CHAPTER – I

INTRODUCTION

1.1 Background of the Study

Nepal is a country having an agrarian economy with its two-third of the population involving in agriculture. Agriculture is chiefly recognized as a mainstream economic sector in Nepal for the overall development and remained a major concern to the government, businesses, and to the general people in large. Owing to geographical diversity, Nepal has diverse crops and vegetation including food grains, cereals, fruits, vegetables, and valuable herbs. The plain land in Terai is serving as a granary for the whole of Nepal. And the grassland in the Mountainous region signifies immense potential for animal husbandry. Similarly, the hilly region is rich in various crops, cereals, and fruits as well. However, the major cereal crops of Nepal are rice, maize, wheat, millet, and barley. The major cash crops of Nepal are oilseed, potato, tobacco, sugarcane, jute, and cotton. Similarly, the major spice crops are cardamom, ginger, garlic, turmeric, and chilly. Lentil, chickpea, pigeon pea, black gram, grass pea, horse gram, and soybean are major pulse crops (MoAD, 2016). The diverse herbs and shrubs indicate that there is a huge scope for medicine factories. Besides that Nepal is the second richest country in freshwater resources. With all these prospects, Nepal is able to establish itself as an agricultural country.

Most of the world's poor people earn their living from agriculture. So, if we knew the economics of agriculture, we would know much of the economics of being poor"(Schultz, 1979). So being one of the LDCs, Nepal needs to understand agricultural economics and need to fill up the gaps by supporting programs and policies. To address the programs and policies, public investment in agriculture and infrastructure is must and should be invested rationally. Agricultural spending is one of the direct and effective tools for enabling sustainable economic growth in developing countries (Fan et al., 2008).

Public expenditure on agriculture is the expenditure borne by government on agriculture. It comprises of capital expenditure as well as recurrent expenditure on agriculture. Here, one may have queries regarding 'what is a public investment?' and how does it work as a stimulator for economic growth. Government expenditure

encompasses the costs borne by the government to sustain itself and provide communal resources, services, and projects aimed at fostering economic growth and enhancing the well-being of the society members. Public expenditures can be divided into various categories such as administration, defense, internal security, healthcare, education, foreign relations, etc. These expenditures comprise both capital and recurrent components. Capital expenditures involve funds allocated for the acquisition of durable assets with extended lifespans, as well as expenses incurred to upgrade existing fixed assets like land, buildings, roads, machinery, and intangible assets. Research-related expenses are also encompassed within this segment of government expenditure. Generally, Capital expenditure is viewed as an investment that yields future benefits, as there may be a time lag between its initiation and its impact on the economy. Conversely, recurrent spending encompasses disbursements for procuring goods and services, compensating employees, day-to-day operations, and providing current grants and subsidies (often classified as transfer payments) (Aigheyisi, 2013)."

National recurrent expenditure refers to the government's spending on goods, services, wages, and salaries, as well as the consumption of fixed capital that doesn't lead to the creation of fixed assets. This type of expenditure, also known as an operational budget, entails ongoing financial transactions that take place regularly, whether on a monthly, quarterly, semiannual, or annual basis. Within this budget, various items such as wages, utilities, rent or lease payments, and taxes are accounted for (Mgbanya et al., 2008).

Budgeting for public expenditure serves as a means of allocating resources for current and future development. The topic of sustainable budget allocation has been a subject of debate in the realm of economic development over the years. Some argue that the idea of a budget aligns with sustainable development because it encompasses concepts related to sustainability within the scope of government spending. Public expenditure serves as a fiscal tool that governments employ to maintain the health of the economy. The crucial questions are: "What should be maintained?" and "What should be cultivated?" Previous research and literature have contended that, for numerous developing nations, agriculture plays a pivotal role in terms of its contributions to gross domestic product (GDP) and employment. Moreover, a significant portion of the global population living in poverty relies on income-generating activities tied to agriculture and related sectors, primarily in rural areas. Consequently, it can be inferred that promoting agricultural development is pivotal for both economic growth and alleviating

poverty, particularly in the rural locales where a large proportion of the impoverished population resides (Apata et al., 2014). Prioritizing effective agricultural development in developing countries must be a foremost objective, requiring the implementation of efficient government mechanisms to ensure cost-effective public spending within the agricultural sector."

Nepalese economy has moved towards the path of structural transformation having 71.62 percent of total GDP occupied by share of agriculture sector in 1975 (Gyanwaly, 2017) which dropped to 29.37 percent in FY 2016/17 (MoF, 2017) which has again declined to 25.8 percent in FY 2020/21 (MoF, 2022). This decline in agricultural GDP is resulted due to liberalization and globalization in the 1990s. The rate of decline reached to the highest level in the Maoist insurgency period (1996-2006) (Gyanwaly, 2017). More importantly, the decline of agricultural GDP is mainly due to lack of government's attention toward the agriculture sector.

Public expenditure can be basically described as government spending that contributes to the augmentation of the collective physical assets available to the public. This encompasses activities such as constructing roads, ports, educational institutions, medical facilities, etc. This aligns with the concept of public investment as depicted in national accounting records, specifically identified as capital expenditure. Public investment serves as a catalyst for fostering economic expansion by harmonizing with private capital, attracting private investment, enhancing market interconnectedness, bolstering aggregate demand, and fortifying the nation's savings. Since public investment is synonymous to creating public goods, we must be aware of different loopholes of public goods like the effects of externalities, asymmetric information and imperfect competition in the market regarding the major characteristics of public goods: non-rivalry and non-excludability (Anderson & Levy, 2006).

The speed and shape of agricultural development, food security, and livelihood of the farmers, particularly women is highly influenced by the investment in capital formation. The major sectors for public expenditure should incorporate the production of public goods that have a direct connection on farm productivity such as irrigation, power road and market structure (Pant, 2015).

The need for a robust agricultural sector cannot be overstated, since it is now a guiding principle for policymakers around the world. (Mani, Bhalachandran, & Pandit, 2011).

Constitution of Nepal, 2072 has also included "Right to Food Security" as one of the fundamental rights. So, to ensure this right and to address the problem of trade deficit, it is high time for Nepal to invest in the agriculture sector to make it more modern, professional, and secure. The associated "Food Inflation" phenomena, which appears to have affected all countries, increases the significance that policymakers must attach to agriculture in terms of both short- and long-term strategies. Thus, with public investment, Nepal can speed up inclusive economic growth as majorities of marginalized and minorities are dependent on agriculture for their subsistence. Nepal's agriculture is suffering from lack of market access, road network, skilled manpower, proper irrigation system, and proper investment. It is true that Nepal needs to extract the full potential of natural resources, labor force, and other resources so that the objective of the fourteenth plan to upgrade the country to middle-income countries by 2030 can be reached on time.

1.2 Statement of the Problem

Despite the fact that two-thirds of Nepal's population relies on agriculture for their livelihood, the contribution of agriculture to the GDP has remained limited to approximately one third. This indicates that the growth of the agricultural sector is unsatisfactory and has not met the expectations set by our periodic plans and annual budgets. Consequently, it is evident that the living standards of farmers are low, underscoring the government’s responsibility to enhance and uplift the agriculture sector in Nepal. Over the years, Nepal has consistently allocated a budget for agriculture, and the sector has received special attention in our periodic plans. Moreover, Nepal has made significant strides towards achieving the Millenium Development Goals (MDGs), successfully reducing the poverty by half. Currently, the fourteenth plan aims to further reduce the poverty level in Nepal to 17 percent. Given the undeniable connection between poverty and agriculture, conducting a study on agriculture and public expenditure in Nepal has become imperative. This study seeks to investigate and analyze the current state of public expenditure in the agriculture sector concerning to the following research questions:

a. What is the trend in agricultural public expenditure (including recurring and capital expenditure) and agricultural GDP?
b. Is there a short-run and long-run link between agricultural public expenditure (recurrent and capital expenditure) and agricultural GDP?

1.3 Objectives of the Study

The general objective of the study is to analyze the effects of public expenditure in agriculture. However, the specific objectives of the study are as given below.

a. To analyze the trend of public expenditure on agriculture and agricultural GDP.
b. To investigate the short run and long run relationship between the public expenditure in agriculture and agricultural GDP?

1.4 Hypothesis of the Study

The hypothesis of the study is as following:

Null Hypothesis (H_0): There is no significant relationship between public expenditure on agriculture and agricultural GDP in Nepal.

Alternative Hypothesis(H_1): There is a significant relationship between public expenditure on agriculture and agricultural GDP in Nepal.

1.5 Significance of the Study

The issue of weak agricultural status in Nepal has been raised for many years and various attempts have been made to improve this situation. But many farmers are not feeling relief with these attempts. This issue is not only a matter of discussion in Nepal, rather it has become a challenge for whole south Asia and other developing nations. So it is very necessary to analyze the situation. This study has attempted to study the situation of public expenditure in agriculture in Nepal and how agriculture is growing in response to these expenditures. Thus, this study can be helpful to understand the scenario and trend of agricultural production as affected by public expenditure in Nepal. In the context of Nepal, there are very few literatures regarding public expenditure and agriculture. So, the study is expected to add small volume to it. The analysis of impact of the public expenditure on agriculture and agricultural production has significant implication on national GDP. There are many studies conducted in order to access the impact of public expenditure on agriculture towards agricultural production. However it is not found that research is done with special concern to Nepal using econometric tool. This study is useful in order to address the situation of expenditure allotment and its impact on total production.

The findings of the study is important to the policy makers and planners to allot the expenditure under several heads and also to reanalyze the pattern of expenditure allotment. This study is also helpful for academicians to do research with determining certain gaps and also to the scholars and stakeholders who have concern on it. The study will also be helpful for general readers who are interested to know the role of public expenditure in boosting agricultural production in the context of Nepal.

1.6 Limitations of the Study

There are few limitations of the study which are mentioned below:

a) The study includes recurrent expenditure and capital expenditure on agriculture as the stimulator to the agricultural production and ignores other factors.

b) The study period covers the time period only from 1975/76 AD to 2021/22 AD where there exist several policy change and structural break. The data included is the earliest period possible.

1.7 Organization of the Study

The study is divided into five chapters, which are as follows:

The first chapter is the introduction, providing an overview of the study's context. It covers the study's background, statement of the problem, objectives, hypothesis, significance of the study along with its limitations and overall structure of the study. Moving on to the second chapter, it comprises a comprehensive literature review. This review is segregated into two main sections: theoretical concept and empirical review. The empirical review is again bifurcated into two sections, focusing on both the global context and Nepalese context. It also includes the research gap and additional contribution of the study.

The third chapter deals with the research methodology that includes research design, conceptual framework, study period covered, data collection procedure, data organization and processing, tools and method of data analysis, specification of the model, specification of the variables, and hypothesis testing.

Chapter four includes the data presentation and analysis. This is the body of the study. In this chapter, the results generated from the statistical tools were analyzed. In this chapter, trend of agricultural GDP, recurrent and capital expenditure on agriculture were examined. Descriptive statistics was studied in order to enter into time series

analysis. Then, Augmented Dickey Fuller (ADF) test, Lag length test, VAR Analysis test, Granger causality test, Serial correlation test and Breusch-Pagan Godfrey test was carried out in this chapter.

The last chapter includes major findings, conclusion, recommendations and future research prospective of the study.

CHAPTER - II

REVIEW OF LITERATURE

This chapter deals with the theoretical and empirical review of literature related to the public expenditure and economic growth. Theoretical concepts deal with the theories that we have taken as based on our study. Furthermore, empirical studies cover the study carried out on this topic at national and international scenario. This chapter also deals with the research gap and additional contribution of the study.

2.1 Theoretical Review

There are many theories on public expenditure. Classical economists championed the concept of "Laissez-faire" and promoted the notion of a free market, attributing economic growth primarily to the profit motive. Certain economists endorsed a modest degree of governmental involvement to ensure a stable economic trajectory. In contrast, Keynesian economists contended that self-regulating mechanisms were lacking in a free market to achieve full employment. Thus, challenging the perspectives of classical economists, they introduced the concept of 'government intervention' as a short-term remedy.

a) Classical Approach

Smith (1776) suggested that the main reason of economic growth in economy is the motive of profit making. Classical economists believed that there is self-adjusting free markets which can maintain full employment economy. According to them, government should restrict its functions to safeguarding against external threats, maintaining internal peace, order, and engaging in public development projects. Any functions beyond these were viewed as unnecessary and extravagant.

Classical economists were never focused on the role of government in the economic activities. They were against the government intervention in economy and aware of its negative impact on economy. So classical economists advocated for laissez faire economy. They emphasized on regulating role of government in the economy. Classical economists view concluded as “the less government, the better” (Weber, 1947).

b) Neo-classical Approach

Neo-classical economists put forward the new concept on government expenditures. According to them, government shrinks the functions and activities of private sector by crowding-out effect.

According to Neo-classical economists the government expenditures shrinks the role of private sector by crowding-out effect. Solow (1956), one of the famous neo-classical economist, on his growth model entitled, ' A Contribution to the Theory of Economic Growth' mentioned that the economic growth fundamentally depends on the expansion of population growth and technical progress, while fiscal policy has no effect on output growth.

c) Keynesian Approach

Keynes (1936) condemned concept of classical economists, which states that "we are all dead in the long run" and recommended the concept of 'government intervention' as short term remedy. Therefore, Keynesian economists argued that there is no self-balancing mechanism in free markets leading to full employment. They focused on effective demand which decides the level of full employment in the economy. They simply suggested that at the time of depression the public investment should be increased (have a deficit budget) but at the period of inflation the public investment should be reduced (have a surplus budget). According to Keynes, public expenditure serves as an external factor which can be applied as a strategic tool to foster economic growth. From Keynesian viewpoint, public expenditure can positively contribute for the advancement of economic growth. Thus, government spending in order to increase government consumption is anticipated to stimulate employment, profitability and investment through the multiplier effect on aggregate demand. Consequently, government spending increases aggregate demand thereby raising the increased output depending on expenditure multipliers.

In conclusion, Keynesian economists advocated that the government intervention is essential to achieve full employment and price stability. They believed public sector expenditure is an external instrument for economic growth.

d) Endogenous Growth Approach

According to endogenous growth theory, long-term growth rate is affected by the change in fiscal policy by influencing the determinants of growth, namely, physical

capital, human capital, change in technology, savings and employment (Hjerppe et al, 2006). Public policies have effect on formation of human capital and technological progress and therefore government policies can affect human capital formation and technological progress and thereby influencing economic growth (King &Rebelo, 1990).

e) Peacock and Wiseman Approach

Peacock and Wiseman (1961) stated that government like to increase public tax as it increases government revenue so that government can increase public expenditure. However, general public do not wish to pay more taxes. So, the best time to increase tax is at the time of war and emergency period. However, after the emergency period, tax and expenditure does not goes back to previous position. Hence it was concluded that public expenditure does not increase in continuous pattern but the pattern takes the shape of jerks or step like fashion.

f) Baumol's Approach

Baumol (1986) introduced the productivity lag hypothesis which explained private and public sector's productivity differentials. It is also called "Baumol's disease". According to this hypothesis, increment in public expenditure is made, when the automatic stabilization of economy is not maintained.

g) Stanley Please Hypothesis

Stanley please Hypothesis focuses on investigating cause and sources of rising government expenditure in least developed countries along with its effectiveness and overall impact on economy. According to this concept, availability of resources influences public expenditure particularly for consumption. Stanley raised the issue that higher tax rates not only lead to increased investment but also expands the volume of government consumption. Thus, this effect holds significant relevance in developing countries. Finally, Stanley gave few policy suggestions, which advocated for government's rational ad self-disciplined approach in formulating public expenditure policies. It was also suggested that recurrent expenditures and alternative use of revenue should be calculated and evaluated. (Acharya, 2016).

h) Rahn Curve

Certain sectors like national defense, infrastructure and the judiciary, are more effectively managed by the government sector. But increased government expenditure

might have the negative influence on the economy through the negative externality in the private expenditure and through crowding out effect. Both of these phenomena discourage private sector investments and undermine overall economic efficiency. Thus, Perthe Rahn Curve takes optimum level of public expenditure as 20 percent of the public expenditure of the GDP. (Acharya, 2016).

i) Musgrave Theory of Public Expenditure Growth

This theory was propounded by Musgrave as he discovered changes in the income elasticity of demand for public services in three ranges of per capita income. He put forward an argument that when the nation's per capita income is low, the demand for public services also decreases as low income primarily caters to fulfill the basic human needs. As per his viewpoint, when per capita income surpasses these initial low levels, the demand for public sector services like healthcare, education, and transportation begins to rise. Consequently, governments find themselves compelled to increase expenditure in these areas. He notes that in highly developed economies with high per capita incomes, the rate of growth in the public sector tends to decline as fundamental needs have already been met (Otiwu et al., 2018).

j) Wagner's Law

Wagner (1983) forwarded his "law of rising public expenditures" through an examination and analysis of patterns in the expansion of public expenditure and the dimensions of the public sector. Wagner's Law states that the government expenditure grows at a faster rate than that of national income. This implies as national income increases, government expenditure also increases in order to meet the increased, social, administrative and positive functions of the state. Increase in public expenditure takes place due to following reasons of application of Wagner's law:

(i) Expansion of Traditional functions such as defense, maintenance of law, social and civic amenities.

(ii) Coverage of New functions such as old age pension, unemployment allowance, health insurance, scholarships, low cost housing, etc.

(iii) Provision of Public and merit goods where, public goods include road, defense, law & order and merit goods include socially desirable goods not on the basis of ability to pay like scholarship right to education, health benefits, etc.

Musgrave and Musgrave (1989) supported Wagner's law and suggested that as progressive nations undergo industrialization, the proportion of the national economy occupied by the public sector consistently expands.

2.2 Empirical Review

Empirical review is another important section of the study which is again divided into two parts as international context and national context as given below.

2.2.1 International Context

Seccareccia (1995) have stated that in the periods of recession, marked by widespread macroeconomic market failures, government should take direct action to boost aggregate demand, even if it means simply employing workers to fill empty bottles with bank notes. Keyne's debate in favor of the "socialization of investment" represents the sole explicit long-term policy recommendation to be found in the *General Theory.* Keynes envisioned that in his proposed framework, approximately "two thirds or three quarters of total investment" would be under the direct influence of public and semi-public entities. These entities would operate based on both the conventional "motive of private exchange" and "technically social" motivations typically associated with investments in social infrastructure. Within an economy driven by expenditures and experiencing high growth, governments should strive to maintain surpluses which is to be transferred to the capital budget, thus gradually replacing dead-weight debt by productive or semi-productive debt." Keynes's rationale for public investment centers on the structure of government expenditure and does not recommend that government expenditures should eventually dominate the process of capital accumulation in the economy as a share of gross national expenditures.

Odhiambo et al., (2004) explored the sources and determinants of agricultural growth and productivity in Kenya for the period 1965-2001. To identify the sources of growth, the 'growth accounting' was used while econometric techniques were used to assess the determinants. It was established that most of the agricultural growth in Kenya was attributable to factor inputs or total factor productivity had accounted for only 10 percent of growth in the entire period accounted. Labor had been essential source of growth and accounted for about 48 per cent of the total growth. Land was recorded as another important determinant of agricultural growth and productivity. Besides,

Kenya's trade policy, climate and government expenditure on agriculture were marked as the major determinants of agricultural total factor productivity growth.

Inocencio and McCornick (2007) have affirmed the close connection between the economic performance of Indian agriculture and variations in agricultural productivity. These changes have been partially attributed to a substantial increase in the irrigated area. However, the efficacy of irrigation investments made by the Indian government and major external funding bodies has shown a diminishing trend over time, while at a global scale, such investments have been increasing. Their analysis revealed that no significant trend was evident in the unit cost of the sampled irrigation projects in India. This implies that costs might not be the primary factor contributing to the decline in project performance, or that other factors exert a more dominant influence. The Indian government's contribution to the total investment cost has decreased in relation to that of external funding agencies. Likewise, projects involving farmers' contributions have also seen a decline. The reduction in government counterpart funding for irrigation projects aligns with the decrease in budget allocation by the central government for irrigation and the expenditures of the states, particularly since the 1980s.

Jha (2007) conducted an analysis focusing on the performance of Indian agriculture, particularly in the period following economic reforms. The study aimed to offer a potential explanation for the stagnation observed in agriculture, highlighting a reduction in agricultural investment as a probable cause and making a case for addressing this issue. The study attributed the lackluster performance to the decline in agricultural investment, even as agricultural subsidies were on the rise. Consequently, while current operations were partially subsidized, resources for enhancing productive capacity in agriculture were diminishing. This situation resulted in sluggish growth in agricultural output and an increase in overall unemployment rates. The policy stance towards Indian agriculture was characterized as neither efficient nor equitable. The escalation of agricultural subsidy expenditures was primarily influenced by political and economic considerations. Moreover, these subsidies were directed solely at current production, lacking provisions for augmenting productive capacity. The study also found that wealthier farmers were disproportionately benefiting from these subsidies, making the subsidy distribution inequitable. The stagnation in agriculture had repercussions across other domains, particularly contributing to elevated unemployment rates. Thus, the study underscored the urgent necessity of redirecting

expenditures from subsidies to investments in order to rejuvenate Indian agriculture from its prevailing stagnation.

Mani et al., (2011) focused on the strategic importance of agriculture in ensuring overall growth and prosperity of India's economy. The study investigated how increased public investment in agriculture could influence the sustainable growth of both the agricultural sector and the overall economy. Government expenditure was quantified as the combined revenue and capital expenditures of both central and state governments, excluding defense expenditures and interest payments. The calculation of government expenditure in real terms, denominated in billions of rupees, was adjusted using the implicit price deflator at 1999-00 prices. The chosen sample period was 1970-71 through 2008-09. It was concluded that higher public investment in agriculture would ensure sustained higher growth in GDP and food security.

Mogues et al., (2012) have said that agriculture is the largest sector in many developing countries, contributing highest share to GDP and employment. More importantly, most world's poor dwells in rural areas with agriculture as their source of livelihood. So, sustainable agricultural development is therefore imperative in the quest for development. Consequently, agricultural expenditure is one of the most important government instruments for promoting economic growth and alleviating poverty in the rural areas of developing countries.

Pukayo and Umaru (2012) investigated the impact of capital expenditure on agriculture and credit to agricultural sector on the output of agriculture in Nigeria (1990-2004). Capital expenditure on agriculture included public investments on heavy farm machinery, ariel sprays of farmland against birds and insects for most of the northern region that grow grains (corn, g/corn, millet) as well as increased credit included the credit provided by the Central Bank and managed by Nigerian Banks, made available to small holders and microfinance institutions for the sector. The study indicated that output of agriculture was positively related to capital expenditure on the sector but negatively related to the credit to agriculture in the long run. The principle constraint to the growth of the agriculture was found to be the traditional structure and method of production that has been followed since independence more than four decades ago. Improvements in government capital expenditure on agriculture was recommended. It was also stressed that credit policies, incentives and institutions should target beneficiaries.

Bathla (2014) conducted an empirical analysis using time series data concerning public investment in agricultural irrigation and the gross state domestic product (GSDP) related to agriculture and related activities across 17 major Indian states. According to Bathla's findings, a pronounced emphasis on public expenditure allowed for the growth of public capital formation in agriculture and subsidies for inputs to increase at a yearly rate of 6% during the period of 2000 to 2013. This, in turn, contributed to a substantially higher growth rate in private investment in agriculture, reaching nearly 9% per annum in real terms (considering 2004-05 prices). Over the course of this process, irrigation intensity escalated from 30% to 50%, leading to a record-high annual growth rate of 3.8% in agriculture. The study spanned the years from 1981/82 to 2013/14 in order to encompass different stages of policy reforms. It was also observed that limited public capital formation during the 1990s adversely affected farmers' investments, hindering technological advancements and agricultural growth. A significant allocation of resources towards agriculture and irrigation starting from 2003-04 was identified as a significant policy move. The substantial increase in irrigation system expenditure in less developed states contributed to reversing the deceleration in productivity growth and fostering an upswing in private investment and income. The study concluded that fiscal policy need to emphasize pressing need to prioritize the agricultural sector. It advocated for enhanced resource allocation to underprivileged states and increased capital investment to accelerate agricultural productivity and income.

Ogbuagu and Ekpenyong (2015) meticulously examined the long-term and short-term impacts of different components of government expenditure on economic growth. To establish these connections, they employed a bound testing technique. The regression results that exhibited the most succinct representation indicated that recurrent government expenditure positively influenced GDP growth solely in the short term. The impact of capital expenditure was evident only in the long run, albeit being negative. The causality test conducted revealed a unidirectional causality, with a flow from GDP to government expenditure, thus affirming Wagner's theory in Nigeria. Notably, the surprising discovery was the negative effect of capital expenditure on GDP. Therefore, the study concluded that policies should be geared towards the comprehensive implementation of capital projects as outlined in the budget.

Jabeen and Shah (2015) empirically examined how government spending contributes to economic growth in Pakistan from 2004 to 2014. Using the regression linear model,

it was found that government spending resulted in insignificance relationship between government expenditure and economic growth. However, it could have significant relationship in long run. Thus it was stressed that government should make policies regarding its spending on education and health sector. Special budgeting to promote education was also recommended to increase economic growth.

Munlinge (2016) studied the effect of recurrent public expenditure on economic growth in Kenya from 1980-2014 with the specific objectives to disaggregate recurrent public expenditure into: government expenditure on social services, government expenditure on general public administration, government expenditure on debt and to find out the impact on economic growth in Kenya. Augmented Dickey Fuller test for unit root tests were employed before applying autoregressive distributed lag approach to test cointegration. The study showed that there was a long term relationship between recurrent public expenditure and economic growth in Kenya. It was also revealed that government recurrent expenditure on debt and social services was fruitful in boosting economic growth in Kenya while government recurrent expenditure on general public administration had a negative effect. The findings implied that policymakers should ensure more funds are allocated to recurrent budgets in the social sectors. The study dispelled the belief that recurrent public expenditure components are always growth retarding in Kenya.

Jambo (2017) undertook an examination of government expenditure, categorized by different spending areas, across Zambia, Malawi, South Africa, and Tanzania from 2000 to 2014. The study aimed to ascertain which component of public expenditure had a more pronounced positive effect on the growth of the agricultural sector. Employing a VECM model, the study assessed the impact of public expenditure, private investment, and net trade on the growth of agricultural GDP. The empirical results uncovered diverse responses of agricultural growth to different types of agricultural spending across the examined countries. The findings indicated that, among various spending types, infrastructure development, which held a lower priority, had a more significant positive influence on growth. The analysis also suggested an inverse relationship between agricultural growth and expenditure on Input Subsidy Programs (ISPs), Price Subsidy Programs (PSPs), and agricultural research in Zambia. In contrast, for Malawi, the empirical analysis showed that spending on agricultural research had a more substantial impact on growth, and unlike Zambia, there was evidence of a positive

correlation between agricultural growth and expenditure on PSPs. Similarly, in the context of Tanzania, a negative association was identified between spending on infrastructure and long-term economic growth. Based on the study's outcomes, the conclusion was drawn that a redirection of public investment towards expenditure categories that promote growth was warranted. Furthermore, it was recommended that the government improve the precision of its public investment targeting to stimulate growth in the agricultural sector, thus contributing to the reduction of poverty and hunger.

Mgbanya et al., (2018) assessed the impact of national recurrent expenditure on the growth of Nigeria's agricultural sector from 1990 to 2017. The econometric analysis results demonstrated significant effects of recurrent expenditure in agriculture on the agricultural GDP share over the examined time span. Consequently, the study strongly recommended a higher allocation of the recurrent expenditure towards agriculture. Within the annual agricultural budget, it was advised to allocate more resources to the fish subsector, which would align with the long-term relationship between the fish subsector and an increasing rate of return to the agricultural GDP share. Similar attention should be given to the forestry and livestock subsectors, paralleling the emphasis on the crop subsector. Given the substantial contribution of small-scale farmers to food, meat, fish, and forest products, the government should utilize fiscal and monetary policies to incentivize youth and farmers to enhance production and facilitate easier access to potential markets such as export zones.

Chen and Singh (2020) conducted an examination of the impact of government expenditure on economic growth in Vanuatu from 1981 to 2016. The study first analyzed the effects of government expenditure on economic growth under various financing sources, including tax revenues, non-tax revenues, and budget deficits/surpluses. Additionally, the study explored the influence of government expenditure compositions on economic growth. The study also tested for the weak exogeneity of fiscal factors concerning investment. The findings indicated that fiscal factors and investment exert causal effects on economic growth in Vanuatu. Specifically, government expenditure negatively impacts long-term economic growth when financed by tax revenues, but positively impacts it when financed through other means such as non-tax revenues and budget surpluses/deficits. Furthermore, among the various expenditure compositions, expenditures on education, health, wages & salaries,

agriculture, and interest payments individually exhibit greater effects on long-term economic growth compared to the remaining components of expenditure."

2.2.2 Nepalese Context

Dhital (1970) has stated that most of the universal characteristics of underdevelopment are readily development are readily visible in Nepal. For instance, the circumstances where the Per Capita Income (PCI) remains at a low level were considered and the productivity per unit of land and labor also remains meager. In such scenarios, a significant portion of the population is engaged in traditional agricultural practices, while the economy is characterized by a dominance of absentee landlords. Additionally, the internal market remains small, with only a portion of the economic activities being monetized. The author emphasizes the importance of recognizing the presence of a small internal market. Even if the production scale within the country is modest, external markets become a necessity, rendering the country more susceptible to the volatility of prices in these external markets. This vulnerability is particularly pronounced given that Nepal's primary exports are heavily reliant on external markets.

Empirical evidence underlines that the low productivity in agriculture stands as a chief contributor to the low levels of per capita income. Furthermore, the growth trajectory of the Nepalese economy is intrinsically linked to the advancements within the agriculture sector. Consequently, the interrelation of agricultural activities with national development ought to be regarded as a matter of paramount importance. Dhital's definition of agricultural development encapsulates a positive escalation in cumulative agricultural output, paired with an increase in the real per capita income for agricultural families. Such development is further signaled by improvements in the productivity per unit of land and labor.

Thapa (1992) stressed that it is very important to understand and analyze the relationship between the development of social and physical infrastructures and rate of agriculture production (Agri-GDP). It helps us to formulate a rational policy for the development of infrastructures and their spatial distribution with the objective of modernizing the agricultural sector in Nepal. Applying the geometric exponential function Thapa estimated the rate of growth of agri-GDP. Infrastructures that increase the rates of the growth of agricultural productivity in the long term are (a) agricultural research and extension manpower, (b) road density, and (c) irrigated area. Agricultural productivity had a negative relation with the stock of educated labor force (i.e. human

capital) irrespective of whether we considered mass education as percentage of the agricultural labor force or on a per hectare basis. Thapa concluded that a mismatched public investment in infrastructures is a key factor behind the lopsided agricultural growth. Agricultural development is "dualistic". Agricultural growth in the prosperous regions and districts (producing cash crops and fine food grains) was high, whereas the agricultural situation in the backward districts (which have predominantly subsistence farming) was stagnant or declining. This exacerbated the inequitable growth of income of purchasing power, undermine food security, exacerbated regional disparity, and discourage investment in the rural economy. So, industry and trade sectors need to do more to strengthen their backward linkages with farming, energy and water resources development and forestry. More importantly, the physical and social infrastructures should be developed by according to priority to the requirements of agriculture, and within it, the needs of the backward districts and backward subsectors (Thapa, 1992).

According to Karkee (2008), a significant portion of agricultural land in Nepal remained untapped by irrigation infrastructure. The adoption of improved seeds had been disappointing, primarily attributed to limited awareness and availability. The lack of substantial commercialization posed a considerable barrier to agricultural progress. One of the major hindrances to Nepal's growth and prosperity was its geographical remoteness, which hindered economic development. To surmount this issue, improved connectivity emerged as a pivotal requirement. However, the degree of connectivity necessary for the diversification and commercialization of agriculture still falls short of being effective for the numerous smallholder farmers dispersed throughout the interior regions of the country.

Interestingly, the proliferation of telecommunication facilities, including mobile phones, has opened avenues for the establishment of efficient and rapid market information systems. Foreign aid has also remained a crucial source of public investment in the agricultural sector. Donor support in agriculture primarily centers on infrastructure development, sustainability of natural resources, and enhancements in livelihoods. International financial institutions have directed their efforts toward expanding growth opportunities through infrastructural development and increased commercialization. Meanwhile, bilateral donors have predominantly focused on improving livelihoods and ensuring the sustainability of natural resources. Karkee (2008) asserts that transforming small-scale agricultural endeavors into commercially

viable enterprises linked to the market holds the potential to unlock the full capacity of the agricultural sector.

In the study conducted by Bhatta (2014), a comprehensive analysis was performed on the prevailing models of structural transformation, alongside an empirical investigation into the economic framework of Nepal. The outcomes of the research indicated that the industrial sector holds notable importance in terms of elevating per capita income, surpassing the contributions of both the agricultural and services sectors within Nepal. While fostering the growth of the agricultural sector appeared essential for achieving high and sustainable economic growth, there remains a need to focus on increasing investment for substantial mechanization and modernization within the agricultural domain. Karki (2015) has stated that Nepal's agriculture is characterized by low level of public and private investment. It has suffered time and again by natural calamities like flood, landslides, cold weather, drought, and earthquake. The total damages and loss in massive earthquake 2015 amount to about NPR 28.3 billion. Karki listed five major agricultural priorities as increasing production and productivity of key agricultural crops**,** promoting agricultural commercialization and modernization for increased efficiency and farm income**,** addressing both food and nutrition security**,** local economic development through agribusiness cluster development and alleviating poverty through small holder agriculture development.

Pant (2015) emphasized the substantial structural challenges faced by the South Asian economy. Notably, a significant disparity exists in income and living standards between those engaged in agriculture and those employed in other sectors. The private sector displays limited interest in investing in agriculture due to the relatively low returns it offers. This reluctance towards private investment in agricultural capital formation stems largely from the constrained availability of public goods, particularly physical infrastructures. It becomes imperative for the public sector to invest in providing these public goods to protect farmers from the uncertainties stemming from climate change and external shocks, such as abrupt price fluctuations or sudden surges in imports. Within the context of South Asian countries, the formulation of policy measures for public investment in agriculture holds paramount importance for ensuring both food security and sustainable livelihoods. Pant suggested a strategy involving the reduction of recurrent expenditure while concurrently increasing investment in physical infrastructure. Additionally, for nations grappling with substantial rural labor

outmigration flows examples, being Bangladesh and Nepal, a potential avenue lies in leveraging remittances to invigorate agricultural development through enhanced investment policies. To effectively achieve this, a distinct political commitment becomes vital to instill confidence in the security of such investments."

Shrestha (2015) has examined the significance of public spending in education in GDP through agricultural technical education. Results from econometric analysis revealed that variables like student's enrollment in agriculture and forestry institute and agriculture output ratio in GDP were not in expected direction though this one was statistically significant. The impact of investment in education was inconclusive demanding deeper analysis about the possible mechanism of the nexus between the two. It was recommended that public investment along with the private coordination and cooperation of the organizations and institutions require for technological improvement and increment of agriculture production and its appropriate market supply mechanisms. This is possible only by linking the education and main economic contributor with the national budget spending.

Thapa (2015) conducted an empirical study aimed at illustrating the connection between government expenditure and economic growth. This investigation employed ARDL (Auto-Regressive Distributed Lag) and co-integration tests and relied on 37 years of time-series data. The findings of this research unveiled an intriguing trend: in the early years, real capital expenditure surpassed real recurrent expenditure, but over time, real recurrent expenditure exceeded real capital expenditure. This observation lends support to both the Keynesian and Wagnerian postulates, indicating the presence of both long-term and short-term relationships between government expenditure and economic growth.

Wagle (2016) examined the logical relationship between agricultural production and government expenditure in Nepal by applying Cochrane-Orcutt autoregressive model from panel data for the period 1983/84 to 2013/14. The empirical evidence confirmed that the expenditure in agriculture sector is the cause of economic growth in Nepal. Research analysis also revealed that government expenditure on agriculture sector had significant positive impact in agricultural outputs.

Chaudhary and Acharya (2018) undertook an examination of the causal correlation between government expenditure and the real interest rate in relation to Nepal's

economic growth during the period from 1975 to 2015. Employing ARDL cointegration techniques, the study identified both a long-term and a short-term connection between the variables in question. Moreover, the research confirmed the presence of bidirectional causality between government expenditure and real income across the studied duration.

Kharel (2020) analyzed the relationship between government expenditures on education, health, transportation, agriculture, and economic growth in Nepal from 1975 to 2019. The study adopted the ARDL approach for co-integration and incorporated the error correction mechanism to discern the long-term and short-term relationships between Real Gross Domestic Product (RGDP) and the exogenous variables in the model. The outcomes of the study unveiled that the government's expenditure on agriculture exerted a notable yet adverse impact on GDP in the long term, while significantly exhibiting a positive effect in the short term. This outcome could potentially be attributed to insufficient investment, inefficiencies, sluggish technology adoption, inadequate mechanization, and instances of corruption."

Mahara (2021) conducted a study to investigate an empirical connection between money supply, inflation, capital expenditure, and economic growth in Nepal by using the time series data from 1976 to 2019 and employed the ARDL approach to co-integration to explore the relationship between selected variables. The study found that there is a significant long-run positive relationship between capital expenditure and growth. The study also found that there is unidirectional causation from capital expenditure to real economic growth in Nepal. The advancement of agriculture in Nepal necessitates the implementation of mechanization, the enhancement of agricultural infrastructure, and the establishment of a robust market mechanism. In 2012, Nepal ranked as the 6th largest country in terms of its remittance to GDP ratio, with a substantial portion of these remittances flowing into rural farming communities. Consequently, a portion of the remittance income could be strategically directed towards mechanization efforts, aiming to elevate productivity and modernize the traditional agricultural sector. This, in turn, would contribute to alleviating labor shortages in key sectors such as agriculture, construction, and other critical industries.

2.3 Research Gap and Additional Contribution

From the examination of the aforementioned literature, it is learned that there has been a noticeable absence of empirical research focused on the relationship between public expenditure in agriculture and agricultural GDP.. Most of the studies has been about government spending and economic growth. Though, there has been some literatures in the international arena. For instance, Jambo (2017) found that agricultural growth responded differently to the agricultural spending type. Infrastructural development was more growth-enhancing. While expenditure on Input Subsidy Programs, Price subsidy programs and agricultural research had negative relationship with agricultural growth. Inoncio and McCornic (2015) highlighted that the unit cost of the sampled irrigation projects in India did not exhibit a substantial trend, suggesting that the costs might not be closely linked to the decline in project performance. Meanwhile, Jha (2007) emphasized the pressing requirement to swiftly transition from a subsidy-oriented approach to an investment-driven strategy in order to rejuvenate the stagnating agricultural sector. In the national context, most of the studies are like 'nature and trend of public expenditure', 'relationship between public expenditure and economic growth and so on. But no any empirical study has been made on the relationship between public expenditure on agriculture and agriculture GDP. Thapa (1992) applied geometric exponential function to estimate the rate of growth of Agri-GDP concluding that mismatched public investment in agriculture is a key factor behind the lopsided agricultural growth.

Some studies revealed that government expenditure on agriculture had positive impact on agricultural output and some show it has significant but negative impact on GDP. For instance, Wagle (2016) concluded that the expenditure in agriculture sector is the cause of economic growth in Nepal. That is, government expenditure on agriculture affects agricultural outputs positively. But, Kharel (2020) concluded that agriculture expenditure of government had significant but negative impact on GDP in the long run but significantly positive impact on GDP in the short run. Hence, in order to particularly check the relationship between public expenditure on agriculture and agriculture GDP, this study has followed vector auto regressive model for the time series data from 1975/76 to 2021/22.

Despite there exist some studies on the relationship between the government expenditure on agriculture and agriculture output, yet no study is conducted to check

the short run and long run relationship between public expenditure (recurrent and capital expenditure) in agriculture and agriculture GDP. Hence, this study checks the relationship between government recurrent expenditure on agriculture and agriculture GDP as well as the relationship between government capital expenditure on agriculture and agriculture GDP. This study also analyses the trend of capital expenditure, recurrent expenditure on agriculture and agriculture GDP.

CHAPTER - III
RESEARCH METHODOLOGY

Research involves diligent inquiry and investigation, encompassing the exploration and interpretation of facts, the reevaluation of established theories or laws based on newfound facts, or the practical application of these revised theories or laws. Research methods offer specific and intricate guidance on how to execute a research endeavor, outlining the precise steps for initiating, executing, and completing the research task. On the other hand, research methodology encompasses broader frameworks and guidelines for conducting research, encompassing principles for organization, planning, design, and execution.

Therefore, this chapter is dedicated to expounding upon the research methodology undertaken for this study. It outlines the research design, sources of data, data collection procedures, and the tools and techniques employed to analyze the data.

3.1 Research Design

The approach undertaken for this study is descriptive, analytical, and explanatory in nature. The research design of the study is both qualitative and quantitative. The study focuses on the quantitative analysis of government recurrent expenditure and capital expenditure on agriculture and agricultural GDP. The deductive approach, working from general to more specific, was applied to quantify the short run relationship and causal relationship between the variables. For this, time series annual data of the variables were analyzed qualitatively to access the trend of growth from 1975/76 to 2021/22.

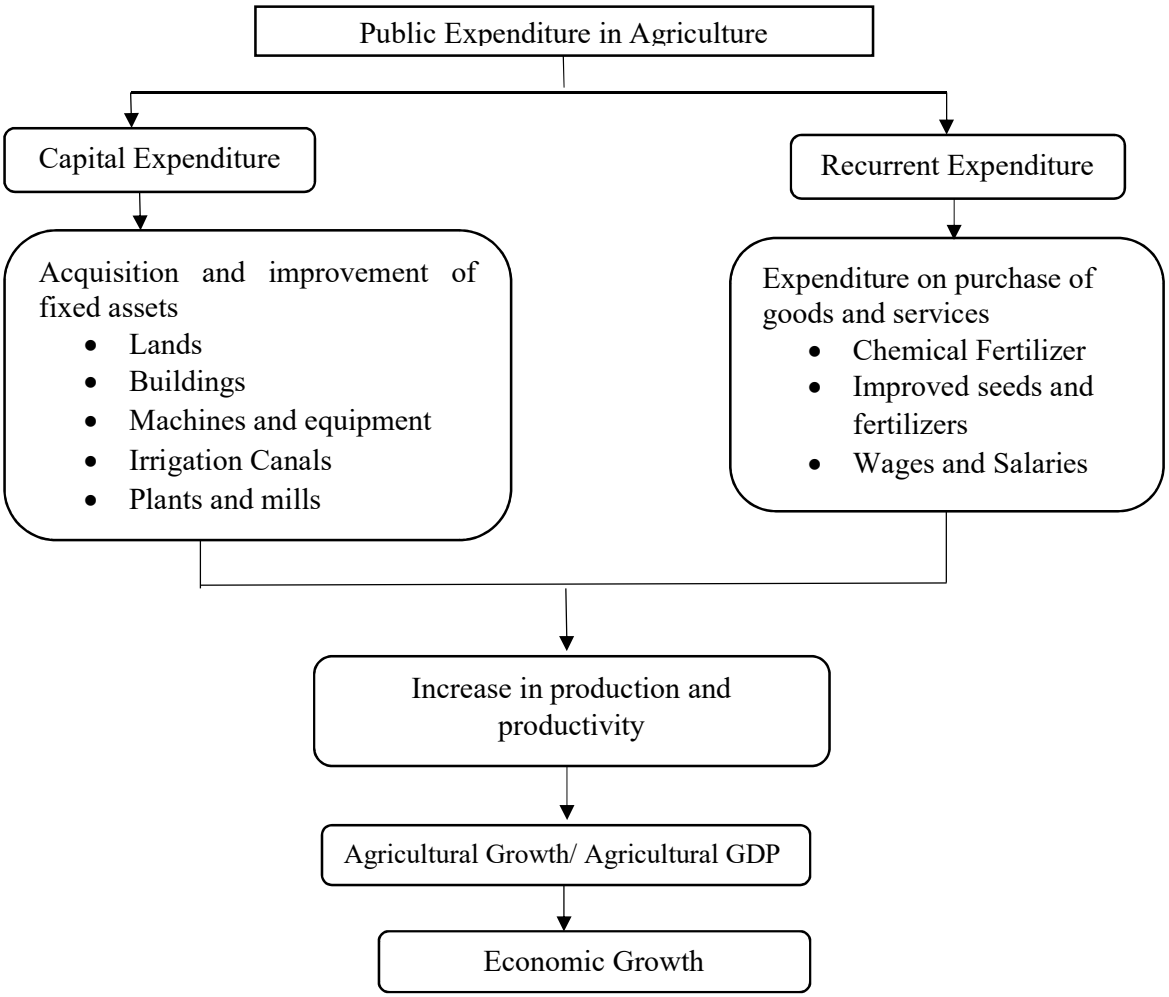
Second, time series econometrics tools were used to examine the short run relationship and causal relationship between capital expenditure, recurrent expenditure on agriculture and agriculture GDP. For this purpose, first the unit root test was performed to confirm, all the variables were stationary of the same order. Then the correlation between the variables was accessed.

Finally to access short run relationship between the variables, EVIEWS 12 SV software was applied with different econometric analyses. Optimal lag length test, Johansen cointegration test, VAR model test, Serial Correlation test, Breusch-Pagan Godfrey tests and finally, Granger Causality test were performed.

3.2 Conceptual Framework

Public expenditure on agriculture is the expenditure borne by government on agricultural activities. Figure 3.1 illustrates the study's conceptual framework, depicting the connection between public expenditure on agriculture, agriculture GDP and overall economic growth.

Figure 3.1: Relationship between Public Expenditure on Agriculture and Agriculture GDP



The study encompasses both capital and recurrent expenditures on agriculture. Recurrent expenditure includes costs incurred for purchasing goods and services, paying wages and salaries, and covering operational expenses. On the other hand, capital expenditure refers to the funds used for obtaining fixed assets and maintaining or upgrading them, such as irrigation canals, machinery and equipment. Both types of

expenditures play a crucial role in enhancing agricultural production and productivity, thereby contributing to economic growth.

3.3 Nature and Sources of Data

The study is fully based on data and information which are secondary in nature. The required data are used to show the relationship between recurrent and capital expenditure on agriculture sector and agriculture GDP. The time series data are collected from the secondary sources such as Quarterly Economic Bulletin of NRB, Economic Survey, Economic Review, CBS reports, Macroeconomic dashboard etc.

3.4 Study Period Covered

The study covers the study period of 47 years froam 1975/76 to 2021/22. The study uses the annual data of agriculture GDP, recurrent expenditure on agriculture and capital expenditure on agriculture as obtained from various sources like Economic Survey, Central Bureau of Statistics (CBS), Ministry of Finance (MoF), and National Planning Commission (NPC).

3.5 Process of Data Collection

First of all, GDP at constant price, GDP at current price and agriculture GDP are collected from macroeconomic dashboard available in official website of Ministry of Finance. The study used time series secondary data from the year 1975/76 to 2021/22. Hence the data are taken accordingly. Therefore, the data are collected from the following secondary sources:

(a) Economic Survey: Ministry of Finance- government expenditure variable.
(b) Annual Reports: Central Bureau of Statistics (c)
(c) Quarterly Economic Bulletin: Nepal Rastra Bank

3.6 Data Organization and Processing

First of all, the GDP deflator often known as price index is calculated. For which, GDP at current price is divided by GDP at constant price to get the value of GDP deflator (price index). Recurrent and capital expenditure in agriculture from 1975/76 to 2021/22 are collected from economic survey of different years. Then, to convert the raw data into real data, we divided agriculture GDP, recurrent expenditure and capital expenditure by GDP deflator with the help of excel. Then, natural log of real data are

calculated. After that difference of natural log of real data are obtained using Eviews. Finally, the data are processed by using different table, graphs and econometric tools and techniques.

3.7 Model Specification

This study is founded upon the Keynesian theory, which underscores the significance of government expenditure in driving the economic growth of a nation. Okoro (2013) contends that the relationship between government expenditure and the growth of real gross domestic product (real GDP) in Nigeria can be elucidated through a model such as

$$RGDP = f(GREXP, GCEXP) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

Where, RGDP is Real gross domestic product; GREXP is Government recurrent expenditure; GCEXP is Government capital expenditure.

We assume that agricultural output or agricultural growth is supported by public expenditure invested by government. Basically, government expenditure can be categorized into capital expenditure and recurrent expenditure. Here we take agriculture gross domestic product as dependent variable whereas capital expenditure in agriculture and recurrent expenditure in agriculture as independent variable. The real gross domestic product is based on prices of 2000/01. Following the framework outlined by Okoro (2013) with slight adjustments, the model for this study is articulated as follows:

$$RAGDP = f(RREA,RCEA) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

Where, RAGDP = Real Agricultural Gross Domestic Product

RREA = Real Recurrent Expenditure of government in agriculture

RCEA = Real Capital Expenditure of government in agriculture

Transforming the model eq^{n} (ii) into linear econometric form, we have

$$RAGDP_t = \propto + \beta_1 RREA_t + \beta_2 RCEA_t + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iii) \text{ and}$$

By placing natural logarithms on both sides, the equations can be expressed in its natural log form as.

$$\ln RAGDP_t = \alpha + \beta_1 \ln RREA_t + \beta_2 \ln RCEA_t + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots (iv)$$

Where, $t = 1975/76 - 2021/22$ in model (ii); $\propto$ and $\beta 1$ and β_2 are coefficients of relevant variables.

3.8 Variable Description

The study uses following variables.

(a) Agricultural Gross Domestic Product (AGDP)

Gross domestic product from agriculture is agriculture GDP (AGDP). Agricultural GDP is the contribution of agriculture sector which includes agriculture, forest and fisheries to GDP (MoF, 2022). The study uses the variable as the dependent variable.

(b) Government Recurrent Expenditure in Agriculture Sector (REA)

It is the spending of the government on the purchase of goods and services related to the agriculture sector. Therefore, it includes expenditures on the purchase of chemical fertilizers, improved seeds, and fertilizers, wages, and salaries, and other regular expenditures.

(c) Government Capital Expenditure in Agriculture Sector (CEA)

It is the spending of the government on the purchase of goods and services related to the acquisition and improvement of fixed assets, lands, buildings, machines, and equipment, Irrigation canals, plants, and mills. Such expenditure of the government is expected to increase the productive capacity of the agriculture sector and thereby contribute to the economic growth of the nation.

3.9 Hypothesis Testing

Null hypothesis H_0: There is no significant relationship between public expenditure on agriculture and agricultural GDP in Nepal.

Alternate hypothesis H_1: There is a significant relationship between public expenditure on agriculture and agricultural GDP in Nepal.

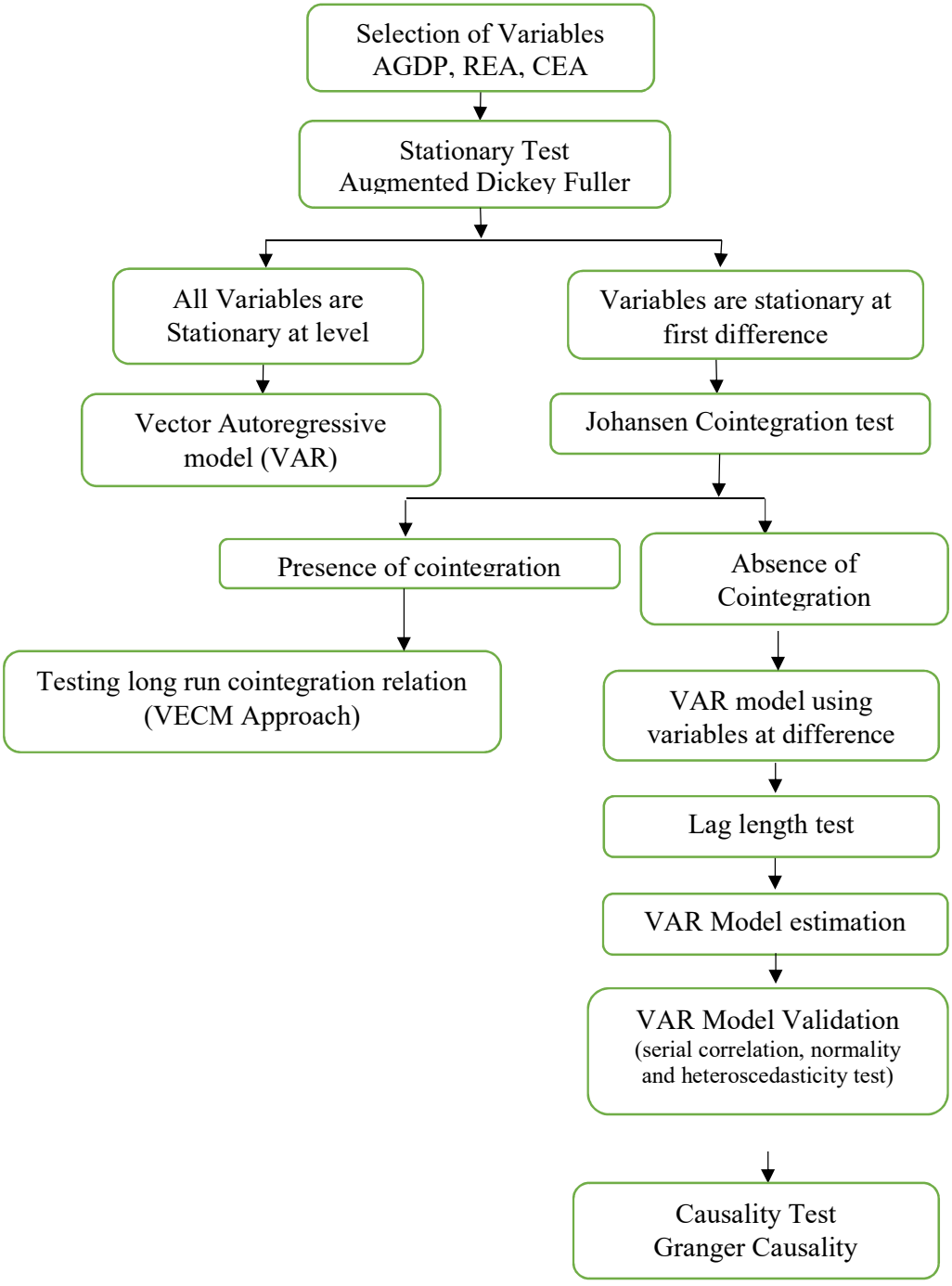
Above mentioned hypothesis is tested using the tools and method of data analysis as explained below in 3.10.

3.10 Tools and Methods of Data Analysis

The analytical framework of this study is summarized in figure 3.2. This framework provides the map for the analysis process of the time series data. Indeed the analysis involves applying an econometric methodology consisting of variables selection followed by stationarity analysis, lag length selection, Johansen cointegration test, vector autoregressive modeling, Wald test and different diagnostic tests. It must be

pointed out that the choice of VAR model is guided mainly by the statistical properties of the data, in this case: the degree of integration of the variables and the absence of cointegration relations.

Fig. 3.2. Analysis Process of the Study



Source: Elalaoui et al., (2021)

The data and information have been analyzed using computer software's like excel and EViews 12 SV. The major statistical tools that are used in the study are briefly explained below:

3.10.1 Unit Root Test

Unit root tests serve to examine stationarity within a time series. A time series is deemed stationary if a temporal shift doesn't result in alterations to the distribution's structure. Unit roots constitute a factor contributing to non-stationarity. A time series achieves stationarity when its mean and variance remain constant across time, and the covariance between two time periods remains consistent. There are different methods of testing unit root test. The study uses the Augmented Dickey Fuller (ADF) test for unit root test.

3.10.2 Lag Order Selection

Time-series econometric models require an appropriate lag period in the data set. There are different ways of selecting the lag length of the model. The lag selection criteria include Akaike's information criterion (AIC), Schwarz's information criterion (SIC), Phillips' posterior information criterion (PIC), and others. The study applies Akaike's information criterion (AIC) for the selection of appropriate numbers of lag in the model.

3.10.3 Co-integration Test

When we finish exploring the order of integration of the variables, we can proceed by testing whether the variables are co-integrated (Engle and Granger, 1987). The co-integration test is a technique used to test for the existence of equilibrium relationship among variables that are nonstationary at level but are integrated of the same order, meaning they are stationary after first differenced and if they are not integrated of the same order, an unrestricted VAR model is estimated.

The most powerful and reliable method of testing the co-integration between the variables is Johansen Co-integration test. Co-integration only tells about long run relationship between the series but it does not fix the direction of such relationship (Luo, 2013).

$$\lambda\text{Trace}(r) = \sum_{i=r+1}^{g} \ln(1 - \widehat{\lambda i}) \ldots\ldots\ldots \text{(v)}$$

$$\lambda\text{Max}(r, r+1) = -T\ln(1-\boldsymbol{\lambda}_{r+1}) \ldots\ldots\ldots \text{(vi)}$$

The multivariate Johansen cointegration test has been performed in this study. When the data are not cointegrated, the unrestricted Vector Autoregressive Model has been used for short run relationship.

3.10.4 VAR Model

In this study, we adopt the Vector Autoregressive model (VAR) introduced by Engle-Granger (1969) and further refined by Sims (1980) to define our empirical model. Sims raised concerns about the limitations of conventional simultaneous equation modeling, which he found overly restrictive, leading to inconsistent and subjective choices of endogenous and exogenous variables. He proposed that within a VAR model, all variables are treated as endogenous, and each variable can be expressed as a function of its own lag and the lags of all other variables, thus resolving the challenges of simultaneity. The VAR model offers the advantage of accommodating variables that lack cointegration. Given that the data exhibit first-order integration, we utilize the first differences of the data for the VAR models. The equations for bivariate VAR models are outlined as follows (Asteriou & Hall, 2007):

$$y_t=\beta_{10}-\beta_{12}x_t+\gamma_{11}y_{t-1}+\gamma_{12}x_{t-1}+u_{yt}\ldots\ldots\ldots\ldots\ldots\text{(vii)}$$

$$x_t=\beta_{20}-\beta_{21}y_t+\gamma_{21}y_{t-1}+\gamma_{22}x_{t-1}+u_{xt}\ldots\ldots\ldots\ldots\text{(viii)}$$

Where, the time series y_t is affected by current and past values of x_t and, simultaneously, the time series x_t to be a that is affected by current and past values of the y_t series.

3.10.5 Diagnostic Test of Residual Term

For the diagnostic test of residual term, serial correlation, normality and heteroscedasticity test are carried out.

3.10.6 Granger Causality Test

Granger (1969) introduced the ideology of causality speaking that B variable is said to be Granger caused by variable X if present value of B can be predicted with greater accuracy by using past value of A. The study employs Granger Causality in order to investigate the causal relationship between the GDP and variables like public recurrent and capital expenditure on education, gross fixed capital formation and secondary education enrollment rate. Given two time series Y_t and X_t, the series X_t fails to Granger cause Y_t if in a regression of Y_t on lagged Y's values and lagged X's values, the coefficient of later is zero (Maddala, 2009).

The Granger representation theorem (Robert & Granger, 1987) clarifies that if two variables are cointegrated and each is individually I (1), then either Y_{1t} Granger causes Y_{2t} or Y_{2t} toY_{1t}.

$$\Delta Yt = \alpha_0 + \alpha_1 \Delta Yt-1 + \cdots + \alpha_n \Delta Yt-n + \beta_1 \Delta Xt-1 + \ldots + \beta_n \Delta Xt-n\ ut \ldots\text{(ix)}$$

$$\Delta Xt = \gamma_0 + \gamma_1 \Delta Xt - 1 + \ldots + \gamma n \Delta Xt - n + \delta_1 \Delta Yt - 1 + \ldots + \delta_n \Delta Yt - n + vt \ldots . (x)$$

It is assumed that disturbances u_t and v_t are uncorrelated.

There is following hypothesis tested for determining causality:

H_0: $\beta_1 = \beta_2 = \ldots = \beta_n = 0$, this shows X does not have effect on Y.

H_1: At least one $\beta_1 \neq 0$ i.e., X has effect on Y.

Similarly, H_0: $\delta_1 = \delta_2 = \ldots = \delta_n = 0$, i.e., Y does not have effect on X.

H_1: At least one $\delta_i \neq o$ i.e., Y does not have effect on X.

It shows, H_0: $\beta_1 = \beta_2 = \ldots = \beta_n = 0$ and H_0: $\delta_1 = \delta_2 = \ldots . = \delta_n = 0$, X and Y are independent. There is no Granger Causality in any direction.

H_1: At least one $\beta_1 \neq 0$ and $\delta_i \neq o$ At least one, both X and Y causes each other that is there exists bidirectional causality.

CHAPTER - IV

PRESENTATION AND ANALYSIS OF DATA

In this chapter, data presentation and analysis work are made dividing into two sections. The first section is related to the trend and structure of public expenditure on agriculture (PEA) sector and agricultural gross domestic product (AGDP). The second section is related to the relationship between AGDP and public expenditure on agriculture sector.

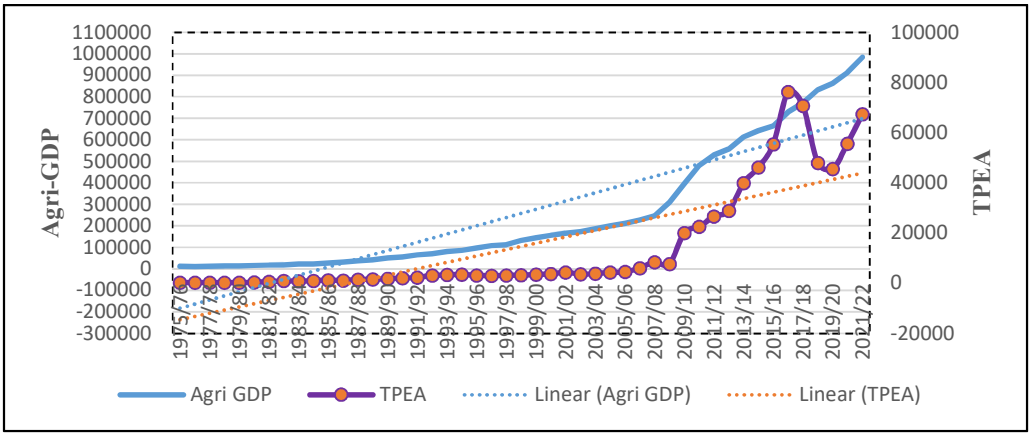
4.1 Trend of Public Expenditure on Agriculture and Agriculture GDP

In this section, trend of total public expenditure on agriculture sector (TPEA) and total agriculture gross domestic product (TAGDP), trend of public expenditure, capital expenditure, and recurrent expenditure on agriculture, share of recurrent and capital expenditure on total expenditure, government expenditure in different political regime of Nepal, nature of agriculture GDP, and public expenditure on agriculture with respect to 5-year on average.

4.1.1 Trend of Total Public Expenditure on Agriculture and Total Agriculture GDP

As agriculture is the backbone of Nepalese economy, government expenditure on agricultural sector and agricultural GDP are gradually increasing over the time period. But increasing trend of both government expenditure on agricultural sector and agricultural GDP are not linear and proportional over the study period.

Figure 4.1: Trend of Total Public Expenditure on Agriculture and Agriculture GDP



Source: Author's construction based on appendix I

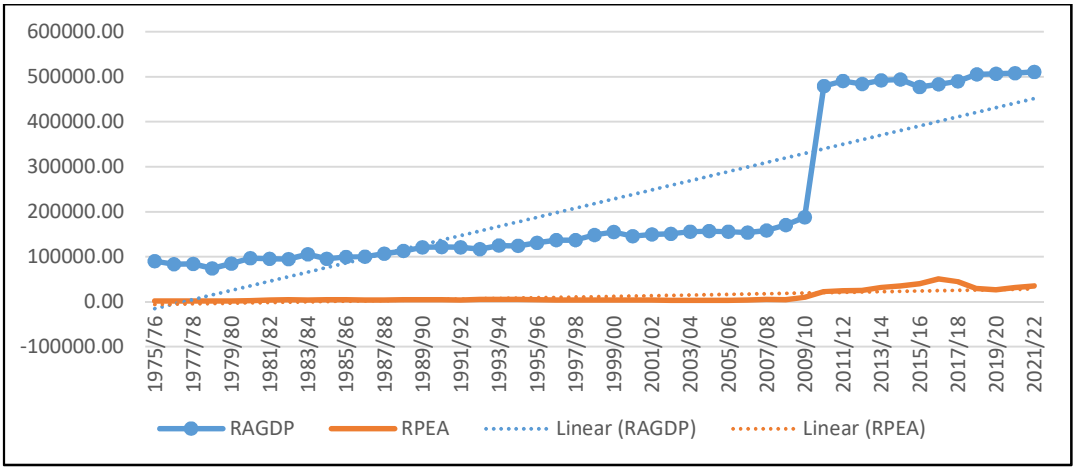
The trend of total public expenditure on agricultural (TPEA) sector and total agricultural GDP (TAGDP) are presented in the figure 4.1.

Figure 4.1 shows the upward trajectory of AGDP over the study period. There has been a notable surge in AGDP, particularly since the 2008/09 period, which can potentially be attributed to a significant increase in both capital and recurrent expenditures within the agriculture sector during that study period. The progressive growth in agriculture can be observed as time unfolds. The plot of public expenditure on agriculture also shows the increasing trend. Public expenditure on agriculture increased drastically after 2008/09. The ratio of agricultural budget to AGDP almost doubled between 2008/09 and 2013/14. As a result, public expenditure and agriculture GDP increased in good pace which also might be due to the new policies followed by republic period in Nepal which started from 2008/09.

4.1.2 Trend of Real Public Expenditure on Agriculture and Real Agricultural GDP

Both of real public expenditure on agricultural and real agricultural GDP are gradually increasing over the time period. But increasing trend of both of public expenditure on agricultural sector and real agricultural GDP are not linear and proportional over the study period as well. The trend of both real public expenditure in agricultural (RPEA) sector and real agricultural GDP (RAGDP) are presented in the figure 4.2.

Figure 4.2: Trend of Real Public Expenditure on Agriculture and Agricultural GDP



Source: Author's construction based on Appendix II

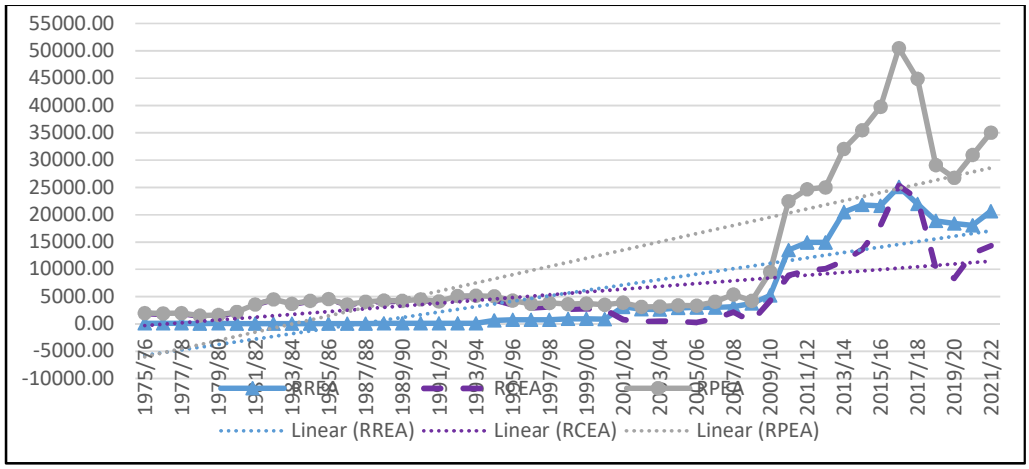
Figure 4.2 shows the trend of real agriculture GDP (RAGDP) and real public expenditure on agriculture during the study period. The figure shows that real agriculture GDP (RAGDP) is increasing over the period of time. Drastic increase in

RAGDP is observed in 2010/11 which might be the response toward drastic increase in capital expenditure and recurrent expenditure in agriculture in the particular year. Base year 2010/11 has been applied for the calculation of GDP deflator, which could be the reason for abrupt rise in RAGDP and RPEA during the same period. It shows the increasing trend of the real agriculture GDP along with the time. As a result, public expenditure and agriculture GDP increased drastically.

4.1.3 Trend of Real Public Expenditure, Real Recurrent Expenditure and Real Capital Expenditure on Agriculture

The structure of total public expenditure on agriculture is to be divided into recurrent expenditure and capital expenditure on agriculture. Hence, real public expenditure on agriculture is the sum of real recurrent expenditure and real capital expenditure on agriculture of respective years under study period. So, the structure of real public expenditure on agriculture dividing into real recurrent expenditure and real capital expenditure on agriculture during study period can be shown with the help of given figure.

Figure 4.3: Trend of Real Public Expenditure, Real Capital Expenditure, and Real Recurrent Expenditure on Agriculture



Source: Author's construction based on Appendix II

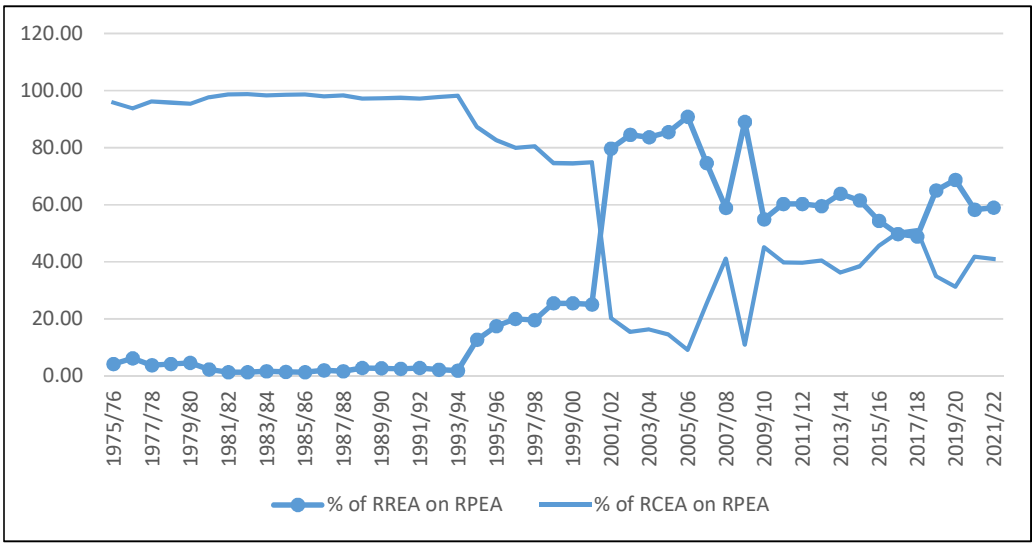
In Figure 4.3, it is observed that public expenditure along with the capital and recurrent expenditure had increasing trend over the period of time. However there are some irregularities along with the period of time. So, it also shows that the data has increasing trend and non-stationary in nature. Capital expenditure on agriculture was higher than recurrent expenditure on agriculture until 2000/01. From 2001/02 onwards, recurrent

expenditure on agriculture seems to be dominant in total public expenditure on agriculture**.** Further, to know the process of nature of variable, descriptive test is carried out in table 4.3.

4.1.4 Share of Recurrent and Capital Expenditure on Total Public Expenditure on Agriculture

The overall public spending on the agricultural sector can be categorized into two components: recurrent expenditure and capital expenditure.. The share of real recurrent expenditure is gradually increasing up to the few of given study period. Then, it starts gradually decreasing and fluctuates over time period. Similarly, the share of real capital expenditure is gradually decreasing up to the few of given study period. Then, it starts gradually increasing and fluctuates over time period. It can be shown with the help of given figure 4.4.

Figure 4.4: Share of Recurrent and Capital Expenditure on Total Public Expenditure on Agriculture



Source: Author's construction based on appendix III

It is evident from the figure 4.4 that the share of RCEA holds large portion from 1975/76 to 2001/02. From 2001/02, the share of RCEA is immensely being smaller than RREA. However, the share of RCEA is on increasing trend. During the year 2016/17 and 2017/18, both RCEA and RREA shares around 50 percent of total expenditure. After that period, RREA continues to hold large potion than RREA as seen in the graph. Government seems to give more priority on RREA for subsidy programs and other operational costs.

4.1.5 Public Expenditure on Agricultural and Agricultural GDP in Different Political Regimes of Nepal

Political instability has been a major characteristic of Nepal since 1975 until today. Nepal has experienced three broader political regimes namely Panchayat (1960-1990), Constitutional Monarchy (1990-2008), and the Federal Democratic Republic of Nepal (from 2008 till date) (Gyanwali, 2017). On the basis of these political regimes in Nepal, average under different regimes are calculated and analyzed in table 4.1.

Table 4.1: Average under Different Political Regimes (In NRs. Million)

SN	Political Regimes / System	RREA	RCEA	RPEA	RAGDP
1	Panchayat (1975/76-1989/90)	75.75	3126.77	3202.52	96229.34
2	Democracy (1990/91-2007/08)	1481.01	2580.21	4061.22	141258.77
3	Republic (2008/09-2021/22)	17089.71	12223.28	29312.99	448400.05

Source: Author's calculation through Excel based on Appendix II

Table 4.1 shows the trend of real agricultural GDP (RAGDP), real public expenditure on agricultural (RPEA), real recurrent expenditure on agricultural (RREA), and real capital expenditure on agriculture (RCEA) for the period ranging 1975/76 to 2021/22 under the different political regimes. It shows that RREA, RCEA, RPEA and RAGDP are much higher in republic system. But, RPEA and RAGDP have lowest average in Panchayat period and maintained medium average in democracy system. In Panchayat and democracy system, capital expenditure is given more focus, as average of RCEA is higher than RREA.

But in republic system recurrent expenditure is dominant in comparison to capital expenditure as average of RCEA is lower than RREA. Pattern of RREA shows ascending order as average of RREA gradually increases from Panchayat to republic system. However, RCEA shows different scenario. RCEA declined in democratic system in comparison to panchayat system. Later in republic system RCEA increased in comparison to democratic system. However, share of capital expenditure is lesser than the share of recurrent expenditure in republic system, which used to occupy more share in previous periods.

4.1.6 Nature of Public Expenditure on Agriculture and Agricultural GDP in 5 Year Average

As the study period of the study is 47 years, the nature of public expenditure on agriculture and agricultural GDP can be analyzed through the grouping of five

years interval on average of the study period that makes simple and easy to understand the change and fluctuation in public expenditure on agriculture public expenditure and agricultural GDP in every five years interval that can be shown with the help of given table 4.2.

Table 4.2 Public Expenditure on Agriculture and Agriculture 5-year average (in NRs. million)

Time Period	Composition of Public Expenditure in Real Term			
	RREA	RCEA	RPEA	RAGDP
1975-1979	83.34	1732.23	1815.57	83189.93
1980-1984	56.35	3586.92	3643.27	97428.44
1985-1989	87.55	4061.16	4148.72	108069.66
1990-1994	215.82	4578.32	4794.14	121698.00
1995-1999	821.49	3014.15	3835.64	141607.71
2000-2004	2445.13	985.06	3430.19	151702.24
2005-2009	3646.50	1661.77	5308.27	165061.33
2010-2014	17120.74	10818.81	27939.55	487893.56
2015-2019	21192.64	16999.26	38191.89	492396.25
2020-2021	19351.25	13641.43	32992.68	509231.47

Source: Author's calculation through Excel based on Appendix II

The table 4.2 shows that the average of agriculture GDP shows that it is increasing over the period of time in real term. The average has increased from NRs. 83189.93 million starting the year 1975-1979 to 509231.47 million on the period of two year average 2020-2021. The average of public expenditure on agriculture shows that it increasing from Nrs.1815.57 million starting the year 1979-1979 to 4794.14 million on the period of 1990-1994. However, the average decreased over the period of the year 1995-1999 and 2000-2004. Later it increased from NRs. 5308.27 million on the year 2005-2009 to 32992.68 million on the period of two year average 2020-2021.

4.2 Relationship between Public Expenditure on Agriculture and Agricultural GDP

In order to examine the short run and long run relationship between the public expenditure in agriculture and agricultural GDP, the second section analyzed the relationship between public expenditure on agriculture and agricultural GDP by using various statistical and econometric tools like descriptive statistics, unit root test, lag length test, co-integration analysis, vector auto-regression (VAR) model, and various

tests related to diagnostic test like normality test, serial correlation test (residual diagnostic test), heteroskedasticity test, and VAR Granger causality test. Capital expenditure and recurrent expenditure on agriculture are Unit root test of variables are performed before conducting the VAR model test of variables. Augmented Dickey Fuller (ADF) test is conducted to check the unit root of lnRAGDP, lnRREA, and lnRCEA that are followed by Johansen Co-integration test, and VAR model. Then, causal test and diagnostic tests are carried out which are shown below:

4.2.1 Descriptive Statistics

This section provides an overview of the descriptive statistical outcomes obtained in the study. Descriptive statistics is the term given to the analysis of data that helps to describe, show, or summarize data in a meaningful way. The descriptive statistics of the study in log form are shown in table 4.3.

Table: 4.3 Descriptive Statistics of Variables Used

Statistics	lnRAGDP	lnRREA	lnRCEA
Mean	12.0607	6.8216	8.1586
Median	11.8895	6.7810	8.2944
Maximum	13.1437	10.1316	10.1418
Minimum	11.2158	3.8893	5.7159
Std. Dev.	0.6539	2.2892	1.0548
Skewness	0.7858	0.1127	-0.3501
Kurtosis	2.0607	1.4576	2.8140
Jarque-Bera	6.5650	4.7581	1.0276
Probability	0.0375	0.0926	0.5982
Total Observations	47	47	47

Source: Author's calculation based on data set shown in appendix IV and V.

Table 4.3 displays the summary statistics for the variables under examination in this study. The dataset comprises a total of 47 observations, corresponding to the 47-year time frame considered. The table offers an overview of the descriptive statistics, offering fundamental insights into the data's performance, patterns, and trends across both time and space.

The dataset contains a span of 47 years, commencing from 1975/76 and extending to 2021/22. The descriptive statistics reveal that the mean of lnRAGDP stands at 12.0607, accompanied by a standard deviation of 0.6539. The maximum and minimum of lnRAGDP are 13.1437 and 11.2158 respectively. Similarly, the mean of lnRREA is 6.8216 with standard deviation of 2.2892. The maximum and minimum of lnRREA are 10.1316 and 3.8893 respectively. The mean of lnRCEA is 8.16 with standard deviation of 1.05. The maximum and minimum of lnRCEA are 10.1418 and 5.7159 respectively.

Skewness measures the degree of asymmetry of the series. From the table 4.3, it can be seen that lnRAGDP and lnRREA are positively skewed, whereas, lnRCEA is negatively skewed. Kurtosis measures the flatness or peakness of the distribution of the series. Since the value of kurtosis of all three variables is less than three, it can be shown that the curve of all three data is somewhat flat in nature. The probability of Jarque-Bera is less than 0.05 for lnRAGDP, which means the distribution of lnRAGDP is not normal. The probability of Jarque-Bera is more than 0.05 for lnRREA and lnRCEA, which means the distribution of these variables are normal.

4.2.2 Unit Root Test

The stationarity of the data in this study is checked by using Augmented Dickey Fuller (ADF) test.

Table 4.4: Results of Augmented Dickey Fuller (ADF) Unit Root Test

Variables	Level		First Difference		Order of Integration
	Intercept	Intercept & Trend	Intercept	Intercept & trend	
lnRAGDP	- 0.1463 [0.9378]	- 2.1380 [0.5116]	- 6.3003 [0.0000]	- 6.2660 [0.0000]	I (0)
lnRCEA	- 1.5950 [0.4770]	- 1.8523 [0.6627]	- 7.3615 [0.0000]	- 7.2978 [0.0000]	I (1)
lnRREA	- 0.2431 [0.9252]	- 2.7643 [0.2173]	- 7.2759 [0.0000]	- 7.2623 [0.0000]	I (1)

Source: Author's calculation through e-views (See: Appendix – VI)

The hypothesis to be tested is:

H_o: The series is non-stationary or has a unit root against the alternative hypothesis.

H_1: The series is stationary or has no unit root.

Presented in table 4.4 are the outcomes of the unit-root tests, conducted using the Augmented Dickey-Fuller (ADF) tests for each variable's order. When assessing the series in their original levels, the null hypothesis of unit roots in the series cannot be dismissed even at a significance level of 5 percent. However, this null hypothesis is rejected for each differenced series, as indicated by probability values below zero and negative coefficients. This points to the variables being integrated at order I(1)..

4.2.3 Lag Length Test

For the econometric analysis of time series data, the optimal lag is needed. To select the optimal number of lags there are several methods as shown in the following table.

Table 4.5: Results of Lag Length Selection

Lag	LR	FPE	AIC	SC	HQ
0	NA	0.1133	6.3360	6.4589	6.3813
1	209.6591	0.0008	1.3787	1.8702*	1.5600*
2	12.6563	0.0009	1.4458	2.3059	1.7629
3	10.6412	0.0010	1.5419	2.7706	1.9950
4	26.9608*	0.0007*	1.0618*	2.6592	1.6508

Source: Authors calculation through E-views [See: Appendix-VI]

Note: LR: Sequential modified LR test statistic (each at 5 % level),
FPE: Final Prediction Error, AIC: Akaike Information Criterion,
SC: Schwartz Information Criterion, HQ: Hannan Quinn information Criterion
* Indicates lag order selected by criterion

Utilizing Vector Auto-regression, the selection of an appropriate lag length is crucial to ensure that the research outcomes accurately mirror the actual economic landscape and, importantly, maintain consistency with both economic and econometric theories. Sequential modified LR test statistic, Final Prediction Error (FPE) criterion, and Akaike Information Criterion (AIC) all indicate that a lag length of 4 is necessary. Conversely, the Schwarz Information Criterion and Hannan-Quinn Information Criterion suggest a lag length of 1.Thus thesis has considered lag 4 as suggested by these criteria. Lag 4 is used for co-integration test and vector auto regression model (VAR Model).

4.2.4 Co-integration Analysis

Here, the data became stationary after first difference as shown by Augmented Dicky Fuller test. One special feature of this is that they are of the same order of integration. To verify further the relevance of the model, there is need to test for co-integration.

The hypothesis is stated as:

H_0: There exists no co-integration equation.

H_1: H_0 is not true**.**

To achieve this, Johansen Multivariate Co-integration test is used. The results of the Johansen's Trace test is shown in Table 4.6 and 4.7.

Table 4.6 Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob**
None*	0.3061	26.9153	42.9153	0.686
At most 1	0.1858	10.8364	25.9721	0.8844
At most 2	0.0399	1.7904	12.518	0.98

Source: Author's calculation through E-views [See: Appendix-VIII]

Note: Trace indicates no co-integrating equations at the 0.05 % level.
* denotes rejection of the hypothesis at the 0.05 level.
** Mackinnon-Haug-Michelis(1999) p-values.

First of all it is checked the trace statistic. When the null hypothesis is none, it refers to no co-integration between the variables. The p-value is 0.6860 which is greater than 5 percent. Thus, in this case the null hypothesis is not rejected. That suggests there is no co-integration between the variables. Checking the trace statistic for the none case, trace statistic (26.9153) is less than the critical value (42.9153). This also suggests that we cannot reject null hypothesis implying that there is no co-integration between the variables which means there is no long run relationship between the variables.

After checking the trace statistics, Max-Eigen test is checked which is shown in table 4.7. In this case for the non-case, the p-value is 0.5377 which is greater than 5 percent. Thus we cannot reject null hypothesis which means there is no co-integration between the variables.

Table 4.7: Unrestricted Co-integration Rank Test (Maximum Eigen Value)

Hypothesized No. of CE(s)	Eigen Value	Max-Eigen Statistic	0.05 Critical Value	Prob**
None*	0.3061	16.0789	25.8232	0.5377
At most 1	0.1858	9.046	19.387	0.7197
At most 2	0.0399	1.7904	12.519	0.98

Source: Author's calculation through E-views [See: Appendix-VIII]

Note: Max-Eigen indicates no co-integrating equations at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05% level.
** Mackinnon-Haug-Michelis(1999) p-values.

Max Eigen Statistic for this null hypothesis is 16.0789 which is less than critical value (25.8232). This also suggests that there is no co-integration between the variables. Hence, it is concluded that a long run relationship does not exist among the three variables. Now, short run model is estimated, which is VAR.

4.2.5 Vector Auto Regression Model

As co-integration analysis suggested no co-integrating equation among the variables, we conducted Vector Auto Regressive Model (VAR) in E-views. The result of VAR model is following.

DlnRAGDP = C(1)*DlnRAGDP(-1) + C(2)*DlnRAGDP(-2) + C(3)*DlnRCEA(-1) + C(4)*DlnRCEA(-2) + C(5)*DlnRREA(-1) + C(6)*DlnRREA(-2) + C(7)

Table 4.8: Result of Vector Auto-regression Model

Variables	Coefficients	Std. Error	t-statistic	Prob.
DlnRAGDP(-1)	0.1584	0.1657	0.9562	0.3452
DlnRAGDP(-2)	0.0588	0.1311	0.4487	0.6563
DlnRCEA(-1)	0.1191	0.0339	3.5157	0.0012
DlnRCEA(-2)	-0.1257	0.0414	-3.0360	0.0044
DlnRREA(-1)	0.08129	0.0470	1.7324	0.0917
DlnRREA(-2)	-0.02598	0.0489	-0.5310	0.5986
Constant	0.0250	0.0194	1.2880	0.2057

Source: Author's calculation through E-views [See: Appendix-IX]

Examining the table 4.8, it is found that, for AGDP itself, first lagged period has significant positive influence on current period. The absolute value of coefficient of first period lag has a great influence on AGDP at current period than that of second period lag. Similarly, recurrent expenditure in first lagged period has positive influence on AGDP at current price. However, recurrent expenditure in second lagged period seems to have negative influence on AGDP at current price. Capital expenditure in first lagged period has positive influence on AGDP at current period. However, capital expenditure in second lagged period seems to have negative influence on AGDP at current period.

4.2.6 Diagnostic Test Results of the Models

To confirm that used models are not wrongly specified, this section shows the results of the tests for serial correlation or autocorrelation, normality, and heteroscedasticity. The absence of serial correlation, normal distribution of random disturbances and homoscedastic variance of random disturbances confirm the model stated are best fitted models. Here the diagnostic results of the model are shown serially.

a) Normality Test: - For diagnostic test, histogram normality test is conducted which suggested the probability value is 0.00. Since the probability value is less than 0.05, we reject null hypothesis meaning that that the distribution is not normal which might be due to small sample size. [See: Appendix-X]

b) Serial Correlation Test (Residual diagnostic test):- After conducting the normality test, Serial Correlation LM test is conducted to test residual diagnostic which result is shown below:

Table 4.9 Result of Serial Correlation Test

F-statistic	0.599012	Prob. F(2,41)	0.5541
Obs*R-squared	1.3060	Prob. Chi-Square(20)	0.5205

Source: Author's calculation through E-views. [See: Appendix-XI]

Here serial correlation LM test shows Prob. Chi-Square to be 0.5205 which is greater than 0.05 percent level. T Hence we conclude that there is no serial correlation among the variables.

c) Heteroskedasticity Test:- The Breush-Pagan Godfrey test of heteroskedasticity shows that there is not the presence of heteroskedasticity.

Table 4.10: Breush-Pagan Godfrey test

F-statistic	1.5694	Prob. F(6,37)	0.1836
Obs*R-squared	8.9264	Prob. Chi-Square(6)	0.1778
Scaled explained SS	22.1414	Prob. Chi-Square(6)	0.0011

Source: Author's calculation through E-views. [See: Appendix-XII]

4.2.7 VAR Granger Causality Test Results

To identify the causality of AGDP, recurrent expenditure on agriculture, capital expenditure on agriculture, vector auto regression granger causality test is carried out. The result of VAR Granger Causality Test is shown in table 4.11.

Table 4.11: VAR Granger Causality Test Results

Dependent Variable	Excluded	Chi-sq	D.F.	P-value
lnRAGDP	lnRCEA	21.7067	2	0
	lnrRREA	6.0983	2	0.0474
	All	27.2907	4	0
lnRCEA	lnRAGDP	5.5693	2	0.0618
	lnrRREA	4.2203	2	0.1212
	All	6.4808	4	0.166
lnrRREA	lnRAGDP	0.01387	2	0.9931
	lnRCEA	1.3856	2	0.5002
	All	1.504	4	0.8259

Source: Author's calculation through E-views. [See: Appendix-XIII]

Table 4.11 shows that capital expenditure on agriculture granger causes AGDP since the p-value is less than 0.05. Recurrent expenditure on agriculture also granger cause

AGDP since p-value is less than 0.05. Both the variables when put together also granger cause AGDP since the p-value is less than 0.05. The study shows that RAGDP and RREA does not granger cause RCEA as the p-value is greater than 0.05. Similarly, RCEA and RAGDP also do not cause RREA. It shows that there is unidirectional causality between recurrent expenditure in agriculture and agricultural GDP. Similarly capital expenditure in agriculture shows unidirectional causality with agricultural GDP. Thus, it is concluded that there is unidirectional causality in short run between public expenditure in agriculture and agricultural GDP.

CHAPTER - V

MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Major Findings

Public expenditure on agriculture refers to the funds allocated by the government for agricultural purposes which includes both capital and recurrent expenses related to agriculture. Recurrent expenditure involves spending on goods, services, wages, salaries and daily operational activities. On the other hand, capital expenditure pertains to acquiring fixed assets and upgrading existing ones, like irrigation canals, machinery, and equipment used in agriculture.

The significance of public expenditure on agriculture lies in its pivotal role in promoting agricultural production. By aiming to boost agricultural output, this expenditure contributes to an increase in agri-GDP, which constitutes a substantial portion of the overall national GDP. Consequently, public expenditure on agriculture becomes imperative for the economic growth.

The studies on national and international context do not have common consensus about the relationship between public expenditure on agriculture and agriculture GDP. But most of the studies accepted the importance of public expenditure to boost economic growth. The findings of the available literature related to the study can be summarized as below. Theoretically, public expenditure as policy instrument to promote economic growth has been advocated by John Maynard Keynes. This is supported by numerous economists and scholars in the field. The endogenous growth approach, Peacock and Wiseman Approach, Baumol's approach, Stanley Please Hypothesis supported the concept.

However, counter argument of the positive link between public expenditure and economic growth are also found in the empirical literature. Classical economists were never in favor of government's role in the economic activities. Neo-classical approach also argued with the point that fiscal policy does not have any effect on the growth of output and economic growth in the long run. Rahn curve hypothesis also supported limited government expenditure and concluded that higher government expenditure might have negative impact on the economy.

Majority of the empirical studies find a positive impact of public expenditure in agriculture on agricultural GDP. The results are confirmed by the work of Mani et al., (2011), Mogues et al.,(2012), Thapa (2015), Chaudhary and Acharya (2018), Wagle (2016), Karkee (2008). Many studies recommended government capital expenditure in order to increase the output of agriculture. This recommendation is supported by the study of Pukayo and Umaru (2012), Bathla (2014), Thapa (1992), Inoncio and McCornick (2007), Jha (2007), Jambo (2017). While other authors found that the effect of capital expenditure on GDP was negative. Many empirical studies have shown that recurrent government expenditure had a positive impact on GDP as confirmd by Ogbuagu and Ekpenyong (2015), Mulinge (2016), Mgbanya et al., (2018). While other authors have found only short run or negative impact of recurrent and capital government expenditure in agriculture on GDP as confirmed by Kharel (2020), Pant (2015), Jabeen and Shah (2015).

In summary, the empirical literature in the linkage between public relationship on agriculture and agriculture GDP does not provide a consensus with its theoretical relationship as many authors documented a positive relationship between them while others do not trace it, or at best report very weak relationship. Author's perspective, sample selection, methodologies, and analytical tools applied in their study etc. are the reasons resulting in a wide difference in results. Besides, the country-specific characteristics concerning the economic, technological, infrastructural and institutional developments and policy instruments indeed matter significantly to gauge empirical relationships.

The primary aim of the study was to investigate the correlation between public expenditure and agricultural GDP in Nepal covering annual data from 1975/76 to 2021/22. However, the first specific objective of the study is to analyze the trend of public expenditure on agriculture and agriculture GDP. Public expenditure along with the capital and recurrent expenditure had increasing trend over the period of time. However, there are some irregularities along with the period of time. So, it also shows that the data has increasing trend and non-stationary in nature. Capital expenditure on agriculture was higher than recurrent expenditure on agriculture until 2000/01. From 2001/02 onwards, recurrent expenditure on agriculture seems to be dominant in total public expenditure on agriculture. Real agriculture GDP is also increasing over the period of time. There has been a notable surge in AGDP and public expenditure on

agriculture, particularly since the 2008/09 period, which can potentially be attributed to a significant increase in both capital and recurrent expenditures within the agriculture sector during that study period, which also might be due to the new policies followed by republic period in Nepal which started from 2008/09. The progressive growth in agriculture can be observed as time unfolds. We can see the increasing trend of the real agriculture GDP along with the time. The ratio of agricultural budget to AGDP almost doubled between 2008-09 and 2013-14 (Sharma, et. al, 2017). As a result, public expenditure and agriculture GDP increased drastically.

The second specific objective of the study is to analyze the short run and long run relationship between the public expenditure (capital and recurrent expenditure) in agriculture and agricultural GDP. This study considered variables in the real form for the analysis. The agricultural GDP was taken as the proxy of the agricultural growth and is the dependent variable, recurrent and capital expenditure of the government in the agriculture sector are taken as an explanatory variable, to find the relationship between public expenditure and agricultural GDP. The study conducted Johansen cointegration test which showed that there is no long run relationship between the public expenditure in agriculture and agriculture GDP. So, the study used VAR model which showed that there exists short run relationship between public expenditure and agriculture GDP.

The empirical findings derived from the estimated model revealed that, concerning AGDP itself, the first lagged period exerts a significantly positive impact on the current period. The magnitude of the coefficient associated with the first period lag holds a more substantial influence on the AGDP in the current period compared to that of the second period lag. Similarly, recurrent expenditure in the first lagged period demonstrates a positive effect on the AGDP in the current period. However, for the second lagged period, recurrent expenditure appears to exert a negative influence on the AGDP in the current period. In terms of capital expenditure, the first lagged period has a positive influence on the AGDP in the current period. Conversely, the second lagged period for capital expenditure seems to exert a negative impact on the AGDP in the current period.

Granger causality test reveal that over the period from 1975/76 to 2021/22, there is unidirectional causality between recurrent expenditure in agriculture and agriculture

GDP. Capital expenditure in agriculture also showed unidirectional causality with agriculture GDP. Overall public expenditure granger caused agricultural GDP in Nepal

5.2 Conclusion

It has been observed that capital expenditure on agriculture has a positively correlated with agriculture GDP. To potentially increase the contribution percentage of capital expenditure to agricultural GDP, effective implementation and supervision of Nepal government policies and strategies are essential. Numerous ongoing projects focusing on capital expenditure are yet to yield their results, which could potentially boost the growth rate of agricultural output in the future.

However, in the short run, recurrent expenditure in the agriculture sector shows a negative effect on the growth rate of agricultural output, though this effect is not statistically significant. The negative impact is attributed to the lack of financial discipline in resource disbursement across different aspects of recurrent expenditure, with a significant portion being allocated to staff payments and administrative matters.

In conclusion, the study suggests that allocating more resources to capital aspects plays a crucial role in enhancing agricultural productivity and production in the long run, as opposed to increasing recurrent expenditure by the government. This finding aligns with the Keynesian theory of government expenditure, indicating that government spending can stimulate economic growth. Nevertheless, it is important to control the rise of recurrent expenditure to avoid burdening the national economy, ensuring that funds are directed towards logical areas. Additionally, delays in large projects could lead to inefficient capital expenditures. Therefore, meticulous preplanning, policymaking and feasibility studies for projects such as irrigation and industrial initiatives are vital to prevent premature abandonment and ensure timely and fruitful results.

5.3 Recommendations

The findings of this study and other relevant kinds of literature suggest that government expenditure plays vital components for agricultural productivity in Nepal. However, many inefficiencies are entailed in the allocation of government expenditure because of which economic growth is not satisfactory and there is an inverse association

between recurrent expenditure and agricultural production. So, on the top of above findings and various reviews, the following recommendations are made.

- Capital expenditure is key for infrastructural development. Thus government should focus on increasing capital expenditure so that farmers' access to the infrastructures like irrigation canals, plants, and mills, machines, and equipment is easier and cheap.
- The expenditure invested by the government in chemical fertilizer, improved seeds, and other agricultural inputs should be increased. But, the expenditure on wages and salaries, travel allowances, and daily allowances of employees which cover a large volume of recurrent expenditure should be allocated logically and result-oriented.
- As our country's economy is significantly based on the agriculture and majority of people are dependent on agriculture, Government should emphasize increasing expenditure on agriculture. As agriculture provides raw materials for the industries, investment in agriculture supports industries to produce secondary goods. Thus, investment in agriculture boosts up economic growth, directly and indirectly, both, first by supporting the people indulged in it, second by providing raw materials for industries.

5.4 Future Research Direction

This study has examined only the relationship between agriculture GDP, recurrent and capital expenditure on agriculture. However, another side of the expenditure like miscellaneous expenditure with contingencies and others along with the foreign capital flow, market interest rate, and environmental factors also affect agricultural productivity and growth of agricultural output. So, there is a scope of future research on expenditure on agricultural inputs and miscellaneous expenditure along with other stated variables.

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Appendix-I

Public Expenditure on Agriculture and Agricultural GDP (1975/76 to 2021/22)

Year	Agriculture GDP in million (AGDP)	Recurrent expenditure on Agri & Forest (REA)	Capital expenditure on Agri & Forest (CEA)	Total Public Expenditure on Agri & Forest (TPEA)	GDP Current Price	GDP constant price	GDP deflator/ price index
1975/76	11495	10.7	244.3	255	1739.4	13609.4	12.78
1976/77	10389	15	226.7	241.7	1728	13838.9	12.49
1977/78	11616	10.3	265.8	276.1	1972.7	14288.6	13.81
1978/79	13365	11.4	263.3	274.7	2612.8	14524	17.99
1979/80	13520	12	247.6	259.6	2335.1	14573.4	16.02
1980/81	15510	8	346.3	354.3	2553	15874.7	16.08
1981/82	17715	9.1	653.4	662.5	3098.8	16644.1	18.62
1982/83	19082	11.8	896.7	908.5	3382.1	16820.4	20.11
1983/84	22570	13.2	781.6	794.8	3929	18299.2	21.47
1984/85	22761	15	994	1009	4658.7	19552.9	23.83
1985/86	27136	16.6	1221.2	1237.8	5573.4	20483.8	27.21
1986/87	30623	21.6	1070.1	1091.7	6386.4	20915.2	30.53
1987/88	36755	23.6	1378.5	1402.1	7690.6	22390.3	34.35
1988/89	42572	45.5	1572.9	1618.4	8927	23597.9	37.83
1989/90	50470	48.9	1730.7	1779.6	10341.6	24749.1	41.79
1990/91	55368	50.4	1994.7	2045.1	12037	26395.5	45.6
1991/92	65156	63	2160.3	2223.3	14948.7	27687.5	53.99
1992/93	70090	66.9	3006	3072.9	17149.2	28644.9	59.87
1993/94	80589	60.3	3266.8	3327.1	19927.2	30911.5	64.47
1994/95	85569	445.1	3047.8	3492.9	21917.5	31840.7	68.83
1995/96	96896	549.5	2602.7	3152.2	24891.3	33668.1	73.93
1996/97	108785	588	2353.4	2941.4	28051.3	35358.6	79.33
1997/98	112495	620.4	2554.7	3175.1	30084.5	36559.2	82.29
1998/99	132373	820.4	2406.7	3227.1	34203.6	38234.8	89.46
1999/00	145131	890.4	2608.5	3498.9	37948.8	40574.6	93.53
2000/01	155625	940.8	2808.2	3749	44151.9	41342.9	106.79
2001/02	166090	3453.6	881.4	4335	45944.3	41409.2	110.95
2002/03	172803	3055.4	560.7	3616.1	49223.1	42969.9	114.55
2003/04	186125	3179.7	620	3799.7	53674.9	44865.4	119.64
2004/05	199368	3699.3	628.2	4327.5	58941.2	46316.5	127.26
2005/06	211704	4112.7	413.4	4526.1	65408.4	48043.5	136.14

2006/07	226823	4488.8	1526.7	6015.5	72782.7	49365.1	147.44
2007/08	247191	4967.4	3462.4	8429.8	81565.8	52226	156.18
2008/09	309553	6842.4	838.7	7681.1	98827.2	54265.2	182.12
2009/10	395755	11025	9049.2	20074.2	119277	56575.9	210.83
2010/11	480326	13561.4	8950.8	22512.2	156268	155922	100.22
2011/12	528851	16045.1	10562.2	26607.3	175838	163204	107.74
2012/13	557940	17183.8	11670.1	28853.9	194929	168957	115.37
2013/14	613094	25499.1	14463.7	39962.8	223253	179114	124.64
2014/15	642713	28406.6	17751.4	46158	242364	186236	130.14
2015/16	665553	30138.9	25312.5	55451.4	260818	187042	139.44
2016/17	729270	37930.4	38319.3	76249.7	307714	203834	150.96
2017/18	771875	34587.9	36104.3	70692.2	345595	219371	157.54
2018/19	832887	31164	16769.2	47933.2	385893	233974	164.93
2019/20	862518	31278.4	14258.1	45536.5	388870	228430	170.24
2020/21	911916	32395.3	23236.9	55632.2	427730	238131	179.62
2021/22	983233	39784	27616.3	67400.3	485162	252032	192.5

Sources: Macroeconomic Dashboard (2021/22), MoF; Current Macroeconomic and Financial Statistics (2021/22), NRB.

Appendix-II

Real Agricultural GDP and Real Public Expenditure on Agriculture

Year	Real Agri GDP (RAGDP)	Real recurrent expenditure on Agri & Forest (RREA)	Real capital expenditure on Agri & Forest (RCEA)	Real Public Expenditure on Agri & Forest (RPEA)
1975/76	89939.22	83.72	1911.45	1995.17
1976/77	83201.76	120.13	1815.56	1935.69
1977/78	84136.71	74.60	1925.24	1999.84
1978/79	74293.40	63.37	1463.63	1527.00
1979/80	84378.56	74.89	1545.28	1620.17
1980/81	96442.07	49.74	2153.31	2203.06
1981/82	95149.81	48.88	3509.51	3558.38
1982/83	94901.65	58.69	4459.61	4518.30
1983/84	105119.10	61.48	3640.28	3701.76
1984/85	95529.56	62.96	4171.89	4234.85
1985/86	99732.37	61.01	4488.25	4549.26
1986/87	100289.08	70.74	3504.53	3575.27
1987/88	107007.97	68.71	4013.34	4082.05
1988/89	112536.10	120.28	4157.85	4278.13
1989/90	120782.77	117.03	4141.84	4258.87
1990/91	121414.48	110.52	4374.11	4484.63
1991/92	120679.84	116.69	4001.24	4117.92
1992/93	117073.74	111.75	5021.03	5132.77
1993/94	125011.39	93.54	5067.53	5161.07
1994/95	124310.57	646.62	4427.70	5074.32
1995/96	131062.03	743.26	3520.43	4263.68
1996/97	137123.25	741.17	2966.46	3707.63
1997/98	136705.85	753.92	3104.52	3858.44
1998/99	147974.34	917.09	2690.35	3607.44
1999/00	155173.08	952.01	2788.99	3741.00
2000/01	145723.30	880.94	2629.54	3510.48
2001/02	149695.66	3112.70	794.40	3907.10
2002/03	150850.22	2667.25	489.47	3156.72
2003/04	155576.88	2657.83	518.24	3176.07
2004/05	156665.16	2906.94	493.64	3400.59
2005/06	155500.09	3020.84	303.65	3324.49
2006/07	153843.30	3044.54	1035.49	4080.03
2007/08	158274.60	3180.59	2216.95	5397.54
2008/09	169973.18	3757.11	460.52	4217.63
2009/10	187715.50	5229.40	4292.24	9521.64
2010/11	479263.17	13531.39	8930.99	22462.38

2011/12	490853.40	14892.27	9803.31	24695.58
2012/13	483600.54	14894.24	10115.19	25009.43
2013/14	491881.24	20457.77	11604.13	32061.90
2014/15	493869.45	21828.03	13640.42	35468.45
2015/16	477292.40	21613.70	18152.51	39766.21
2016/17	483076.63	25125.54	25383.15	50508.69
2017/18	489957.10	21955.10	22917.65	44872.74
2018/19	504995.37	18895.32	10167.48	29062.81
2019/20	506659.74	18373.54	8375.48	26749.02
2020/21	507693.17	18035.51	12936.73	30972.25
2021/22	510769.78	20666.99	14346.12	35013.11

Source: Author's calculation through Excel.

Appendix-III

Share of Recurrent and Capital Expenditure on Total Public Expenditure on Agriculture

Year	% of RREA on RPEA	% of RCEA on RPEA	Year	% of RREA on RPEA	% of RCEA on RPEA
1975/76	4.20	95.80	2007/08	58.93	41.07
1976/77	6.21	93.79	2008/09	89.08	10.92
1977/78	3.73	96.27	2009/10	54.92	45.08
1978/79	4.15	95.85	2010/11	60.24	39.76
1979/80	4.62	95.38	2011/12	60.30	39.70
1980/81	2.26	97.74	2012/13	59.55	40.45
1981/82	1.37	98.63	2013/14	63.81	36.19
1982/83	1.30	98.70	2014/15	61.54	38.46
1983/84	1.66	98.34	2015/16	54.35	45.65
1984/85	1.49	98.51	2016/17	49.74	50.26
1985/86	1.34	98.66	2017/18	48.93	51.07
1986/87	1.98	98.02	2018/19	65.02	34.98
1987/88	1.68	98.32	2019/20	68.69	31.31
1988/89	2.81	97.19	2020/21	58.23	41.77
1989/90	2.75	97.25	2021/22	59.03	40.97
1990/91	2.46	97.54			
1991/92	2.83	97.17			
1992/93	2.18	97.82			
1993/94	1.81	98.19			
1994/95	12.74	87.26			
1995/96	17.43	82.57			
1996/97	19.99	80.01			
1997/98	19.54	80.46			
1998/99	25.42	74.58			
1999/00	25.45	74.55			
2000/01	25.09	74.91			
2001/02	79.67	20.33			
2002/03	84.49	15.51			
2003/04	83.68	16.32			
2004/05	85.48	14.52			
2005/06	90.87	9.13			
2006/07	74.62	25.38			

Source: Author's calculation through Excel.

Appendix-IV

Natural Log value of RAGDP and Public Expenditure

Year	lnRAGDP	lnRREA	lnRCEA	Year	lnRAGDP	lnRREA	lnRCEA
1975/76	11.41	4.43	7.56	2007/08	11.97	8.06	7.70
1976/77	11.33	4.79	7.50	2008/09	12.04	8.23	6.13
1977/78	11.34	4.31	7.56	2009/10	12.14	8.56	8.36
1978/79	11.22	4.15	7.29	2010/11	13.08	9.51	9.10
1979/80	11.34	4.32	7.34	2011/12	13.10	9.61	9.19
1980/81	11.48	3.91	7.67	2012/13	13.09	9.61	9.22
1981/82	11.46	3.89	8.16	2013/14	13.11	9.93	9.36
1982/83	11.46	4.07	8.40	2014/15	13.11	9.99	9.52
1983/84	11.56	4.12	8.20	2015/16	13.08	9.98	9.81
1984/85	11.47	4.14	8.34	2016/17	13.09	10.13	10.14
1985/86	11.51	4.11	8.41	2017/18	13.10	10.00	10.04
1986/87	11.52	4.26	8.16	2018/19	13.13	9.85	9.23
1987/88	11.58	4.23	8.30	2019/20	13.14	9.82	9.03
1988/89	11.63	4.79	8.33	2020/21	13.14	9.80	9.47
1989/90	11.70	4.76	8.33	2021/22	13.14	9.94	9.57
1990/91	11.71	4.71	8.38				
1991/92	11.70	4.76	8.29				
1992/93	11.67	4.72	8.52				
1993/94	11.74	4.54	8.53				
1994/95	11.73	6.47	8.40				
1995/96	11.78	6.61	8.17				
1996/97	11.83	6.61	8.00				
1997/98	11.83	6.63	8.04				
1998/99	11.90	6.82	7.90				
1999/00	11.95	6.86	7.93				
2000/01	11.89	6.78	7.87				
2001/02	11.92	8.04	6.68				
2002/03	11.92	7.89	6.19				
2003/04	11.95	7.89	6.25				
2004/05	11.96	7.97	6.20				
2005/06	11.95	8.01	5.72				
2006/07	11.94	8.02	6.94				

Source: Author's calculation through Excel.

Appendix-V

Descriptive Statistics Test Result

	LNRAGDP	LNRCEA	LNRREA
Mean	12.06068	8.158575	6.821585
Median	11.88946	8.294359	6.780994
Maximum	13.14367	10.14184	10.13164
Minimum	11.21578	5.715871	3.889315
Std. Dev.	0.653931	1.054752	2.289158
Skewness	0.785811	-0.350052	0.112655
Kurtosis	2.060657	2.813984	1.457639
Jarque-Bera	6.565042	1.027632	4.758050
Probability	0.037534	0.598208	0.092641
Sum	566.8518	383.4530	320.6145
Sum Sq. Dev.	19.67080	51.17506	241.0512
Observations	47	47	47

Appendix-VI

Unit Root Test Results through E-views

Null Hypothesis: LNRAGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.146348	0.9378
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRAGDP)
Method: Least Squares
Date: 07/18/23 Time: 08:41
Sample (adjusted): 2 47
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRAGDP(-1)	-0.004992	0.034109	-0.146348	0.8843
C	0.097843	0.411143	0.237978	0.8130

R-squared	0.000487	Mean dependent var	0.037756
Adjusted R-squared	-0.022230	S.D. dependent var	0.144996
S.E. of regression	0.146599	Akaike info criterion	-0.959729
Sum squared resid	0.945614	Schwarz criterion	-0.880223
Log likelihood	24.07377	Hannan-Quinn criter.	-0.929945
F-statistic	0.021418	Durbin-Watson stat	1.882761
Prob(F-statistic)	0.884315		

Null Hypothesis: LNRAGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.138029	0.5116
Test critical values:	1% level	-4.170583	
	5% level	-3.510740	
	10% level	-3.185512	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRAGDP)
Method: Least Squares
Date: 07/18/23 Time: 08:42
Sample (adjusted): 2 47
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRAGDP(-1)	-0.168989	0.079039	-2.138029	0.0382
C	1.869967	0.871649	2.145321	0.0376
@TREND("1")	0.008593	0.003773	2.277535	0.0278

R-squared	0.108080	Mean dependent var	0.037756
Adjusted R-squared	0.066596	S.D. dependent var	0.144996
S.E. of regression	0.140085	Akaike info criterion	-1.030143
Sum squared resid	0.843822	Schwarz criterion	-0.910884
Log likelihood	26.69330	Hannan-Quinn criter.	-0.985468
F-statistic	2.605311	Durbin-Watson stat	1.791437
Prob(F-statistic)	0.085507		

Null Hypothesis: D(LNRAGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.300251	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRAGDP,2)
Method: Least Squares
Date: 07/18/23 Time: 08:43
Sample (adjusted): 3 47
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRAGDP(-1))	-0.953277	0.151308	-6.300251	0.0000
C	0.038529	0.022686	1.698325	0.0967

R-squared	0.480005	Mean dependent var	0.001865
Adjusted R-squared	0.467913	S.D. dependent var	0.201649
S.E. of regression	0.147092	Akaike info criterion	-0.952096
Sum squared resid	0.930346	Schwarz criterion	-0.871800
Log likelihood	23.42215	Hannan-Quinn criter.	-0.922162
F-statistic	39.69317	Durbin-Watson stat	2.003199
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNRAGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.265962	0.0000
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRAGDP,2)
Method: Least Squares
Date: 07/18/23 Time: 08:44
Sample (adjusted): 3 47
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRAGDP(-1))	-0.963888	0.153829	-6.265962	0.0000
C	0.016687	0.046462	0.359145	0.7213
@TREND("1")	0.000927	0.001717	0.540102	0.5920

R-squared	0.483592	Mean dependent var	0.001865
Adjusted R-squared	0.459001	S.D. dependent var	0.201649
S.E. of regression	0.148318	Akaike info criterion	-0.914573
Sum squared resid	0.923928	Schwarz criterion	-0.794129
Log likelihood	23.57789	Hannan-Quinn criter.	-0.869672
F-statistic	19.66553	Durbin-Watson stat	1.996200
Prob(F-statistic)	0.000001		

Null Hypothesis: LNRCEA has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.595014	0.4770
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRCEA)
Method: Least Squares
Date: 07/18/23 Time: 08:56
Sample (adjusted): 2 47
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRCEA(-1)	-0.124248	0.077898	-1.595014	0.1179
C	1.053691	0.638242	1.650927	0.1059

R-squared	0.054659	Mean dependent var	0.043818
Adjusted R-squared	0.033174	S.D. dependent var	0.555331
S.E. of regression	0.546042	Akaike info criterion	1.670264
Sum squared resid	13.11913	Schwarz criterion	1.749770
Log likelihood	-36.41607	Hannan-Quinn criter.	1.700047
F-statistic	2.544070	Durbin-Watson stat	2.081357
Prob(F-statistic)	0.117868		

Null Hypothesis: LNRCEA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.852307	0.6627
Test critical values:	1% level	-4.170583	
	5% level	-3.510740	
	10% level	-3.185512	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRCEA)
Method: Least Squares
Date: 07/18/23 Time: 08:58
Sample (adjusted): 2 47
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRCEA(-1)	-0.154201	0.083248	-1.852307	0.0709
C	1.142210	0.643896	1.773904	0.0832
@TREND("1")	0.006593	0.006481	1.017277	0.3147

R-squared	0.076876	Mean dependent var	0.043818
Adjusted R-squared	0.033940	S.D. dependent var	0.555331
S.E. of regression	0.545826	Akaike info criterion	1.689961
Sum squared resid	12.81082	Schwarz criterion	1.809220
Log likelihood	-35.86910	Hannan-Quinn criter.	1.734636
F-statistic	1.790469	Durbin-Watson stat	2.067920
Prob(F-statistic)	0.179100		

Null Hypothesis: D(LNRCEA) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.361483	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRCEA,2)
Method: Least Squares
Date: 07/18/23 Time: 09:00
Sample (adjusted): 3 47
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRCEA(-1))	-1.114945	0.151457	-7.361483	0.0000
C	0.050820	0.084343	0.602532	0.5500

R-squared	0.557574	Mean dependent var	0.003442
Adjusted R-squared	0.547285	S.D. dependent var	0.838450
S.E. of regression	0.564143	Akaike info criterion	1.736410
Sum squared resid	13.68509	Schwarz criterion	1.816706
Log likelihood	-37.06923	Hannan-Quinn criter.	1.766344
F-statistic	54.19143	Durbin-Watson stat	2.041484
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNRCEA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.297827	0.0000
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRCEA,2)
Method: Least Squares
Date: 07/18/23 Time: 09:02
Sample (adjusted): 3 47
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRCEA(-1))	-1.118117	0.153212	-7.297827	0.0000
C	-0.008878	0.178501	-0.049737	0.9606
@TREND("1")	0.002493	0.006551	0.380585	0.7054

R-squared	0.559095	Mean dependent var	0.003442
Adjusted R-squared	0.538099	S.D. dependent var	0.838450
S.E. of regression	0.569838	Akaike info criterion	1.777412
Sum squared resid	13.63805	Schwarz criterion	1.897856
Log likelihood	-36.99177	Hannan-Quinn criter.	1.822312
F-statistic	26.62927	Durbin-Watson stat	2.043318
Prob(F-statistic)	0.000000		

Null Hypothesis: LNRREA has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.243180	0.9252
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRREA)
Method: Least Squares
Date: 07/18/23 Time: 09:04
Sample (adjusted): 2 47
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRREA(-1)	-0.006377	0.026225	-0.243180	0.8090
C	0.162830	0.186623	0.872506	0.3877

R-squared	0.001342	Mean dependent var	0.119757
Adjusted R-squared	-0.021355	S.D. dependent var	0.394519
S.E. of regression	0.398709	Akaike info criterion	1.041337
Sum squared resid	6.994647	Schwarz criterion	1.120843
Log likelihood	-21.95076	Hannan-Quinn criter.	1.071121
F-statistic	0.059136	Durbin-Watson stat	2.179197
Prob(F-statistic)	0.808996		

Null Hypothesis: LNRREA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.764347	0.2173
Test critical values:	1% level	-4.170583	
	5% level	-3.510740	
	10% level	-3.185512	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRREA)
Method: Least Squares
Date: 07/18/23 Time: 09:05
Sample (adjusted): 2 47
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRREA(-1)	-0.248813	0.090008	-2.764347	0.0084
C	0.800828	0.286585	2.794384	0.0077
@TREND("1")	0.042527	0.015198	2.798272	0.0077

R-squared	0.155184	Mean dependent var	0.119757
Adjusted R-squared	0.115890	S.D. dependent var	0.394519
S.E. of regression	0.370955	Akaike info criterion	0.917523
Sum squared resid	5.917133	Schwarz criterion	1.036782
Log likelihood	-18.10302	Hannan-Quinn criter.	0.962198
F-statistic	3.949321	Durbin-Watson stat	2.020607
Prob(F-statistic)	0.026631		

Null Hypothesis: D(LNRREA) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.275870	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRREA,2)
Method: Least Squares
Date: 07/18/23 Time: 09:05
Sample (adjusted): 3 47
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRREA(-1))	-1.099343	0.151094	-7.275870	0.0000
C	0.126255	0.062278	2.027263	0.0489

R-squared	0.551795	Mean dependent var	-0.004998
Adjusted R-squared	0.541372	S.D. dependent var	0.590451
S.E. of regression	0.399866	Akaike info criterion	1.048051
Sum squared resid	6.875384	Schwarz criterion	1.128347
Log likelihood	-21.58115	Hannan-Quinn criter.	1.077984
F-statistic	52.93829	Durbin-Watson stat	1.933267
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNRREA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.262328	0.0000
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRREA,2)
Method: Least Squares
Date: 07/18/23 Time: 09:06
Sample (adjusted): 3 47
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRREA(-1))	-1.106897	0.152416	-7.262328	0.0000
C	0.050462	0.126432	0.399123	0.6918
@TREND("1")	0.003196	0.004630	0.690201	0.4939

R-squared	0.556822	Mean dependent var	-0.004998
Adjusted R-squared	0.535718	S.D. dependent var	0.590451
S.E. of regression	0.402323	Akaike info criterion	1.081217
Sum squared resid	6.798275	Schwarz criterion	1.201661
Log likelihood	-21.32738	Hannan-Quinn criter.	1.126117
F-statistic	26.38501	Durbin-Watson stat	1.941469
Prob(F-statistic)	0.000000		

Appendix-VII

Results of Lag Length Selection

VAR Lag Order Selection Criteria
Endogenous variables: LNRAGDP LNRCEA LNRREA
Exogenous variables: C
Date: 07/18/23 Time: 09:16
Sample: 1 47
Included observations: 43

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-133.2235	NA	0.113310	6.335977	6.458852	6.381290
1	-17.64224	209.6591	0.000798	1.378709	1.870207*	1.559958*
2	-10.08362	12.65629	0.000860	1.445750	2.305871	1.762936
3	-3.150699	10.64123	0.000963	1.541893	2.770637	1.995016
4	16.17122	26.96081*	0.000615*	1.061804*	2.659171	1.650864

* 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

Appendix-VIII

Johansen Multivariate Cointegration Test

Date: 07/18/23 Time: 09:28
Sample (adjusted): 4 47
Included observations: 44 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: LNRAGDP LNRCEA LNRREA
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.306101	26.91527	42.91525	0.6860
At most 1	0.185834	10.83641	25.87211	0.8844
At most 2	0.039874	1.790393	12.51798	0.9800

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.306101	16.07886	25.82321	0.5377
At most 1	0.185834	9.046016	19.38704	0.7197
At most 2	0.039874	1.790393	12.51798	0.9800

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNRAGDP	LNRCEA	LNRREA	@TREND(2)
-11.59559	2.643743	2.241029	0.069452
-0.576043	0.523366	2.121934	-0.358339
0.026755	-1.030570	0.432609	-0.029447

Unrestricted Adjustment Coefficients (alpha):

D(LNRAGDP)	0.044411	-0.008171	0.012992
D(LNRCEA)	-0.125630	-0.042457	0.089176
D(LNRREA)	0.057383	-0.154080	-0.011180

1 Cointegrating Equation(s): Log likelihood -3.852325

Normalized cointegrating coefficients (standard error in parentheses)

LNRAGDP	LNRCEA	LNRREA	@TREND(2)
1.000000	-0.227996	-0.193266	-0.005990
	(0.02452)	(0.04463)	(0.00790)

Adjustment coefficients (standard error in parentheses)

D(LNRAGDP)	-0.514968
	(0.18399)
D(LNRCEA)	1.456750
	(0.95642)
D(LNRREA)	-0.665392
	(0.71884)

2 Cointegrating Equation(s): Log likelihood 0.670683

Normalized cointegrating coefficients (standard error in parentheses)

LNRAGDP	LNRCEA	LNRREA	@TREND(2)
1.000000	0.000000	0.976054	-0.216397
		(0.41685)	(0.07256)
0.000000	1.000000	5.128693	-0.922859
		(1.81123)	(0.31526)

Adjustment coefficients (standard error in parentheses)

D(LNRAGDP)	-0.510262	0.113134
	(0.18354)	(0.04260)
D(LNRCEA)	1.481207	-0.354353
	(0.95407)	(0.22147)
D(LNRREA)	-0.576635	0.071066
	(0.65507)	(0.15206)

Appendix-IX

Vector Auto Regression Model

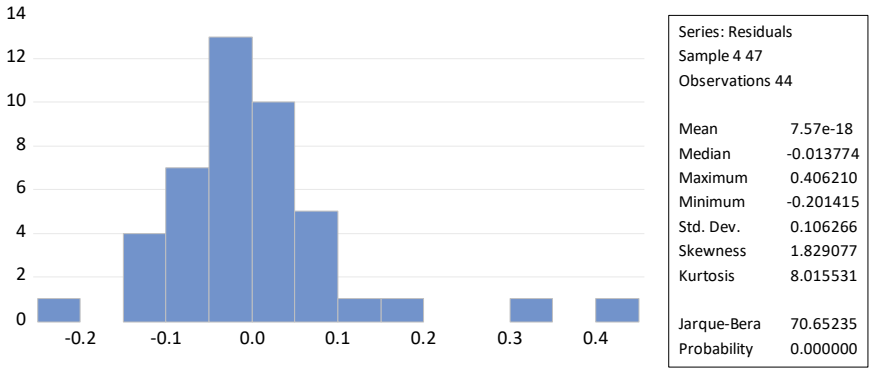
Dependent Variable: DLANRAGDP
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/18/23 Time: 09:38
Sample (adjusted): 4 47
Included observations: 44 after adjustments
DLANRAGDP = C(1)*DLANRAGDP(-1) + C(2)*DLANRAGDP(-2) + C(3)
*DLNRCEA(-1) + C(4)*DLNRCEA(-2) + C(5)*DLNRREA(-1) + C(6)
*DLNRREA(-2) + C(7)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.158431	0.165679	0.956253	0.3452
C(2)	0.058825	0.131112	0.448663	0.6563
C(3)	0.119198	0.033904	3.515689	0.0012
C(4)	-0.125721	0.041411	-3.035950	0.0044
C(5)	0.081290	0.046950	1.731416	0.0917
C(6)	-0.025984	0.048934	-0.530988	0.5986
C(7)	0.024991	0.019403	1.288051	0.2057

R-squared	0.478736	Mean dependent var	0.040988
Adjusted R-squared	0.394207	S.D. dependent var	0.147186
S.E. of regression	0.114559	Akaike info criterion	-1.350546
Sum squared resid	0.485578	Schwarz criterion	-1.066698
Log likelihood	36.71202	Hannan-Quinn criter.	-1.245282
F-statistic	5.663553	Durbin-Watson stat	1.502196
Prob(F-statistic)	0.000298		

Appendix-X

Normality Test



Appendix-XI

Serial Correlation Test (Residual diagnostic test)

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.599012	Prob. F(2,41)	0.5541
Obs*R-squared	1.305964	Prob. Chi-Square(2)	0.5205

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 08/27/23 Time: 12:04
Sample: 2 47
Included observations: 46
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNRCEA	0.003926	0.038118	0.102987	0.9185
DLNRREA	0.000433	0.052901	0.008180	0.9935
C	-0.000164	0.021621	-0.007583	0.9940
RESID(-1)	-0.158478	0.157878	-1.003798	0.3214
RESID(-2)	0.039209	0.157615	0.248767	0.8048

R-squared	0.028391	Mean dependent var	5.73E-18
Adjusted R-squared	-0.066401	S.D. dependent var	0.135111
S.E. of regression	0.139525	Akaike info criterion	-0.998823
Sum squared resid	0.798157	Schwarz criterion	-0.800057
Log likelihood	27.97292	Hannan-Quinn criter.	-0.924364
F-statistic	0.299506	Durbin-Watson stat	1.989541
Prob(F-statistic)	0.876574		

Appendix-XII

Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.569442	Prob. F(6,37)	0.1836
Obs*R-squared	8.926380	Prob. Chi-Square(6)	0.1778
Scaled explained SS	22.14135	Prob. Chi-Square(6)	0.0011

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/16/23 Time: 06:44
Sample: 4 47
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009199	0.004820	1.908390	0.0641
DLANRAGDP(-1)	0.036817	0.041159	0.894514	0.3768
DLANRAGDP(-2)	0.015027	0.032572	0.461367	0.6472
DLNRCEA(-1)	0.011705	0.008423	1.389631	0.1729
DLNRCEA(-2)	-0.021137	0.010288	-2.054651	0.0470
DLNRREA(-1)	0.007552	0.011664	0.647452	0.5213
DLNRREA(-2)	-0.007666	0.012157	-0.630579	0.5322

R-squared	0.202872	Mean dependent var	0.011036
Adjusted R-squared	0.073608	S.D. dependent var	0.029568
S.E. of regression	0.028459	Akaike info criterion	-4.135765
Sum squared resid	0.029968	Schwarz criterion	-3.851917
Log likelihood	97.98684	Hannan-Quinn criter.	-4.030501
F-statistic	1.569442	Durbin-Watson stat	0.988928
Prob(F-statistic)	0.183570		

Appendix-XIII

VAR Granger Causality Test Result

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 08/01/23 Time: 10:03
Sample: 1 47
Included observations: 45

Dependent variable: LNRAGDP

Excluded	Chi-sq	df	Prob.
LNRCEA	21.70666	2	0.0000
LNRREA	6.098304	2	0.0474
All	27.29070	4	0.0000

Dependent variable: LNRCEA

Excluded	Chi-sq	df	Prob.
LNRAGDP	5.569273	2	0.0618
LNRREA	4.220275	2	0.1212
All	6.480818	4	0.1660

Dependent variable: LNRREA

Excluded	Chi-sq	df	Prob.
LNRAGDP	0.013867	2	0.9931
LNRCEA	1.385606	2	0.5002
All	1.503951	4	0.8259