IMPACT OF AGRICULTURAL CREDIT FINANCE ON FOOD PRODUCTION IN NEPAL

A Thesis

Submitted to the Department of Economics, Patan Multiple Campus,
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DECLARATION

I hereby declare that the thesis entitled, "**IMPACT OF AGRICULTURAL CREDIT FINANCE ON FOOD PRODUCTION IN NEPAL**" submitted to the Department of Economics, Patan Multiple Campus, in partial fulfillment of the requirement for the Degree of MASTERS OF ARTS in ECONOMICS, is entirely my original work prepared under the guidance of my supervisor. I have made due acknowledgments to all ideas and information borrowed from different sources in the course of writing this thesis. The result of this thesis have not been presented or submitted anywhere else for award of any degree or for any other purpose. No part of the content of this thesis has ever been published in any form before. I shall be solely responsible in any evidence is found against my declaration.

Anuj Dulal

LETTER OF RECOMMENDATION

This thesis, entitled IMPACT OF AGRICULTURAL CREDIT FINANCE ON FOOD PRODUCTION IN NEPAL has prepared by Mr. Anuj Dulal under my guidance and supervision. I, hereby, recommend it in partial fulfillment of the requirements for the Degree of MASTERS OF ARTS in ECONOMICS for the final examination.

Dr. Raghu Bir Bista
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Date: September, 2023

LETTER OF APPROVAL

We certify that this thesis entitled IMPACT OF AGRICULTURAL CREDIT FINANCE ON FOOD PRODUCTION IN NEPAL submitted by Mr. Anuj Dulal to the department of Economics Faculty of Humanities and Social Science, Patan Multiple Campus, Tribhuvan University, in partial fulfillment of the requirements for the Degree of MASTERS 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

The institutional credit has always been perceived as a critical factor for agricultural development in Nepal through complementing working capital, easing liquidity and investment constraints. The present study has examined the trends and variations in institutional credit flow to agriculture in Nepal for the period 2005 to 2020 using compound annual growth rate. Further, impact of agricultural credit on food production was also assessed using time series data. The study is based on the secondary data collected from various published sources. Results indicated that institutional credit to agriculture in real terms has registered a significant positive growth during the past one and half decade and the highest annual growth was observed during 2007 and the overall compounding annual growth rate of sixteen year is 29.99 percent. The study further analyses the short run and long run impact of agricultural credit on food production in Nepal. This study used annual data covering the period 2005–2020. The autoregressive distributed lag (ARDL) approach is applied to explore the cointegration between underlying variables. The findings of the ARDL Long-Run Bounds Test suggest that there is long term relationship among food production, agricultural credit and cultivation land area. The empirical results reveal that food production, agricultural credit, and cultivating land area have a positive and significant impact on agricultural production in both the short-run and long-run. Therefore, the study has suggested for better access to agricultural credit to farmers for enhancing food production.It is desirable for both the government and the NRB to consider amendment current policies, investing more in actual farmers and enhance credit flow to the agriculture sector to ensure that they have access to the agricultural needs and facilities to drive agricultural transformation.

Keywords: food production; agricultural credit; CAGR; ARDL approach; Nepal

TABLE OF CONTENT

ACRONYMS AND ABBREVIATIONS

BFIs	Bank and Financial Institutions
GDP	Gross Domestic Product
NRB	Nepal Rastra Bank
OLS	Ordinary Least Square
VIF	Variance Inflation Factor
MoF	Ministry of Finance
WB	World Bank
GoN	Government of Nepal
MSP	Minimum Support Price
et al.	And Others
CBS	Central Bureau of Investigation
ADO	Asian Development Outlook
CEMAC	Central African Economy and Monitory Community
MoA	Ministry of Agriculture
ILO	International Labor Organization
CAGR	Compounding Annual Growth Rate
CAPEX	Capital Expenditure
ATM	Automated Teller Machine
RBB	Rastriya Banijya Bank Limited
ADB	Agricultural Development Bank Limited
FSSS	Financial Sector Reform Strategy
LN	Natural Logarithm
ADF Test	Augmented Dickey Fuller Test
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
CUSUM	Cumulative Sums
CUSUMSQ	Cumulative Sum of Squares
ECM	Error Correction Model

LIST OF TABLES

LIST OF FIGURES

CHAPTER I
INTRODUCTION

1.1 Background of the study

Agriculture sector accounts for agriculture is diverse and full of contradictions. The sector accounts for comparatively small share of the global economy, but remains central comparatively small share of the global economy, but remains central to the lives of a great many people. 1050 million people in the world are directly and indirectly employed in agricultural sector (FAO, 2020). Agriculture accounts for a much greater share of national income and to be found, agriculture accounts for a much greater share of national income and employment—for instance, in India, agriculture represents 16.60 percent of national income and 46 percent of employment (World Bank, 2022).

In Nepal, the agricultural sector is a source of income, employment, and livelihood. Most of the Nepalese industries are agriculture-based accounting for about 34 percent of annual export (Department of Customs, 2019). Expansion of agriculture sector is the milestone for the overall economic growth of the country (MoF, 2018). Agricultural sector provides employment opportunities to 66 percent of the total population and contributes about 36 percent in the GDP (GoN, 2023). The agricultural sector has been accorded top priority since the fifth five years plan among the various periodic plans by allocating the all-time highest proportion (34.8 percent) of total outlay in the fifth periodic plan (Gaihre and Dhakal, 2022). Nearly, 15.10 percent of people in Nepal live below the poverty line (Economic Survey, 2023). In Nepal, farmers are economically underdeveloped and have few resources. Agricultural productivity is low in Nepal. This is because of the fluctuation of ago-based products, small land holding, traditional culture, methods, poor irrigation facilities, low or misuse of farm technology, low productivity of land and problem of credit availability, farmers cannot invest in agriculture from their savings (Dahal and Thapa, 2020). Thus, credit agencies are necessary to help farmers in applying and undertaking the improved farm practices. Therefore, agricultural credit plays a major role in agricultural development. Different sources, like formal and informal are available in the agricultural credit market in Nepal (Dahal and Thapa, 2020).

Despite Nepal being the predominantly subsistence-based agricultural society, the majority of the population is adapting itself with traditional systems which holds from achieving its true economic potential. The agriculture sector has been characterized by very low productivity. The adoption of improved technology is still at a very low level and there is a huge gap between current and the potential productivity of agricultural products across the various geographical domains. The major reasons for current level of low agricultural development are insufficient investment in infrastructure and agricultural research, low level of input use, lack of quality education about agriculture and production, monsoon dependence, climate change, migration, insufficient adoption of modern technology, fragmented land, inadequate availability of improved seeds and quality fertilizers, lack of basic infrastructures and transportation, warehouses and assured markets (Pandey & Gurung, 2017).

An entity's economy includes all of its processes for producing, consuming, and exchanging goods and services. According to Gurley & Shaw (1955), the real sector cannot function without the financial sector. A different perspective on the connection between financial development and economic growth was established by Buffie (1984). At the time of the industrial revolution, the importance of financial development to economic growth was fundamentally established, and it continues to be so in the context of developing nations (Gupta, 1984). This is due to the financial sector's management of large working capital as well as its provision of knowledge and original ideas to entrepreneurs who, among them many newcomers to the market, run new businesses that increase output and employment as well as additional consumption and saving (Perera & Paudel, 2009).Huge working capital helps entrepreneurs, many of whom are new to the market, run the new entity, add to output and employment, increase additional consumption and saving, and provide information and innovative ideas (Perera & Paudel, 2009). When financial activities are physically accessible, procedures are simple, and the cost of the finance is low, a large portion of the population can participate (Pant, 2016). It had to do with prosperity in the economy. Easy access to a comfortable lifestyle is strongly correlated with income level. Basic needs like food, shelter, health care, and education are met, and this improves both the material and subjective well-being (Diener

et al.2010).

The internal and external shocks that affect the agriculture sector are likely to affect the country's national income and a large segment of the population (Bochtis et al., 2020). To address this volatility, the government has formulated policies to support and stabilize the agriculture sector. For instance, the government has implemented a policy of food security through the provision of agricultural credit for purchasing farm machinery, fertilizers and seeds (Hussain & Thapa, 2012). The implementation of agricultural mechanization alongside the utilization of diverse inputs ensures to increased productivity. However, it needs funds for the farmers' community (Bashir et al., 2010). Farmers use their savings or have to borrow to meet these needs. Thus, to meet the required investment, agricultural credit is an important element (Riaz et al., 2012). Furthermore, agricultural financing plays a vital role in advancing and commercializing farming practices, fostering development in emerging economies. (Saqib et al., 2016). Nielson and (Tierney, 2013) revealed that Farmers are given the opportunity via agricultural financing to implement successful technologies and employ resources more effectively to increase food security. Farmers acquire credit from both formal and informal sources. Formal sources include banks, micro-credit organizations and other non-governmental organizations (NGOs). Informal sources include borrowing from fellow farmers, family members, vendors and private cash loan providers (Saqib et al., 2018). Farmers who lack access to formal financing frequently use informal credit from these sources. (Amjad & Hasnu, 2007) Observed that improving farmers' access to credit is far more important than any other element for improving resource usage efficiency in the agricultural industry.

The financial sector is a life blood of trade, commerce and industry development of country that provide financial services to commercial and retail customers. A strong financial sector is a sign of a healthy economy of a country. The financial sector generates a major portion of its revenue from loans and mortgages and thrives in a low-interest-rate environment. This sector consists of different industries including banks, investment companies, insurance companies, and real estate firms. The financial sector

plays an important role in the development of the country economy and financial inclusion. Strong financial institutions are critical for increased investment, economic growth, employment and poverty alleviation (Kyalo, 2002). Banks act as a production organization, generating both deposits and loans by using labor and capital (Abdul-Majid et al., 2011). Abusharbeh (2017) stated that banking sector is crucial to the economic growth because of its ability to collect deposits from the surplus unit and provide loans to the deficit unit for encouraging investment and production functions which helps to create economic expansion for most of the economic sectors including agriculture, industry and trade sector and its contribution to the formation of initial capital for investment projects. Thus, the banking sector financial services play a vital role in the economic growth and development of a country (Kenourgios and Samitas, 2007).

According to Ayaz and Hussain (2011), the availability of financing to farmers has a considerably greater impact on resource use efficiency in the agricultural sector than any other aspect. The study found that credit to agricultural sector has more constructive and significant impact on the farmers‟ technical efficiency than other factors like farming experience, education, herd size and number of cultivation practices. Duy et al. (2012) Examined the influence of agricultural credit on farm productivity, and the findings reveal that access to credit, education level, and farm technology positively affected both technical efficiency and rice yield. It also demonstrates that access to formal credit sector had a larger effect on rice production than access to informal credit.

Devi (2012) found that agricultural credit not only helped to increase the productivity but also develop the process of cultivation as a whole in Andhra Pradesh, India. Claims that agricultural credit led to a significant rise in the adoption of modern seeds, improved inputs, fertilizers, and pesticides, resulting in higher yields per acre, which increased yield per acre and thus the income of the farmers. The study also further observed that the impact of agricultural credit was more significant in non-irrigated and semi-irrigated villages than the irrigated villages. Akram et al. (2013) observe that access to credit results in a higher level of technical efficiency of farmers. The study indicated that agricultural credit in the study area helped the farmers obtain the farm inputs in time,

resulting in a higher level of technical efficiency.

According to Ayegba and Ikani (2013), unregulated private money lenders continue to play a significant role in funding Nigeria's agricultural sector. Meanwhile, formal sector agricultural credit faces obstacles such as exorbitant interest rates, bureaucratic hurdles, delayed loan approvals, and excessive collateral demands, among other challenges. The study showed that banks and financial institutions should create credit instruments and services that are tailored to the risks and cash flow patterns in the agricultural sector. The banks should open up new branches in rural areas and avoid unnecessary credit conditionality's that discourage famers from borrowing

Ibrahim and Bauer (2013) have analyzed the impact of micro-credit on rural farmers' profit taking a case of Dry land of Sudan employing the Heckman Selection Model to analyze the responses from 300 samples. The findings from the study affirm the fact that farmers with access to credit are better off compared to those who do not have such access. The research suggests that enhancing loan amounts can facilitate the provision of efficient and sustainable agricultural technology to farmers, potentially boosting farm profits. In a related study, Sharma (2014) examined the influence of agricultural credit from commercial banks on the GDP growth of Nepal, utilizing time series data spanning from 2002 to 2012. This study has found that agricultural credit has positively and significantly impacted agricultural GDP of Nepal. However, use of fertilizer and improved seeds has not shown any significant impact on agricultural GDP. The study also indicated that the extension and deepening of financial service system in the rural area and facilitating the agricultural lending. Rahman et al. (2014) emphasizes agricultural credit as a major determinant of farm productivity. The study revealed that the positive association between credit and agricultural productivity, they conclude that timely provision of appropriate amount of loan to farmers is helpful for the enhancement of agricultural productivity as it enables them to purchase high yielding variety seeds, fertilizers and pesticides.

Iftikhar & Mahmood (2017) indicated that Institutional Agricultural Credit is significantly helping in combating food insecurity while Non-Institutional Agricultural

Credit shows unexpected results. Therefore, it is strongly recommended institutional credit to reduce food insecurity issues in the country. Chaiya et al. (2023) examined that agricultural credit enhanced crops' production. However, according to percentage use, misuse of the credit was more common than its proper utilization. The study found creditors misused agricultural credit for healthcare, education of children, domestic needs and business. According to the regression model's findings, factors influencing the amount of agricultural credit given to farmers included their age, experience, farm size, income, labor force, and land ownership. To meet the goal set for agricultural productivity, policy steps should be made to prevent the misuse of agricultural finance.

Farmers need loans when their earnings or income do not meet their consumption and investment needs. There are two sources of agro-finance; the formal sector and the informal sector. Out of the total rural credit requirements, it is estimated that only about 30 percent of rural demand is fulfilled by the formal sector and rest 70 percent agro-finance is fulfilled by the informal sector (Dahal and Thapa, 2020). Nepalese banking sector comprises 20 commercial Banks, 17 Development Banks, 17 Finance Companies, 57 Micro finance Development Banks as at mid- july 2023. Likewise, there is 1 cooperative bank, 1 infra-structure development bank and 14 other institutions that are licensed by NRB (NRB, 2023). Financial Institutions collects the scattered deposit from the surplus sector and mobilizes for the capital formation in the productive sector and thereby support economic growth. The presence of branches of commercial banks reached to 745 local bodies out of 753. Total deposit of BFIs till mid-july 2020 stood at 3923.09 billion and credit stood at 3,477.87 billion. The overall agricultural credit stood at 225.77 billion which became 6 percent over overall credit. NRB directed BFIs to increase this ration to 15 percent till mid-july 2023 (commercial banks) and mid-july 2024 (development banks) as mentioned above. The largest share of such loans flowed in Bagmati province (43 percent) in mid-January 2021. The lowest share of such loans remained in Karnali Province with 1.0 percent (NRB, 2021) which indicates the concentration of agricultural credit in the region. A loan occurs when one or more people, businesses, or other entities lend money to other people, businesses, or other entities. The recipients incur debt and are usually liable to pay interest on that debt until it is repaid as

well as to repay the principal amount borrowed. For a number of reasons, mainstream financial institutions are hesitant to provide services to the agriculture industry. First, they consider the sector to be highly risky with low performance. Also, agricultural activities depend on the weather, they take place in remote rural areas, and commodities prices are volatile. All these aspects make it hard for conventional banks to reach their profit goals when lending to farmers. Since microfinance was conceived, it has generated much hope for alleviating poverty in low-income countries. Microfinance offers accessible money to those in relatively low-income classes by offering loans they would not otherwise be able to access due to geographical and economic limitations.

The importance of bank credit as a critical input to agriculture is reinforced by the unique role of Nepalese agriculture in the macro-economic framework and its role in poverty alleviation. Recognizing the sector's significance for Nepal's growth, the government and central bank have been instrumental in setting up a broad institutional framework to meet the sector's expanding credit needs. Agricultural policies in Nepal have been reviewed from time to time to maintain pace with the changing requirements of the agriculture sector, which is an important segment of the priority sector lending of scheduled commercial banks and target of 15 per cent of net bank credit has been stipulated for the sector. The Agricultural Development Strategy (2015-2035) has set a target of 12 percent (Target Short Term 5 Years), 14 percent (Target Medium Term – 10 Years) and 20 percent (Target Long Term – 20 Years) for the agriculture business GDP as share of overall GDP. In this context, the need for affordable, sufficient and timely supply of bank credit to agriculture has assumed critical importance.

Nepalese bank and financial institutions are committed to the dreams of farmers by understanding the responsibilities of turning the dreams into reality. They focus on commercialization of agriculture sectors as Government of Nepal has been providing prime focus on rising commercialization of agriculture production / processing. They have introduced Agriculture products to scale up and diversify the business. Various funded and non-funded credit facilities are provided to the firm/business entities involved in commercial agriculture farming. The unified directives of NRB gives several

concessions on agricultural credit. The loan processing fee shall be free. The Interest Rate shall be 2 percent premium on base rate. NRB provides Interest Subsidy of 5 percent (i.e base rate + 2 percent Premium) on agricultural credit. There shall be revolving facilities: Maximum up to one year, renewable every year subject to satisfactory performance review. In context of fixed term loan Maximum up to 15 years (as per nature of business) for Fixed Assets (inclusive of livestock/cattle/plantation /Building, shed construction etc.) including the Moratorium period. Interest Subsidy on tenure up to 5 years. In case of Loan Value Exceeding Nrs.50 Million, 5 percent subsidy will be provided on First Nrs.50 million and 2 percent on the remaining amount exceeding Nrs. 50 million subject to pre-approval from NRB. The Agriculture lending sub-sectors are Livestock Farming: Cattle (Cow, buffalo, pig, goat, sheep), poultry (Broilers, layers, ostrich, kaliz), and Processing: Dairy, slaughter houses, meat processors, and others Food Crops: Paddy, wheat, maize, millet, oilseeds, pulses and others, Vegetables Farming: Seasonal, off- seasonal, Tunnel, Hi-tech and others, Cash Crops: Tea, Coffee, Sugarcane, Cardamom, Apple, Kiwi, Banana, mushroom and others, Floriculture: Cut flower, Rose, Orchids, Ornamental plants and others, Aquaculture/Fishery: Fish, Nursury, Hetchary, Bio-flocks and others, Apiculture/Bee keeping: Cerana and mellifera, processing of honey etc, Special crops: Seed production, spices, herbs, walnut etc and Agricultural Mechanization: Transplanted, Broadcaster, Tractor, Riper, Thresher and other Agriculture Machineries.

Since 1991–1992, the NRB has issued directives to banks and financial institutions encouraging them to extend credit to the underprivileged in an effort to improve their socioeconomic standing (Dhakal and Panthi, 2002). The socioeconomically and marginally disadvantaged population, including women, small farmers, laborers, etc., is included in the affected sectors. The provision of lending this credit in micro credit form, the NRB directive 2020 has directed all the BFIs to lend at least 5 percent of total credit as deprived sector credit. Failure to comply such provision cause the BFIs to be penalized in monetary terms. For agriculture purpose farmers, farmers' groups, agricultural firms are given several amounts of micro-credit for production, buying the agri-inputs, machineries, building cold storage, processing units, livestock, poultry production etc. The women, unemployed, youth, farmers, workers, youth returned from foreign job are

mostly targeted for this credit to support them for investing in agriculture, and income generating activities (NRB, 2020). Similar to this, wholesale loans are also given to MFIs from A, B, and C class BFIs with a requirement that they invest in deprived sectors. In 2021 July, deprived sector loan disbursement stood 7 percent of total credit compared to the minimum regulatory requirement of 5 percent by the commercial banks, development banks, and finance companies (MoF, 2021).

The budget speech for 2023 reflects the government's relatively expansionary fiscal strategy, which is centered on bolstering social protection, industry, infrastructure, and agriculture. In order to control domestic demand, growing prices, and increasing imports, monetary policy is contractionary and aims to slow down rapid credit expansion. The country's inflation will likely marginally decline to 6.1 percent in FY2023 from 6.3 percent in FY2022, restrained by tight monetary policy, a normal harvest, somewhat subdued oil prices, and a modest inflation decline in India. The current account deficit is estimated to narrow to 8.1 percent of GDP in FY2023 owing to a moderation in merchandise imports amidst stable remittance inflows. The commercialization of agriculture, the support of small and microbusinesses, the growth of information technology, and the promotion of tourism are the main areas where the government will launch the National Production and Employment Promotion Programme at the local level. The Nepali Production and Consumption Growth Programme, introduced by the prime minister, aims to support small and medium-sized businesses in the fields of agriculture, clothing, footwear, and medicines.

The farmers' agricultural productivity has been improved due to agricultural financing. With such a credit facility, farmers will have a better access to improved seeds, fertilizer, pesticides and better irrigation facility. Thus, farmer friendly agricultural credit services should be extended and deepened even in the rural areas. It will help the farmers of the rural area attain a higher level of technical efficiency and higher farm productivity (NRB, 2014). Under this background, the study entitled "Impact of institutional credit finance on food production in Nepal" attempts to understand the effect of agricultural credit resources in agriculture production –Food Crops in Nepal. The research is to examine the effect of bank's credit, cultivation land, Fertilizer, governments' capital expenditure in

agriculture production of food crops in Nepal.

1.2 Statement of the Problem

The problem statement revolves around the inadequacy of comprehensive research in Nepal, particularly the absence of nationwide assessments concerning the impact of agricultural credit on food production. Several key concerns, including the structure and growth rate of agricultural credit, their influence on food crops, and the role of cultivation land area in food production, remain unaddressed. Furthermore, existing literature reveals varying findings on the relationship between credit disbursement in the agricultural sector and agricultural growth, with some studies reporting positive correlations, while others yield inconclusive or mixed results. The temporal aspect of this relationship, whether it is short-term, long-term, or both, also lacks consensus in the literature. Limited research in Nepal has explored the co-integration between these variables over extended time periods and utilizing diverse research methodologies. Therefore, this study aims to investigate the relationship between food production and agricultural credit in Nepal. The magnitude and direction of this relationship are crucial indicators of Nepal's potential for agricultural transformation and, consequently, national development.

To contextualize this problem, relevant international and national studies are cited, such as Ngong et al.'s (2022) examination of bank credit's impact on agricultural productivity in the Central African economy and monetary community. Kumar's (2019) research on the role of institutional credit in crop production, and Dong et al.'s (2010) findings regarding the constraints posed by credit availability on agricultural productivity are referenced. These studies emphasize the significance of credit availability in agricultural development and productivity.

In Nepal, modernizing agriculture is vital for economic growth, and achieving this necessitates meeting the financial requirements of farmers. The flow of credit from the financial services system is essential for realizing agricultural growth, directly influencing the country's economic development. The role of agricultural finance in enhancing agricultural output and its associated economic growth potential is

acknowledged. Nevertheless, studies assessing the impact of institutional financing on the national agricultural sector are limited. Consequently, this study intends to address this research gap by investigating the dynamics of agricultural credit and its effects on farm productivity at the national level, utilizing data collected from the Nepal Rastra Bank (NRB) and various government ministries.

1.3 Objectives of the Study

The broader objective of the study is to examine the impact of agriculture credit on food production in Nepal. The following are the specific objectives of the study:

1) To analyze the structure and pattern of agriculture credit in Nepal.
2) To examine the impact of agricultural credit and cultivation land area on food production in Nepal.

1.4 Significance of the Study

Research on the agricultural sector plays a pivotal role in equipping decision-makers with the essential insights needed to address industry challenges effectively and allocate resources strategically. Consequently, this research contributes to the attainment of both technical and allocative efficiency while advancing long-term economic goals. While previous research has explored agricultural credit and its impact on productivity, there remains a notable gap in understanding the specific relationship between agricultural credit and food crop output. This study endeavors to bridge this gap by investigating the influence of agricultural credit on food production in Nepal. Furthermore, it assesses the role of cultivated land area in bolstering the growth of food crops within the country. The study's significance is underscored by its ability to provide quantitative results at the national level, shedding light on the precise impacts of agricultural credit. Additionally, this research holds value in offering potential policy recommendations related to agricultural credit and its contributions to agricultural productivity. The study's findings and recommendations are anticipated to serve as a valuable resource for policymakers and future research endeavors.

In the context of a developing economy like Nepal, where a substantial proportion of both the population (50.40 percent) and GDP (24.10 percent) stems from the agricultural sector, understanding its dynamics and challenges is imperative (Economic Survey, 2021/22). Despite this reliance on agriculture, there are evident shortcomings, including low per-capita productivity, reliance on traditional farming methods, inadequate irrigation infrastructure leading to dependence on monsoons, recurring shortages of essential inputs like fertilizer and quality seeds, and limited access to formal financial services. As the agricultural sector faces an uncertain future as a means of subsistence, this study offers an invaluable foundation for policymakers. It provides insights that can be leveraged to maximize the sector's potential, thereby bolstering exports, supporting industrial growth, and enhancing overall economic development through heightened technical and allocative efficiency. Furthermore, the study's findings can aid in identifying barriers to agricultural credit access and guide policy interventions aimed at promoting credit availability to this critical sector. In this context, the study holds particular relevance for the Nepal Rastra Bank (NRB) policymakers and the government of Nepal, equipping them with the necessary policy tools and actions to pursue these overarching objectives effectively.

1.5 Scope and Limitations of the Study

This research study also has some limitations: -

i. This study covers the period from 2005 to 2020 that helps to conduct empirical analysis. The data regarding food production and agricultural credit was hard to found before 2005.
ii. Only food crop has been taken into consideration while measuring the impact of agricultural credit on food production.
iii. Agricultural credit from the NRB-licensed A class commercial banks, B class development bank and C class finance companies is considered.
iv. The source of data is secondary. Hence, any errors in the key information like data and other sources might affect the accuracy of the outcome of the study.

1.5 Outline of the study

This study has been divided into five chapter viz. Introduction, Review of literature, Research Methodology, Data Presentation and Analysis and Summary and Conclusions.

Chapter I: Introduction

The first chapter deals with introduction. This includes back ground of the study, statement of the problem, objectives of the study, significance of the study, limitations of the study.

Chapter II: Review of Literature

The second chapter contains review related literatures from National and International sources.

Chapter III: Research Methodology

This chapter is most important part of the study. The chapter explains the research methodology has been used in the study to access the impact of agricultural credit of bank and financial institution on food crops output in Nepal. It includes introduction, theoretical/conceptual frame work, sampling design, sources of data and samples, tools of analysis/empirical model.

Chapter IV: Data Presentation and Analysis

This chapter shows that the data presentation and analysis of study in order to draw the conclusion of the study. They are as follows.

Chapter V: Summary and Conclusions

This is the last chapter of the study. This chapter presents the summary and conclusion of the study which helps to improvise the credit flow system of BFIs to generate high agricultural productivity. Finally, an extensive bibliography and annexes are also presented at the end of the thesis work.

CHAPTER II
REVIEW OF LITERATURE

2.1 Introduction

This chapter aims to review the relevant literature on credit finance and food crops. First, a comparison between credit finance and food crops as well as some historical backdrops for behavioral finance is provided. Second, to get a comprehensive view of credit finance effect on food crops. Finally, a research model is proposed to follow during the research.

2.2. Literature Review

A. International Context

Ngong et al. (2022) investigated the impact of bank credit on agricultural productivity in Central African economies from 1990 to 2019, using annual secondary data from global development indicators. They calculated agricultural productivity by incorporating agricultural value added as an endogenous variable in GDP, with exogenous variables including domestic credit to the private sector (DCPSB), broad money supply, land, inflation, physical capital, and labor. Cointegration tests (Johansen–Fisher and Kao Residual) revealed long-run cointegration among these variables. The study employed the autoregressive distributed lag technique to determine long-run coefficients. Findings indicated that domestic credit extended through banks, land, and physical capital had a significant and positive impact on agricultural value added in the long run. Notably, bank credit significantly and positively influenced agricultural productivity in CEMAC countries. The study's recommendations emphasized the need for CEMAC governments to facilitate increased bank credit flow to private agricultural enterprises through effective banking intermediation to enhance agricultural productivity. It's important to note that the study measured agricultural productivity as agricultural value added to GDP and did not analyze credit flow trends over the review period.

Florence and Nathan (2020) examined the impact of commercial bank lending on the agricultural sector in Uganda. They divided the loans into two categories: credit for

production and credit for processing and marketing. The study analyzed quarterly time series data from the Bank of Uganda and the Uganda Bureau of Statistics, spanning from 2008Q3 to 2018Q4, using an autoregressive distributed lag (ARDL) approach. The findings revealed that commercial bank financing had a positive influence on the development of the agricultural GDP. Interestingly, it was noted that financing for production had a more significant impact on agricultural GDP compared to financing for processing and marketing, even though the latter received a larger share of the financing. It's important to note that this study was based on a 10-year time series data analysis and did not delve into the specific contribution of credit to agricultural production.

Joseph et al. (2020) analyzed the impact of total loan amount, prepayment, and loan interest rates on Nigeria's agricultural sector output. They also explored the relationship between commercial bank liquidity and agricultural production. The study utilized data from central bank statistical bulletins and employed multiple regression techniques. Their findings revealed significant associations between loans, interest rates, liquidity, and bank assets with agricultural production. The study recommended timely provision of agricultural credit by banks, emphasizing that interest rates on loans should remain in the single-digit range. Additionally, it stressed the importance of commercial banks having sufficient funds available. Furthermore, the research underscored the notion that interest rates in a free-market economy should be market-driven.

Wirakusuma and Irham (2020) investigated the impact of credit programs on agricultural productivity in Indonesia, focusing on government program financing and non-program financing. They analyzed data from 86,922 rice farmers using a production function model and a two-stage least squares method to eliminate selectivity bias. The results showed that government program financing has a limited impact on agricultural productivity. Socioeconomic factors, agricultural subsidies, risk perceptions, and views on agricultural profitability influenced credit utilization from both government programs and non-programs. The results emphasized that increasing agricultural production requires not only financial support but also incentives such as agricultural extension and irrigation infrastructure. Financing to agricultural households improves farmers' financial

performance and gives them access to better inputs and technology. However, this study had limitations because it focused only on government loans and did not take into account the impact of loans from financial institutions on agricultural productivity.

Seven et al. (2020) presented a study on agricultural credits and agricultural productivity cross-national evidence, indicating a positive impact of agricultural credit on agricultural productivity. They utilized annual country-level data from the Food and Agriculture Organization (FAO) and the World Bank's World Development Indicators dataset, covering 104 developed and developing countries over 24 years. Their regression model revealed that doubling agricultural credit leads to an average increase in agricultural productivity of 4 to 5 percent. Moreover, the study suggested that countries with limited financial development in the agricultural sector can achieve higher agricultural growth rates by promoting the expansion of agricultural credit. Notably, the impact of agricultural credit on agricultural productivity was found to vary significantly between developing and developed countries.

Shivaswamy et al. (2020) inspected the impact of institutional credit on agricultural productivity in India: A time series analysis and found that institutional credit is crucial for agricultural development in India, addressing working capital and investment constraints. Their study analyzed credit trends from 1991-92 to 2016-17, showing significant growth, particularly between 2001-02 to 2010-11. Commercial banks emerged as major credit sources, while cooperative banks remained vital for production credit. Southern states had the highest credit access, while eastern and northeastern states lagged. Panel data regression confirmed a positive and significant impact of institutional credit on agricultural productivity. The study recommends simplifying procedures to enhance credit access for smallholders, especially in eastern, western, and northeastern states.

Eukwe et al. (2020) examined the Agricultural Credit Guarantee Program Fund's impact on agricultural production in Nigeria using secondary data from various sources. They found a steady increase in program funds allocated to the agricultural sector from 1998 to

2009. The study revealed positive and significant impacts of ACGSF on crop, livestock, and fish production, with an overall R^2 of 0.8523. The results suggest that increasing support for this program could help reduce Nigeria's dependence on oil exports and boost agricultural output.

Kumar (2019) examined the impact of institutional credit on farmers' income in Madhubani district, Bihar. The district was categorized as one of India's 100 least developed agricultural regions, with low agricultural productivity, reduced urban-to-rural income flow, and limited deposits. Kumar used a paired t-test to compare income before and after receiving institutional agricultural credit. The study focused on key crops—rice, wheat, maize, and potatoes—representing over 80 percent of the total cultivated area. The findings revealed credit utilization increases of 7.65 percent, 7.18 percent, 13.41 percent, and 23.01 percent for these crops, resulting in net income boosts of 37.01 percent, 31.83 percent, 33.03 percent, and 31.61 percent, respectively. Furthermore, the net return per rupee spent on paddy, wheat, maize, and potatoes increased by 26.22 percent, 22.22 percent, 14.16 percent, and 7.02 percent, respectively.

Zakaria et al. (2019) examined the impact of financial development on agricultural productivity in South Asian countries like Bangladesh, India, Nepal, Pakistan, and Sri Lanka from 1973 to 2015. They used a Cobb-Douglas production function with two inputs, finding an inverted U-shaped relationship between financial development and agricultural productivity. This suggests that as financial development increases, agricultural productivity initially rises, but eventually declines. They also found that agricultural productivity increased with physical and human capital growth, as well as with trade openness and higher income levels.

Manaresi and Pierri (2018) focused on the importance of reliable external financing for business growth. Their study, based on Italian firms, highlighted the role of credit supply in improving firm performance over the short and long term. They created a relational-level dataset covering interactions between firms and financial intermediaries from 1997 to 2013, finding that firms with increased credit supply were more productive. Negative

credit supply shocks had a larger impact than positive ones, emphasizing the significance of credit stability. They also noted that firms sought new lending relationships more often after experiencing negative credit shocks.

Duy (2015) investigated the impact of credit access on rice production efficiency in rural households in the Mekong Delta, Vietnam. Using stochastic frontier analysis (SFA) and quantile regression models with data from the Vietnam Living Standards Survey - VLSS 2008, the study included 45,945 households sampled from various regions. The findings indicated that access to credit had a positive effect on rice farmers' production and technical efficiency, as evidenced by significant coefficients in the quantile regression model.

Narayan (2015) studied the relationship between formal agricultural credit and agricultural GDP in India was explored using state-level data from 1995-96 to 2011-12. The study employed a mediation analysis framework to uncover how institutional credit affected agricultural GDP. To address endogeneity concerns, a control function approach was utilized. The findings revealed that increased institutional credit had a significant impact on various agricultural inputs, such as fertilizer consumption (1.7 percent increase), pesticide usage (5.1 percent increase), and tractor purchases (10 percent increase). However, agricultural GDP did not exhibit the same level of sensitivity, implying that while credit played a supportive role, its impact was limited by technical inefficiencies and productivity issues. Despite these general conclusions, further in-depth research is necessary for a more comprehensive understanding of the topic.

B. National Context

Pandey (2022) discussed the prospects and challenges related to credit and financial surplus in Nepali agriculture. He found that weak credit expansion is hindering agricultural development in Nepal. To promote commercialization, mechanization, competitiveness, and export promotion in the agricultural sector, optimal investment is crucial. However, certain credit policies and high operating costs for financial institutions have deterred investment in agriculture. To address this, Pandey suggested loosening

credit policies, classifying farmers, strengthening insurance, relaxing credit limits for commercial farmers, financing warehouses, and monitoring financial institutions' lending practices.

Ghimire and Dhakal (2021) observed a significant increase in the use of agricultural inputs over a 30-year period (1990-2019) in Nepal. The study divided this period into three phases and used analytical models like CAGR and regression analysis. They found that irrigated area and improved seed usage for major cereal crops had significantly increased growth rates. Chemical fertilizer use showed positive growth but faced shortages during the growing season. Pesticide use increased despite health concerns. The agricultural workforce remained relatively stable, but net cultivated area decreased due to migration and land fragmentation. The growth of cultivated area, irrigated area, and pesticide use had a statistically significant impact on agricultural GDP growth. The study emphasizes the need for the government to ensure an adequate supply of agricultural inputs to promote sustainable agricultural and economic growth. However, it did not analyze the specific impact of different agricultural inputs on agricultural production, focusing instead on agricultural GDP as a measure of productivity.

Seven et al. (2020) presented a study on agricultural credits and agricultural productivity cross-national evidence, indicating a positive impact of agricultural credit on agricultural productivity. He found to have a positive impact on agricultural productivity across 104 countries, including Nepal, from 1991 to 2014. They used regression analysis and discovered that doubling agricultural credit led to an average increase in agricultural productivity of 4 to 5 percent. The study emphasized that countries with underdeveloped financial sectors in agriculture could achieve higher agricultural growth by promoting agricultural credit policies. Moreover, they highlighted differences in the impact of agricultural credit between developed and developing countries, with developing countries seeing increases in the agricultural component of GDP, while developed countries experienced growth in agricultural labor productivity.

Upadhyay et al. (2020) had examined the performance of agricultural credit and had

identified the determinants of increased use of credit at the farm household level in Nepal. The research relied on 107 randomly gathered samples from the Chitwan district as the foundation of its survey data. They had used Probit Model as methodology and concluded that lack of finance is one of the main constraints of Nepalese farmers due to which they have a lower capacity to invest in the agriculture sector. They also mentioned that Co-operative is the best organization that creates financial linkage to its member; therefore, they suggested the government to financially strengthen them to facilitate the loan procedure to the farmers. The study is based on chitwan district of Nepal and based on survey data consisting of 107 samples. This study might not clarify the overall contribution of agricultural credit of bank and financial institutions to agricultural output.

Dahal and Thapa (2020) analyzed Agriculture Sector Credit and Output Relationship in Nepal. analyzed the relationship between credit and agricultural production in Nepal using Excel and EViews software. They considered data from 1999 to 2018, including loans to various sectors and GDP figures. Their results showed that the manufacturing sector received more loans from commercial banks than agriculture. They also found no long-term correlation between commercial bank loans and agricultural production, but the least squares method suggested a positive causal link between agricultural loans and agricultural growth.

Baidya (2019) examined the impact of financial resources on agricultural production in Nepal using data from 2003 to 2014. The study revealed mixed effects of bank loans and foreign subsidies on agricultural productivity, with both positive and negative correlations. Foreign loans were found to have limited significance in influencing the agricultural sector compared to other sources of finance due to the nature of productive activities. The study has concluded that the different sources of financial resources and its effect on the agriculture production.

Zakaria et al. (2019) examined the impact of financial development on agricultural productivity in five South Asian countries (Bangladesh, India, Nepal, Pakistan, and Sri Lanka) using data from 1973 to 2015. They employed the Cobb-Douglas production

function with various inputs, including physical capital, human capital, trade openness, and income level. Their findings indicated that financial development has an inverted U-shaped impact on agricultural productivity, initially increasing and then decreasing. Agricultural productivity also improved with increased physical and human capital, trade openness, and income levels. A robustness analysis revealed that terms of trade negatively affected agricultural productivity, while industrialization had positive effects, and carbon emissions and rural labor negatively impacted agricultural productivity.

Rimal (2015) focused on the impact of agricultural credit from commercial banks on agricultural production in Nepal from 2002 to 2012. They used a Cobb-Douglas production function with agricultural gross domestic product (AGDP) as the dependent variable and agricultural credit from commercial banks as the independent variable. Agricultural credit from commercial banks increased over the study period, positively influencing Nepal's agricultural production. However, the consumption of fertilizers and improved seeds did not significantly affect agricultural production. The study recommended expanding and deepening urban-oriented financial services to provide timely agricultural credit and support the rural agricultural industry.

Bhatta (2014) conducted a case study on agricultural credit in Kailali district, Nepal. They used a sample of 100 farmers and 10 officials from banks and financial institutions. Employing the Cobb-Douglas production function and stochastic frontier analysis, they concluded that agricultural credit positively impacted agricultural productivity in the study area. They recommended expanding and improving agricultural credit services in rural areas to enhance technical efficiency and agricultural productivity for rural farmers.

2.3 Research Gap

Despite the significance of agriculture in Nepal, there is a noticeable dearth of comprehensive research on the relationship between agricultural credit and its impact on food production in the country. While some studies have briefly examined this connection, the overall body of literature remains inadequate in addressing this vital

issue. This research aims to bridge this research gap by investigating the intricate relationship between agricultural credit and food production in Nepal. The study adopts an econometric approach and utilizes an annual time series dataset spanning the period from 2005 to 2020. In this analysis, food production is considered the dependent variable, while agricultural credit and cultivation land area are treated as independent variables. This choice of variables allows for a comprehensive examination of the multifaceted factors influencing food production in Nepal.

Existing research primarily focuses on short-term effects, providing only a limited perspective on the long-term ramifications of agricultural credit on food production and overall agricultural productivity. Furthermore, many studies have confined their analysis to regional datasets, which limits their ability to offer insights at the national level. Consequently, a substantial research gap exists concerning the literature, methodology, and geographical distribution of agricultural loans and their influence on food production and productivity. To address this research gap, the current study seeks to fill the void by employing national-level time series data spanning from 2005 to 2020. By doing so, we aim to provide a comprehensive analysis of the impact of agricultural credit and cultivation land area on food production in Nepal. This research endeavor will contribute valuable insights to the existing body of knowledge in the field and offer a more holistic understanding of the factors shaping food production in the country.

CHAPTER III
RESEARCH METHEDOLOGY

3.1. Introduction

This chapter presents the methodologies used in this research to meet the objectives of the study. It provides a detailed presentation of the researcher's chosen research design. This chapter is structured into research design, population and sample, sources and methods of data collection, instrumentation, and data analysis.

3.2. Theoretical Framework

It is defined as the network or plane of linked concepts that together provide comprehensive understanding of phenomenon. The study aims to measure the impact of agricultural credit to food production using the ARDL model. Moreover, the study also objects to track the growth and pattern of food production, agricultural credit and cultivation land area. Its objectives are to analyze the magnitude of agricultural credit and cultivation land area and explore their relationship with food production, drawing conclusions about their effectiveness on long-run economic growth in Nepal. The study provides empirical evidence and historical trends on the relationship between food production, agricultural credit and available cultivating land area in Nepal, making it useful for future researchers, scholars, government, and policymakers.

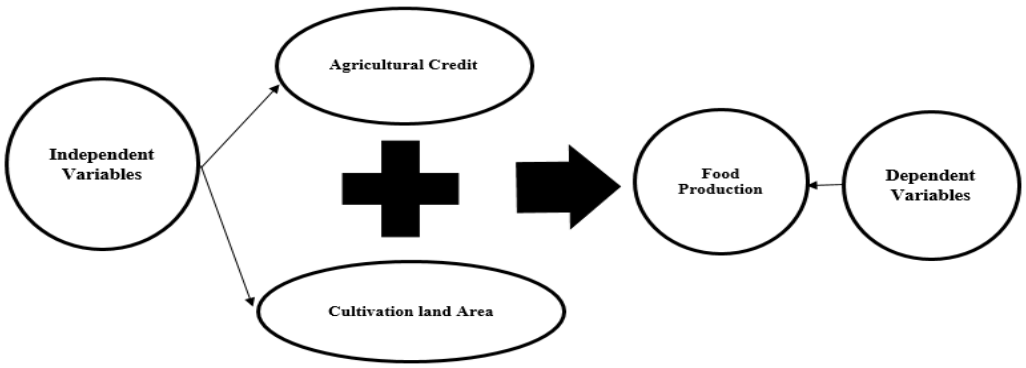


Figure 1 Theoretical Framework (*Source*: Mohammed and Bashir, 2018)

3.3 Research design

This study is based on the descriptive as well as the empirical research design. For descriptive analysis, the study presents summary statistics of all the variables including mean, median, standard deviation, skewness, kurtosis and Jarque-Bera test. Similarly, this study analyzed the nature and trend of the agriculture GDP as well as the lending made by commercial banks on agriculture sector using tables, charts and percentages. Moreover, different econometric tools and techniques such as unit root test of the variables; Autoregressive Distributed Lag bounds testing approach to co-integration test for identifying the long-term relationship between the variables; Error Correction Model to estimate the short-run relationship test are employed. This design has been adopted to understand the directions, patterns, magnitude and forms to observe the impact of agriculture credit on food production in Nepal.

3.4 Nature and sources of the data

The study's character encompasses both analytical and descriptive aspects. Data and information for this study have been gathered from several secondary sources. The secondary data source is mainly Economic Survey (2005-2020), Economic Activities Study Report and Banking and Financial Statistic (2005-2020), Nepal Population Projection Report (2011-2030), Labor Force Engaged in Agriculture by World Bank, Statistical Information on Nepalese Agriculture (2005-2020) etc. Other various Publications, Journals, Dissertations and Articles are also considered as valuable resources during the research. The sources of variables used in the study is detailed below:

i. Government of Nepal, Ministry of Finance:

- Issues of Budget Speeches, Economic Surveys, detailed account of income and expenditure (Red-book) and other publications.

ii. Nepal Rastra Bank (Central Bank of Nepal):

- Reports on Economic Activity Studies, NRB Special Publications on the Present Macroeconomic and Financial Landscape, as well as Banking and Financial Statistics, alongside various other publications.

iii. Government of Nepal, Ministry of Agriculture and Livestock Department:

- Statistical Information on Nepalese Agriculture,

iv. Government of Nepal, National Planning Commission, Central Bureau of Statistic

- National Population and Housing Census 2011, Nepal Population Census 2011 and other publications

v. World Bank

- Percentage of the workforce engaged in agricultural employment (estimated by the International Labour Organization) in Nepal.

Previous research works done by reputed Nepalese institutions and Ph.D. scholars, National and international journals, reports, seminar papers, articles etc Further, extensive library research at TUCL e-Library have been studied and analysed during the research period.

The analysis includes two core variables: Food Production and Agricultural Credit, and one control variable Cultivation Land Area. The study utilizes annual time series data spanning 16 years, from fiscal year 2004/05 to fiscal year 2019/20. The time frame from 2005 to 2020 was selected due to the limited availability of data for all variables beyond this period.

3.5. Data Collection Methods

This study has been basically designed to know the impact of credit finance on food production in Nepal. The study is based on the secondary data which are gathered from NRB and Ministries of Nepal.

3.5.1. Study Area

Credit finance in the context of food production in Nepal is a complex and multifaceted topic related to agriculture credit policies, micro finance and food crops, agriculture value chain, climate change and food production. These are just a few potential study areas of the study. Depending on our interests and background, there may be other areas that are more relevant or interesting to us. Whatever you choose to focus on, it's important to conduct thorough research and engage with stakeholders in the food production sector in

Nepal to gain a comprehensive understanding of the challenges and opportunities related to credit finance. This study is selected to eliminate the deviation of agriculture credit in other than agro products and food crops.

3.5.2. Sampling design

It is a micro level study fully based on secondary data using 16 years from 2005 to 2020. The data are collected from renowned data base such as NRB, MoA, MoF and Central Bureau of Statistics. The sample design of 16 years is selected for time series analysis. This also helps to understand the trend and structure of variables. In order to examine the interrelationship between agricultural credit, cultivation land area and food production in Nepal, under qualitative techniques it has observed the nature and trend of variables through graphical and tabular presentation. For quantitative analysis it has done descriptive analysis like unit root test, long run bounds test, error correction form and diagnostic tests using ARDL model.

3.5.3. Data Collection Tools

Data collection tools refer to the methods or instruments used to collect data for a study. This study used quantitative data of NRB, Ministries of Nepal, World Bank, Economic Survey, annual report of government authorities, academic journal of finance.

3.6. Tools of Analysis

This study concerns different statistical tools such as mean, standard deviation, median, minimum, maximum, skewness, kurtosis, Jarque-Bera test for analyzing descriptive statistics of the variables. The compounded annual growth rate (CAGR) is one of the most accurate ways to calculate and determine returns for anything that can rise or fall in value over time. The tables, bar lines, line charts are used to analyze the nature and trend of lending by commercial banks in agriculture sector and agricultural growth. The ADF test, ARDL bounds testing approach to cointegration, ECM are employed for empirical analysis. Moreover, CUSUM and CUSUMSQ statistics are applied to check the stability of the model. Similarly, a diagnostic test is done using the Breusch-Godfrey LM test for serial autocorrelation, Ramsey's RESET test, normality test and KB test for heteroscedasticity. The study uses Eviews-10 software for data analysis.

3.6.1 Unit Root Test

A unit root test is a statistical test used in econometrics and time series analysis to determine whether a time series data set is stationary or non-stationary. Stationarity is an important concept in time series analysis because many statistical models and forecasting techniques assume that the data is stationary. A stationary time series is one whose statistical properties, such as mean, variance, and autocorrelation, do not change over time. There are several unit root tests, but one of the most commonly used ones is the Augmented Dickey-Fuller (ADF) test. The ADF test is designed to test the null hypothesis that a time series has a unit root, which implies that it is non-stationary. The alternative hypothesis is that the time series is stationary.

3.6.2 Augmented Dickey-Fuller (ADF) Test

The Augmented Dickey-Fuller (ADF) test is a statistical test used in econometrics and time series analysis to determine whether a given time series is stationary or non-stationary. Stationarity is an important concept in time series analysis because many time series forecasting models and statistical techniques assume that the data is stationary. A stationary time series is one whose statistical properties, such as mean, variance, and autocorrelation, remain constant over time. In contrast, a non-stationary time series exhibits trends, seasonality, or other patterns that make its statistical properties change over time. The ADF test is an extension of the original Dickey-Fuller test and is designed to handle time series data that may have higher-order autoregressive components. It tests the null hypothesis that a unit root is present in a time series, which implies that the series is non-stationary. If the test results reject the null hypothesis, it suggests that the time series is stationary.

The ADF test involves estimating an autoregressive (AR) model of the form:

$$\Delta y_t = \rho y_{t-1} + \alpha + \beta_t + \gamma^1 \Delta y_{t-1} + \gamma^2 \Delta y_{t-2} + \ldots + \gamma^p \Delta y_{t-p} + \varepsilon_t$$

Where:

Δy_t represents the differenced time series (i.e., the change between consecutive

observations).

ρ is the coefficient being tested for the presence of a unit root. If ρ = 1, it suggests a unit root is present.
α is a constant term.
β_t represents a time trend.
γ^1, γ^2... γ^p are coefficients for lagged differences of the time series.
ε_t is the error term.
(*Source*: Dickey and Fuller, 1979)

The ADF test calculates a test statistic based on the estimation of ρ and assesses its significance using critical values. If the test statistic is less than the critical value, the null hypothesis of a unit root (non-stationarity) is rejected, indicating that the time series is stationary.

3.6.3 Lag Length Selection

Lag length selection in ARDL (Autoregressive Distributed Lag) modeling refers to the process of determining the appropriate number of lagged variables to include in the model. ARDL models are commonly used in econometrics for analyzing the long-run relationships and short-run dynamics between variables. These models typically involve lagged values of the dependent and independent variables. Selecting the right lag length is important because including too few or too many lags can lead to problems such as omitted variable bias or over fitting. Information criteria like the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Hannan-Quinn Information Criterion (HQIC) are often used to select the lag length. These criteria balance the goodness of fit of the model with the complexity of the model. Smaller values of these criteria indicate a better model fit, but you should avoid over fitting.

3.6.4 Autoregressive Distributed Lags

The autoregressive distributed lag (ARDL) cointegration procedure introduced by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (1997, 2001) has been used to examine the long-run relationship between the money demand and its determinants. This

test offers numerous benefits compared to the widely recognized residual-based method introduced by Engle and Granger (1987) and the maximum likelihood-based technique presented by Johansen and Julius (1990) and Johansen (1992). Autoregressive Distributed Lags (ARDL) is a statistical and econometric modeling technique used to analyze the relationship between variables over time. It is particularly useful in the context of time series data and is commonly employed in econometrics and macroeconomic modeling. ARDL models are designed to capture both short-term and long-term dynamics between variables. One of the important features of this test is that it is free from unit-root pre-testing and can be applied regardless of whether variables are I(0) or I(1). In addition, it does not matter whether the explanatory variables are exogenous (Pesaran and Shin, 1997). The short-and long-run parameters with appropriate asymptotic inferences can be obtained by applying OLS to ARDL with an appropriate lag length. Following Pesaran et al. (1997, 2001), an ARDL representation of

equation (2) mentioned below can be written as:

$$\Delta lnFP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta lnFP_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta lnACD_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta lnCLA_{t-i} +$$

$$\alpha_1 \Delta lnFP_{t-1} + \alpha_2 \Delta lnACD_{t-1} + \alpha_3 \Delta lnCLA_{t-1} + e_t \quad \text{..... (3)}$$

Where, Δ is the first difference operator, β 0 the drift component and the coefficients ($\alpha 1 - \alpha 3$) represent the long-run relationship whereas the remaining expressions with summation sign ($\beta 1 - \beta 3$) represent the short-run dynamics of the model. In order to investigate the existence of the long-run relationship among the variables in the system, the bound tests approach developed by Pesaran et al. (2001) has been employed. The bound test is based on the Wald or F-statistic and follows a non-standard distribution. Under this, the null hypothesis of no cointegration $\alpha 1 = \alpha\ 2 = \alpha\ 3 = 0$ is tested against the alternative of cointegration $\alpha 1 \neq \alpha\ 2 \neq \alpha\ 3 \neq 0$. Pesaran et al. (2001) provide the two sets of critical values in which lower critical bound assumes that all the variables in the ARDL model are I(0), and the upper critical bound assumes I(1). The null hypothesis is rejected, suggesting cointegration, if the estimated F-statistics is larger than the required upper bound critical values. The null cannot be rejected if such statistics fall below the lower bound, demonstrating the absence of cointegration. But if it falls between the lower

and higher boundaries, the findings are not conclusive. After establishing the evidence of the existence of the cointegration between variables, the lag orders of the variables are chosen by using the appropriate Akaike Information Criteria (AIC) or Schwarz Bayesian Criteria (SBC).

The unrestricted error correction model based on the assumption made by Pesaran et al. (2001) was also employed for the short-run dynamics of the model. Thus, the error correction version of the ARDL model pertaining to the equation (3) can be expressed as:

$$\Delta lnFP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta lnFP_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta lnACD_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta lnCLA_{t-i} + \alpha_1 \Delta lnFP_{t-1} + \alpha_2 \Delta lnACD_{t-1} + \alpha_3 \Delta lnCLA_{t-1} + \lambda EC_{t-1} + e_t \quad \text{..... (4)}$$

Where, λ is the speed of adjustment parameter and EC is the residuals that are obtained from the estimated cointegration model of equation (3). In order to check the performance of the model, the diagnostic tests associated with the model which examines the serial correlation, functional form and heteroscedasticity have been conducted. On assess the model stability, the CUSUM and CUSUMSQ tests on the residuals of the equation have also been used. The cumulative sum of recursive residuals based on the initial set of n observations is the foundation of the CUSUM test. For the stability of the long-run and short-run coefficients, the plot of the two statistics must stay within the 5 percent significant level.

3.7. Model Specification

Model I

Following Chandio A.A. et.al (2020) the study examines the impact of agricultural credit and cultivation land area on food production in Nepal from 2005 to 2020. The empirical framework for this study is specified and the implicit form is as follows:

Food Production: $FP_t = f(ACD_t, CLA_t)$..... (1)

Where,

FP_t = Food Production in Nepal

ACD_t = Agricultural Credit

CLA_t = Cultivation Land Area

Numerous estimation tests are conducted as part of the empirical study, therefore Equation (1) may be expressed as follows:

$$lnFP_t = \beta_0 + \beta_1 lnACD_t + \beta_2 lnCLA_t + \varepsilon_t \quad \text{(2)}$$

Where,

$\boldsymbol{lnFP_t}$ =Natural Logarithm of Food Production in Nepal.

$\boldsymbol{lnACD_t}$= Natural Logarithm of Agricultural Credit.

$\boldsymbol{lnCLA_t}$= Natural Logarithm of Cultivation Land Area.

$\boldsymbol{\varepsilon_t}$ = Error term

$\boldsymbol{\beta_0}$ is the constant term and$\boldsymbol{\beta_1}$and $\boldsymbol{\beta_2}$ are the beta coefficients of variables.

Model 2

By following Ghimire and Dhakal (2021) the trend in growth of agricultural inputs was determined using CAGR (Compound Annual Growth Rate).The trend and growth of agricultural inputs (dependent and independent variables) are determined using CAGR (Compound Annual Growth Rate). Y denotes the observation (e.g agricultural credit of bank and financial institutions) at time t and r is compounded growth rate. The equation that serves as the basis for the model employed for estimating the CAGR is as follows:

$$Y=Y_o (1+r)^t$$

3.8 Operational definition of the variables

This section discusses a short description of the variables used in this study for descriptive statistics as well as empirical analysis. The variables are described below:

a. Food Production in Nepal (FP)

FP, or output of food crops, refers to the production from agriculture activities. It represents the production quantity of food crops in Nepal and is an important indicator of growth in the volume of production. The dependent variable in this study is FP, which is expressed in of rupees.

b. Agricultural Credit of Bank and Financial Institutions (ACD)

ACD, or Agricultural Credit of BFIs represents the capital in the basic agriculture production function. This variable provides insights into funding of BFIs in to agricultural industry. The aim of the study is to identify the impact of agricultural credit on food production. Therefore, in this study, ACD serves as the main independent variable and is expressed in rupees.

c. Cultivation Land Area (CLA)

Land area is measured in kattha which is explained as the total land area used for agricultural purpose of food crops. It serves as moderating variable in the regression.

CHAPTER IV
DATA PRESENTATION AND ANALYSIS

4.1 Introduction

The overall objective of the study is to analyze the impact of BFIs credit on agricultural output of food crops in Nepal considering cultivation land area, chemical fertilizer, and government capital expenditure in the agricultural sector. Keeping the objectives in view, the secondary data collected were compiled, tabulated and analyzed within the framework of the specified methodology and also with specific reference to each of the objectives set forth for the present study.

4.2 Overview of Agriculture in Nepalese Economy

The contribution of agricultural sector to GDP of Nepal is 25.80 (MoF, 2021) More than 60.40 (MoF, 2021) active labour force directly involved in agriculture. The industrial sector provides employment opportunities to a significant portion of Nepal's labor force. According to the World Bank, the industrial sector employed about 11 percent of the country's labor force in 2020. The industrial sector's contribution to Nepal's GDP has been increasing over the years. In 2020, the industrial sector contributed about 19.4 percent to Nepal's GDP. The agriculture sector includes several sub-sectors such as crop production, livestock, fisheries, and forestry. The major crops produced in Nepal include rice, wheat, maize, millet, and potatoes. The major agricultural exports from Nepal include tea, coffee, cardamom, ginger, and lentils.

Paddy (Rice) is the staple food of Nepal, and it is grown in most parts of the country. It is the most important crop in terms of area under cultivation and production. Some of the popular rice varieties grown in Nepal include Basmati, Mansuli, Masuli, and Rato Chandra. Similarly, Wheat is the second most important food crop in Nepal after rice. It is grown mainly in the Terai and mid-hill regions. The popular varieties of wheat grown in Nepal are HD-2967, WK-1204, and WH-1105. Likewise, Maize is an important food crop in Nepal, particularly in the hill and mountain regions. It is also used as animal feed.

The popular varieties of maize grown in Nepal include Arun-2, Chamal-55, and Manakamana-3. Apart from this, Millet is a traditional food crop in Nepal, mainly grown in the mountainous regions. The popular varieties of millet grown in Nepal are finger millet, foxtail millet, and pearl millet. Moreover, Barley is a food crop that is mainly grown in the high-altitude areas of Nepal. It is used for making traditional alcoholic beverages such as chang and beer. Furthermore, Potato is an important food crop in Nepal, grown mainly in the hill and mountain regions. The popular varieties of potato grown in Nepal include Jyoti, Chandramukhi, and Kufri Chandramukhi.

The overall development of national economy is heavily dependent on agricultural productivity, on the other hand the comparative benefit and the probability of competitiveness is also higher in agricultural sector. Agricultural sector plays vital role to maintain price level, reduction of trade imbalance, preservation of export, effective supply channel and strong foundation to industrialization. The central bank of Nepal has set an mandatory to flow 12 percent of its total loan to agricultural sector till ashad end, 2079, 13 percent till ashad end, 2080, 14 percent ashad end, 2081 and 15 percent ashad end, 2082. The current status of such credit flow is 12.28 percent amounting NRs. 490 arab 15 crore. The importance of agriculture sector is prime in terms of lending too. The details of area under principal food grains and cash crops and production of major agricultural products are presented in table 1 and table 2 below:

Table 1 Area under Principal Food Grains and Cash Crops (In Hectares)

Crops	2018/19	2019/20	2020/21	Percentage Change	
				2019/20	2020/21
1. Food and Other Crops	4,341,953	4,333,817	4,328,464	-0.2	-0.1
Paddy	1,500,502	1,474,888	1,490,780	-1.7	1.1
Maize	983,743	983,530	986,645	0	0.3
Wheat	680,703	706,753	708,707	3.8	0.3
Millet	252,594	263,020	264,717	4.1	0.6
Barley	24,645	24,831	23,728	0.8	-4.4
Buckwheat	9,591	9,631	10,357	0.4	7.5
Potato	197,144	207,459	214,026	5.2	3.2
Sugarcane	79,423	69,762	70,209	-12.2	0.6
Sanpat	6,732	7,352	7,317	9.2	-0.5
Tobacco	561	570	575	1.6	0.9
Soyabean	26,113	27,929	29,405	7	5.3

Pulses	341,833	327,425	322,672	-4.2	-1.5
Oil Seed	238,369	230,667	230,577	-3.2	0
2. Vegetable and Gardening	328,292	334,079	344,657	1.8	3.2
Vegetable	321,263	325,682	335,967	1.4	3.2
Gardening	7,029	8,067	8,691	14.8	7.7
3. Fruits and Spices	265,060	284,015	290,599	7.2	2.3
Orange	33,225	34,770	36,266	4.6	4.3
Mango	52,525	55,518	56,752	5.7	2.2
Banana	20,215	21,652	22,508	7.1	4
Apple	11,243	11,766	13,571	4.7	15.3
Other Fruits	40,540	42,333	41,983	4.4	-0.8
Spices	72,227	77,346	77,661	7.1	0.4
Tea	17,100	17,265	14,554	1	-15.7
Coffee	21,028	23,366	27,305	11.1	16.9

Source: (NRB, 2020/21)

Table no.1 represents the land area under food grains and cash crops. According to the World Bank, Nepal had a total land area of 14.7 million hectares in 2019. Out of this, the total agricultural land area was estimated to be around 5.2 million hectares, which is approximately 35 percent of the total land area. However, it's worth noting that this estimate may vary depending on the source and methodology used. According to the World Food Programme, around 9.7 million people in Nepal are estimated to be food insecure, which is approximately one-third of the total population. The situation is particularly acute in the remote and mountainous regions of the country, where access to food and other basic necessities is limited. The table indicates that the land used for food and other crops decreasing slightly by 0.2 percent and 0.1 percent respectively in year 2019/20 and 2020/21. The overall land area sued for food and other crops are 4,341,953 Hectors, 4,333,817 Hectors and 4,328,464 Hectors respectively. Among various food and other crops land used for Paddy, Buckwheat and Sugarcane show noticeable growth in recent year whereas land used for Wheat, Millet, Barley and *Sanpat* reflect major drops. The Vegetable & Gardening and Fruits & Spices shows positive note over land area utilization for production as both of these reflects significant growth over the years. Land area used for Vegetable and Gardening increases by 1.8 percent in year 2019/20 and 3.2 percent in year 2020/21. Out of the total land area used for agriculture, 88 percent has been utilized to produce food and other crops. Only 12 percent is used to produced nonfood crops. This indicates that Nepalese agricultural system needs more diversification and variety to balance between food and nonfood crops. Food crops is

vital for survival of human beings whereas nonfood products like tobacco, sugarcane, tea and coffee are also the major raw materials for industries.

Table 2 Production of Major Agricultural Products (in Mt.)

Crops	2018/19	2019/20	2020/21	Percentage Change	
				2019/20	2020/21
1. Food and Other Crops	17,966,553.46	17,440,502.08	17,722,238.33	-2.9	1.6
Paddy	5,610,011.82	5,550,878.74	5,621,707.05	-1.1	1.3
Maize	2,735,671.86	2,897,027.31	2,939,059.36	5.9	1.5
Wheat	2,012,568.07	2,073,900.83	2,002,479.50	3.0	-3.4
Millet	301,617.18	312,538.43	315,809.40	3.6	1.0
Barley	26,956.36	31,038.35	29,154.75	15.1	-6.1
Buckwheat	10,231.14	10,449.87	11,088.73	2.1	6.1
Potato	2,902,580.04	2,956,102.99	3,117,371.58	1.8	5.5
Sugarcane	3,773,364.91	3,027,250.20	3,081,755.25	-19.8	1.8
Sanpat	11,623.00	11,673.00	10,481.68	0.4	-10.2
Tobacco	2,007.25	1,987.25	1,894.75	-1.0	-4.7
Soyabean	30,295.72	32,699.91	35,327.84	7.9	8.0
Pulses	323,227.90	308,501.88	325,819.15	-4.6	5.6
Oil Seed	226,398.21	226,453.33	230,289.29	0.0	1.7
2. Vegetable and Gardening	4,020,734.30	4,193,991.02	4,271,044.37	4.3	1.8
Vegetable	3,726,699.30	3,857,427.02	3,935,966.37	3.5	2.0
Gardening	294,035.00	336,564.00	335,078.00	14.5	-0.4
3. Fruits and Spices	1,722,595.88	1,777,832.80	1,859,164.86	3.2	4.6
Orange	212,747.62	219,319.41	211,325.28	3.1	-3.6
Mango	313,411.18	347,937.00	414,968.90	11.0	19.3
Banana	289,339.10	321,505.20	345,490.06	11.1	7.5
Apple	40,590.29	49,153.24	55,184.10	21.1	12.3
Other Fruits	261,040.44	261,687.40	232,874.20	0.2	-11.0
Spices	586,223.34	558,976.84	577,101.50	-4.6	3.2

Tea	18,339.00	18,327.10	21,175.10	-0.1	15.5
Coffee	904.91	926.61	1,045.72	2.4	12.9
Honey	2,136,184.95	2,129,729.26	2,283,893.68	-0.3	7.2

Source: NRB, 2020/21

Table 2 describes the situation of agricultural output in last three years in Nepal. Rice is the staple food in Nepal, and it is cultivated across the country. Some of the popular rice varieties in Nepal include Basmati, Jethobudho, Masuli, and Madhupati. Maize is an important food crop in Nepal, and it is used for both human consumption and animal feed. Some of the popular maize varieties in Nepal include Simal, Arun-3, and Khumal-4. Wheat is another important food crop in Nepal, and it is used to make various food items, including bread, noodles, and pasta. Some of the popular wheat varieties in Nepal include Sonalika, Vijay, and Annapurna. Nepal produces a range of fruits and vegetables, including apples, oranges, bananas, tomatoes, potatoes, carrots, and cabbage. These products are in high demand in both domestic and international markets. Nepal produces high-quality tea, which is in demand in international markets. Some of the popular tea varieties in Nepal include Orthodox, Green, and CTC tea. Nepal produces a range of spices, including cardamom, ginger, turmeric, and cumin. These products are in high demand in both domestic and international markets. Lentils are an important source of protein in Nepal, and the country produces a range of lentil varieties, including Masoor, Chana, and Mug. Barley is another important food crop in Nepal, and it is used to make various food items, including beer and porridge. Some of the popular barley varieties in Nepal include Himalayan, Manang, and Solu. Therefore, Nepal has a rich variety of food crops products, including rice, maize, wheat, fruits and vegetables, tea, spices, lentils, and barley. These products provide employment opportunities for millions of people, contribute significantly to the country's exports, and are a vital source of food and nutrition for the population.

In Nepal, rice is the better performer among food crops due to several reasons:

1. Rice is the staple food in Nepal, and it is the most important crop in terms of production, consumption, and trade. It is consumed by almost all Nepalese households and is an essential part of the Nepalese diet.
2. Nepal is a major producer of rice, with an annual production of around 5 million tons.

The country has favorable agro-climatic conditions for rice cultivation, with plenty of water and fertile land.

3. Rice cultivation provides employment opportunities for a large number of people, especially in the rural areas. It is estimated that rice cultivation employs over 60 percent of the Nepalese population.
4. Nepal exports rice to neighboring countries, including India, Bangladesh, and Bhutan. Rice is a major contributor to Nepal's export earnings, and the country has a competitive advantage in rice production.
5. Rice is a vital source of food and nutrition for the Nepalese population, especially for the poor and vulnerable. The availability of rice ensures food security for the population, which is crucial for human development and poverty reduction.

Food and other crops output was decreased by 2.9 percent in year 2019/20 but showed slight growth by 1.6 percent in year 2020/21. The output of Barley decreased drastically in year 2020/21 by 6.1 percent which was increased by 15.1 percent in year 2019/20. The output of paddy increased by 1.3 percent in review period which was decreased by 1.1 percent in previous year. Maize output has positive growth over the years as it was grown by 5.9 percent in year 2019/20 and by 1.5 percent in year 2020/21. The output margin of Sugarcane and Sanpat shows dramatic downfall in two different years. Sugarcane output was dwindled by 19.8 percent in year 2019/20 and Sanpat by 10.2 percent in year 2020/21. Wheat production decreased by 3.4 percent in review period. The growth rate of vegetable productivity also getting down in last two years which was 4.3 percent in year 2019/20 but it was grown by 1.8 percent in year 2020/21. The growth rate of fruits and other spices remains positive in last three years. The details of composition of gross domestic product is presented in table 3 below:

Table 3 Composition of Gross Domestic Product

Industrial Classification	2018/19	2019/20	2020/21
Agriculture, forestry and fishing	24.92	26.21	25.83
Mining and quarrying	0.66	0.59	0.58
Manufacturing	5.75	5.03	5.08
Electricity, gas, steam and air conditioning supply	1.01	1.23	1.23

Water supply; sewerage, waste management and remediation activities	0.59	0.58	0.55
Construction	7.01	5.93	5.68
Wholesale and retail trade; repair of motor vehicles and motorcycles	16.25	15.04	15.67
Transportation and storage	6.46	5.18	5.43
Accommodation and food service activities	2.26	1.46	1.56
Information and communication	2.22	2.23	2.17
Financial and insurance activities	6.20	6.81	6.88
Real estate activities	8.85	9.18	9.43
Professional, scientific and technical activities	0.98	1.02	1.06
Administrative and support service activities	0.76	0.79	0.76
Public administration and defence; compulsory social security	6.54	7.99	7.70
Education	7.53	8.35	8.05
Human health and social work activities	1.49	1.75	1.73
Arts, entertainment and recreation; Other service activities; and Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0.54	0.62	0.61

Source: NRB, 2020/21

The importance of Agriculture in Nepalese's economy can be observed through Table 3. One-fourth of the GDP of Nepal gets contributed from agriculture sector. The contribution of agriculture sector to overall GDP of Nepal remains 24.92 percent, 26.21 percent and 25.83 percent respectively in year 2018/19, 2019/20 and 2020/21. Since agriculture is the backbone of Nepalese economy, it provides livelihood for two-third of Nepalese people. Agriculture is the key entry point for poverty reduction and ensuring national food and nutritional security of the people in Nepal. Development of Agricultural sector brings multiplier effect in the economy as it provides raw material for industrial growth as well. Moreover, agriculture is complex activities with more than a single sector provides foods, medicines, industry, diverse livelihood and employment. The details of Export of Major Agricultural Commodities are presented in table 4 below:

Table 4 Export of Major Agricultural Commodities

S.N.	Heading	2018/19	2019/20	2020/21		
		Annual	Annual	Annual	Share in Total Exports (%)	Percent Change
1	Soyabean oil	2,346.37	12,691.12	53,651.60	38	322.7
2	Cardamom	4,283.88	4,007.27	6,935.93	4.9	73.1
3	Jute Goods	5,811.42	5,262.20	6,705.10	4.8	27.4
4	Juice	4,549.85	3,430.23	4,215.79	3	22.9
5	Oil Cakes	1,608.10	1,566.41	2,265.91	1.6	44.7
6	Herbs	1,316.55	1,510.26	1,620.31	1.1	7.3
7	Medicine (Ayurvedic)	734.04	975.8	1,592.24	1.1	63.2
8	Rosin	1,385.56	812.06	1,125.09	0.8	38.5
9	Pulses	1,274.34	949.34	567.71	0.4	-40.2
	Total Exports	23,310.1	31,204.69	78,679.68	55.8	152

Source: NRB, 2020/21

Table 4 enlarges the importance of agricultural sector to maintain balance of payment and mitigate trade deficit of Nepal. The 55.8 percent of major export of Nepal comes from agricultural sector. In Nepal, agriculture plays a crucial role as the primary source of income for the country. Its development holds great importance for overall economic progress. Nepal's economic growth is closely tied to advancements in its agricultural sector, which not only sustains the local population with food but also supplies raw materials to various industries. This shift from agricultural to industrial labor is pivotal for the nation's industrialization.

One of the pressing challenges faced by underdeveloped countries like Nepal is the need to increase and sustain agricultural production to meet the demands of a growing population and mitigate trade deficits. To understand the current state of agricultural inputs in Nepal, here are some key points:

Dependence on Inputs: The agricultural sector in Nepal heavily relies on inputs such as seeds, fertilizers, pesticides, machinery, and irrigation systems to enhance productivity and efficiency.

Seed Quality: Quality seeds are scarce in Nepal. Only a small fraction of farmers uses certified seeds, while most depend on informal seed sources, resulting in poor seed quality and lower crop yields.

Fertilizer Use: Although the use of chemical fertilizers is on the rise, it still falls below

recommended levels. Factors like high fertilizer costs, limited supply in remote areas, and insufficient agricultural extension services contribute to this.

Pesticide Concerns: Pesticide use is increasing, but concerns persist regarding their safety and quality. Farmers lack awareness about proper pesticide use, leading to indiscriminate application that poses health and environmental risks.

Machinery: Modern farming machinery adoption remains limited in Nepal. Smallholder farmers continue to rely on traditional tools and manual labor for cultivation and harvesting.

Irrigation: Inadequate irrigation facilities prevail in Nepal, with only about one-third of agricultural land benefiting from irrigation. This limitation restricts crop diversity and reduces yields.

The current state of agricultural inputs in Nepal poses significant challenges to the sector's growth and development. To address these issues, collaborative efforts involving governments, the private sector, and farmers themselves are essential. Potential solutions include promoting certified seed usage, improving access to fertilizers and pesticides, offering training and extension services on proper input utilization, and investing in irrigation infrastructure and modern farming machinery. These measures are crucial to enhance agricultural productivity and, consequently, Nepal's overall economic development.

According to the Nepal Agriculture Research Council (NARC), the total agricultural land in Nepal is around 4.1 million hectares. Of this, about 1.55 million hectares are irrigated and the remaining 2.55 million hectares are rain-fed. The land area available for food crops in Nepal varies from year to year depending on the cropping pattern, land use changes, and other factors. According to the Ministry of Agriculture and Livestock Development, the land area used for food crops in Nepal in the fiscal year 2020/21 was as follows:

Paddy (rice)	1.52 million hectares
Maize	766,376 hectares
Wheat	469,697 hectares

Millet	283,914 hectares
Barley	111,666 hectares
Buckwheat	22,677 hectares
Potato	58,327 hectares
Vegetables	186,587 hectares
Fruits	87,782 hectares

In conclusion, Nepal has a significant amount of agricultural land available for food crop production, with paddy (rice) being the most important crop. However, the country still faces challenges in increasing the productivity and efficiency of agriculture, including improving access to inputs, addressing land use changes and degradation, and enhancing the resilience of agriculture to climate change.

Nepal has a total land area of about 147,181 square kilometers, out of which around 26 percent is considered to be fertile land suitable for agriculture. This fertile land is primarily found in the southern Terai plains and some valleys and basins in the mid-hills. The Terai region, which comprises only about 17 percent of Nepal's total land area, is the most fertile region and the breadbasket of the country. The soil in this region is alluvial, and the land is irrigated by numerous rivers, making it ideal for rice cultivation, as well as the production of various other crops such as wheat, maize, sugarcane, oilseeds, and vegetables. In the mid-hills, the valleys and basins have fertile soils and are suitable for growing crops such as maize, millet, wheat, barley, potatoes, and vegetables. However, due to the rugged terrain and limited access to irrigation, rain-fed agriculture is the primary farming system in these areas.

The average land holding area in Nepal is relatively small, with around 60 percent of farmers having less than 0.5 hectares of land. According to the Agricultural Census conducted by the Government of Nepal in 2011, the average land holding area in the country was 0.99 hectares, with significant variations among the ecological regions and socioeconomic groups. In the Terai region, the average land holding area was relatively larger at 1.54 hectares, compared to the mid-hills and high mountains, where the average land holding area was 0.91 and 0.50 hectares, respectively. However, the Terai region

also had higher levels of landlessness and tenancy compared to the other regions. The land holding area also varies among different socioeconomic groups. For example, the average land holding area of small and marginal farmers (with less than 1 hectare of land) was 0.32 hectares, while the average land holding area of large farmers (with more than 5 hectares of land) was 8.75 hectares. Small land holding areas pose challenges to farmers in terms of accessing inputs, credit, and markets, and may limit their ability to adopt modern technologies and practices. Addressing these challenges through appropriate policies and interventions, such as land consolidation and land-use planning, could help to improve the efficiency and productivity of agriculture and enhance the livelihoods of smallholder farmers in Nepal.

4.3 Trend and structure of input variables

The production function mentioned in methodology is consist of three different variables. Agricultural output is considered as dependent variable and agricultural credit is independent variable nevertheless cultivation area, labour force, fertilizer, irrigated area, improved seed and governments' capital expenditure are taken as moderating variables. The study of trend and structure of various variables reflect the progress and direction which leads to draw the conclusion of their impacts.

4.3.1 Cultivating Land Area

Cultivating land area is a major moderating variable and it directly impacts the agricultural output. The land problem is a paramount issue for every country. For developing countries such as Nepal, it is more important in order to meet most of the United Nation Sustainable Development Goals (SDGs), particularly, reducing poverty and enhancing food security by promoting sustainable agriculture. Out of the total 147,181 square kilometers land area of Nepal, agricultural land is 28 percent of which 21 percent is cultivated and 7 percent uncultivated (CBS, 2019/20). The details of land area allocation in Nepal is presented below:

Table 5 Allocation of total land area of Nepal

Category	Area (000 Hectares)	Percentage (%)
Agricultural land cultivated	3,091	21.00
Agricultural land uncultivated	1,030	7.00
Forest	4,268	29.00
Shrubland	1,560	10.60
Grass land and pasture	1,766	12.00
Water	383	2.60
Others	2,620	17.80
Total	**14,718**	**100.00**

Source: CBS, 2019/20

Table 6 Cultivation Land Area

Year (Mid-July)	Cultivation Land Area (in thousand hectares)	Growth/(Decline) %
2005	3,502.20	-
2006	3,513.70	0.33
2007	3,456.45	-1.63
2008	3,827.60	10.74
2009	3,850.40	0.60
2010	3,835.50	-0.39
2011	3,947.86	2.93
2012	3,887.60	-1.53
2013	3,744.66	-3.68
2014	3,901.33	4.18
2015	3,807.13	-2.41
2016	3,731.33	-1.99
2017	3,955.85	6.02
2018	3,848.85	-2.70
2019	3,906.29	1.49
2020	3,867.63	-0.99
	CAGR	0.66

Source: MoF (2005-2020)

Figure 2 Cultivating Land Area (in thousand hectares)

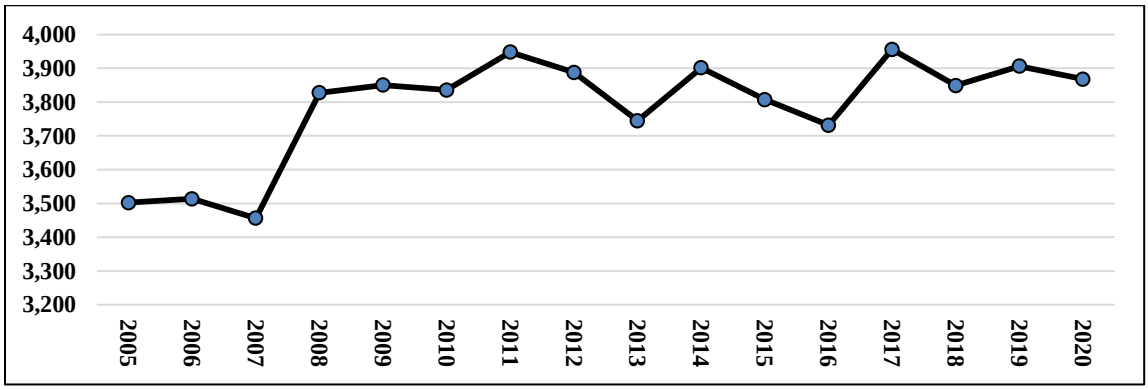


Table 6 represents the area used for cultivating major food crops and major cash crops in Nepal. The cultivation land area is increased significantly in year 2008, 2014 and 2017 by 10.74 percent, 4.18 percent and 6.02 percent respectively. However, major decline in cultivation land area finds in year 2013, 2016 and 2018 in last 15 years. The compounded annual growth rate in cultivating land area is around 0.66 percent which indicates stagnant growth over the period.

4.3.2 Chemical Fertilizers

Increasing cultivated area, fertilizer use and water availability will lead to increased rice production. The estimated short-term and long-term results show that rice production in Pakistan is positively and significantly affected by changes in cultivated area and fertilizer use (Chanido et al., 2018). Fertilizers here mainly include urea, DAP and potassium. Sourcing, transportation, port storage, inland transportation, inland warehousing, local transportation, distribution and consumption are the key functions of the chemical fertilizer supply chain specifically for Nepal . Major problems related to fertilizer supply in Nepal include an unfavorable regulatory environment, inadequate regulations, lack of financing and inadequate infrastructure. Other issues related to the industry include unregistered agricultural dealers selling subsidized fertilizers and illegal trade across India's open borders. Although the government has invested significant revenue in fertilizer subsidies, it has not achieved the expected results in improving productivity.

Chemical fertilizers are used in Nepal to increase crop yields by providing essential nutrients to the soil. The main nutrients provided by chemical fertilizers are nitrogen, phosphorus and potassium, which are necessary for plant growth and development. In addition, they may contain other secondary micronutrients, such as sulfur, calcium and magnesium, which are also essential for plant growth. The use of chemical fertilizers in Nepal has increased over the years, reflecting the growing demand for food products and the need to increase agricultural productivity to meet this demand. According to the Central Bureau of Statistics, chemical fertilizer consumption in Nepal increased from 79,458 tonnes in 2005/06 to 536,136 tonnes in 2019/20. However, using chemical fertilizers in Nepal has both advantages and disadvantages. Benefits include increased agricultural productivity, improved soil fertility and increased food production, which can contribute to food security and rural development. In addition, chemical fertilizers can be used to overcome nutrient deficiencies in the soil, which in turn can improve crop quality and reduce crop losses due to pests. On the other hand, disadvantages of using chemical fertilizers include the possibility of environmental pollution, soil degradation, and adverse health effects due to excessive fertilizer use. Additionally, the high cost of chemical fertilizers may limit their accessibility to small farmers, who constitute the majority in Nepal. To address these challenges, there is a need to promote sustainable use of chemical fertilizers in Nepal by adopting appropriate technologies, such as precision agriculture and integrated nutrient management, and promoting Use organic and natural fertilizers. Additionally, it is essential to develop policies and programs that promote the efficient use of chemical fertilizers while minimizing potential negative impacts on the environment and human health.

The chemical fertilizer supply system in Nepal involves many players, including fertilizer manufacturers, importers, wholesalers and retailers, as well as government agencies responsible for regulation. and monitoring the fertilizer market. Most chemical fertilizers used in Nepal are imported from India and other countries and distributed through a network of wholesalers and retailers. Fertilizer distribution is managed by private companies, which import fertilizer and supply it to wholesalers and retailers. The Nepal Agricultural Research Council (NARC) is responsible for monitoring the quality of

fertilizers and ensuring they meet required standards. The Department of Agriculture (DOA) is responsible for managing fertilizer distribution and issuing licenses to companies engaged in the fertilizer business. The Nepal government also provides subsidies to farmers on chemical fertilizers to promote their use and increase agricultural productivity. The subsidy is provided through the Agricultural Inputs Company Limited (AICL), a state-owned company that imports and distributes fertilizers to farmers at subsidized prices. However, the supply system of chemical fertilizers in Nepal is not without challenges. One of the major challenges is the limited availability and accessibility of fertilizers, particularly in remote areas. This is due to inadequate infrastructure, such as roads and transportation facilities, which limit the distribution of fertilizers to these areas. Additionally, the high cost of fertilizers may also limit their accessibility to smallholder farmers, who are the majority in Nepal.

The Fertilizer Policy of Nepal was formulated in 2002 to ensure the availability of adequate and quality fertilizers to farmers at affordable prices. The policy aims to promote the balanced use of fertilizers, reduce their environmental impacts, and ensure the sustainable use of soil and water resources. The government of Nepal provides a subsidy on chemical fertilizers to farmers to increase their accessibility and affordability. The subsidy is provided through the Agriculture Inputs Company Limited (AICL), which imports and distributes fertilizers to farmers at a subsidized price. The government of Nepal has adopted the Integrated Plant Nutrition System (IPNS) approach to promote the efficient and sustainable use of fertilizers. The IPNS approach aims to promote the use of organic and natural fertilizers, reduce the use of chemical fertilizers, and improves soil fertility and crop productivity. The government of Nepal regulates the fertilizer market to ensure the availability of quality fertilizers and prevent the sale of substandard and counterfeit fertilizers. The Nepal Agricultural Research Council (NARC) and the Department of Agriculture (DOA) are responsible for regulating and monitoring the fertilizer market. The government of Nepal supports research and development in the field of fertilizer use and soil management. The National Agriculture Research and Development Fund (NARDF) provides funding for research and development projects related to agriculture, including fertilizer use and soil management.

Overall, these policies aim to promote the efficient and sustainable use of chemical fertilizers in Nepal and ensure their availability and affordability to farmers. However, there is a need to further strengthen these policies and interventions to address the challenges of fertilizer use in Nepal, such as environmental degradation and the limited accessibility of fertilizers to smallholder farmers. The details of chemical fertilizer used is presented below:

Table 7 Chemical Fertilizer Used

Year (Mid-July)	**Chemical Fertilizer Supply/(Metric ton)**	**Increase/ (Decrease)%**
2005	122,706	-
2006	91,553	-25
2007	90,848	-1
2008	53,753	-41
2009	12,810	-76
2010	10,329	-19
2011	110,013	965
2012	144,813	32
2013	176,963	22
2014	232,189	31
2015	298,677	29
2016	327,520	10
2017	328,217	0
2018	348,734	6
2019	344,004	-1
2020	394,595	15
	CAGR	**8.10**

Source: (MoA, 2005-2020)

Figure 3 Chemical Fertilizer Supply (Metric ton)

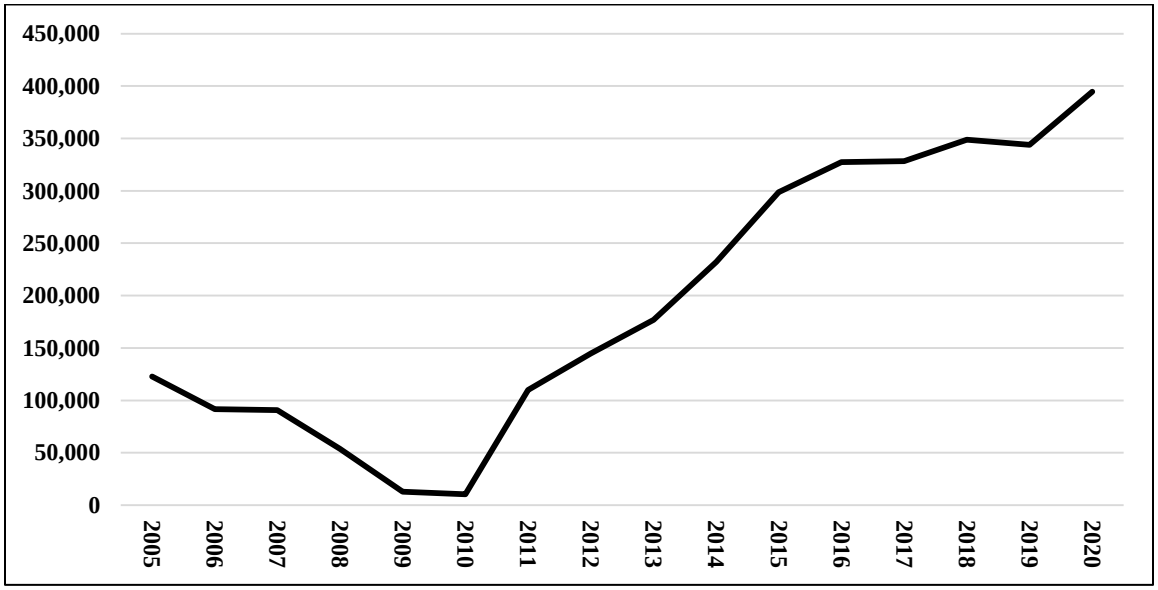


Table no. 7 indicates that the structure and trend of supply of chemical fertilizer was decreasing since year 2062/63 till 2066/67 but the trend was reversed and it was in increasing trend since 2067/68 till the study period. The annual CAGR of chemical fertilizer used is 8.10 percent indicating significant growth during the review period.

4.3.3 Government's Capital Expenditure on Agricultural Sector

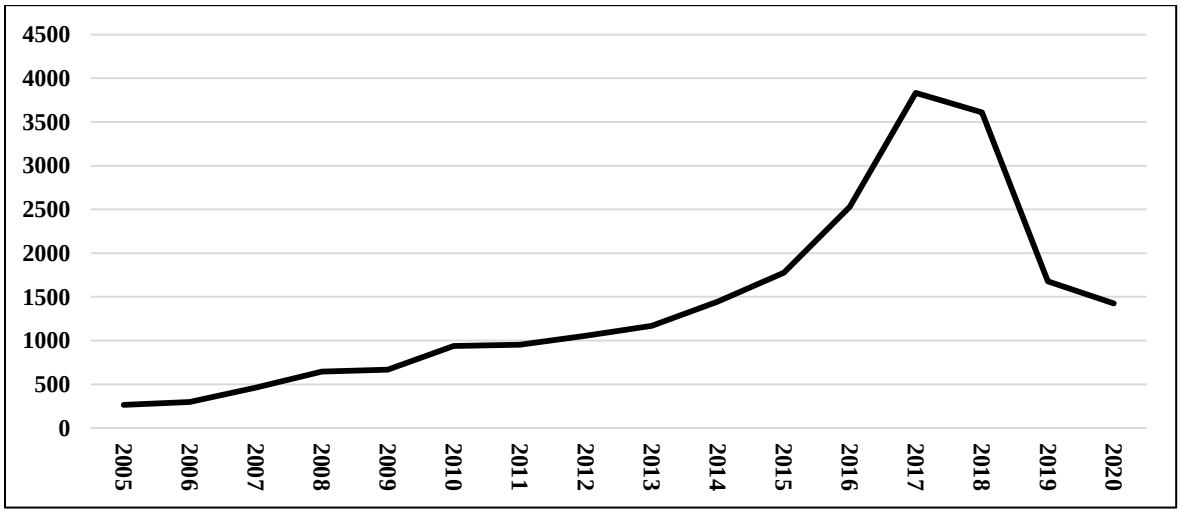
Investment in agricultural R&D aimed at improving production technologies and modernization of farming will contribute significantly to agricultural productivity growth (Anik et. al., 2016) said that the government expenditure policies are of vital importance for the growth of agricultural sector and any reduction in agricultural government expenditure adversely affects agricultural sector performance. It was also said that instability in agricultural government expenditure is inversely related to the growth of the sector. (Wagle, 2016) examined the logical relationship between Agriculture Production and Government Expenditure in Nepal and concluded that Government Expenditure on agriculture sector has significant positive impact in agriculture outputs. The budget for the fiscal year 2021-22 had accorded priority to the agriculture sector as the government had earmarked Rs45.09 billion for the farm sector. Government's capital expenditure on agricultural sector during the study period is presented in table 8 below:

Table 8 Government's Capital Expenditure on Agricultural Sector

Year (Mid-July)	Capital Expenditure (in ten million)	Increase/ (Decrease)%
2005	263.83	-
2006	297.50	13
2007	460.54	55
2008	644.30	40
2009	665.93	3
2010	939.05	41
2011	952.60	1
2012	1,056.22	11
2013	1,167.01	10
2014	1,446.37	24
2015	1,775.14	23
2016	2,531.25	43
2017	3,831.93	51
2018	3,610.43	-6
2019	1,676.92	-54
2020	1,425.81	-15
	CAGR	**11.90**

Source: MoF, 2005-2020

Figure 4 Government's Capital Expenditure (in ten million)



As shown in Table no. 8, the annual compounded growth rate of agricultural capital expenditure is 11.90 percent. The trend of capital expenditure is positive and upward till FY 2017 but is remained downward since year 2018. The maximum percent change in capex is 55 percent in Year 2007 and lowest was -54 percent in year 2019. The overall trend and structure of capital expenditure looks progressive nevertheless the trend of last three years is negative.

4.4 Growth and Structure of Agricultural Credit

4.4.1 Importance of agricultural on GDP Growth

Economic growth depends on capital investment as well as capital productivity. Without productivity, investment alone cannot create growth. Productivity itself is an innovation and is based on the state of technology, the state of the employed workforce and above all the economic policy structure of the country. Economic growth must be adjusted based on the priorities of the economic sector to allocate resources effectively. Agriculture has traditionally been considered the mainstay of the Nepalese economy despite the growing importance of other service sectors in Nepal. Nepal remains primarily an agricultural economy. In the context of Nepali economy, agriculture is linked to various sectors and is mainly aimed at generating large-scale growth and development. Agriculture is therefore essential to sustain life and has become the foundation of economic growth as it continues to account for a significant share of GDP, total exports and the majority of the labor force. Credit is especially important in the agricultural sector because it allows farmers to invest in their farms and increase productivity, which can lead to increased income and improved livelihoods. Here are some key reasons why credit is important in agriculture:

1. Access to credit allows farmers to purchase seeds, fertilizers, pesticides and other inputs needed for agricultural production. With these inputs, farmers can increase agricultural productivity and improve their overall productivity.
2. Credit can also be used to purchase agricultural equipment such as tractors, plows and irrigation systems. This can help farmers mechanize operations and improve efficiency, reduce labor costs and increase output. 3. Credit can be used to invest in

crop diversification, allowing farmers to grow a variety of crops that can reduce the risk of crop failure due to pests, diseases or weather-related phenomena.

3. Credit can also be used to invest in marketing and storage facilities, allowing farmers to store their produce until prices are favorable and sell when demand is high. This can help them increase their income and reduce their vulnerability to market fluctuations.
4. Credit can also be used to invest in insurance policies to protect farmers from crop failure and other risks. This can help reduce their vulnerability and give them greater financial security.

Overall, access to credit is essential to the agricultural sector because it allows farmers to invest in their farms, increase productivity, and improve their livelihoods overall. Without access to credit, many farmers will find it difficult to make the investments needed to grow their businesses and improve their standards of living. In Nepal, there are many sources of credit available to farmers and other individuals in the agricultural sector. Some major sources of credit in Nepal include:

1. Commercial banks in Nepal provide loans and other forms of credit to individuals and businesses in the agricultural sector. These loans may be secured or unsecured and can be used for a variety of purposes, including purchasing inputs, equipment or land.
2. Development banks in Nepal provide long-term loans and other forms of credit to individuals and businesses in the agricultural sector. These loans can be used for a variety of purposes, including investing in new infrastructure, purchasing land or equipment, or financing other development projects.
3. Agricultural cooperatives are community organizations that provide financial services and other support to farmers and other subjects in the agricultural sector. These cooperatives may offer loans, savings accounts, and other financial services to their members.

Overall, there are a variety of sources of credit available in Nepal to support the agricultural sector. Individuals and businesses in the sector may choose to access credit from one or more of these sources depending on their specific needs and circumstances.

Agricultural credit has increased in Nepal over the years as the government and financial institutions recognize the importance of the agricultural sector to the country's economy. According to data from Nepal Rastra Bank, Nepal's central bank, agricultural credit increased from NPR 102.17 billion in 2016/17 to NPR 164.51 billion in 2020/21. This increase in agricultural credit is due to many factors, including government policies to promote agriculture, increasing interest of financial institutions in lending to the agricultural sector and the growing demand for credit by farmers and those involved in agriculture. One of the main policy initiatives contributing to increased agricultural credit is the Government's agricultural development strategy aimed at increasing the productivity and competitiveness of the agricultural sector. The strategy includes various measures to support farmers, including access to credit and other financial services. Nepali financial institutions are also increasingly focusing on lending to the agricultural sector, recognizing the potential for growth and profitability in this sector. This has been supported by various government initiatives, including the establishment of the Agricultural Development Bank and the establishment of various credit and subsidy programs for the agricultural sector.

Overall, the agricultural credit trend in Nepal is positive, with an increasing amount of credit to support the growth and development of the agricultural sector. However, additional investment in agriculture is still needed, especially in areas such as infrastructure, technology, research and development, to fully exploit the sector's potential and support growth and long-term sustainability.

The Government of Nepal has implemented various policies and programs to support the agricultural sector and provide access to credit to farmers and others involved in agriculture. The following are some key policies related to agricultural credit in Nepal.

1. Agricultural Development Bank (ADB) was established in 1968 with the purpose of providing credit to farmers and promoting domestic agricultural development. The bank offers various types of credit, including short, medium and long-term loans to farmers and others involved in agriculture.
2. The Government's agricultural development strategy was implemented in 2015 with the aim of increasing the productivity and competitiveness of the agricultural sector.

The strategy includes various measures to support farmers, including access to credit and other financial services.

3. The Government of Nepal has launched a crop insurance program to provide coverage for farmers' crops in case of natural disasters or other events that could lead to crop loss. The program aims to help farmers manage risk and improve access to credit.
4. The government provides interest subsidy on loans extended by commercial banks and other financial institutions for agriculture and allied activities. The program aims to reduce the cost of credit for farmers and encourage financial institutions to increase lending to the agricultural sector.
5. The government provides interest subsidy on loans issued by commercial banks and other financial institutions for agriculture and allied activities. The program aims to reduce the cost of credit for farmers and encourage financial institutions to increase lending to the agricultural sector. 6. Microfinance institutions (MFIs) play an important role in providing credit to farmers and others involved in agriculture in Nepal. The Government has introduced policies to support the development of microfinance institutions and improve the capacity to provide credit to the agricultural sector.

Overall, these policies and programs aim to improve access to credit for farmers and promote the development of the agricultural sector in Nepal. However, there is still a need for further investment in agriculture, particularly in areas such as infrastructure, technology, and research and development, to support sustainable growth over the long term.

From the above analysis showed that contribution of agriculture to the GDP was more than 62.0 percent before 1980s. It was more than 90.0 percent before 1956 A.D at the time when Nepal Rastra Bank established as a central of Nepal. In the decade of1990s it has been declined to 51.0 percent and it has further declined to 40.0 percent in 2000 A.D. (Paudel, 2015). Then, by now it has been contracted stood around 26.20 percent in 2020. The details of Contribution of Agricultural Sector to overall GDP is presented in table 9 below:

Table 9 Contribution of Agricultural Sector to overall GDP

Year (Mid-July)	Agricultural GDP (%)
2005	34.71
2006	33.09
2007	32.05
2008	31.22
2009	32.54
2010	35.00
2011	36.68
2012	34.82
2013	33.45
2014	32.61
2015	31.27
2016	31.08
2017	29.14
2018	27.58
2019	26.50
2020	26.20

Source: CBS and NRB, 2005-2020

Figure 5 Agricultural GDP (%)

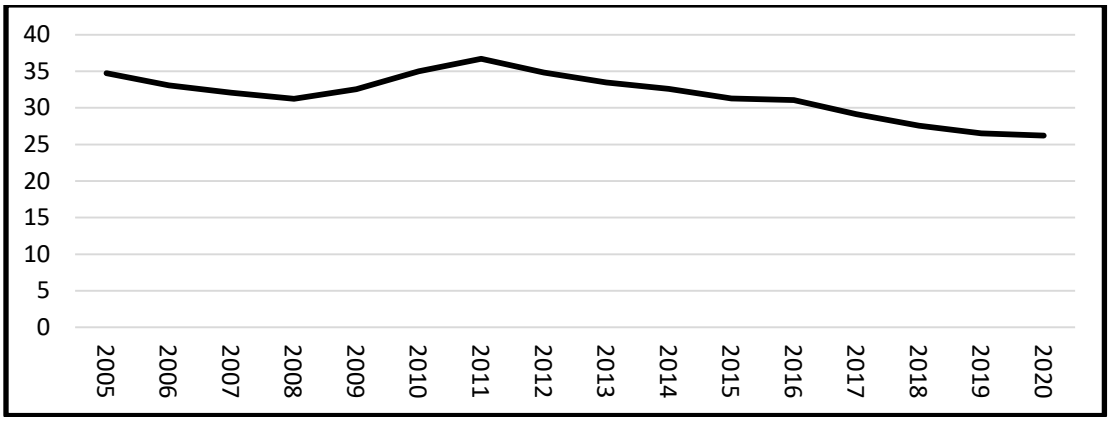


Table no. 9 represents the contribution of agricultural sector's GDP to overall GDP of the

nation. AGDP contributed 34.71 percent to overall GDP and then it decreased and remained 32.54 percent in year 2065/66. Then after, it increased from 2066/67 to 2067/68 to 35 percent and 36.68 percent respectively. The trend of AGDP contribution since 2067/68 remained downward and reached to 26.20 percent in last year of review period. The decreasing trend of AGDP contribution to overall GDP might be due to enhancement of service sector and industrial sector in Nepal. The cost of agricultural machinery like tractors, harvesters, planters and so on are astronomically high and are out of the reach of an average Nepalese farmer. Also included is inadequate supply of critical inputs such as hybrid seeds, fertilizers and agro - chemicals at the appropriate time and at affordable prices have remained major constraints to increased agriculture productivity in Nepal. Consequently, productivity of agriculture sector might be remained low during the last few years.

4.4.2 Importance of Agricultural Credit in Nepal

Nepal is a small, extremely divergent and landlocked country. Agricultural development is the foundation for the economic development in Nepal as one third of GDP is contributed by the Agriculture sector. As per ministry of agricultural and livestock department of Nepal 65 percent of total population of Nepal is directly engaged in this sector and also create the opportunity of employment and also agricultural sector contributes around 27 percent to the national gross domestic product.

Agricultural lending in Nepal has increased over time with the increasing number of bank and financial institutions. The outstanding credit to this sector is from A class, B class and C class financial institutions which is 198.07 billion as of fiscal year 2020. Agricultural credit remains major highlight for central bank hence it has developed mandatory for BFIs to flow certain margin of overall credit to agricultural sector. As per the unified directive issued by NRB for year 2020, it was outlined that class A commercial bank should disburse 11 percent, 13 percent and 15 percent of its total credit to agricultural sector till Ashad end, 2021, Ashad end, 2022 and Ashad end, 2023 respectively. Agricultural credit could play a catalytic role in strengthening the agricultural output volume and augmenting the productivity of scarce resources. When newly developed potential seeds are combined with purchased inputs like fertilizers &

chemicals in appropriate / requisite proportions will result in higher productivity. This could also help farmers to purchase new technologies and that ultimately helps to increase productivity.

Agricultural credit helps the farmers to purchase of new inputs and implements, it also helps to manage the various risk in systematic way, it helps to improve land fertility and marketing of produced crops. Moreover, the credit helps the farmers to cop up with new and emerging challenges and threats.

There are mainly three types of agricultural credit in bank and financial institutions. Short term credit that generally ranges upto one year are disbursed to fulfil short term need and financial obligations. The farmers need short term loan to purchase improved seed, plants, pesticides and other casual expenses. These kinds of credits also taken for paying rents, revenue and also meeting the financial requirements of the family. The short-term credit is repaid after marketing the product of next crop. Midterm credit extends from 1 to 5 year and it helps farmer to improve water resources, purchase of cattle and implements. Long term credit has duration of more than 5 years and need this kind of loan by farmers to make long term changes in agricultural land, purchase of fixed assets like plant & machinery building warehouse, improving irrigation system in large scale.

4.4.3 Sources of Agricultural Credit

4.4.3.1 Traditional Sources of Credit

Traditional sources of non-institutional credit in Nepal include non-institutional credit providers such as moneylenders, landlords, agricultural traders, friends and relatives who serve financial needs of rural farmers. These sources often offer short-term loans with high interest rates, often ranging from 10 to 60 percent. However, interest rates have decreased due to the presence of commercial banks in the villages.

Additionally, there are unique systems like 'Manka-Jya', where cooperative agricultural activities are carried out, and 'Dharma Bhakari', in which villagers contribute grain to communal funds and loans are given. granted to contributors at an interest rate of 10 to 25. percent. “Parma” is another semi-institutional agency that distributes income based

on work completed. “Dhikuri” is a community lending program originating from the Thak area of Mustang district, where members contribute money to help each other start businesses with loans provided at 10 percent interest. In western Kathmandu, many Dhikuri groups operate successfully.

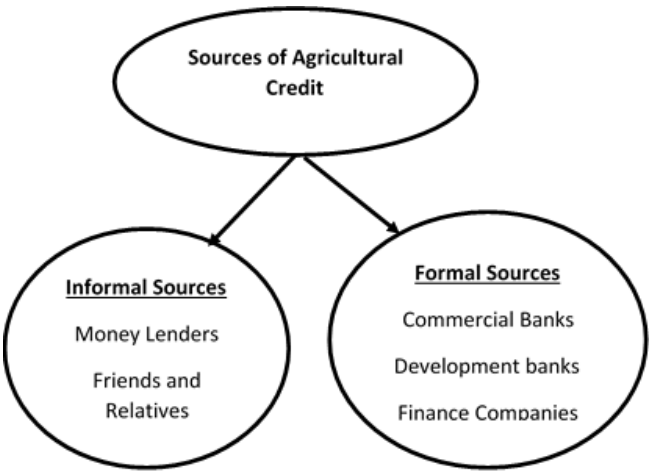


Figure 6 Sources of Agricultural Credit (*Source:* Acharya S.K., 2010)

4.4.3.2 Modern Sources of Credit

Until 1954, farmers were the only merchants and pawnbrokers lending. The government believes that development is not possible without rural development, so it launched the “Ek Gaun Ek Sahakari” program to collect savings and build capital. When Nepal emerged from the Rana regime, the government felt that cooperatives would be the best way to provide credit to farmers. Therefore, the government launched the cooperative movement in 1954/55. The Cooperative Bank was established in 1963 and the Agricultural Development Bank in 1967. After many commercial banks were established, credit disbursement activities developed strongly and had a positive impact on the agricultural sector. Furthermore, in 1976, various banks such as Nepal Bank, Agricultural Development Bank and other commercial financial institutions started providing loans to poor farmers. Today, many commercial banks are established and provide credit for many different purposes. In addition, many cooperatives also operate to collect savings and disburse loans.

Agriculture is the activity of engaging in various agricultural and related activities for

production (credit is needed for farming, short term credit is needed for agriculture related activities), investment and other activities as defined by NRB to meet the needs of farmers. credit and consumer demand. It also has many other purposes which can be discussed below:

1. Grain and industrial crops, vegetable and fruit growing, flower growing and aromatic herb production.
2. Post-harvest (preserving food crops)
3. Raising livestock, poultry, aquatic products and insects.
4. Breeding house/slaughterhouse
5. Irrigation equipment (all culverts, canals, hand pumps, generators, undercarriage pumps), pipes, pumps, etc.
6. Agricultural machinery and tools. (Tractors, threshers, harvesters, modern plows, hoes, cultivators, cultivators, cultivators and other motorized or hand-operated agricultural equipment)
7. Infrastructure/sheds for livestock/birds/fishing etc. Infrastructure for agriculture with special technology such as tunnel farming/spray irrigation, etc.
8. Construction and management of cold storage
9. Other activities as prescribed by NRB in the agricultural sector from time to time

4.4.4 Effort of NRB for Agricultural Credit in Nepal

In Nepal, Agriculture Development Bank (ADB) was established to provide agriculture credit to farmers in 2024 B.S. Likewise, other BFIs were also authorized by NRB to establish and provide the financial services along with others and to extend the agricultural credit, but remained mostly reluctant in this area despite of different types and numbers of BFIs reached more than 164 with around 9,394 branch networks in various geographical areas in Nepal (NRB, 2019). Although, the BFIs, since then, are providing loans to the farmers for meeting their short- and medium-term requirements has not been sufficient and as it is required. It is negligible both in percentage and volume of total loan extended by them. BFIs provide agricultural credits for the purchase of inputs, livestock, tractors, dairy farming, installation of tube wells, etc. The agricultural loans are given to the farmers against the security of land, crops, fixed assets, and even

on personal security. In Nepal BFIs provide loans under the regulated credit scheme of NRB and outside of this scheme. In addition to the BFIs regulated by the NRB, cooperatives are oldest institutional sources of agriculture credit in Nepal but their performance in the spread and utilization of credit to the small farmers is not satisfactory. NRB has made the following efforts since its establishment for the development of agricultural sector and credit to agriculture.

- Establishment of Agriculture Development Bank (2024).
- Directed Credit Program (2031).
- Micro Credits for woman, Third Animal Husbandry Program, Western Poverty Alleviation Program and other targeted credit program in different times in various geographical reasons of Nepal.
- Deprived Sector Lending Requirement to BFIs. At present BFIs of A, B and C class should provide minimum of 5 percent loan in the specified deprived sector.
- Liberal Licensing policy of opening BFIs for making access of rural credit.
- Establishment of Co- operatives with limited banking facilities in the past decade.
- Establishment of Rural Self-Reliant Fund and financing for agriculture groups through cooperatives.
- Mandatory regulation for BFIs to disburse minimum of 20 percent of total loan to the Productive Sector and of which at least 11 percent, 13 percent and 15 percent till mid-july 2021, 2022 and 2023 to agriculture sector. Likewise, both B and C class BFIs made mandatory to disburse minimum of 20 and 15 percent of total loan in the productive sector by mid-July 2024. (NRB, 2021).

4.4.5 Trend and Structure of Agricultural Credit

Nepalese banking sector comprises 27 commercial Banks, 17 Development Banks, 17 Finance Companies, 67 Micro finance Development Banks as at mid- Jan 2022. Likewise, there are 16 cooperatives and 1 infra-structure development bank and 15 other institutions that are licensed by NRB. Financial Institutions collects the scattered deposit from the surplus sector and mobilizes for the capital formation in the productive sector and thereby support economic growth. The presence of branches of commercial banks

reached to 745 local bodies out of 753. Total deposit of BFIs till mid-july 2020 stood at 3923.09 billion and credit stood at 3,477.87 billion. The overall agricultural credit stood at 225.77 billion which became 6 percent over overall credit. NRB directed BFIs to increase this ration to 15 percent till mid-july 2023 (commercial banks) and mid-july 2024 (development banks) as mentioned above. The largest share of such loans flowed in Bagamati province (43 percent) in mid-January 2021. The lowest share of such loans remained in Karnali Province with 1.0 percent (NRB, 2021) which indicates the concentration of agricultural credit in the region. Table 10 and table 11 presents the disbursement of agricultural credit before and after declaration of constitution of Nepal, 2015.

Table 10 Disbursement of Agricultural Credit

(Before Declaration of Constitution of Nepal, 2015)

Year (Mid-July)	Total Credit (in Ten Lakh)	Increase/ Decrease %	Agricultural Credit (in ten Lakhs)	Increase/ Decrease %	Total no. of BFIs	Agro Credit % of total credit
2005	214,835.81	-	4,415.50	-	114	2
2006	235,123.50	9	4,572.00	4	128	2
2007	281,724.85	20	14,770.01	223	144	5
2008	371,726.60	32	14,384.30	-3	173	4
2009	410,334.97	10	15,112.29	5	181	4
2010	509,206.23	24	18,923.02	25	203	4
2011	702,232.15	38	18,278.48	-3	218	3
2012	823,651.64	17	28,794.08	58	214	3
2013	1,022,428.77	24	39,783.84	38	207	4
2014	1,234,360.16	21	50,909.84	28	204	4

Source: NRB 2005-2020

Figure 7 Disbursement of Agricultural Credit

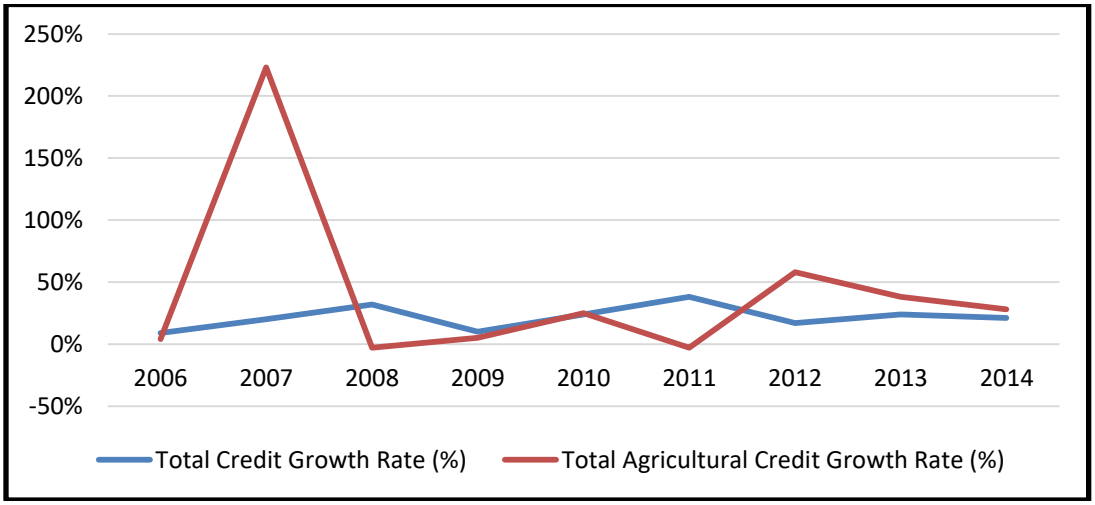


Table 11 Disbursement of Agricultural Credit
(After Declaration of Constitution of Nepal, 2015)

Year (Mid July)	Total Credit (in Ten Lakh)	Increase/ Decrease %	Agricultural Credit (in ten Lakhs)	Increase/ Decrease %	Total no. of BFIs	Agro Credit % of total credit
2015	1,490,106.83	21	65,159.78	28	192	4
2016	1,858,522.63	25	78,791.45	21	179	4
2017	2,138,266.85	15	90,041.16	14	149	4
2018	2,618,885.23	22	135,756.55	51	151	5
2019	3,188,323.80	22	193,457.41	43	170	6
2020	3,477,867.29	9	225,772.40	17	154	6
	Overall CAGR			**29.99%**		

Figure 8 Disbursement of Agricultural Credit

(After Declaration of Constitution of Nepal, 2015)

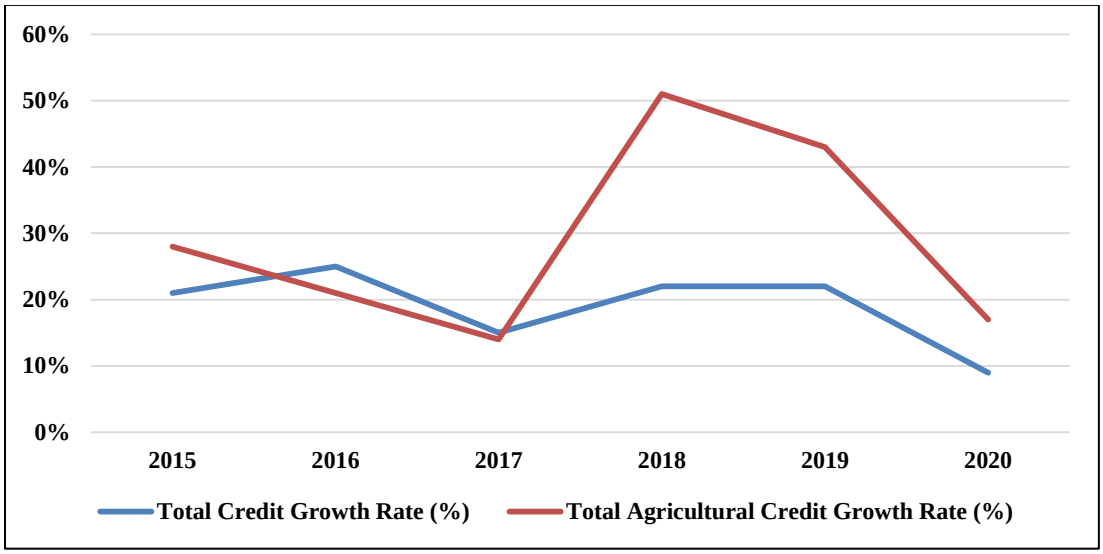


Table no. 10 and 11 shows the trend and structure of overall credit of BFIs and change in agricultural credit disbursement before and after the declaration of Constitution of Nepal, 2072 (2015) which formally divides Nepal in to seven different provinces. The tables indicate that the growth rate of agricultural credit is not proportionately to growth of overall credit. The growth rate of agricultural loan/credit is very low as it was just growing to 6 percent from 2 percent in last 15 years whereas the overall credit was growing rapidly during the period. These facts show that still the mandatory requirement in agriculture credit has not been fulfilled by the BFIs but ready to pay penalty rather than extending loans in the agriculture sector. Despite various effort made by the central bank of Nepal for increasing agricultural credit and expansion of financial services in the rural areas for access and inclusion, BFIs still remain reluctant to extend the loan in the targeted areas. Some progress in this matter has been achieved in the past few years along with the announcement of mandatory productive sector credit policy and deprived sector credit policy but still the agriculture financing has not been reachable to the required areas and people both in urban and rural areas of Nepal.

As indicated in table, the margin of agriculture credit to total credit is still remains in single digit i.e., 6 percent. The loan portfolio of BFIs has very less exposure over agro

loan which reflects the reluctance of BFIs providing agro focused loan. The compounding annual growth rate of agro loan over the last 15 years is 29.99 percent but the growth rate is decreased in year 2020 from 43 percent to 17 percent. Nepal Rastra Bank has directed BFIs to maintain at least 15 percent loan exposure to this sector till 2023. This reflects the seriousness of central bank towards the development of economy via sustainable growth of agricultural sector.

4.5 Enhancement of BFIs in Nepal

The financial market has formal and informal segments. Informal intermediaries only provide credit facilities while formal intermediaries provide savings, credit and remittance services. Farmers must choose wisely the number of services they will use in each market. In cases where informal intermediaries only provide credit, farmers must choose whether to use credit or not. Farmers have the right to choose between these services or combine them, as formal financial intermediaries provide savings, credit and remittance services. Any economy – developed, growing, transitional or emerging – looks to its financial sector as the foundation or engine of growth.

Any economy – developed, growing, transitional or emerging – looks to its financial sector as the foundation or engine of growth. It plays a very important role in the development of all sectors of the economy and effectively acts as a lubricant by providing financial resources. It acts as an intermediary between surplus and deficit financial units, i.e., lenders/savers and borrowers/spenders. It offers various opportunities to savers to invest their savings in financial products and services as per their needs and provide funds to borrowers/investors at competitive rates most competitive. Financial markets provide a playground for financial institutions and their customers (depositors, borrowers, investors, etc.) with all types of financial instruments such as deposits, loans and advances, securities, credit policies, insurance, corporate bonds and stocks, etc. The modern financial sector offers electronic banking (ebanking) services, ATM services, credit cards, debit cards, innovative insurance products and services, pension schemes and products. Attractive derivatives, risk prevention and futures finance. It can provide a wider range of financial services at lower costs while minimizing financial risks for a

large number of customers.

The history and development of the Nepal banking system can be explained in terms of different stages of development. The modern banking system came into being since the establishment of Nepal Bank Limited on November 15, 1937 with authorized capital 1 crore, issued capital 25 lakh and 8.42 lakh paid up capital. The central bank of Nepal, Nepal Rastra Bank, was established on 26 April 1956 under the Napal Rastra Bank Act of 1955. The central bank of Nepal officially launched the banknote system from 19 February 1960 by introducing banknotes of 1, 5, 10 and 100. Rastriya Banijya Bank and Agricultural Development Bank were established on 23 January 1966 and 21 January 1968 respectively.

The second phase of the banking industry development process, also known as the banking industry liberalization process. During this period, various private banks were established in Nepal. Nepal Arab Bank Ltd., Nepal's first private sector bank, was established on 12 July 1984, followed by Grindlays Bank Ltd. and Himalayan Bank Ltd., established on January 30, 1987 and January 18, 1993, respectively. The details of quantitative growth of financial intermediaries on different phases is presented below:

Table 12 Quantitative Growth of Financial Intermediaries

Category of Financial Institution	**First Phase (1937-1956)**	**Second Phase (1957-2002)**		**Third Phase (2003-current: Mid-July, 2021)**
		Sub-period A (1984)	**Sub-period B (2002)**	
Commercial Banks	1	4	18	27
Development Banks	-	1	9	18
Finance Companies	-	-	51	17
Microfinance	-	-	46	70
Saving and Credit Cooperatives	-	-	16	-
Other Institutions	-	-	-	15
Infrastructure Development Bank	-	-	-	1
Total	1	5	140	148

Source: NRB, 2021

Third Stage of Banking sector development was focused on legal improvement of financial sector. In this stage various legal provisions regarding banking sector were introduced. Financial Sector Reform Strategy (FSSS) was introduced in 2000 in coordination with Government of Nepal, Nepal Rastra Bank and International Monitory Fund. Nepal Rastra Bank Act, 2002 prescribed and established it as an independent regulator of financial sector. Bank and Financial Institution related ordinance was passed on 4th February 2004 and the concept of universal banking was introduced in Nepalese banking sector that categories banking entities in to four different categories A, B, C and D.

The fourth stage of development of banking sector is considered as improvement and reform of financial sector. During this stage central bank has restricted to provide license to bank and financial institutions. Merger and Acquisition of Bank and Financial Institution related regulation, 2017 was introduced and the required minimum paid up capital of commercial bank was hiked by 4 times to 8 arab through monitory policy of year 2015. The Quantitative Growth of Bank and Financial Institutions is presented in table 13.

Table 13 Quantitative Growth of Bank and Financial Institutions

Year (Mid July)	Types of BFIs				
	Commercial Banks	Development Banks	Finance Companies	Microfinance	Total No. of BFIs
1983	2	2	-	-	4
1984	3	2	-	-	5
1985	3	2	-	-	5
1986	4	2	-	-	6
1987	5	2	-	-	7
1988	5	2	-	-	7
1989	5	2	-	-	7
1990	5	2	-	-	7
1991	5	2	-	-	7
1992	5	2	1	-	8
1993	8	2	8	2	20
1994	8	2	28	2	40
1995	10	3	30	4	47
1996	11	3	37	4	55
1997	11	3	42	6	62
1998	11	5	44	6	66
1999	13	7	46	7	73

2000	13	7	47	7	74
2001	15	8	48	8	79
2002	16	11	54	11	92
2003	17	11	57	11	96
2004	17	14	58	11	100
2005	17	26	60	11	114
2006	18	29	70	11	128
2007	20	38	74	12	144
2008	25	58	78	12	173
2009	26	63	77	15	181
2010	27	79	79	18	203
2011	31	87	79	21	218
2012	32	88	70	24	214
2013	31	86	59	31	207
2014	30	84	53	37	204
2015	30	76	48	38	192
2016	28	67	42	42	179
2017	28	40	28	53	149
2018	28	33	25	65	151
2019	28	29	23	90	170
2020	27	20	22	85	154
2021	27	18	17	70	132

Source: NRB, 2021

Table no. 13 gives clear idea over the development of bank and financial institutions in Nepal since year 1983. There were two commercial banks and two development banks in Nepal but there are 132 bank and financial institutions in Nepal as of year 2021. The increase in the number of BFIs also increases the financial activities in the economy and provide significant boost to credit creation and money supply.

Currently, there are 144 bank and financial institutions, out of which 27 are Class "A" (Commercial Bank), 17 are Class "B" (Development bank), 17 are Class "C" (Finance Companies) 67 Class "D" (Microfinance Institutions), 1 is Infrastructure Development Bank and remaining 15 are Other Institutions as of Mid-Jan 2022.

4.6 Analysis of Portion of Agricultural Credit on Total Credit and Agricultural Output

Generally, the loan increases the investment and investment increases the volume of production and growth of the product. This general conclusion may also apply to the agricultural sector. The agricultural loan portfolio of overall loan is just 6 percent in Nepal as this sector contributing 66 percent on employment and 26.2 percent of overall

GDP of the nation. The agricultural credit is growing slightly in Nepal due to mandatorily requirement prescribed by central bank of Nepal and ultimately the output is also increasing in volume. Table 14 presents the portion of agro credit and growth in agro output.

Table 14 Portion of Agro credit and growth in agro output

Year	Credit (in ten Lakhs)	% of total loan	Output (in 000 mt. ton)	Increase /(Decrease)%
2005	4,415.50	2	7,477.00	-
2006	4,572.00	2	7,365.00	-1.50
2007	14,770.01	5	7,044.00	-4.36
2008	14,384.30	4	8,069.00	14.55
2009	15,112.29	4	8,115.00	0.57
2010	18,923.02	4	7,762.00	-4.35
2011	22,896.05	3	8,614.84	10.99
2012	26,021.44	3	9,457.00	9.78
2013	37,005.09	4	8,737.05	-7.61
2014	47,300.71	4	9,562.35	9.45
2015	60,769.00	4	9,266.24	-3.10
2016	76,360.60	4	8,614.29	-7.04
2017	91,834.50	4	9,772.42	13.44
2018	111,941.08	5	10,009.37	2.42
2019	155,176.25	6	10,685.55	6.76
2020	198,074.49	6	10,935.66	2.34

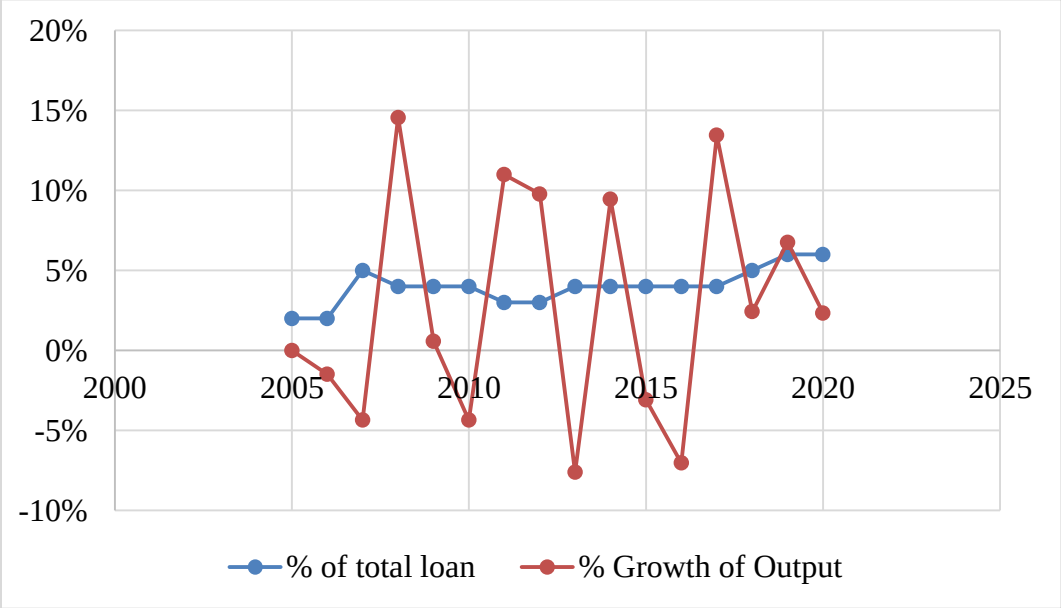


Figure 9 Agricultural Credit % vs Food Crops Output Growth %

As presented in table 14 and Figure – 9, the increasing portion of agricultural credit have both positive and negative impact in output of food crops. We can see that when agricultural credit portion on overall portfolio was 2 percent and 5 percent the output was decreased by 1.50 percent and 4.36 percent respectively. But when it went up to 4 percent, the productivity also increased by 14.55 percent in year 2008, 13.44 percent in year 2017. Recently, when the portion of agricultural credit was 6 percent it again increased by 6.76 percent and 2.34 percent respectively in 2019 and 2020.But the growth rate was limited to 2.34 percent at the end of the review period. But due to the stagnant growth in agricultural credit since last 16 years the productivity of such loan also remains volatile.

4.7 Unit Root Test for Stationarity

A unit root test, also known as a unit root test for stationarity, is a statistical test used in time series analysis to determine whether a time series dataset is stationary or non-stationary. Stationarity is an important concept in time series analysis because many time series models assume that the data is stationary. A stationary time series is one whose statistical properties, such as mean, variance, and autocorrelation, do not change over time.

Table 15 Unit Root Test for Stationarity

Variable	Type	Level		First Difference		Second Difference		Remarks
		ADF Statistics	p-value	ADF Statistics	p-value	ADF Statistics	p-value	
CROP_OUTPUT	Dependent	-0.35	0.89	-5.74	0.0006*			Integrated at i(1)
AGRO_CREDIT	Independent	-0.74	0.81	-5.46	0.0016*			Integrated at i(1)
LAND_AREA	Independent	-2.27	0.19	-5.09	0.0015*			Integrated at I1)

* represents significance at 5%.

Source: Author's computation using E-views 10

CROP_OUTPUT represents natural log of agricultural output of food crops, AGRO_CREDIT represents natural log of agricultural credit of BFIs, LAND_AREA

represents natural log of cultivation land area. For ARDL model to be used, dependent variable must be stationary at first difference and independent variables at either I(1) or I(0) and none of the variables should be stationary at I(2).The variables above satisfy the condition for ARDL model. Hence ARDL model can be used. The stationarity condition to run ARDL is satisfied. Hence, ARDL-based co-integration test can be undertaken.

4.8 Lag Length Selection

To run ARDL test, appropriate lag length should be selected. AIC test is used to select the appropriate lag for the study. Lag length selection is an important step when estimating time series models, particularly autoregressive (AR), moving average (MA), and autoregressive integrated moving average (ARIMA) models. The lag length refers to the number of past observations included in the model to capture the temporal dependencies in the data. Selecting the appropriate lag length is crucial for obtaining accurate and reliable model forecasts.

Table 16 VAR lag order selection criteria

VAR Lag Order Selection Criteria
Endogenous variables: CROP_OUTPUT AGRO_CREDIT LAND_AREA
Exogenous variables: C
Date: 09/15/23 Time: 12:22
Sample: 2005 2020
Included observations: 13

Lag	LogL	LR	FPE	AIC	SC	HQ
0	41.05586	NA	5.76e-07	-5.854748	-5.724375	-5.881545
1	77.90767	51.02558*	8.43e-09*	-10.13964	-9.618150	-10.24683
2	85.50969	7.017250	1.44e-08	-9.924568	-9.011957	-10.11215
3	104.8371	8.920337	8.95e-09	-11.51340*	-10.20967*	-11.78137*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Author's computation using E-views 10

We can select the order of lags by either the Akaike Information Criterion (AIC) or the Schwarz Bayesian Criterion (SBC) as they are frequently used in most of the research papers with time-series data. While selecting lag order, we need to select the regression that gives us least residual value considering negative sign of the number given by different lag selection criteria. Additionally, we can consider the lag selection criteria that yields the highest adjusted R-squared value. Among these, AIC has the smallest digit i.e. -11.51, which is a cause for concern because the premise is that the smaller the residual value, the better the model. As per VAR Lag Order Selection Criteria in the above table, lag 3 is selected based on AIC criteria for each variable in their autoregressive distributed lag structures.

4.9 Long Run Bound Test

A long-run bound test, often referred to as a cointegration test or cointegration analysis, is a statistical method used in econometrics to determine whether there is a long-term relationship or equilibrium between two or more time series variables. This test is particularly useful when analyzing economic and financial data, as it helps to understand how different variables interact over the long term.

Selected Lag:
CROP_OUTPUT:1,
AGRO_CREDIT:3,
LAND_AREA: 3

Estimation:
CROP_OUTPUT = C(1)*CROP_OUTPUT(-1) + C(2)*AGRO_CREDIT +
C(3)*AGRO_CREDIT(-1) + C(4)*AGRO_CREDIT(-2) + C(5)*AGRO_CREDIT(-3) +
C(6)*LAND_AREA + C(7)*LAND_AREA(-1) + C(8)*LAND_AREA(-2) +
C(9)*LAND_AREA(-3) + C(10)

Results:

Table 17 Conditional Error Correction Regression

ARDL Long Run Form and Bounds Test
Dependent Variable: D(CROP_OUTPUT)
Selected Model: ARDL(1, 3, 3)
Case 2: Restricted Constant and No Trend
Date: 09/15/23 Time: 12:22
Sample: 2005 2020
Included observations: 13

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-46.69834	9.283355	-5.030331	0.0151
CROP_OUTPUT(-1)*	-1.262839	0.343359	-3.677900	0.0348
AGRO_CREDIT(-1)	0.079908	0.027710	2.883765	0.0633
LAND_AREA(-1)	3.966622	0.637256	6.224530	0.0084
D(AGRO_CREDIT)	0.262666	0.057051	4.604073	0.0193
D(AGRO_CREDIT(-1))	0.199682	0.052811	3.781058	0.0324
D(AGRO_CREDIT(-2))	0.103239	0.041326	2.498162	0.0878
D(LAND_AREA)	2.077813	0.448540	4.632390	0.0189
D(LAND_AREA(-1))	-0.533432	0.249407	-2.138801	0.1220
D(LAND_AREA(-2))	-0.485765	0.162075	-2.997155	0.0578

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGRO_CREDIT	0.063277	0.007199	8.789614	0.0031
LAND_AREA	3.141035	0.677242	4.637980	0.0189
C	-36.97885	12.44826	-2.970604	0.0590

EC = CROP_OUTPUT - (0.0633*AGRO_CREDIT + 3.1410*LAND_AREA
-36.9789)

Source: Author's computation using E-views 10

As detailed in above table, in the long-run, agricultural credit has a significant (p-value=0.0031<0.05) and positive impact on crop output. This means a 1 percent increase in the agro_credit leads to 0.06 percent increase in the crop output. The impact of land area is also significant and positive. A 1 percent increase in the cultivable land area leads to 3.14 percent increase in the crop output. In the long run, the impact of land area is higher than the agricultural credit. This means, crop production can be increased with the access to more cultivable land.

4.10 F – Bound Test

Table no. 18 shows the long-run relationship of food production with agricultural credit and land area. The F-statistics 10.60727>3.87 at 5 percent significance level. Since F-

statistics is higher than I(1) at 5 percent significance level, the null hypothesis "No long-run co-integration" is rejected. Hence, there exists a long-run co-integration between the dependent variable and regressors.

Table 18 F-Bounds Test

F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	10.60727	10%	2.63	3.35
K	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Source: Author's computation using E-views 10

4.11 Error Correction Form

In error correction models (ECM) like the Autoregressive Distributed Lag (ARDL) model, it also estimates the relationship between variables in levels and differences. The error correction form is used to capture the long-run equilibrium relationship between the variables.

Table 19 ECM Regression

ARDL Error Correction Regression
Dependent Variable: D(CROP_OUTPUT)
Selected Model: ARDL(1, 3, 3)
Case 2: Restricted Constant and No Trend
Date: 09/15/23 Time: 12:23
Sample: 2005 2020
Included observations: 13

ECM Regression

Case 2: Restricted Constant and No Trend

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(AGRO_CREDIT)	0.262666	0.020661	12.71334	0.0010
D(AGRO_CREDIT(-1))	0.199682	0.030968	6.448042	0.0076
D(AGRO_CREDIT(-2))	0.103239	0.021811	4.733227	0.0179

D(LAND_AREA)	2.077813	0.134919	15.40040	0.0006
D(LAND_AREA(-1))	-0.533432	0.154284	-3.457479	0.0407
D(LAND_AREA(-2))	-0.485765	0.096635	-5.026811	0.0152
CointEq(-1)*	-1.262839	0.137089	-9.211847	0.0027

R-squared	0.987295	Mean dependent var	0.033846
Adjusted R-squared	0.974590	S.D. dependent var	0.073546
S.E. of regression	0.011724	Akaike info criterion	-5.750688
Sum squared resid	0.000825	Schwarz criterion	-5.446485
Log likelihood	44.37947	Hannan-Quinn criter.	-5.813216
Durbin-Watson stat	2.272608		

Source: Author's computation using E-views 10

As presents in Table no. 19, In the short-run, AGRO_CREDIT is positive and significant. A 1 percent increase in agricultural credit leads to 0.26 percent increase in the food production. The changes (increase or decrease) in agricultural credit in previous periods (last year, and the year before last year) also significantly affects the food production. The impact of the availability of cultivable land area is highly significant as a percent increase in the land area leads to 2.08 percent increase in the crop production in the short run. The coefficient of one period lagged error correction term, i.e. CointEq(-1), is -1.26. This coefficient is negative and statistically significant. Thus, the error correction term further supports the existence of co-integration of the dependent variable (CROP_OUTPUT) with the regressors included in the estimates. Further, the size of CointEq(-1) is -1.26 suggests that about 13.7 percent of the disequilibrium caused by previous period's shocks in the system converges back to the long run equilibrium. The coefficient of determination, i.e. R-squared, is 0.9873 explaining 98.73 percent goodness of fit. The degree of goodness of fit is high, meaning that the model properly explains CROP_OUTPUT.

4.12 Diagnostic Tests

a. <u>Ramsey RESET Test</u>

H_0= No evidence of misspecification
H_1= Evidence of misspecification

Ramsey RESET Test

Equation: UNTITLED
Specification: CROP_OUTPUT CROP_OUTPUT(-1) AGRO_CREDIT AGRO_CREDIT(-1) AGRO_CREDIT(-2) AGRO_CREDIT(-3) LAND_AREA LAND_AREA(-1) LAND_AREA(-2) LAND_AREA(-3) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.825274	2	0.4960
F-statistic	0.681077	(1, 2)	0.4960

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000209	1	0.000209
Restricted SSR	0.000825	3	0.000275
Unrestricted SSR	0.000615	2	0.000308

The value of t-statistics and f-statistics are 0.4960 and 0.4960. These values are greater than 0.05, meaning that they exceed 5 percent significance level. Therefore, the study accepts the null hypothesis that there is no evidence of model misspecification.

b. Heteroskedasticity Test

H_0=Homoscedasticity or constant variance of the residuals
H_1= Heteroskedasticity or non-constant variance of the residuals

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.449930	Prob. F(9,3)	0.8451
Obs*R-squared	7.467591	Prob. Chi-Square(9)	0.5886
Scaled explained SS	0.299897	Prob. Chi-Square(9)	1.0000

The probability of f-statistics and Obs*R-squared are 0.85 and 0.59 resepctively. Both values ar greater than 5 percent significance level, meaning that the null hypothesis of constant variance of the residuals is accepted.

c. Serial Correlation Test

H_0= No serial correlation
H_1= Serial correlation

Breusch-Godfrey Serial Correlation LM Test:

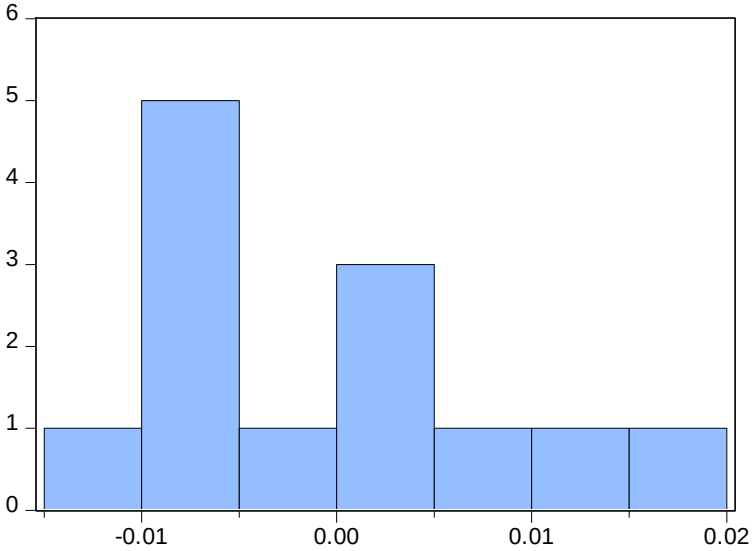
F-statistic	0.474172	Prob. F(2,1)	0.7164
Obs*R-squared	6.327670	Prob. Chi-Square(2)	0.0423

The probability value of f-statistics is 0.7164, which is greater than 0.05. This means the null hypothesis is accepted, i.e. there is no serial correlation in the data set.

d. Normality test

H_0= There is normality in the residuals

H_1= There is non-normality in the residuals

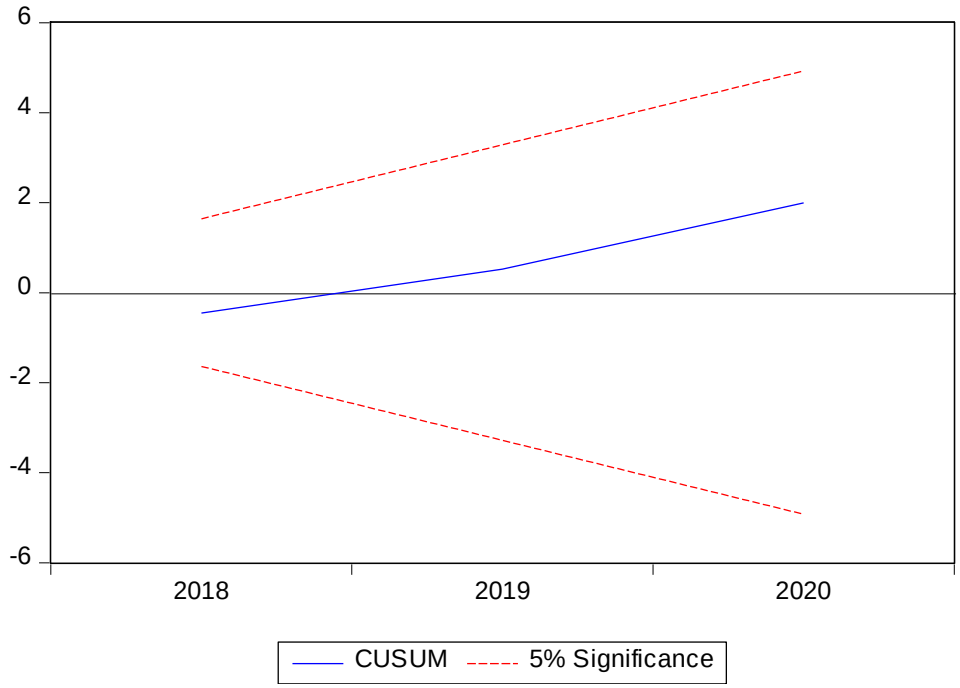


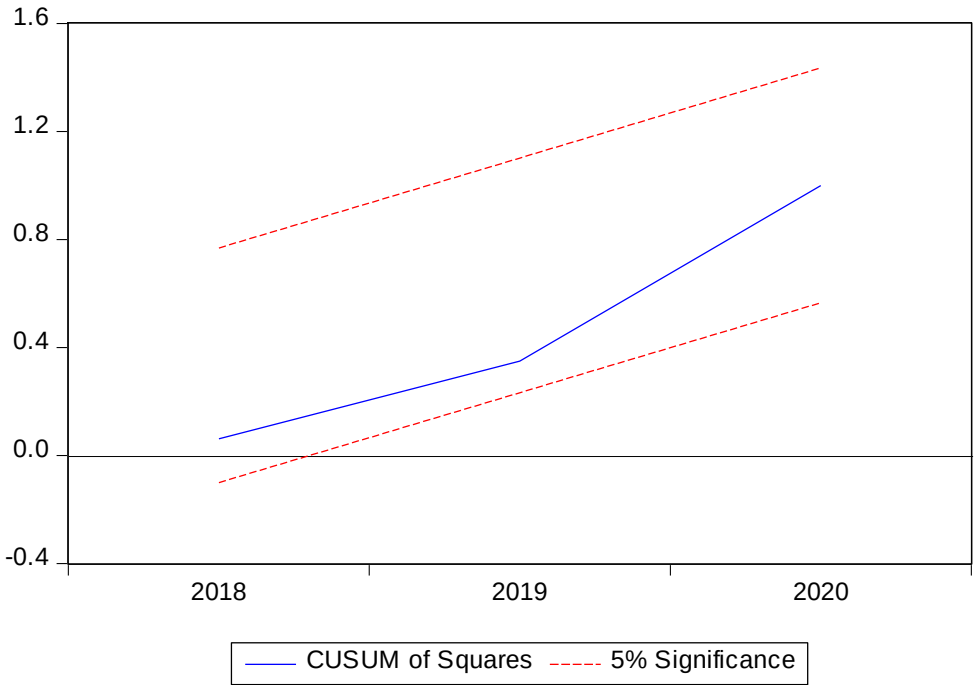
Series: Residuals	
Sample 2008 2020	
Observations 13	
Mean	7.65e-15
Median	-0.002634
Maximum	0.016674
Minimum	-0.010119
Std. Dev.	0.008290
Skewness	0.771121
Kurtosis	2.508223
Jarque-Bera	1.419359
Probability	0.491802

Jarque-Bera statistics is 1.42 with a probability value 0.49, which exceed 5 percent significance level. This indicates acceptance of the null hypothesis, i.e. the residuals are normally distributed.

e. Stability/ Recursive Test Results

Figure 10 Plot of Cumulative Sum of Recursive Residuals





The stability diagnostics examine whether the parameters of the estimated model are stable or not. The CUSUM and the CUSUMSQ tests proposed by Brown, Durbin, and Evans (1975) have been applied to test the stability of the model. In figure 10 CUSUM and CUSUMQ test show significant results as both of the graphs lie within upper bounds and lower bounds.

4.14 Discussion

This study analyzes the impact of institutional credit finance on food production in Nepal using 16 years of secondary data from 2005 to 2020. It aims to understand the relationship between agricultural credit, cultivation land area, and food production. The research reveals that agricultural credit has a positive impact on food production, with a 1 percent increase in credit leading to a 0.06 percent increase in food production in the long run. Cultivation land area also has a significant positive effect, with a 1 percent increase resulting in a 3.14 percent increase in food production. In the short run, agricultural credit shows a positive and significant impact, with a 1 percent increase leading to a 0.26 percent rise in food production. The study concludes that improving access to credit and expanding cultivation land can enhance food production in Nepal, which is crucial for the country's agricultural economy and overall growth.

The findings of this study align with similar research conducted by Ngong et al. (2022), which emphasizes the importance of increasing bank credit flow to the agricultural sector to boost productivity. However, it contradicts the results of a study by Raynica (2020), which suggests a negative impact of credit access on productivity among farmers. Notably, this study shares a common observation with Rahman et al. (2014) that credit finance has a relatively limited impact on food production, highlighting the need for improvements in the financial support provided to the agricultural sector to drive economic growth in Nepal, given its agricultural economy's significance.

CHAPTER V
SUMMARY AND CONCLUSIONS

5.1 Summary

The present study has been under taken to examine the impact of agricultural credit to the food production in Nepal. The study is based on the secondary data of last sixteen years from different sources. The study keeps food crops as dependent variable and agricultural credit and cultivating land area as independent variables. The contribution of agriculture sector to overall GDP of Nepal remains 24.92 percent, 26.21 percent and 25.83 percent respectively in year 2018/19, 2019/20 and 2020/21. Since agriculture is the backbone of Nepalese economy, it provides livelihood for two-third of Nepalese people. Agriculture is the key entry point for poverty reduction and ensuring national food and nutritional security of the people in Nepal.

Agricultural output is important to maintain balance of payment and mitigate trade deficit of Nepal. The 55.8 percent of major export of Nepal in Year 2020/2021 comes from agricultural sector. This also reflected that agriculture is the major source of National Income. The quantitative growth of Bank and financial institution remains significant in last few decades. There were total four bank and financial institutions in Nepal in year 1983 and it increases to 132 in year 2021. 21 percent of total land area of Nepal i.e. 3,091,000 hector are cultivated land where as 7 percent of total land area i.e. 1,030,000 hector land is still remains uncultivated. The compounding growth rate of cultivating land area is merely 0.66 percent in last 15 years.

There are mainly three types of agricultural credit in bank and financial institutions. Short term credit that generally ranges up to one year are disbursed to fulfil short term need and financial obligations. Mid - term credit extends from 1 to 5 year and it helps farmer to improve water resources, purchase of cattle and implements. Long term credit has duration of more than 5 years and need this kind of loan by farmers to make long term changes in agricultural land, purchase of fixed assets like plant & machinery building

warehouse, improving irrigation system in large scale. There are mainly two types of sources of agricultural credit i. Traditional Sources of Credit ii. Modern Sources of Credit. Traditional or informal sources of credit can be Money Lenders of village, Friends and Relatives, Shopkeepers and Commission Agents. Formal or modern sources of credit can be Commercial Banks, Development banks, Finance companies, Microfinance and Co-operatives. NRB has prescribed Mandatory regulation for BFIs to disburse minimum of 20 percent of total loan to the Productive Sector and of which at least 11 percent, 13 percent and 15 percent till mid-july 2021, 2022 and 2023 to agriculture sector. Likewise, both B and C class BFIs made mandatory to disburse minimum of 20 and 15 percent of total loan in the productive sector by mid-July 2024.

The margin of agriculture credit to total credit is still remains in single digit i.e. 6 percent. The loan portfolio of BFIs has very less exposure over agro loan which reflects the reluctance of BFIs providing agro focused loan. The compounding annual growth rate of agro loan over the last 15 years is 29.99 percent but the growth rate is decreased in year 2020 from 43 percent to 17 percent. When agricultural credit portion on overall portfolio was 2 percent, the output was increased by 2.11 percent but when it went up to 4 percent, the productivity also increased by 12.59 percent in year 2008, 10.52 percent in year 2017. Recently, when the portion of agricultural credit was 6 percent it again increased by 6.97 percent but the growth rate was limited to 0.25 percent at the end of the review period. But due to the stagnant growth in agricultural credit since last 15 years the productivity of such loan also remains volatile.

The results of the ADF test shows that all the variables have unit root in the level form but stationary after first differencing which means that all the variables are integrated of order one. In the long-run, agricultural credit has a significant (p-value=0.0031<0.05) and positive impact on food production. This means a 1 percent increase in the agricultural credit leads to 0.06 percent increase in the food production. The impact of land area is also significant and positive. A 1 percent increase in the cultivable land area leads to 3.14 percent increase in the food production. In the long run, the impact of land area is higher than the agricultural credit. This means, crop production can be increased with the access

to more cultivable land. Low impact of agricultural credit may be due to several reasons in Nepal. In the short-run, agricultural credit is positive and significant. A 1 percent increase in agricultural credit leads to 0.26 percent increase in the food production. The changes (increase or decrease) in agricultural credit in previous periods (last year, and the year before last year) also significantly affects the food production. The impact of the availability of cultivable land area is highly significant as a percent increase in the land area leads to 2.08 percent increase in the crop production in the short run. The coefficient of one period lagged error correction term, i.e. CointEq(-1), is -1.26. This coefficient is negative and statistically significant. Thus, the error correction term further supports the existence of co-integration of the dependent variable food production (CROP_OUTPUT) with the regressors included in the estimates. Further, the size of CointEq(-1) is -1.26 suggests that about 13.7 percent of the disequilibrium caused by previous period's shocks in the system converges back to the long run equilibrium. The coefficient of determination, i.e., R-squared, is 0.9873 explaining 98.73 percent goodness of fit. The degree of goodness of fit is high, meaning that the model properly explains food production (CROP_OUTPUT).

5.2 Conclusion:

According to the study, the agricultural sector's contribution to GDP is declining as a result of the expansion of services in non-agricultural sectors and a change in national priorities toward the industrial and service sectors. The data reveals, however, that financing to the agricultural sector has increased dramatically year over year. This increase in lending may be the result of shifting government priorities that place more emphasis on the agriculture sector through lending to priority sectors as well as the growth of the financial sector, which has widened access to credit.

The research confirms the existence of cointegration between agricultural loans and food production, which was the study's explicit goal. Over the course of the study period, the long-run model reveals a strong and positive link between the variables; additionally, the relationship is also significant in the short-run. Based on this finding and a few other studies conducted in the context of Nepal, it can be concluded that financing to the

agricultural sector benefits Nepal and increases food productivity. According to these findings, credit has made it possible to vary the input mix and employ purchased inputs more frequently. Food production and agricultural loans appear to have a minor but positive influence in Nepal. This might be because of a number of things, such as a somewhat limited sample size and problems with credit distribution and spending in the nation. Due to illiteracy and the perceived risk of repaying debt, many real farmers in Nepal could not have access to financing (Bhatta, 2014). Credit investments may also not be used as planned, may be as a result of insufficient bank and financial institution oversight. All of these elements may play a role in Nepal's poor observed correlation between agricultural loans and food output. Additionally, because only credit from banks and other financial institutions is taken into consideration, the credit flow analyzed does not adequately reflect the entire credit flow to the agriculture sector in Nepal as a whole. This implies that other lending sources, like microfinance organizations, cooperatives, and government initiatives, are not taken into account in the analysis. This might have an impact on how agricultural finance and food production are related since these extra sources of credit might have a distinct effect on the industry.

5.3 Recommendations

Since 7 percent of Nepal's land is still uncultivated, a focus on increasing agricultural productivity and food production should be made. This can be done by practicing intensive farming, implementing new technologies, making organic and chemical fertilizers easily accessible, using better seeds, and developing irrigation systems. Data on food production from 2016 to 2020 shows that the government of Nepal's efforts to implement several programs, including the establishment of the Prime Minister Agricultural Modernization Project, a program to provide subsidies for agriculture, insurance for livestock and medicinal herbs, agricultural inputs, and cooperative farming, were successful. Plans and programs of this nature are required to boost the agriculture sector's productivity. Banks and financial institutions have doubts about the agriculture sector's ability to repay loans. As a result, they expect a large mortgage and a farmer's yearly income. Consequently, small farmers have limited access to agricultural credit. Agricultural insurance policies should be implemented to address this issue, and fair

market prices for agricultural products should be guaranteed. According to the report, agricultural finance has improved food production in Nepal. Farmers will have easier access to better crops, fertilizer, insecticides, and irrigation systems with such a loan facility. Therefore, even in rural areas, farmer-friendly agricultural financial services should be expanded and improved. It will assist farmers in rural areas in achieving greater technical proficiency and increased farm productivity.

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APPENDIX: A

Raw data used in empirical analysis:

Year	Major Food Crops Output (in kg.)	Agricultural Credit of BFIs (in NRs.)	Cultivating Land Area (in Kattha)	Chemical Fertilizer Used (in Kg.)	Government Capital Expenditure (in NRs.)
2005	7,477,000,000.00	4,415,500,000.00	103,595,076.00	122,706,000.00	2,638,300,000.00
2006	7,365,000,000.00	4,572,000,000.00	103,935,246.00	91,553,000.00	2,975,000,000.00
2007	7,044,000,000.00	14,770,010,000.00	102,241,791.00	90,848,000.00	4,605,400,000.00
2008	8,069,000,000.00	14,384,300,000.00	113,220,408.00	53,753,000.00	6,443,000,000.00
2009	8,115,000,000.00	15,112,290,000.00	113,894,832.00	12,810,000.00	6,659,300,000.00
2010	7,762,000,000.00	18,923,020,000.00	113,454,090.00	10,329,000.00	9,390,500,000.00
2011	8,614,840,000.00	18,278,484,670.97	116,777,698.80	110,013,000.00	9,526,000,000.00
2012	9,457,000,000.00	28,794,083,336.32	114,995,208.00	144,813,000.00	10,562,200,000.00
2013	8,737,050,000.00	39,783,838,311.08	110,767,042.80	176,963,000.00	11,670,100,000.00
2014	9,562,350,000.00	50,909,843,385.23	115,401,341.40	232,189,000.00	14,463,700,000.00
2015	9,266,240,000.00	65,159,776,093.84	112,614,905.40	298,677,000.00	17,751,400,000.00
2016	8,614,290,000.00	78,791,454,301.18	110,372,741.40	327,520,000.00	25,312,500,000.00
2017	9,772,420,000.00	90,041,163,963.84	117,014,043.00	328,217,000.00	38,319,300,000.00
2018	10,009,370,000.00	135,756,552,066.56	113,848,983.00	348,734,000.00	36,104,300,000.00
2019	10,685,550,000.00	193,457,405,290.12	115,548,058.20	344,004,000.00	16,769,200,000.00
2020	10,935,660,000.00	225,772,404,494.20	114,404,495.40	394,595,000.00	14,258,100,000.00

APPENDIX: B

Logarithmic Value of raw data used in empirical analysis:

Year	MajorFood Crops Output (in kg.)	Agricultural Credit of BFIs(in NRs.)	Cultivating Land Area (in Kattha)	Chemical Fertilizer Used (in Kg.)	Government Capital Expenditure (in NRs.)
2005	22.74	22.21	18.46	18.63	21.69
2006	22.72	22.24	18.46	18.33	21.81
2007	22.68	23.42	18.44	18.32	22.25
2008	22.81	23.39	18.54	17.80	22.59
2009	22.82	23.44	18.55	16.37	22.62
2010	22.77	23.66	18.55	16.15	22.96
2011	22.88	23.63	18.58	18.52	22.98
2012	22.97	24.08	18.56	18.79	23.08
2013	22.89	24.41	18.52	18.99	23.18
2014	22.98	24.65	18.56	19.26	23.39
2015	22.95	24.90	18.54	19.51	23.60
2016	22.88	25.09	18.52	19.61	23.95
2017	23.00	25.22	18.58	19.61	24.37
2018	23.03	25.63	18.55	19.67	24.31
2019	23.09	25.99	18.57	19.66	23.54
2020	23.12	26.14	18.56	19.79	23.38