related characteristics of migrant and non-migrant households is initially computed using simple statistical technique and then t-test was carried out to see the difference. The data related to productivity and technical efficiency of migrant and non-migrant households were measured separately and then compared to see the effect of labour migration.

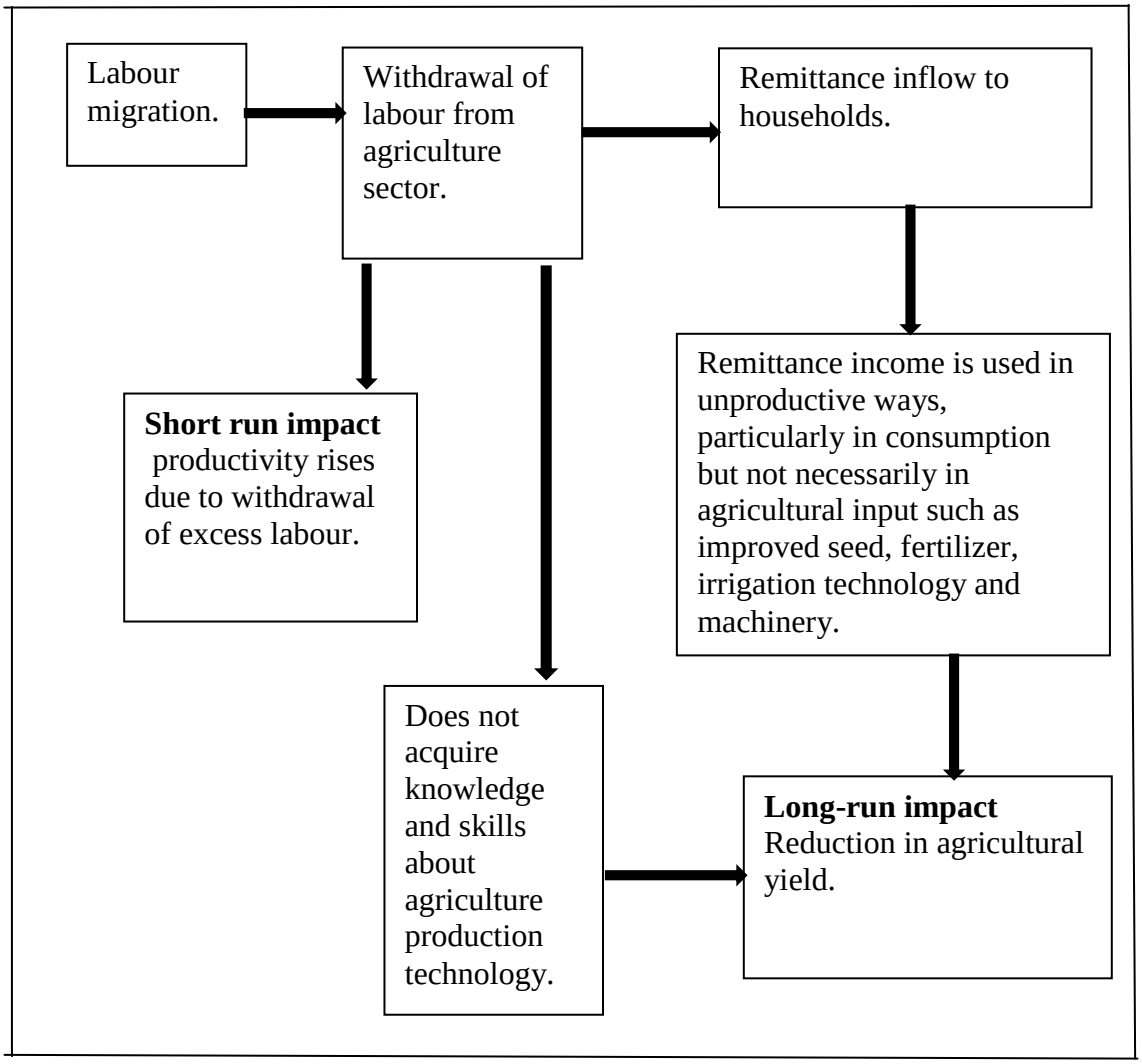
Thus, this study is based on mixed method approach; descriptive as well as analytical research design to meet the objective of the study. Descriptive research design focuses on describing the actual situation of socio-economic and farm-related characteristics, productivity and technical efficiency of migrant and non-migrant households. Similarly,

the analytical research design identifies effects of various factors on technical efficiency and productivity. In addition, inferential statistics is employed to see differences in socio-economic and farm-related characteristics, productivity and technical efficiency of migrant and non-migrant households.

3.2 Conceptual framework

The review of literature suggest that transnational migration and remittances have time and place-specific effects that largely depend on the contextual characteristics of origin communities and their potential for agricultural improvement. The concept for this paper is based on the previous studies in the context of Nepal where it can be clearly seen that despite the outmigration of large number of youths from rural farming communities, investment in the agricultural productivity enhancing resources and technology is not significant. The following chart has been created to understand the effect of labour migration for foreign employment on rice productivity and technical efficiency of farm households.

Figure 1: Effect of labour migration on productivity and technical efficiency



3.3 Sampling design

Sample size for the study consists of a total of 140 households, 73 from non-migrant and 67 from migrant households. Four villages of Kanchanpur district were purposively selected for the study. Simple random sampling was used to select the respondent households.

3.4 Sources of data

The study is based on primary data. Data required for the study were collected from household survey conducted during the month of January 2022 using direct interview schedule. Household head or other family members were interviewed directly using semi-structured questionnaire. The survey questionnaire covered a wide range of information including household's socio-economic and farm-related characteristics, such as participation in foreign employment, size of the land holding, ownership of the agricultural land they are using, access to irrigation, state of farm mechanization, main source of income of household head, membership in cooperative, among others. The study was conducted in Kanchanpur district. Four villages of Bedkot municipality were selected purposively for the study; ward no. 02, 03, 09 and 10. Ward no. 09 and 10 has a public canal for irrigation while ward no. 02 and 03 depends on either private boring or rainfall for irrigation purpose. A sample of 140 households (73 non-migrant and 67 migrant households) was selected for the study following simple random sampling procedure.

3.5 Specification of model

Production function is the prerequisite relationship between inputs and outputs. The structure of production function can be defined using different production model. In case of the estimation of the stochastic frontier and technical efficiency, number of literatures often utilized Cobb-Douglas model or trans-log model (see, for example, Msuya & Ashimogo, 2005; Anuja et al., 2019; Iheke, Nwaru & Onyenweaku, 2013). This study employs stochastic production frontier with Cobb-Douglas functional form (Aigner,

Lovell & Schmidt, 1977) to measure farm level technical efficiency scores. The Cobb-Douglas function can be expressed as:

$$Yi = f(Xi) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1) \qquad i = 1, 2, 3, \ldots, n.$$

Equation (1) represents the general form of the production function. Yi is the output produced and f (Xi) is the inputs processed and technology utilized, *Xi* includes different quantity of inputs and their organization and, i represent firms. The production function is the mathematical interpretation of the production process and efficiency is the ability to produce higher output utilizing the minimum inputs. We can estimate technical efficiency using either input oriented or output oriented technical efficiency methods. Input-oriented method minimizes input for observed output and output-oriented method maximizes the output for given inputs.

Technical efficiency can be estimated through parametric method such as stochastic frontier analysis (SFA) and non-parametric methods such as data envelopment analysis (DEA). Non-parametric models do not differentiate between random shocks and the actual technical inefficiency. Any shortfall to achieve the potential output fall into inefficiency. It ignores the effects of random shocks like measurement errors in the output variable, natural disaster, weather conditions, diseases, and the combined effects of unobserved or uncontrollable inputs on production process.

The SFA model is superior to DEA because it separates technical inefficiency from other shocks. It has two error terms one to account for random effects and another to account for technical inefficiency. Both error terms together are known as composite error. In addition, DEA model is employed when the research aims to analyze multiple outputs and multiple inputs. However, the focus of this study is single output (rice) and multiple inputs. Therefore, the stochastic frontier production function is employed to achieve the objective of this study.

3.5.1 The stochastic frontier model with technical inefficiency effect

The stochastic frontier production functions were independently proposed by Aigner, Lovell & Schmidt (1977) and Meeusen & Van Den Broeck (1977). The original specification involved a production function specified for cross sectional data which had an error term consisting two components, one to account for random effects and another to account for technical inefficiency. This original specification has been used in a vast number of empirical applications over the past decades. The specification has also been altered and extended in a number of ways. Many studies used a second stage regression method to determine the firm specific attributes and to observe their effect on firm level technical efficiency. However, Battese & Coelli (1995) proposed a stochastic frontier model which allows us to regress the frontier model to generate firm level technical efficiencies and the factors affecting efficiency differential among farms in a single stage. This single stage model has firm effects assumed to be distributed as a truncated normal random variable. The stochastic frontier model, following Battese & Coelli (1995) is expressed as:

$Yi = Xi\beta + (Vi-Ui)$ ……. (2) i=1……. N

Where, Yi is the production of the ith farm,

Xi represents inputs used by the ith farm,

β is a vector of unknown parameters,

Vi is a random systematic error which is assumed to be exogenous to the farm households or independent of Ui and represents measurement error, omitted explanatory variables and statistical noise,

Ui represents technical inefficiency in production. Ui is assumed to be independently distributed as truncation of the normal distribution with mean, μi and variance, σU^2 ($N(\mu i, \sigma U^2)$). That means the distribution of Ui is truncated normal.

Where, $\mu i = Zi\ \delta$…… (3)

μi represents the inefficiency of ith farm,

Zi is a vector of farm-specific variables that may cause inefficiency and

δ is a vector of parameters to be estimated.

Technical efficiency of the ith farm, given the level of input is denoted by TEi, and is given by

$TE_i = \exp(-U_i)$ …… (6)

The technical efficiency of the firm lies between 0 and 1 and is inversely related to the level of technical inefficiency effect. $|U_i| = 0$ for a firm whose production lies on the frontier and $|U_i| > 0$ for a firm whose production lies below the frontier.

Given research objectives, the generalized stochastic frontier model can be expressed as:

$\ln Y_i = \beta_0 + \beta_1 \ln X1i + \beta_2 \ln X2i + \beta_3 \ln x3i + \beta_4 \ln X4i + V_i - U_i$ ……. (8)

where,

Ln = denotes logarithms to base e.

Yi = output of i^{th} farm for given level of all inputs.

X1 = size of farm land.

X2 = labour utilized.

X3 = total machinery input.

X4 = fertilizer.

B0 = constant.

βi's = unknown parameters to be estimated.

Vi is a random error which represents the factors outside the control of the firm. Vi is widely accepted to have a zero mean normal distribution N $(0, \sigma v^2)$ and is independent of Ui.

And Ui represents non-negative random variable which accounts for technical inefficiency in production. The inefficiency model is expressed as fóllows:

$U_i = \delta Z_i = \delta_0 + \delta_1 Z1 + \delta_2 Z2 + \delta_3 Z3 + \delta_4 Z4 + W_i$……. …… (11)

Where,

Z1= age of the household head.

Z2 = gender of the household head.

Z3 = Access to irrigation.

Z4 = State of mechanization.

W = unexplained component of inefficiency error.

δ i's = inefficiency parameters to be estimated.

3.5.2 Cobb-Douglas production function

One of the main objectives of the measurement of productivity is to estimate the economic returns (or, simply, returns) generated by the factors of production either separately for each factor or collectively. Returns to a given factor of production can be defined as the physical output or cash profit generated using one unit of a factor of production. Returns to factors of production are directly linked to the capacity of the holding to generate income (efficiency). The Cob-Douglas production function has been used for measuring productivity.

The general form of Cobb-Douglas production function can be expressed as follows:

$\ln Y = \beta 0 + \beta 1 \ln X1 + \beta 2 \ln X2 + \beta 3 \ln X3 + \beta 4 \ln X4 + \beta 5 \ln X5 + \beta 6 \ln X6 + e$

Ln = natural logarithm.

Y = Total yield of rice.

X1 = Size of the farm land.

X2 = labour used.

X3 = Machine hours.

X4 = Cost of fertilizer in Rs.

X5 = Access to irrigation.

X6 = State of mechanization.

B0 =Constant / coefficient.

B1, β2, β3, ……, β6 are production coefficients of respective variable, and

e = error term

3.6 Specification of the variables and its measurement

Various quantitative and descriptive variables are used in the study. Variables, their measurement and descriptions are presented in tables below.

Table 1: Variables used in stochastic production frontier and its measurement

Variables	Measurement
Dependent	
1. Total yield of rice (Y)	Quintals
Independent	
1. Total area of farm land (X1)	Kattha
2. Total labour utilized (X2)	Man-days (8 hours = 1 man-day)
3. Total machinery input utilized (X3)	Machine hour
4. Total cost of fertilizer (X4)	Rs.

Table 2: Description of the variables used in inefficiency model

S.N.	Variables	Description
1	Age of the household head	It is a continuous variable measured in number of years.
2	Gender of the household head	It is a binary variable where ' 1 ' represents MALE and '0' represents FEMALE.
3	Access to irrigation	It is a binary variable where '1' represents YES and '0' represents NO.
4	State of mechanization	It is a categorical variable where '1' denotes only one activity is mechanized, '2', '3', and '4' denotes 2 activities, 3 activities and 4 activities are mechanized, respectively.

Table 3: Description of variables related to land use practices

S. N.	Variables	Description
1	Continuation	If the household has continued subsistence cereal farming without any major changes in their land use practice during last 20 years.
2	Diversification	If the household has shifted to high value crop (e.g., fruits or vegetable) or livestock.
3	Land abandonment	If the household has retained their farm plots as uncultivated for at least one year.
4	Underutilization of land	If the household has retained part of the land as uncultivated land at least for three or more months in a year, resulting in a reduced number of crop rotation.
5	Farmed by other	If the farmland is given to others for farming, either as a sharecrop or lease or in any other form.

3.7 Tools of analysis

Initially, the survey data from questionnaire were entered in Microsoft Excel. Later on, data from excel were imported to Stata Software for the purpose of analysis and interpretation. The technical efficiency scores were estimated using the stochastic production frontier with technical inefficiency effects assumed to have a truncated normal distribution proposed by Battese & Coelli (1995).

Marginal productivities of inputs were estimated by multiplying the elasticities of the statistically significant inputs (estimated from Cobb-Douglas production function) by the ratio of the output to respective inputs.

Simple statistical techniques were used to present the result of the study related to socio-economic and farm-related characteristics of migrant and non-migrant households. T-test was conducted to see the difference between socio-economic and farm-related characteristics of migrant and non-migrant households. Appropriate tables and graphs have been used to present the analysis.

CHAPTER IV

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter provides systematic presentation and analysis of primary data in the form of presentation, interpretations and analysis. The chapter is divided into three different sections. Section 4.2 presents the description of the study area. Section 4.3 presents the analysis of socio-economic and farm-related characteristics of the sample along with tables and figures. Similarly, section 4.4 presents the result and analysis of productivity of migrant and non-migrant households, section 4.5 presents the analysis of technical efficiency along with the various factors which affect the level of technical efficiency. Finally, section 4.6 presents the discussion.

4.2 Description of the study area

The study was conducted in Bedkot municipality of Kanchanpur district of Sudurpaschim province, Nepal. Bedkot municipality is located in a distance of 3 to 13 kilometer from Mahendranagar town along the east-west highway. It consists of total 10 wards which are scattered across 160 kilometers of geographical area with a population of 49,479 and total 9,219 households with an average of 5.37 members per household (CBS, 2011). Four wards out of total 10 wards were selected purposively for the study; ward no. 02, 03, 09 and 10. Ward no. 09 and 10 has a public canal for irrigation while ward no. 02 and 03 depends either on private boring or on rainfall for irrigation purpose. Data were collected from 140 households comprising of 67 migrant and 73 non-migrant households following a simple random sampling procedure. Household head or other family members were interviewed using semi-structured questionnaire. The survey questionnaire covered a wide range of information that included household's socio-economic and farm-related characteristics, such as participation in foreign employment, size of the land holding, ownership of the agricultural land they are using, access to irrigation, state of farm

mechanization, main source of income of household head, membership in cooperative, among others.

4.3 Socio-economic and farm-related characteristics of sample

This section deals with the socio-economic and farm-related analysis of the sample. Following tables contain the data related to gender, age, education level and occupation of the household head, access to irrigation, state of mechanization, ownership of the agricultural land, membership in cooperative, ethnicity, destination country for foreign employment and number of absentee members in migrant households. Some of the data are presented in the figures also.

Table 4: Classification of household heads by gender

Gender	Migrant households (n=67)		Non-migrant households (n=73)	
	Number	Percent	Number	percent
Male	32	47.7	69	94.5
Female	35	52.2	4	5.5

Source: Field survey, 2022

The classification of household headship by gender is presented in table 4. Data shows that 47.7 percent of the migrant households are headed by male while it is 94.5 percent for non-migrant households. Similarly, female household headship for migrant family is 52.2 percent and it is 5.5 percent for non-migrant family. This justifies that majority of the migrant families are headed by female and non-migrant families are headed mostly by males.

Table 5: Classification of household head by age group

Age	Migrant HHs		Non-migrant HHs	
	Number	Percent	Number	Percent
20-30	5	7.5	2	2.7
30-40	18	27.0	16	22.0
40-50	15	22.4	29	39.7
50-60	22	32.7	22	30.0
60 above	7	10.4	4	5.6
Total	67	100	73	100

Source: Field survey, 2022

On the basis of age group, household heads are classified in to five categories; 20-30 years, 30-40 years, 40-50 years, 50-60 years and above 60 years. With regards to age, results indicate that majority of the household head of migrant families were between the age 50 and 60 years, representing 32.7 percent, followed by age group 30-40 years, representing 27 percent, age group 40-50 years, representing 22.4 percent, age group above 60 years, representing 10.4 percent and 20-30 years, representing 7.5 percent. Similarly, majority of the household head of non-migrant families were between the age 40-50 years, representing 39.7 percent, followed by age group 50-60 years, representing 30 percent, age group 30- 40 years, representing 22 percent, age group above 60 years, representing 5.6 percent and age group 20-30 years, representing 2.7 percent.

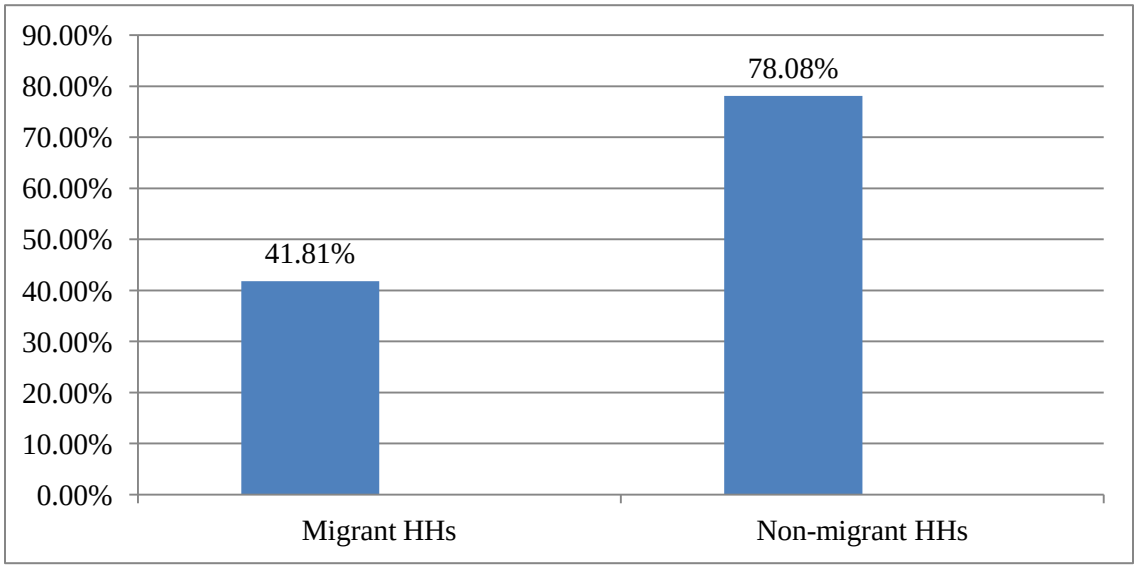
Table 6: Classification of household head by education level

Education level	**Migrant HHs (n=67)**		**Non-migrant HHs (n=73)**	
	Number	Percent	Number	Percent
1. Illiterate	25	37	14	19
2. Primary	15	22.5	12	16.5
3. Secondary	21	31.5	31	42.5
4. Above secondary	6	9	16	22
Total	67	100	73	100

Source: Field survey, 2022

The academic qualification of the household head is categories into four categories i.e., illiterate, primary (class 1-5), secondary (class 6-10) and above secondary (more than class 10). Table 6 shows that most of the household head of the migrant family are illiterate (37 percent), followed by secondary level (31.5 percent), primary level (22.5 percent) and above secondary (9 percent). Similarly, majority of the household head of non-migrant family have educational qualification of secondary level (42.5 percent), followed by illiterate (19 percent), primary level (16.5 percent) and above secondary (22 percent). This justifies that household head of migrant family lack in education in comparison to non-migrant family.

Figure 2: Access to irrigation



Source: Field survey, 2022

Figure 2 suggests that only 41.8 percent of the migrant family have access to irrigation while majority (78 percent) of the non-migrant families have such access. For this study, if the household have their own private source of irrigation such as boring and pump set or public canal is defined as households having access to irrigation. Households having no private or public source of irrigation who depend either on rainfall or their neighbors for irrigation are classified as households with no access to irrigation.

Table 7: Occupation of the household head

Occupation	**Migrant HHs (n = 67)**		**Non-migrant HHs (n = 73)**	
	Number	Percent	Number	percent
1. Agriculture	56	83.58	33	45.2
2. Other	11	16.42	40	54.8
3. Total	67	100	73	100

Source: Field survey, 2022

Table 7 presents the occupation of the household head of migrant and non-migrant households. Table shows that 83.58 percent of the migrant households have agriculture as the main occupation of their household head while it is 45 percent for non-migrant households. Similarly, 16.42 percent of migrant households' head have main occupation

other than agriculture while it is 54.8 percent for non-migrant households. Result shows that most of the migrant households head depend on agriculture as the main occupation while non-agriculture is the main occupation of majority of the non-migrant households head.

Table 8: State of mechanization-households using machines for various activities

Activity	Migrant HHs (n = 63)		Non-migrant HHs (n = 63)	
	Number	Percent	Number	percent
1. Land ploughing	51	80.95	57	90.47
2. Land preparation	30	47.62	47	74.60
3. Cutting	1	1.59	8	12.70
4. Threshing	62	98.41	63	100

Source: Field survey, 2022

The main activities involved in rice farming are land ploughing, land preparation, seed pulling, rice transplantation, cutting and threshing. In the study area, out of six activities seed pulling and rice transplantation were completely done manually by the farmers due to unavailability of machines related to these activities. For rest of the other activities machines were available. State of mechanization of migrant and non-migrant households is presented on table 8. State of mechanization in this study refers to the number of activities for which machines were used by the households instead of labour.

Table 8 suggests that 80.95 percent of the migrant households use machine for land ploughing while 90.47 percent of the non-migrant households use machine for the same. Similarly, 47.62 percent of migrant households use machines for land preparation while it is 74.6 percent for non-migrant households. For cutting, only 1.59 percent migrant households use machine while 12.7 percent of non-migrant households use machine for the same. Similarly, 98.4 percent migrant households and 100 percent of non-migrant households use machine for threshing. It is clear from the above table that threshing is the highly mechanized activity (almost fully) while cutting is least mechanized for both migrant and non-migrant households.

Table 9: Ownership of agricultural land

Ownership of land	Migrant HHs (n = 67)		Non-migrant HHs (n = 73)	
	Number	percent	Number	percent
1. Own land	47	70.15	55	75.34
2. Leased	3	4.48	4	5.48
3. Share cropped	17	25.37	14	19.18

Source: Field survey, 2022

Table 9 presents the ownership of cultivated land by migrant and non-migrant households. The table shows that out of 67 migrant households 70.15 percent use their own land, 25.37 percent use sharecropping and only 4.48 percent households use leased land for production. Similarly, out of 73 non-migrant households, 75.34 percent use their own land, 19.18 percent use share cropping and only 5.48 percent use leased land for production.

Table 10: Land use practices of the households

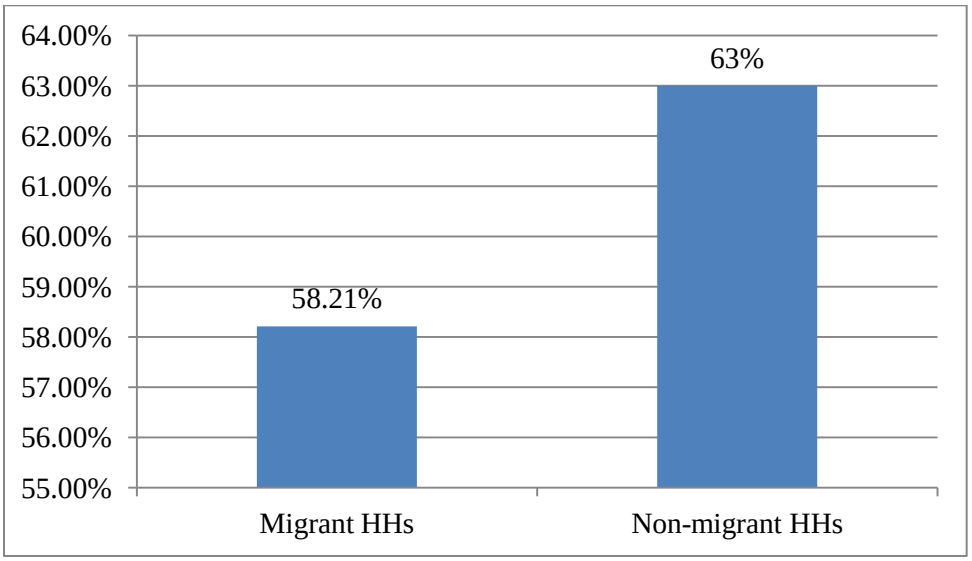
Category	Migrant HHs (n = 67)		Non-migrant HHs (n = 73)	
	Number	percent	Number	percent
1. Continued	56	83.58	55	82
2. Diversification	1	1.49	8	11.94
3. Underutilization	1	1.49	3	4.48
4. Farmed by others	9	13.44	7	10.45

Source: Field survey, 2022

Table 10 shows almost equal percent of migrant (83.5%) and non-migrant (82%) households reported continuation of the traditional subsistence farming practices. Only 1.49 percent of migrant and 11.94 percent of non-migrant family reported diversification of traditional subsistence farming to commercial farming including fruits, vegetable and livestock. Moreover, 1.49 percent of migrant and 4.48 percent of non-migrant households reported underutilization of farm land. However, this underutilization was not due to foreign employment but due to heavy winter rainfall causing the accumulation of water in the farm land during wheat plantation. Furthermore, 13.44 percent of migrants and 10.45 percent non-migrant family reported that their land is framed by others. Unlike the study of KC & Race (2020), neither migrant nor non-migrant family reported land

abandonment. This could be due to high fertility of land in Terai region in comparison to Hills and easy substitution of capital (machines) for labour.

Figure 3: Membership in cooperative



Source: Field survey, 2022

Figure 3 presents the membership in cooperative for migrant and non-migrant households. The figure suggests that out of 67 migrant households, 58.21 percent have membership in cooperative while it is 63 percent for non-migrant households (out of 73 HHs). In this study the membership in cooperative represents the membership either of the household head or the spouse.

Table 11: Ethnicity of migrant and non-migrant households

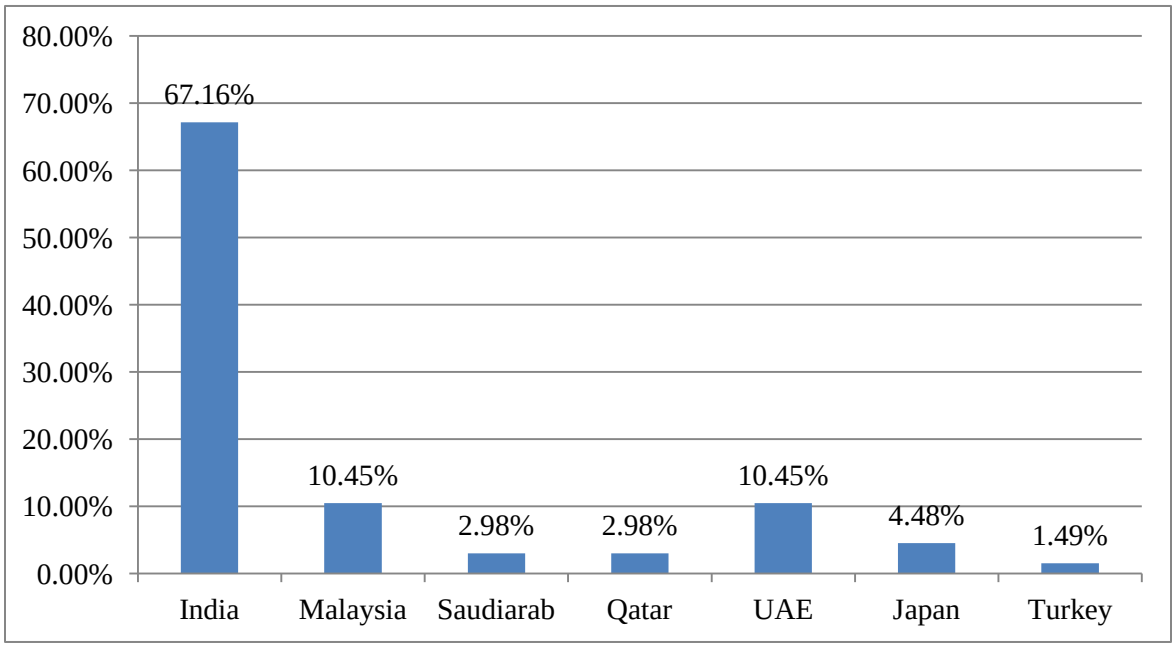
Ethnicity	Migrant HHs (n = 67)		Non-migrant HHs (n = 73)	
	Number	percent	Number	percent
1. Brahmins	14	20.89	27	36.98
2. Chhetri	39	58.2	24	32.87
3. Janjati	5	7.46	22	30.14
4. Dalit	9	13.43	0	0

Source: Field survey, 2022

Table 11 presents the ethnicity of migrant and non-migrant households. It is clear from the table that out of 63 migrant households, 20.89 percent are Brahmins, 58.2 percent are

Chhetri, 7.46 percent are Janjati and 13.43 percent are Dalit. Similarly, out of 73 non-migrant households, 36.98 percent are Brahmins, 32.87 percent are Chhetri, 30.14 percent are Janjati and Dalit are zero percent.

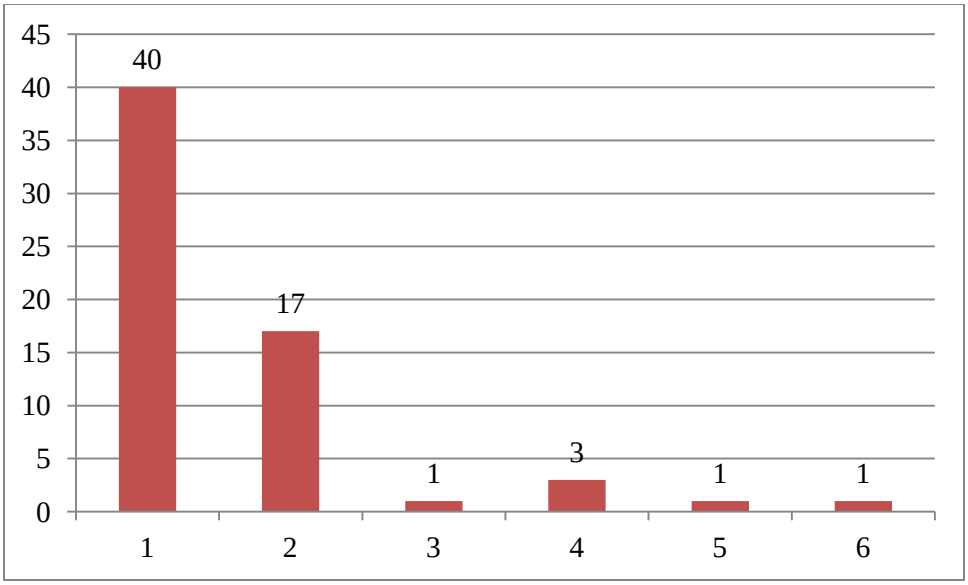
Figure 4: Destination country for foreign employment



Source: Field survey, 2022

Figure 4 suggests that most of the people choose India as destination for foreign employment representing 67.16 percent. Similarly, Malaysia and UAE are the second destination representing 10.45 percent each, followed by Japan 4.8 percent, Saudi Arabia and Qatar representing 2.98 percent each and Turkey representing 1.49 percent.

Figure 5: Number of absentee members of migrant households



Source: Field survey, 2022

Figure 5 shows that out of 63 migrant households 40 households have 1 member absent for foreign employment. Similarly, 17 households have 2 members absent, one household have 3 members absent, 3 households have 4 members absent 1 household have 5 members and one have 6 members absent for foreign employment. For this study, family member of age 15 years or more who are abroad for employment has been taken as an absentee member for foreign employment.

Table 12: Mean values and differences of socio-economic characteristics

Variables	Mean value (std. error)		Difference (Std. error)
	Migrant HHs (n=63)	Non-migrant HHs (n=63)	
1. Education of the HHs head (no. of schooling year)	4.94 (0.55)	7.17 (0.57)	2.23 (0.79) ***
2. Gender of the HHs head (male =1, female = 0)	0.49 (0.06)	0.94 (0.03)	0.44(0.07) ***
3. Age of the HHs head (in years)	45.26 (1.38)	46.16 (1.22)	0.88 (1.84)
4. Access to irrigation (Y=1, N=0)	0.44 (0.06)	0.76 (0.05)	0.31 (0.08) ***
5. Membership in cooperative (Y=1, N=0)	0.57 (0.06)	0.63 (0.06)	0.06 (0.08)
6. Occupation of the HHs head	0.85 (0.12)	0.39 (0.24)	0.46 (-0.12) ***

Notes:

1. 1 hectare = 1.5 bigha = 30 kattha, 1 kattha = 0.033 hectare
2. ***, ** and * indicate significant at 1 percent, 5 percent and 10 percent respectively.

Source: Field survey, 2022

Table 12 shows the comparison between migrant and non-migrant households. Several socio-economic indicators were analyzed for this comparison. The t-test was conducted to see the differences between the selected variables of migrant and non-migrant households.

The mean education of the household head of migrant households was lower by 2.23 years at 1 percent level of significance indicating household heads of non-migrant families are more educated than that of migrant families. Result shows the difference in the gender of the household head of migrant and non-migrant families. The male household headship was relatively lower in the migrant families than that of non-migrant families indicating that foreign employment has resulted in transformation in women's roles and responsibilities in a family. However, there was not much difference between the age of heads of migrant and non-migrant households (not statistically significant). Similarly, the access to irrigation for migrant households was relatively lower compared to non-migrant households. It could be due to the fact that remittance incomes are not invested on productivity-enhancing agricultural capital goods (Tuladhar, Sapkota & Adhikari, 2014). The difference between the migrant and non-migrant households in

terms of membership in cooperative was not significantly different. When we finally look at the occupation, result shows that there is a difference between migrant and non-migrant household at one percent level of significance. Agriculture as the main occupation of the household head is significantly higher for migrant households than that of non-migrant households, while other than agriculture as the main occupation is higher for non-migrant households head. For this study other occupation includes government service, formal private jobs, trade and business and others.

4.4 Effect of labour migration on productivity

The summary statistics of inputs and output used for analysis of productivity and efficiency for both migrant and non-migrant households are presented in table 13. It shows that the average area under the rice cultivation for migrant households is 12.13 kattha and on an average a migrant household produces 16.13 quintals of rice in a rice cropping season using on average 27.20 days of labour, 2.99 hours of machine and fertilizer of Rs. 2571. For non-migrant households the average area under rice cultivation is 16.38 kattha and on an average a non-migrant household produces 22.82 quintals of rice using on an average 28.03 days of labour, 4.71 hours of machine and fertilizer of Rs. 3901. The means of inputs and output presented in the table suggest that at the time of survey, migrant households lagged behind on both counts.

Table 13: Summary statistics of output and inputs used

Variables	Migrant households (n=63)				Non-migrant households (n=63)			
	Mean	Min.	Max.	S. D.	Mean	Min.	Max.	S. D.
1. Rice (quintal)	16.13	7	60	11.16	22.82	8	100	16.47
2. Land size (kattha)	12.13	5	40	7.39	16.38	5	60	11.14
3. Labour days	27.20	11	70	12.17	28.03	12	65	11.38
4. Machine hour	2.99	0.60	8.3	1.89	4.72	0.60	14.40	2.42
5. Fertilizer (Rs.)	2571	800	7000	1271.8	3901	1000	12000	2166.4

Note: 1 hectare = 1.5 bigha = 30 kattha, 1 kattha = 0.033 hectare
Source: Field survey, 2022

Table 14: Mean values and differences of output and inputs used

Variables	Mean value (std. error)		Difference (Std. error)
	Migrant HHs (n=63)	Non-migrant HHs (n=63)	
1. Output	16.13 (1.41)	22.82 (2.07)	6.76 (2.51) ***
2. Land size (kattha)	12.13 (0.93)	16.38 (1.40)	4.25 (1.68) **
3. Labour days (8 hours = 1 labour day)	27.20 (1.53)	28.03 (1.43)	0.84 (2.10)
4. Machine hour	2.99 (.24)	4.72 (0.30)	1.72 (0.39) ***
5. Cost of fertilizer (Rs.)	2571 (160)	3901 (272)	1330 (316) ***

Note: 1 hectare = 1.5 bigha = 30 kattha, 1 kattha = 0.033 hectare
Source: Field survey, 2022

Table 14 shows the comparison between the output and inputs used by migrant and non-migrant households. The t-test was conducted to see the differences between the selected variables.

The mean output of the migrant households was lower by 6.76 quintals compared to non-migrant households (significant at 1 percent level). The mean land holding of migrant households was lower by 4.25 kattha compared to non-migrant households and it was significant at 5 percent level. The mean labour days used by migrant households were lower by 0.84 days than non-migrant households but the difference was not statistically significant. The mean machine hour used by migrant households is lower by 1.72 hour than that of non-migrant households (significant at 1 percent level). The cost of fertilizer of migrant household was lower compared to non-migrant household by Rs. 1330 and the difference was statistically significant at 1 percent level. From above analysis it is clear that there is a difference between migrant and non-migrant households in terms of both, use of inputs and the output. In other words, migrant households use less inputs and their output are also lower compared to non-migrant households. Earlier studies have shown that though the average yield of migrant households is lower than that of non-migrant households, there is no variation in input use intensity between two categories (Anuja et al., 2020).

Table 15: Regression results for estimating the Cobb-Douglas production function

Variables	Migrant households (n=63)				Non-migrant households (n=63)			
	coefficient	Std. error	t-ratio	p-value	coefficient	Std. error	t-ratio	p-value
Constant	-0.277	0.775	-0.36	0.722	-1.409**	0.603	-2.33	0.023
Land size (kattha)	0.671***	0.184	3.65	0.001	0.698***	0.104	6.68	0.000
Labour days	0.206	0.166	1.24	0.220	-0.222	0.142	-1.56	0.124
Machine hour	0.024	0.097	0.25	0.804	0.026	0.065	0.41	0.685
Fertilizer (Rs.)	0.072	0.112	0.65	0.520	0.393***	0.090	4.33	0.000
Access to irrigation	0.091	0.072	1.27	0.210	0.013	0.057	0.23	0.820
Mechanization	0.013	0.089	0.15	0.883	0 .004	0.052	0.09	0.931
R-squared	0.8193				0.8971			

Note: ***, ** and * indicate significant at 1 percent, 5 percent and 10 percent respectively.
Source: Field survey, 2022

The Cobb-Douglas production function was used for estimating the marginal productivity of inputs of migrant and non-migrant households, particularly land. For the estimation of marginal productivity of inputs, the variables were converted into their log values. The regression result of the log linear form is provided in table 15 where the coefficients give a measure of the elasticities of respective production inputs. For migrant households, the land size appeared to be statistically significant while all other inputs such as labour days, machine hour, cost of fertilizer, access to irrigation and state of mechanization did not turn out to be statistically significant. On the other hand, land size and cost of fertilizer were significant in case of non-migrant households while other variables were statistically not significant

Multiplying the elasticities of the statistically significant inputs by the ratio of the output and respective inputs provides us the marginal productivities of the respective inputs. Accordingly, the marginal productivities of the respective inputs were estimated. Similarly, average Productivity of land was estimated by dividing the total output by total area of cultivated land. Table 16 shows the estimated mean values of marginal and average productivity of land for migrant and non-migrant households.

Table 16: Estimates of the marginal and average productivity of land

	Migrant HHs (n=63)			Non-migrant HHs (n=63)			Difference (std. error)
	Mean (S.D.)	Min.	Max.	Mean (S.D.)	Min.	Max	
MP of land per kattha	0.89 (0.19)	0.45	1.34	1.00 (0.22)	0.52	1.39	0.11 (0.36) ***
AP of land per kattha	1.33 (0.28)	0.67	2	1.43 (0.31)	0.75	2	0.10 (0.52) **

Notes: 1. 1 hectare = 1.5 bigha = 30 kattha, 1 kattha = 0.033 hectare
2. *** and ** indicates significant at 1 percent and 5 percent respectively.
Source: Field survey, 2022

The mean value of marginal productivity of land was estimated 0.89 quintal per kattha for migrant households and 1 quintal per kattha for non-migrant households indicating 11 percent higher productivity of non-migrant households compared to migrant households. Studies have shown that when remittance is relatively high, farmers do not invest in low-productivity subsistence crop farming, and prefer the non-farm sector or use remittances for more leisure and consumption goods (Maharjan, Bauer and Knerr, 2013).

Thus, the comparison (t-test) shows that we reject null hypothesis and conclude that non-migrant households are more productive compared to migrant households. The marginal productivity of each kattha of land for migrant households ranged between 0.45 and 1.34 quintal while it ranged between 0.52 and 1.39 quintal for non-migrant households. The estimation coefficients which were not statistically significant were not considered for estimating the marginal productivities.

Likewise, table 16 indicates that the average productivity of land was 1.33 and 1.43 quintal per kattha for migrant and non-migrant households, respectively. The average productivity of each kattha of land for migrant households ranged between 0.67 and 2 quintals while it ranged between 0.75 and 2 quintals for non-migrant households. The result of t-test indicates that average productivity of non-migrant households was higher than that of migrant households and it was significant at 5 percent level.

4.5 Effect of labour migration on technical efficiency

This section deals with estimating and analyzing the effect of foreign employment on technical efficiency of rice production of migrant and non-migrant households. Table 17 presents the result of the stochastic production frontier model and table 18 presents the average level of technical efficiencies for the two groups of households.

Table 17: Estimated result of the stochastic frontier model

	Variables	Migrant households			Non- migrant households		
		Coefficient	Std. error	p> | z |	Coefficient	Std. error	p> | z |
Production frontier	Land size	0.652***	0.128	0.000	0.718***	0.098	0.000
	Labour days	0.382***	0.134	0.004	-0.228*	0.121	0.059
	Machine hour	0.036	0.053	0.497	0.043	0.046	0.353
	Fertilizer	-0.007	0.076	0.925	0.366***	0.085	0.000
	Constant	0.088	0.477	0.852	-1.169**	0.562	0.038
Technical inefficiency determinants	Access to irrigation	-0.659	0.994	0.507	-4.520	8.166	0.580
	Age	0.046	0.063	0.463	-0.731	0.607	0.229
	Gender	-0.683	0.998	0.493	2.289	16.865	0.892
	State of mechanization	-0.265	0.455	0.560	0.504	9.998	0.960
	Constant	-2.003	3.694	0.588	11.390	39.549	0.773
V sigma	Constant	-4.660	0.524	0.000	-3.582	0.215	0.000
Gamma (γ)		0.96			0.97		
Log-likelihood		14.677			21.978		
LR test		18.37			3.83		
No. of observations		63			63		

Note: ***, ** and * indicate significant at 1 percent, 5 percent and 10 percent respectively.
Source: Field survey, 2022

Table 17 provides the estimates of the stochastic production frontier and technical inefficiency model assuming truncated normal distribution of *Ui*. The estimated coefficient of the land under cultivation showed positive values of 0.652 and 0.718 for migrant and non-migrant households respectively, which were statistically significant at 1 percent level. Therefore, an increment of land under cultivation by 1 kattha will increase an output of migrant and non-migrant households by 0.65 and 0.72 quintal respectively. The estimated coefficient of labour-days showed the positive value of 0.382 for migrant

households and negative value of 0.228 for non-migrant households, respectively. It indicates that an increment of labour by one man-day will increase output by 0.38 quintal for migrant households but reduce output by 0.22 quintal for non-migrant households. This shows that non-migrant households currently over utilize labour.

The estimated coefficient of fertilizer showed negative value of 0.007 for migrant households but it was statistically not significant. For non-migrant household, coefficient of fertilizer showed positive value of 0.366 at 1 percent level of significance. This indicates that an increase in cost of fertilizer by 1 percent will increase output by 0.37 percent. The estimated coefficient of machine hour for migrant and non-migrant households showed positive values of 0.036 and 0.043, respectively. However, they were not statistically significant, hence no conclusion can be made regarding the effect of change in machine hour on output of migrant and non-migrant households.

The result of the inefficiency model indicates that access to irrigation, age and gender of the household head and state of mechanization has no effect on rice production for both, migrant and non-migrant households as they turn out to be statistically not significant.

Table 18: Estimation of technical efficiency

	Migrant households			**Non-migrant households**			**Difference (std. error)**
	Mean (Std. error)	Min.	Max.	Mean (Std. error)	Min.	Max.	
Efficiency level (in percent)	82.4 (0.136)	40.2	97	94.3 (0.482)	59.8	97.6	0.12 (0.18) ***

Source: Field survey, 2022

The average technical efficiency of migrant households is lower than that of non-migrant households implying that households with no migrants are more efficient than households having migrant members. This finding is consistent with that of Khanal (2013), Iheke, Nwaru & Onyenweaku (2013) and Anuja et al., (2020) but not consistent with that of Dharmadasa & Wijethilaka (2014) which found that technical efficiency of migrant household higher than that of non-migrant households. Mean efficiency of 82 percent and 92 percent for migrant and non-migrant households respectively indicate that migrant

and non-migrant households produce about 82 percent and 94 percent of its potential output, respectively. This suggests that there is a room to improve technical efficiency by 18 percent for migrant households and by 6 percent for non-migrant households using existing resource and technology.

The result of the t-test shows that the difference in the level of technical efficiency between migrant and non-migrant households is statistically significant at one percent level. Thus, the null hypothesis of no difference is rejected and it is concluded that migrant households are less efficient compared to non-migrant households in utilizing existing resources to produce maximum output.

4.6 Discussion

The study is based on primary data collected from household survey in Kanchanpur district. This study aims to analyze the socio-economic and farm-related characteristics of migrant and non-migrant households and analyze the effect of labour migration for foreign employment in rice productivity and technical efficiency of farm households. However, the study has not been able to incorporate the effect of labour migration on other aspects of migrant households such as health, education, living standard, wealth accumulation and human capital development.

At first, the socio-economic and farm-related characteristics of households' have been analyzed in section 4.3 where descriptive statistics have been conducted initially and then t-test was carried out to see the difference between two groups. The result shows that migrant households lagged behind in socio-economic and farm-related characteristics including land holding, access to irrigation, mechanization, education use of inputs and output compared to non-migrant households.

Secondly, the productivity of migrant and non-migrant households is computed and compared in section 4.4. Result shows that rice productivity per kattha of land for migrant households is less (0.89 quintal) compared to that of non-migrant households (1

quintal). This result is in agreement with the findings of Tuladhar, Sapkota & Adhikari (2014) which estimated that migration adversely affects agricultural yields by inducing a labour shortage and there is no improvement in agricultural productivity of remittance receiving households despite increased household incomes. However, the finding contradicts with the findings of K.C. et al., (2022) which suggests that the rice productivity of migrant households was higher compared to non-migrant households.

Finally, the results related to technical efficiency is presented in section 4.5 which shows that the level of technical efficiency of migrant households is lower (82.4 percent) compared to non-migrant households (94.3 percent). The result indicates that migrant and non-migrant households produce about 82 percent and 94 percent of its potential output, respectively. In addition, migrant households can increase the level of technical efficiency by 18 percent while non-migrant households by 6 percent using existing resource and technology. This result is similar to the study of Khanal (2013) and Anuja et al., (2020) which found the negative impact of migration in technical efficiency but dissimilar with the study of Dharmadasa & Wijethilaka (2014) which found positive and significant effect of migration and remittance on the technical efficiency of farmers. However, unlike previous studies this study does not find any significant effect of age and gender of the household head on rice production for both; migrant and non-migrant households.

CHAPTER V

SUMMARY AND CONCLUSIONS

5.1 Introduction

This concluding chapter highlights the major findings and conclusions of the study. Section 5.2 provides summary of the major findings of the study and section 5.3 presents the concluding remarks.

5.2 Summary

Labor migration for foreign employment and remittance influences resource use efficiency and productivity in agriculture. However, the effect varies across countries and communities. Whether the smallholder agricultural systems are deteriorated, are reinforced or remain unchanged through migration and remittance received largely depends on the contextual characteristics of origin communities and their potential for agricultural improvement.

This study aims to analyze socio-economic and farm-related characteristics of migrant and non-migrant households and the effect of labour migration for foreign employment on productivity and technical efficiency of rice farmers. The study is based on primary data collected from household survey in Kanchanpur district of Sudurpaschim Province during January 2022. Data were collected from 140 households comprising 67 migrant and 73 non-migrant households. Survey data were initially entered to Microsoft Excel and then imported to Stata software for analysis and interpretation which includes descriptive and inferential statistics. The study employs stochastic production frontier with technical inefficiency effects and utilizes maximum likelihood estimator to estimate the level of technical efficiencies of migrant and non-migrant households. Similarly, the Cobb-Douglas production function was used to estimate the productivity of households. T-test was conducted to determine if there is a significant difference between the socio-

economic and farm-related characteristics of migrant and non-migrant households. Based on the data analysis, following are the major findings of this study.

The study estimated technical efficiency equivalent to 82 percent and 94 percent for migrant and non-migrant households respectively assuming truncated normal distribution of the error term in the production model. This means that on an average non-migrant household produces about 94 percent of the potential output while migrant households produce about only 82 percent of it. This suggests that there is a room to improve technical efficiency by 18 percent for migrant households and by 6 percent for non-migrant households using existing resource and technology. Similarly, the calculated marginal productivity of land for migrant and non-migrant households is equal to 0.89 quintal and 1 quintal per kattha, respectively. The marginal productivities of other inputs (labour, machine hour and fertilizer) used in the production were not estimated as they turned out to be statistically insignificant. Finally, the study conducted the two-sample t-test to see whether there is a significant difference between the socio-economic and farm-related characteristics of migrant and non-migrant households.

5.3 Conclusion

The primary objective of the thesis was to examine how labour migration for foreign employment affects the rice productivity and technical efficiency of households. The findings of the study revealed that migrant households are less productive and less efficient than non-migrant households. Moreover, the migrant households lagged behind in socio-economic and farm-related characteristics including land holding, access to irrigation, mechanization, education, use of inputs and output compared to non-migrant households. Result from this study provides evidence that supports the previous literature where the labour migration and remittance income does not necessarily improve the agricultural productivity and efficiency of the migrant households.

The result of the stochastic production frontier suggests that the size of the land under cultivation and fertilizer had positive and significant effect on production while the labour days used had negative effect on production for non-migrant households. Similarly, the size of the land under cultivation and the labour days used revealed significant positive effect while the fertilizer had no significant effect on the production for migrant households. The study showed no significant effect of machine hour used on the production for both migrant and non-migrant households. Though the result of the stochastic production frontier revealed that non-migrant households are more efficient than migrant households, it did not find any significant effect of age and gender of the household head, access to irrigation and state of mechanization on the level of technical efficiency.

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APPENDIX

APPENDIX A: Literature review matrix

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
1	Aigner, Lovell & Schmidt (1977)	Formulation and estimation of stochastic frontier production function models.	To suggest a new approach to the estimation of frontier production function.	Stochastic frontier model .		Provided methodology for estimating efficiency.

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
2	Adaku (2013)	The effect of rural-urban migration on agricultural production in the northern region of Ghana.	Examine the relationship between migration and agricultural productivity.	Cobb-Douglas production function.	Temporary migration significantly reduces farm production while permanent migration has no significant effect on production.	Was helpful in understanding how migration affects farm production.
3	Anuja et al. (2020)	Pattern and implications of labour migration on technical	To evaluate the impact of labour migration on crop productivity and	Stochastic production frontier with Cobb-Douglas	Non migrant HHs are more efficient than migrant HHs; education, farming	Similar objective, methodology and results.

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
		efficiency of farm households: A study in Bundelkhand region of central India.	technical efficiency.	functional form .	experience, and access to extension services significantly reduce technical inefficiency for migrant HHs.	
4	Battese & Coelli (1995)	A model for technical inefficiency effects in a stochastic frontier production function for panel data.	propose a model for technical inefficiency effects in a stochastic frontier production function for panel data.	stochastic frontier production function with technical inefficiency effects.	inefficiency effects depend on the farm-specific variables and model specification permits the estimation of both technical change and time-varying technical inefficiency, given that inefficiency effects are stochastic and have a known distribution.	Provided guidance on employing inefficiency model.

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
5	Dharmadasha & Wijethilaka (2014).	Impact of Labor Out-Migration on Technical Efficiency of Tea Smallholders in Low Country Wet Zone.	To investigate the effect of labour out migration and remittance on technical efficiency.	Stochastic production frontier.	Remittance has positive and significant effect on tea production.	Similar objective but different results.
6	FAO (2018)	Guidelines for the measurement of productivity and efficiency in agriculture.	To assist countries in improving their measurement and monitoring of agricultural productivity.		provide tools to understand the conceptual framework, guidance on the type of data to collect and how to collect it and analyze productivity.	Was helpful in better understanding the meaning of technical efficiency and productivity.
7	Iheke, Nwaru & Onyenweaku (2013)	The impact of migrant remittances on the technical efficiency of arable crop farm	To examine the impact of migrant remittances on the technical efficiency smallholder arable	stochastic frontier analysis in a single stage maximum likelihood estimation	Non-remittance receiving HHs are more technically efficient (53%) than the remittance receiving HHs	Similarity in objective and findings.

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
		households in south eastern Nigeria.	crop farm HHs.	method.	(42%).	
8	Jokinen (2018)	Migration-related land use dynamics in increasingly hybrid peri-urban space: insights from two agricultural communities in Bolivia.	Investigate the impact of transitional migration on agriculture.	Qualitative analysis/ thematic analysis.	Remittance function to maintain farming for subsistence and as a secondary livelihood and does not lead to increase in agricultural investment.	Provided insight on how migration affects farm households.
9	K.C. et al. (2022)	Household members' migration and rice productivity.	To assess the consequences of previous out-migration (2006 - 2015) for recent agricultural activities.	Multivariate linear regression analysis.	Migration has a positive impact on rice productivity.	Finding was important reference to justify the literature that the impact of migration and remittance varies across communities

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
						depending on their potential for agricultural improvement.
10	K.C. & Race (2019)	Outmigration and land-use change: A case study from the middle hills of Nepal.	To explore how outmigration affects land management practices.	Thematic analysis	The underutilization and abandonment of farmland was higher in the migrant households than non-migrant households.	Provided understanding on how migration and remittance affects land management decisions of households.
11	Khanal (2013)	Family labour out-migration and technical efficiency: a case of rice farmer in Tanahu.	To analyze the role of family member out-migration in explaining efficiency and identify other factors determining	Stochastic production frontier.	Level of technical efficiency was 78%, 68% and 66% for HHs with no migrants, international migrants and internal migrants, family members,	Similarity in objective, methodology and findings.

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
			technical efficiency.		respectively.	
12	McCarthy et al. (2009)	Assessing the impact of massive out-migration on Albanian agriculture.	To recover the impact of international migration on agricultural household decisions.	Regression analysis	International migration does not increase households farm production but instead facilitate the transition away from agriculture.	Provided insights on the impacts of out-migration on farm households decisions.
13	Maharjan, Bauer & Knerr (2013)	Migration for labour and its impact on farm production in Nepal.	To analyse the impact of international migration on farm production in the mid-hills of Nepal.	two-stage least-square regression with instrumental variables.	Most farm HHs tend to neglect subsistence farming altogether when there are alternative sources of income.	Provided understanding on migration related agricultural changes in the context of Nepal.
14	Msuya & Ashimogo (2013)	Estimation of technical efficiency in Tanzanian sugarcane	To determine and compare the levels of technical efficiency of outgrower and	The stochastic frontier model with technical efficiency effect.	Non- out-growers are more efficient (80.65%) than out-growers (76.43%); there were significant	Same methodology.

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
		production: A case study of Mtibwa sugar Estate outgrowers scheme.	non-outgrower farmers and to identify the factors causing technical inefficiency.		positive relationships between age, education, and experience with technical efficiency.	
15	Ojha (2015)	Impacts of migration in agriculture and food security in South Asia.	To summarize the issues and challenges; to suggest the course of action to address the issue.	Briefing	Outward migration is posing a serious problem in maintaining or enhancing domestic agricultural production, particularly in Nepal.	Was helpful in understanding how effect of out-migration in Nepalese agriculture are different compared to its South Asian counterparts.
16	Pradhan & Raut (2019)	An estimation of technical efficiency of poultry farming in Nepal	Estimate the technical efficiency of poultry farming in Nepal and its distribution	Stochastic frontier model in a Cobb-Douglas functional form.	Mean TE of 92 and 89 percent; no significant effect of trained owner and credit on production.	Finding of an inefficiency model was an important reference for me.

S.N.	Author	Title	Objectives	Methodology	Findings	Relevance
			spatially across the district.			
17	Tuladhar, Sapkota & Adhikari (2014)	Effects of migration and remittance income on Nepal's agriculture yield.	To analyzes the effects of migration and remittances on agriculture yield.	New economics of labor migration framework developed by Stark (1991).	Migration adversely affects agriculture yield and the remittance-receiving households are not investing such incomes on productivity-enhancing agricultural capital goods and inputs.	Was helpful in understanding how households use remittance income in production enhancing inputs.

APPENDIX B: Questionnaire used for the survey

Questionnaire No:

Introductory Section:

Name of Household Head.....Address.....

1. Gender of the household head?

a) Male [1] b) Female [0]

2. Age of the household head (in years)? ……

3. Education level of the household head (in numbers of schooling years)? ……

4. Is any member/s of the family in foreign employment?

a) Yes [1] b) No [0]

5. Number of absentee members of migrant household? ……

6. Destination country for foreign employment? .....

7. What is the ownership of the agricultural land you are using?

a) Own [1] b) leased [2] c) sharecropped [3]

8. Do you have access to irrigation?

a) Yes [1] b) No [0]

9. Farming experience of household head (in number of years) ……

10. Data related to input used:

a) Size of the land [A] (in kattha) …….

b) Cost of irrigation [I] (in Rs.) …….

c) Cost of machinery inputs [M] (in Rs) …….

d) Total number of labors used [L] (in man-days) ……

- ❖ Labor used in land preparation……
- ❖ Labor used in seed pulling…….
- ❖ Labor used in rice transplantation…….
- ❖ Labor used in harvesting …….

e) Total cost of other variable inputs [O] (in Rs). ……

- ❖ Cost of seed ……
- ❖ Cost of fertilizer ……
- ❖ Cost of Pesticides and other miscellaneous …….

f) Total production of rice [Y] (in quintals) …….....

11. Does the household head (or spouse) have Membership in cooperative?

a) Yes [1] b) No [0]

12. What is the main occupation of the household head?

a) Agriculture [1]

b) Trade/business [2]

c) Government service [3]

d) Private service [4]

e) Others

13. Land use practice of the household:

a) Abandoned

b) Underutilized farmland (

c) Continued land use [3]

d) Diversification [4]

e) Farmed by other [5]

14. State of mechanization:

a) Land ploughing

b) Land preparation

c) cutting

d) Threshing

15. Ethnicity/caste of household.

a) Brahmin b) Chhetri c) Janjati d) Dalit