# AGRICULTURAL GROWTH PERFORMANCE OF KBK AND BARGARH DISTICT

**A thesis submitted to the University of Hyderabad in partial fulfillment of the requirements for the award of the degree of**

Master of Philosophy

**In**

**ECONOMICS**


**By**

**GUNABANTA SAHU**

**Thesis Supervisor**

**Prof. R Vijay**




**SCHOOL OF ECONOMICS**

**UNIVERSITY OF HYDERABAD**

**HYDERABAD - 500 046**



**JUNE 2019**

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# DECLARATION

I, Gunabanta Sahu hereby declare that this thesis entitled '***Agricultural Growth Performance of KBK and Bargarh District'*** submitted by me under the supervision of Prof. R Vijay is a bonafide research work which is also free from Plagiarism. I also declare that it has not been submitted previously in part or in full to this University or any other University or Institution for the award of any degree or diploma. I here agree that my thesis can be deposited in Shodhganga/INFLIBNET.

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***Gunabanta Sahu***

Dedicated to my parents

&

Brothers

## CONTENTS

# LIST OF TABLES

## LIST OF FIGURES

# ABBREVIATIONS

ADI: Agricultural Developmental Index

APY: Area, Production and Yield

DES: Directorate of Economics and Statistics

GCA: Gross Cropped Area

GDP: Gross Domestic Product

GSDP: Gross State Domestic Product

GVA: Gross Value Added

HI: Hirfindhal Index

HVC: high-value crops

HYV: High Yielding Variety

IA: Irrigated Area

IMR: Infant Mortality Rate

ITDP: Integrated Tribes Development Project

KBK: Kalahandi, Balangir, Koraput

MMR: Maternal Mortality Rate

NCA: Net Cropped Area

NEP: New Economic Policy

TLUS: Total Land Under Statistics

# CHAPETR 1

# INTRODUCTION

## 1.1 Background

The supremacy of man over other humans is created by his ability to create his own food. In this context agriculture is the primary sector in every society's economy. The development process was launched as a struggle against nature. The primary force driving behind human civilization was the generation of agricultural surplus. Agricultural surpluses came mainly through enhancing agricultural technology by increasing food production. An extremely advanced agricultural technology results in more agricultural surplus, resulting in accumulation of resources for the growth of the secondary and tertiary sector.

The significance of agriculture for any country, rich or poor, in its economic growth is confirmed by the reality that it is the main source of income of the economy that provides the essential parts required for human life and also offers the majority of raw materials that serve as the basic necessity of the human race when transformed into finished products. Agriculture and the associated sector provide significant raw materials for companies, although demand for many sectors such as pesticides, fertilizers, agriculture equipment and consumer goods is generated. Although significant growth and development have occurred in other industry, agriculture sector still holds human livelihood. Agricultural development is essential not only to guarantee food security and poverty reduction in rural regions, but also to sustain the development of the rest of the economy. Development of agriculture serves as an engine of economic growth, by providing raw material to the needed sector, it helps to initiate and sustain other sector growth & development.

## 1.2 Agricultural status of Odisha

Agriculture and the allied sector plays a critical role in maintaining food security, decreasing poverty, securing development and stimulating growth in India's industries and service sectors. For about 58% of India's people, agriculture is the main source of livelihood. Agriculture has been India's largest employment sector. Gross Value Added by agriculture, forestry and fishing is estimated at Rs 18.53 trillion (US$ 271.00 billion) in FY18. The growth method leads, inter alia,

to a decline in the share of agriculture in Gross Value Added (GVA), which is also being experienced in India.

In developing economies such as India, agricultural sector plays an important role in influencing the overall economic growth, in terms of ensuring food security, providing employment, and poverty reduction (Thorat et al. 2003; Bolt 2004; Byerlee et al. 2005). Improvement of agricultural production has been one of the major developmental concerns in the period of neo-liberalization. The Indian economy has undergone significant structural transformation where tertiary sector dominates the economy with its contribution of about 58 per cent to India's GDP.

The share of agricultural and allied sectors to India's GDP fell from 30.3 per cent during the 1980s to 29 per cent in the 1990s and then to around 13 per cent during the period 2015-16. The trends in population growth show that the share of agricultural workforce declined from 56.7 per cent to around 42 per cent during 2004-05 to 2015-16 indicating a slow movement of workers away from agriculture. Sluggish growth in agriculture would lead to a slowdown in agricultural employment generation (World Bank 2007).

However, the structural changes in agriculture have not occurred drastically in many parts of India including the state of Odisha. Agriculture remains an important feature of the economic, cultural and political landscape in Odisha. Odisha state can largely be classified as an agrarian society with a population of more than two thirds still residing in rural areas. The state was created in 1936 and currently consists of 30 districts. The state occupies 4.74% of the country's in a geographic area, and 42 million individuals reside in the state according to the 2011 census. The state accounts for 3.57% of the inhabitants of the country. Agriculture is the main stay of people contributing nearly 13% of the state's net domestic product. Nearly 65% of the inhabitants are involved in agriculture directly or indirectly. As part of the general GSDP, the sector has obviously decreased. Being over 70 percent of GSDP during 1950s the agriculture contributes only 19.98 percent of GSDP currently during 2017-18. It is an ironic matter of concern that big proportions of the population depend on agriculture and the trend is towards the decreasing share of GSDP. For the food security of the nation, it is essential for the agricultural sector to perform with better production and productivity. Odisha agriculture is characterized by least use of power in the sector, less use of technology, distinction between farmer and land owner, lower per capita land holding and so on. Although Odisha is one of the highest mineralized states, still Odisha is one among the most backward state.

The incidence of rural poverty in the state is regarded to be the country's highest. Poverty also differs within the state. More than 90 percent of the farming group are small and marginal landowners.

Odisha is regarded in India as one of the poorer economical states. Studies have been carried out on multiple aspects of Odisha's economy and the underlying causes of its backwardness and poverty. Issues such as Odisha's backwardness and underdevelopment in fields such as; agriculture, education, industry trade and business, communication and health have been dealt with extensively by past writers. Odisha is classified as the country's poorest state, with a range of indicators by Raghuram Rajan Committee (2013). Odisha, with a human development value of 0,362, stand at the bottom.

India Planning Commission's reports as per 'Tendulkar methodology' poverty is defined not in terms of annual income, but it is in the nature of consumption or spending per individual over a certain period for a basket of essential goods. Further, this methodology sets different poverty lines for rural and urban areas. Based on this in 2013, the Indian government stated 22% of the population lived below its official poverty limit. With national average stood at 21.92%, Chhattisgarh had highest poverty rate of 39.93% people of state leaving below poverty line, Bihar was next with 33.74% poverty rate and Odisha ranked third lowest performing state with 32.59% of its population living under poverty.

Originally, the acronym KBK implies Kalahandi, Balangir, and Koraput. These are Odisha's three south-western districts. Since 1950 KBK districts have been recognized by the Planning Commission as India's most backward districts; even today KBK districts have the identity of Odisha's most backward district as well as India.

Some special area development programs have also been implemented in the KBK districts for the development of the region. In the special area development approach, eliminating regional disparities has been one of the primary concerns of the central government as well as the state government during the successive Five Year Plans. However, this region in Odisha has not enjoyed the development in an equitable fashion and continues to languish. Persistence of high poverty and unemployment in this region has been a cause of concern.

During 1960s most of the regions in Odisha were backward in many aspects. Bargarh is one of the district in Odisha that was more or less similar to that of KBK (in aspects of nature, climate, population, tribes, resources, etc) in 1960s. The district is situated next to Balangir district. So more or less there is similarity in terms of climate, land fertility, living standard, culture, etc. But after the development of Bargarh Canal, channelization of water from Hirakudh dam in Bargarh it becomes one of the most developing region of Odisha in respect of agriculture.

After implementation of so many socio-economic development programs and special area development program, even today the hallmarks of the KBK region are poverty, unemployment, illiteracy, starvation, malnutrition, migration, to name a few. One of the example is that of disparity in literacy rates. As per the Census Report of 2011, literacy rates of KBK districts are as follows: 49%-Koraput, 59%-Kalahandi and 64%- Balangir respectively, which are far below the national and state average literacy rate, while the literacy rate of the Bargarh district is 73.36% (Average literacy rate of Odisha is 72.87% and the national average is 74.04%).

The district-wise analysis of GSDP (2011-2012) reveals that among the districts, Bargarh has the highest percentage share of State's GSDP with 8.54% whereas Kalahandi, Balangir and Koraput contribute only 2.71%, 3.39% and 3.26% respectively. (Odisha Economic Survey 2015-2016).

All these poor socio-economic indicators raise a curiosity for investigation of these social issues in the KBK region.

If someone says growth has taken place in the regions, there can't be no disagreement with them. However, a pertinent question presents itself- who has benefitted the most from growth? Certainly growth has taken place in the region but very few regional pockets have taken the benefit of it. Socio-economic condition of majority of population has shown very negligible improvement in the past twenty years. Their social life is just like what was there twenty years back.

These inter-regional imbalances and inequalities also lead to severe socioeconomic difficulties. In socio-economically depressed areas people are often deeply frustrated and discriminated against by their neighbours. In many areas of KBK, social and economic deprivation can be attributable to naxalism issues, enhanced criminal activity, degradation of the legal and order condition and social disputes.

### 1.3: Motivation of the Present Study

Odisha is a state that mainly relies on agriculture. The agricultural performance of Odisha is distinguished by a comparatively low return of GSDP on low productivity and a high rate of rural employment and high poverty rates. Agriculture remains a major economic, cultural, and political characteristic of Odisha. It is well recognized that development of agriculture is crucial to attain the objectives of overall economic growth, increased incomes, ensuring food security and to focus on marginalized sections and regions (Timmer 2002; Dethier and Effenberger 2012). By acknowledging the significance of agriculture it will be worth finding out the reasons behind low productivity during the years. The combination of meager GSDP contributions and intense demographic dependence on farming demonstrates the need to revive the sector.

Few research works have been done so far on Kalahandi, Balangir and Koraput (KBK) agricultural sector in general and on the present topic in particular. The present study attempts to examine the status of Agriculture in KBK districts in comparison to Bargarh district and Odisha.

Another important motivation comes from the special characteristic of the KBK region as backward and poor agrarian region. As I personally belong to Balangir, which comes under the KBK region, I have witnessed the backwardness of the region which makes me more enthusiastic to carry out research based on the region.

### 1.4: Objectives

1. To analyze the cropping pattern across KBK and Bargarh district of Odisha.

2. To trace the pattern of agricultural developmental across KBK and Bargarh district of Odisha with special focus to rice.

3. To examine the relationship between modern farm input and yield of agricultural crop..

### 1.5 Hypothesis of the Study

Based on preliminary examination of available literature and statistics, the following null hypothesis is taken up for verification during the course of the study. It states that modern agricultural inputs do not influence yield of rice. It may be mentioned that irrigation, chemical fertilizer and tractors are considered here for the analysis of statistical significance although various other modern agricultural inputs also influences yield of rice.

### 1.6 Data Sources and Methodology

The analysis is carried out mainly using secondary data. The variables used in the analysis are area, production and yield of rice, area under different crops and various agricultural inputs like irrigation, modern chemical fertilizers, use of tractors, etc. To find out the cropping pattern across region, Hirfindhal Index has been structured. As one of the objective of the study is to analyze the current status of rice cultivation in Odisha, KBK and Bargarh district comparative analysis of area, production and yield of rice have been carried out. The data for area, production and yield of rice have been analyzed for the period 1998-99 to 2016-17, i.e., 19 years.

In carrying out analysis on the rice cultivation, secondary data were collected mainly from publications from Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India; Directorate of Agriculture and food production, Odisha, Directorate of Economics and Statistics, Odisha; Directorate of Rice Development, India. To understand the district level disparity in the agricultural development, an Agricultural Development Index have been structured using four major variables in Chapter 4 and districts are ranked as per their Agricultural Development Index Score. Furthermore, an econometric estimation based on log-linear model have been presented to perceive the possible influence of modern agricultural inputs like tractors, irrigation, fertilizer etc. on productivity of rice.

### 1.7 Organization of the Thesis

The dissertation is organized into five chapters. The first chapter is the introductory one, highlights the significance of undertaking the study on present status agriculture in Odisha. Objectives of the study and methodologies adopted are also discussed in the first chapter.

In chapter 2, review of available literature has been done on production, yield, use of modern technology, socio-economic status of KBK and Bargarh district and of Odisha. Changes in cropping pattern, rice cultivation, and other factors affecting cultivation and productivity of rice like farm size, tenancy etc.

In chapter 3, we have reviewed Odisha's agro-economic profile. Changes in land use pattern at state and district levels, pattern of land holding, literacy rate, rural-urban population, types of workers etc. were discussed in brief.

In chapter 4, we have examined the present status of agriculture in KBK and Bargarh district and of Odisha. Changes in cropping pattern at state and district levels, use of modern farm inputs, Changes in area, production and yield of rice have been discussed in detail. For understanding current district level disparity, we have analyzed the four districts based on Agricultural Development Index. Finally, to understand the possible impact of modern agricultural inputs like application of fertilizer, irrigation, use of tractors etc., we carried out the econometric estimation based on log linear.

In chapter 5, we summarize the whole study and draws some policy implications.

# CHAPTER 2

# REVIEW OF LITERATURE

## 2.1 : Introduction

Accelerating agricultural productivity development is essential to achieving the twin goals of improving the rural economy and addressing the food security requirements of the increasing population, keeping in mind the ability of the agricultural sector to steer low-income economies ' growth. Traditionally, agriculture's role in economic development has been thought as a passive one where it provides a grounds for industrial growth. However, during the era of economic reforms, the perceived role of agriculture has shifted toward a more specific recognition of its growth links with the rest of the economy (Byerlee et al. 2005). In particular, the achievement of the agricultural sector is restricted by factors such as rainfall vagaries, insufficient credit support, inefficient markets, market risks, inadequate infrastructure, low capital formation, institutional bottlenecks, information deficits and policy paradoxes (Rao 2008).

The present chapter attempts to review the available literature on adoption of modern agricultural technology, linkage between irrigation and agriculture and on general agricultural development of Odisha and some other Indian states. A vast literature exists on the agricultural situation of India. However, due to diverse socio-economic conditions of study area and various methodologies adopted, findings from different studies differ. Therefore, in this chapter we confine ourselves to the review of only those studies, which are relevant to our objectives in a broader sense.

## 2.2 Productivity Relations:

Productivity is the variable that draws attention to a region's cropping pattern in the study. The productivity of a specific crop may depend on multiple factors such as farm size, soil quality, accessibility of irrigation and other infrastructural equipment, quality seeds, climate variable, etc. The most common hypothesis is that irrigation and other modern agricultural technologies have a

favorable relationship with rice or other crop productivity. Crop diversification happens when a specific crop offers more return with the availability of favorable infrastructural and institutional equipment for the cultivation of a crop.

Technology and organizations interact dialectically. The change in institutions offers an incentive for technical change. A number of research of farm methods have shown that the rate of adoption of modern technology in larger farms is greater than in smaller ones. Farm size is the variable that appears commonly in research linked to agricultural economics literature. Farm size may cause or prevent the adoption of a specific crop variety. Since the 19th century, there has been an inverse relationship between farm size and productivity.

As per Bhalla (1979), in the fields of new agricultural technology, the growing revenue of farming families and other rural populations tends to decrease absolute poverty, but revenue generations tend to increase the gap between small and large farmers. Absolute poverty is noted to be high in an agricultural backward state whereas revenue inequality is less present and the revenue distribution inequality in an agriculturally developed country is high, whereas the absolute poverty is lower.

Deepak K Mishra, discusses the production and exchange relationships in rain fed agriculture in rice production systems. The two goals were i) to identify the essential characteristics of "traditional" rain-fed agriculture which lasted until the 21st century and (ii) to examine the rice industry as a system-both for distribution and production. For the field survey, two districts were selected: Koraput and Nuapara (part of the undivided Kalahandi). The results of this study relate to the agricultural framework and relations in paddy production, post-harvest, and marketing. The situation of livelihood resulting from field research generally supports the argument that farm families in many areas of rural India can no longer simply survive on agricultural grounds. That is why a large proportion of the rural household – particularly those of ' independent ' producers – have begun to rely, for survival at least partially, on the wage labor markets. Thus we found the co-occurrence of a vibrant labour market in non-agriculture and stagnation and subsistence in rain-fed paddy production. Although some are pursuing a policy to avoid the ' green revolution, ' some people have already begun to commercialize their production with access to lowlands and irrigation.

Anamitra Saha (2004) has mentioned that, while an integrated approach ensuring availability of storage/marketing, improved technical, economic and infrastructural services could be more useful in augmenting the farm productivity but there is no denying the fact that intensive agriculture in the face of constrained extension necessarily calls for the adoption of new technological practices which alone can increase the productivity even While the farm size decreases.

S.R. Dash, B.K. Rautaray, and A. Dhal (2018) conducted the study in KVK, Jagatsinghpur during 2016-17 in the rabi seasons with sixty numbers frontline demonstrations across in two clusters of Bagoi village in kujanga block of district Jagatsinghpur. This study was under taken for assessing the performance along with yield attributing parameters and economic of return of HYV green gram variety IPM 02-14 in coastal plain zone of Jagtsinghpur district in compression with farmers local cultivar (Jhain mung) and to evaluate the difference between demonstrated technologies vis-a-vis practices followed by the local farmers in green gram crop. The results of demonstrations showed that farmers could increase the Green gram productivity by adopting improved variety and improved production technology. From the front line demonstrations, it was observed that the improved Green gram variety IPM-02-14recorded the higher yield (748kg/ha) compared to the farmers' practices variety (553 kg/ha). The increase in the demonstration yield over farmer's practices was 35 %. Technology gap and the technology index values were 352 kg/ha and 32%, respectively. The increment in yield of green gram crop under front line demonstrations was due to spreading of improved and latest technology viz. YVM resistance variety Hence, the existing local variety (Jhain mung) can be replaced by HYV, IPM 02-14 since it fits to the existing farming situation for higher productivity and income.

Total factor productivity strategy has been adopted by Ashok and Balasubramanian (2006), taking account of factors like irrigation intensity, road density, the input and production markets, rainfall, business cars as transport variable, energy use pumps, high output varieties as technology variable, rural training rates as education variable for Tamil Nadu have great positive impact on total factor productivity.

B. Mishra (2010), in the post-liberalization period, analyzed the situation of agriculture, industry and mining in Orissa. The liberalization process that began in India in the early 1990s has possibly made Orissa the most appealing target by mineral-based private-sector companies for big capital-intensive projects. The indigenous people, particularly those who are likely to be displaced and

those who are indirectly impacted, are facing resistance to these projects. At the same moment, he addresses the significant variables that hinder growth, namely poverty and unemployment. The progress made in the three significant sector of the country, namely agriculture, industry and mining, is analyzed in this scenario. The document reveals the decrease in the agriculture sector of Orissa, which is still the only important factor for per capita income within the State, and the boom in manufacturing and exports from the mining industry, on the basis of an analyzes conducted between districts and States.

K R G Nair (1993) discusses the economic development of Orissa and highlights the causes of the relative economic backwardness of Orissa. In light of this, the effect of the government of India's New Economic Policy (NEP) on regional economic development should be examined. It is significant to do so in particular areas and since Orissa is one of the least developed states in India, attention is mainly focused on Orissa. An in-depth analysis of Orissa's economic development showed clearly that the relative lack of agricultural development hampers Orissa's overall economic development. According to this author Nair (1984) has shown that value added in agriculture in India is inverted with a percentage of small and marginal holdings at the State level in India. Given these results of the economic backwardness caused by less developed regions like Orissa, the analysis of the impact of the NEP on regional economic development is being undertaken. In two stages it's done. The policy's impact on primary activity is initially analyzed. The effect of policy on the manufacturing sector is then investigated. A thorough research by the Orissa group obviously shows that agricultural growth is essential in areas like the Orissa region for economic development and that the failure to implement land reforms constitutes a significant barrier to the growth of agriculture. This significant problem is clearly identified by the NEP and the NEP's effect on the other variables that affect agricultural growth seems overall to run counter to the ongoing growth of the Orissa economy.

Dr. (Mrs.) Kiran Mor, Sarita Devi (2017) **i**n this research, the regional disparities are investigated on the grounds of social and economic indicators. The study found that in successive plan periods after the post reform period, GDP growth rates converged. Increased investment in education is also causing a decrease in inter-state disparities of the literacy rate. Interstate discrepancies also decrease in MMR and IMR. The disparities in the state are diverse, but here only social and economic disparities are discussed. a) The regional disparity in terms of per capita/GDP of the

states. b) The regional disparity in terms of social development indicators like Literacy, Infant Mortality Rate (IMR) and Maternal Mortality Rate (MMR). The results show that in the 11th five-year plan period, Bimaru states are good performing. In fact, convergence increases after the post-reformation era in GSDP, but in 2004-05 to 2011-2012 the PCI disparities across countries are growing. In the event of social indicators, inter-state disparities in the literacy rate are decreasing as education sector investment increases, and when another social variable which is health and comprises IMR and MMR is discussed, the inter-state variation of these variables is decreasing.

Raj Kishor Pradhan tries to analyze these different factors that cause regional imbalances in Odisha and suggests a feasible solution. Uneven economic development, regional marginalization, and people's uprising and political marginalization, apartheid to the local language, peripheral culture and tradition, social, economic and political disparities, and so on are all important issues. Our state is distinctive. We have various cultures, traditions, and languages. Each language, culture, and tradition must be properly respected. The biggest asset of all culture and civilization is self-esteem. The government should not, therefore, take any action to harm a region's self-esteem. People in the west and south should operate properly to eradicate poverty and backwardness. The politicians were long accused of not raising the issue in the right platform. Also, the region's intelligence is not enough to boost the cause. Thus, all sectors of the population should work together to bring prosperity and development in the region.

Mishra and Mahapatra (1981) reviewed the Integrated Tribes Development Project (ITDP) and its performance in the Koraput district of Orissa, with table analyzed primarily for 1974-78 as well as secondary data from different government and NGO sources, have examined its performance in the field of agriculture and services. In terms of income and employment, land reclamation, dug wells and the provision of agricultural implements operations were discovered to be satisfactory. The conclusion was that ITDP contributed to the impoverished tribe's enduring cycle of poverty.

A. Amarender Reddy (2013) The economic, cultural and political landscape of India remains a major characteristic of agriculture. The rate of growth of agriculture is lower in Orissa than in the whole of India during the years 1991 to 2008. Orissa is a highly concentrated paddy crop with a low productive and high consumption of water, with a low diversification to pulses, oily grains, and other high-value crops (HVCs). Areas under certified seeds, irrigation and other productivity must be increased, thereby enhancing inputs to increase agricultural incomes in all crops. In the

upland rainy season, significant income gains will occur through crop diversification from paddy to pulses, oilseeds and HVCs, provided proper drainage, institutional and policy support in the Eastern Ghats, and the northern Plateau of Orissa. For this study, from 1971 to 2008, data from statistical abstracts in various inter-States are used for the interstate comparisons of the agriculture sector with special focus on Orissa. The district gross value of agriculture (GVAP) is evaluated at 2004 continuous prices by combining all crops in the county. Three CP districts, Cuttack, Puri, and Baleswar, rank the highest in rural literacy, while Koraput, Kalahandi and Mayurbhanj rank as the lowest. The four CP districts (Balasore, Cuttack, Puri, and Ganjam) and two CTL districts (Sambalpur and Bolangir) have a more advanced agricultural dimension than others, as shown by the careful analysis of data for the various districts.

Shankar Rao (2017) seeks an understanding of caste-based discrimination and differences in Indian agriculture performance by analyzing caste-based differences in different input and output factors. unit-level data collected. It is both analytic and descriptive. The analysis is carried out in all major caste groups in India, such as SCs, STs, OBCs, and others, at a national level. A comparative analysis between these caste groups and other groups is conducted. At the first level, this paper analyzes the differences between FHs of major caste groups in India in terms of soil, crop yield and farmland productivity. In the next level, it studies caste-wise differences in major explanatory factors to understand these differences. The results show a clear difference among caste groups in India in terms of land, crop yields or agriculture productivity. The empirical findings demonstrate that caste discrimination and differences in Indian agriculture output, as well as input, are disadvantaged by FHs from socially marginalized castes. SCs, STs and OBC farm households across classes lie behind others in terms of land, crop yield rates and the values of productivity. We call upon intensified government interventions in agriculture, as in others sector, to reinforce FHs ' capacity in socially marginal castes (S.C., S.T., and O.B.C.) and to provide broad caste allocation for agricultural developments programs in this country in order to check caste discrimination and differences between agricultural input and output across farm groups.

Sujata P. Parida Poverty and Inequality of KBK* Region of Rural Odisha: A Comparative Analysis (2012) seeks to study the statistical picture of poverty and inequality in rural Odisha's KBK * backward district. unit level state and center pooled data of NSS (National Sample Survey) has been used. The price index scientifically calculated using unit levels data has been used to derive

a special poverty line for KBC. The devices ―GINI COEFFICIENT and ―LORENZ CURVE‖ have been used to measure the inequality in MPCE for KBK and non_KBK regions. The present paper examined a number of problems related to poverty and inequalities in living standards in KBK and Non KBK rural Odisha regions. In all rural Odisha and the region of the backward KBK, the poverty trend is declining. But in KBK, the annual compound poverty rate has declined nearly 4-5 times lower than Non KBK.

Deepak K Mishra (2011) examines the various forms and implications of land grabbing in Orissa known for its abject poverty, deaths from starvation and violent displacement conflicts. Taking into consideration the historical procedures of dispossession and marginalization in rural Orissa, the document tries to argue that the present stage of displacement, involuntary depeasantisation and dispossession needs to be analyzed in the wider context of agrarian transformation in rural Orissa. In the context of the discussion on the irrelevance of the agrarian issue at the era of globalization the idea of "land acquisition" within the context of the ongoing primitive accumulation procedures in globalization is argue that it offers better analytical perspectives into the political and economic forces behind such huge land ownership reconfiguration. The research highlights the links between catastrophic land acquisition and classical land alienation procedures. The competition between national and national governments to attract domestic and foreign capital through liberal (often illegal) concessions, has made state power an essential component of the land grabbing. However, the specific dynamics of land grabbing in contemporary Orissa remain significant in local economic and political processes such as peasants ' differentiation, agrarian distress, seasonal food, and employment insecurity, socially and spatially concentrating poverty, local state capture by a rentier elite.

Rabinarayan Patra analyzes the space-temporal changes in the agricultural development of the province of Odisha, India for 3 years between 2001-02 and 2011-12, identified the underlying factors, analyzed interconnections and identified the political implications of improving the agricultural situation. For that the author used Principal Component Analysis technique and constructing district-wise agricultural development indices. Increased government investment in agricultural facilities, including irrigation, appropriate systems of farming, the creation of suitable and accessible crop and technology, increased loan distribution, regional growth, and plant and crop-specific plans and strategies to mitigate spatial inequalities and achieve a less unbalanced

regional growth in agriculture are recommended. The objective is to analyze paddy productivity and total food grain throughout districts, examine the inter district agricultural performance differences with regard to productivity determinants and draw some political consequences. The study is conducted on a basis of secondary data for three years. 2001-2002, 2006-07 or 2011-12, respectively. Simple statistical tools such as averages, percentages, regression and panel data technique have been used in the study. Most of the districts in the coastal belt (NECP and ESECP zones) and central table land region (WCTL and MCTL zones) are agriculturally more developed than others.

Pradeep Kumar Panda1, in the study concentrates on current situation of Regional Disparity in Development of Odisha Economy, advocates strategies to overcome these issues and bottlenecks which are cause of regional disparities in Odisha. The main objectives are i. Assessment of current scenario of Regional Disparity along with issues and challenges. ii. Assessment of various Central Government and State Government Scheme for addressing Regional Disparity iii. Strategies to overcome these issues and bottlenecks. Methodology used for estimating disparities was General measures of central tendency and dispersion are applied for data analysis and data collected from Odisha Economic Survey. "The State witnesses wide regional, social and general disparities in development. All regions have not shared the gains of development in an equitable manner. A major challenge currently is to enhance the economy's capacity for growth, to deal with the issues of regional disparities, particularly those of widening gap between more developed and less developed areas, a major challenge currently is to enhance the economy's capacity for growth, to deal with the issues of regional disparities, particularly those of widening gap between more developed and less developed areas." "The undivided districts of Koraput, Bolangir and Kalahandi (popularly known as KBK districts) form one such region where the incidence of poverty is very high. regional disparities can be reduced by speedy completion of ongoing irrigation projects, investments in remaining irrigation projects and rehabilitation of tanks etc. in drought prone regions of KBK region. Nine key initiatives, which have been taken to address problems of underdevelopment and regional disparities. Although economic growth increased in Odisha, inclusive and balanced growth has to be improved. 11 suggestions have been given to reduce regional disparities. To conclude, there is a need to operationalize a plan for achieving inclusive and balanced growth during the Plan period and beyond in Odisha. The action plan should cover the priority areas like agriculture, employment and social sectors. It should have a plan for

removing economic and social deprivation across all regions and for socially disadvantaged sections."

Minati Mallick and Urmi Pattanayak, have tried to study the disparities in production and yield of five major crops among 13 Indian states by using secondary data and evaluating the coefficient of variation. The inter-state divergence is seen in the production of pulses and fibres while convergence is there in their productivity. Inter-state divergence has serious in the production and productivity of oilseeds. The states like Punjab, Haryana, Gujarat, Maharashtra, Andhra Pradesh and West Bengal are better performers agriculturally as compared to other states. Creation of consciousness regarding the use of inputs, soil-water management and marketing facilities in those states is essential for balanced agricultural development. The main objectives are 1. To study the variation in agricultural production and yield among states of India. 2. To analyze the inter-state disparities in production and yield of different crops. The methodology used for this study is for the study 5 major crops in 13 large states are productivity and production. The data were gathered in Economy Survey, Agricultural Statistics in India on 2 points of time for 2007-08 and 2013-14, By evaluating the coefficients of variation over such periods, existence and trends of disparities are achieved. there is a weakening in the disparities in agricultural production and productivity as a whole with respect to five major crops among thirteen major states. The same is the case with crops like cereals and sugarcane while interstate divergence is seen in the production of fibres and pulses but convergence in the productivity of these two crops. The interstate divergence has worse in production and productivity of nine oilseeds. This study reveals states like Punjab, Maharashtra, Andhra Pradesh, Gujarat, Haryana and West Bengal are carrying out better agriculturally than the remaining states. Some of the factors behind the existence and widening of disparities between the states in India are differences in rains, irrigation facilities, and resource endowments, soil, climate, storage and marketing services, expansion activities, awareness and attraction towards farming.

Mrutyunjay Swain, looks at the nature and sources of agrarian instability in West Odisha district of Bolangir, India. In determining the agricultural instability index (AII), variables such as area, production of food grain and paddy, irrigation cover and annual rainfall shall be investigated into the nature of instability in agricultural production. The period covered by this study (1984–2009) is divided by two sub-periods – (1984–1993) and (1994–2009), which is characterized by a greater technological spread. The impacts of a shift in essential inputs on crop productivity variability are

evaluated using a double-log model. In order that the role of drought risk factors, the quantity, and productivity of crop inputs are examined, the yield decomposition analysis is used. Due to the high level of rainfall variability and low irrigation coverages, the extent of instability in agricultural production and productivity in the region has been showed to be quite high. In the second sub-period, there is much more instability in the production of food grain. Drought risks such as a fall in rainfall, plant variability, heavy temperature, and drought-induced pest attacks have revealed around 84,4 percent of the total growth change in paddy yields, while the remainder of the change in yield and productivity of large agricultural inputs including labor, fertilizer, pesticides, and irrigations.

Amaresh Samantaraya, Auro Kumar Sahoo, Arundhati Mallick, Biswabhusan Bhuyna, in the present article states that Odisha progressively improved its relative economic position in the second half of the post-reform period contrary to popular perception. The per capita income and key socioeconomic indicators show this clearly. This is also confirmed by a household study to evaluate the condition at the grass-roots stage. An assessment of the study data also indicates that excellent irrigation, highway connectivity and proximity to dynamic financial operations such as mining and industry make more profit and a better living possible. The study developed a multi-stage sampling technique to collect data from rural Odisha at the field levels. In the former, three counties were identified by per capita net district national product (NDDP), namely, Kendujhar (wealthy), Jajapur (medium-income), and Balangir (poor) in three different categories of income. On the second stage, the fi ve villages from the three sample districts were selected mainly for accessibility and the household survey facilities. During the third stage of sample villages, households were taken by simple random sampling methods. In addition, it was found that approximately 70% of the assets were obtained in 2001-11 compared with 30% in 1992-2000. This shows that most living conditions improve in the second half of the post-reform period.

### 2.3 : Literature related to cropping pattern

Agricultural diversification has been embraced by farming societies since ancient times to reduce the risks connected with the specific production system and to protect family food safety (Deka et al., 2013). Similarly, Haque (1996) defined the diversification of small farms as a means of speedy rural development. He went on to explain that the commercialization and diversification of small farms and their proper integration with domestic and international markets can serve as an attitude

to enhancing increased output. Appropriate selection of crop combinations allows farmers to use resources effectively in addition to attaining greater development and stabilization of farm income.

As mentioned previously, there are many variations in methodologies taken in recent times to explain the changing agricultural situation and consequently the findings also vary depending on different socio-economic variables. It is noted that most recent studies have used the Herfindal Index to explain crop diversification (De and Bodosa 2014; Dasgupta and Bhaumik 2014; Ghosh 2011; Mandal 2010). In another study, on the other hand, Mandal and Bezbaruah (2013) introduced the Composite Entropy Index as a measure of crop diversification and also depended on the Tobin model to understand the determinants of crop diversification. Likewise, Location Quotient have been used to determine the concentration of each crop in a region (De and Bodosa 2014; Ghosh 2011). In addition, Simpson's Index (Haque and Bhattacharya, 2010) and Gibb's and Martin's Index (Das and Mili, 2012) has also been used as a measure of crop diversification.

Diversification of crop patterns occurs in some contexts towards inferior crops. This phenomenon occurs when farming communities lack basic inputs to diversify towards high-value crops. In such instances, farming communities attempt to produce whatever they can from their small plots of land using existing traditional technology. In such instances, farming communities attempt to harvest whatever they can from their small plots of land using current traditional technology. In a study on Assam, De and Bodosa (2015) noted that diversification was taking place in the state towards inferior crops. They went on and said that diversification in the state did not reflect much progressive agricultural scenario due to the absence of many variables, such as irrigation and other technology-related variables.

Dinesh Kumar Nayak (2016) examines the structure and nature of crop patterns, crop diversification, crop concentration, productivity level, and inter district disparity in the state of Odisha based on secondary information gathered from various published sources for the period 1980 – 2005. The research has evaluated 30 crops cultivated in Odisha at a disaggregation stage, representing 96-98% of the gross cropped area. The crops selected for the study were (i) Cereals (ii) Oilseeds (iii) Vegetables (iv) Cash crops. The study period, 1980 to 2005 was divided into five sub-periods and quinquennial averages were worked out. For assessment, the research used Herfindahl index, location quotient, Gini coefficient, and panel data regression. The study showed that most districts in Odisha have a lateral movement for crop specialization and crop

diversification in tribal-dominated and technologically less developed districts only. During the investigated period, the study observed a drop in inequality and concluded that Odisha's districts converged in terms of agricultural productivity. The study identified major agricultural productivity determinants in Odisha and proposed policy measures to increase state agricultural productivity.

However, some of the recent studies perceived diversification of Indian agriculture towards high valued crops (Dasgupta and Bhaumik 2014; Ghosh 2011).

Dasgupta and Bhaumik (2014) conducted a study on the trend and pattern of agricultural diversification in West Bengal from 1980-81 to 2009-10. The research was based on secondary data sources and the entire period was split into two sub-periods, from 1980-81 to 1994-95(pre-globalization era) and from 1995-96 to 2009-10 (post-globalization era). The research disclosed a shift in West Bengal's crop pattern in favour of plants such as summer rice, oilseeds, potatoes, and more recently vegetables and fruits. State diversification was taking place towards those crops, which offered a greater relative return to the farmers. The growth of agriculture also varied positively with the diversification of crops.

Bidyut kumar ghosh, in this study focuses on the diversification of the western Bengal agriculture activity, one of the leading agriculture states in India. This research showed that the cultivation pattern in western Bengal was skewed in terms of the distribution of acreage for food crops, using the substitution and expansion methodology from Minhas and Parikh. In the last 15-20 years, however, several important crops have emerged as the main crop for the farmers, namely, boro rice, potatoes, olive seeds, especially mustard. The cropping pattern turned against pulses, cereals and sugarcane. It was also observed, that the expansion effect could explain 54,69% of the gross cultivated area under a crop pattern change and the substitution effect resulted in the remaining 45,31% of the gross cropped ground area.

## 2.4 Summary

This chapter reviewed few existing studies on the agricultural development, cropping patterns, etc. Few important points can be summarized based on the survey of relevant literature above:

- Rate of adoption of new technology was higher on larger farms than the smaller ones, there has been an inverse relationship between productivity and farm size.
- While Crop diversification have been taking place in India, west Bengal, Assam as a mechanism to cope with the limits imposed by several uncontrollable factors, Odisha is experiencing a lateral movement towards crop specialization.
- Diversification of cropping pattern have been taking place towards inferior crops in some regions of Assam, West bengal due to absence of many factors like irrigation and other technology related factors. Odisha is marching towards highly rain fed crop rice.
- "Tenancy have significant impact on the resource use efficiency and productivity of farming. Cash tenant operators are efficient than those of owner and crop share tenant operators in most of the cases."
- Inefficient utilization of irrigation water is the major constraint towards achieving higher production and productivity of crops. Prevalence of mono-cropping is one of the major factors leading to low utilization of irrigation potential.

. With this background of available previous studies on cropping specialization, adoption rice as against other crops, strategy towards mitigating production risk, water management technologies and various aspects of rice cultivation, in the next chapter, we proceed to examine the profile of agricultural economy of Odisha, KBK and Bargarh district.

# CHAPTER- 3

# AGRO-ECONOMIC PROFILE OF ODISHA

## 3.1 Introduction

In the previous chapter, we have reviewed available previous studies on Agricultural (crop) diversification, socio-economic status and agricultural development of the study region. In the present chapter, a brief overview of the present agricultural economy of Odisha is outlined. The present chapter is organized in the following ways: section 3.2 provides brief description on the land use pattern of the state and districts. Section 3.3 presents the land holding structure of the districts and states. To understand the relative position of the people, section 3.4 shows the trends of literacy rates and rural urban population, section 3.5 deals with the working non-working population and finally section 3.6 summarizes the discussions in the present chapter.

## 3.2 Land Use Patterns

Agricultural land use is a dominant characteristics of the land's varied used for multiple productive reasons. It not only involves the land used to grow plants and fodder, but also that used to raise livestock. From the classification of Indian land use, some of the things are the percentage of land under forest, land not accessible for agriculture, fallow land, gross crop area, area shown more than once, crop intensity, area under irrigation for different food and non-food crops, area under different plants etc.

The total area of crops harvested once or more than once in a particular year is Gross Cropped Area (GCA). When crop is sown twice on a piece of land, the area is twice counted in the GCA. On the other hand, the Net Sown Area is the area seeded with crops but counted only once. Area shown more than once is the difference between GCA and NCA. Fallow land is a piece of land usually used for farming but left without crops for a season to recovers its fertility. Whereas barren land is a land having thin soil, rock or sands, where one third of the area has vegetation or other covers.

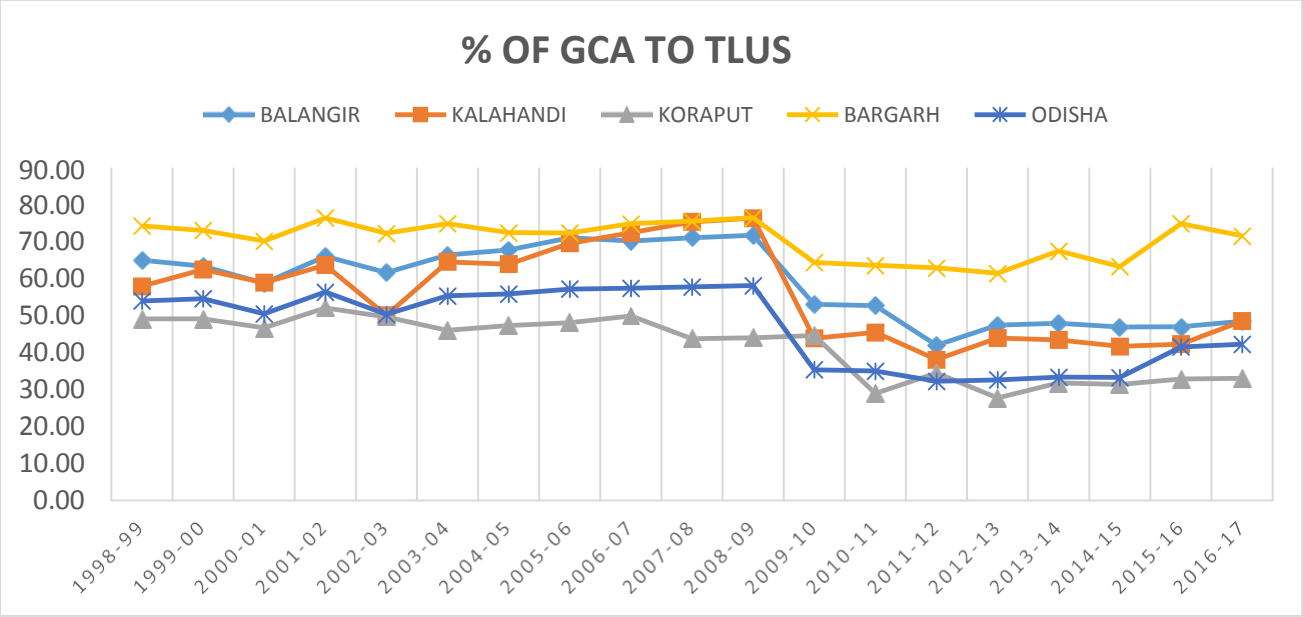
In recent years, land classifications by significant uses in Odisha have been presented in the below Tables.

3.2.1 Gross Cropped Area (GCA)

Table 3.1: GCA as a share of Total Land Under Statistics (TLUS)

| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 65.07 | 58.05 | 49.20 | 74.41 | 54.11 |
| 1999-00 | 63.44 | 62.61 | 49.20 | 73.21 | 54.74 |
| 2000-01 | 58.83 | 59.06 | 46.77 | 70.30 | 50.59 |
| 2001-02 | 66.14 | 63.84 | 52.21 | 76.59 | 56.51 |
| 2002-03 | 61.75 | 50.19 | 49.78 | 72.38 | 50.43 |
| 2003-04 | 66.47 | 64.68 | 46.13 | 75.03 | 55.47 |
| 2004-05 | 67.89 | 64.10 | 47.44 | 72.52 | 55.99 |
| 2005-06 | 71.16 | 69.73 | 48.24 | 72.49 | 57.34 |
| 2006-07 | 70.28 | 72.53 | 50.04 | 74.99 | 57.55 |
| 2007-08 | 71.21 | 75.54 | 43.89 | 75.65 | 57.90 |
| 2008-09 | 71.85 | 76.53 | 44.14 | 76.60 | 58.25 |
| 2009-10 | 53.13 | 43.95 | 44.75 | 64.53 | 35.47 |
| 2010-11 | 52.83 | 45.55 | 29.00 | 63.70 | 35.09 |
| 2011-12 | 42.06 | 38.19 | 34.55 | 63.00 | 32.31 |
| 2012-13 | 47.47 | 44.06 | 27.79 | 61.55 | 32.70 |
| 2013-14 | 48.03 | 43.51 | 31.89 | 67.61 | 33.41 |
| 2014-15 | 46.97 | 41.76 | 31.42 | 63.41 | 33.34 |
| 2015-16 | 47.06 | 42.41 | 32.89 | 75.02 | 41.63 |
| 2016-17 | 48.52 | 48.66 | 33.08 | 71.68 | 42.34 |
| SOURCE : Calculated area Data From Directorate Of Economics And Statistics (DSE), GOI | | | | | |

Figure 3.1 GCA as a share of total land under statistics (TLUS)




Data from table 3.1 shows that, starting from period 1998-99 to 2008-09 the GCA as a share of LUS has been increased for the four district and Odisha. The share of GCA has increased from 65.07 to 71.85 percent in Balangir district, 58.05 to 76.53 percent in Kalahandi district, 49.20 to 44.14 in Koraput district, 74.41 to 76.60 in Bargarh district and 54.11 to 58.25 in Odisha respectively. But after 2008-09 GCA as a share of LUS has undergone a sharp declined in all of these district and state except Bargarh. The decline in share of GCA in Bargarh district after 2008-09 is not more and it has more than 70 percent in recent years. During 2009-10 to 2016-17 the GCA has been declined from 53.13 to 48.52 in Balangir district, 43.95 to 48.66 percent in Kalahandi district, and 44.75 to 33.08percent in Koraput district. The same has declined for Odisha as well from 35.47 in 2009-10 to 33.34 in 2014-15 and has increased to 42.34 percent in 2016-17.

From the above graph 3.1 it can also be observed that the share of GCA has increased from 1998-99 to 2008-09 and the same has declined after 2008-09 to 2016-17 for all the four districts Balangir, Kalahandi, Koraput, Bargarh and for the state Odisha as well. Starting from 1998-99 to 2016-17 Bargarh has the highest share to GCA as compare to other districts followed by Balangir and Kalahandi, whereas Koraput district has the lowest share.

3.2.2 Net Cropped Area (NCA)

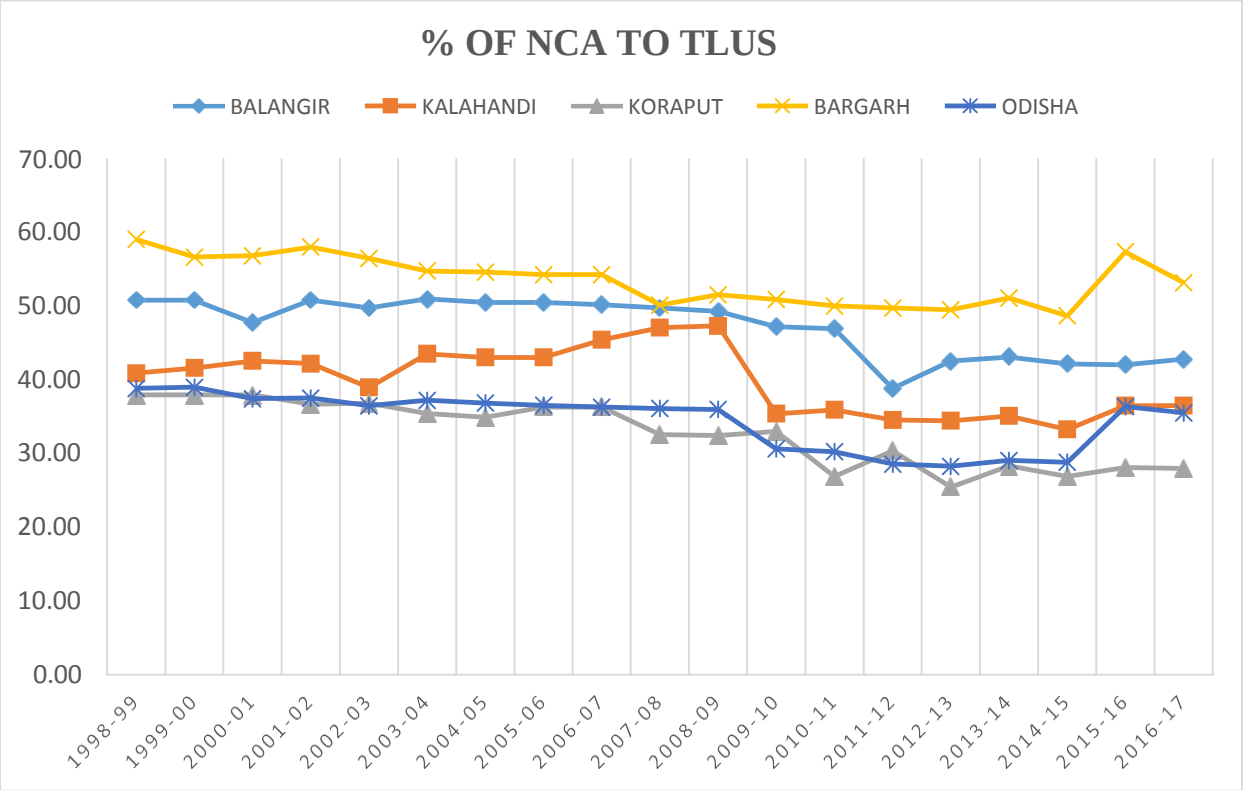
Table 3.2: NCA as a percentage of TLUS

| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 50.84 | 40.91 | 37.97 | 59.08 | 38.84 |
| 1999-00 | 50.84 | 41.63 | 37.97 | 56.68 | 39.01 |
| 2000-01 | 47.79 | 42.58 | 37.97 | 56.85 | 37.43 |
| 2001-02 | 50.84 | 42.22 | 36.71 | 58.05 | 37.54 |
| 2002-03 | 49.77 | 39.00 | 36.84 | 56.51 | 36.48 |
| 2003-04 | 50.99 | 43.54 | 35.44 | 54.79 | 37.22 |
| 2004-05 | 50.53 | 43.06 | 34.94 | 54.62 | 36.86 |
| 2005-06 | 50.53 | 43.06 | 36.33 | 54.28 | 36.55 |
| 2006-07 | 50.23 | 45.45 | 36.33 | 54.28 | 36.31 |
| 2007-08 | 49.77 | 47.10 | 32.58 | 50.17 | 36.12 |
| 2008-09 | 49.32 | 47.35 | 32.46 | 51.54 | 35.99 |
| 2009-10 | 47.20 | 35.43 | 33.03 | 50.91 | 30.65 |
| 2010-11 | 46.97 | 35.95 | 26.91 | 50.03 | 30.26 |
| 2011-12 | 38.83 | 34.59 | 30.39 | 49.77 | 28.59 |
| 2012-13 | 42.56 | 34.46 | 25.48 | 49.51 | 28.29 |
| 2013-14 | 43.10 | 35.12 | 28.33 | 51.11 | 29.06 |
| 2014-15 | 42.20 | 33.30 | 26.89 | 48.71 | 28.83 |
| 2015-16 | 42.06 | 36.50 | 28.12 | 57.38 | 36.39 |
| 2016-17 | 42.83 | 36.53 | 27.98 | 53.20 | 35.54 |
| SOURCE : Calculated area Data From Directorate Of Economics And Statistics (DSE), GOI | | | | | |

Data from table 3.2 shows the share of NCA to LUS for the districts of Balangir, Kalahandi, Koraput, Bargarh and for the state Odisha respectively. Starting from period 1998-99 to 2008-09 the NCA as a share of LUS has been more or less constant near to 50 percentages for Balangir, after 2008-09 the same has declined from 49.32 percentage to 42.83 percentage in 2016-17. The same has increased from 40.91 to 47.35 percentage for Kalahandi over the period 1998-99 to 2008-09, but has declined from 47.35 to 36.53 percentage after 2008-09 to 2016-17. The share of NCA has been in between 30-40 percentages up to 2009-10 but after 2009-10 it has come below 30

percentages for Koraput districts and it is 27.98 percentage in 2016-17. Bargarh district has been able to maintain the NCA more than 50 percentages from 1998-99 to 2016-17 except the year 2011-12, 2012-13 and 2014-15. The share of NCA has been declining for Odisha from 38.94 to 30.26 percentages from 1998-99 to 2010-11 but always above 30 percentages but it falls below to less than 30 percentages for four consecutive years and then again raise to 36.39 and 35.54 percentages in 2015-16 and 2016-17 respectively.

Graph 3.2: NCA as a percentage of TLUS




From the above graph 3.2 it can be observed that all the districts have experienced a slight decline in the share of NCA from 1998-99 to 2008-09 except Kalahandi experiencing increase in the share of NCA and the same has declined continuously after 2008-09 to 2016-17 for the districts Balangir, Kalahandi, Koraput. Bargarh and Odisha has experienced a marginal decline after 2008-09 to 2014-15 and then increased. Starting from 1998-99 to 2016-17 Bargarh has the highest share to NCA as compare to other districts followed by Balangir and Kalahandi, whereas Koraput district has the lowest share.

3.2.3 Area Shown More Than Once

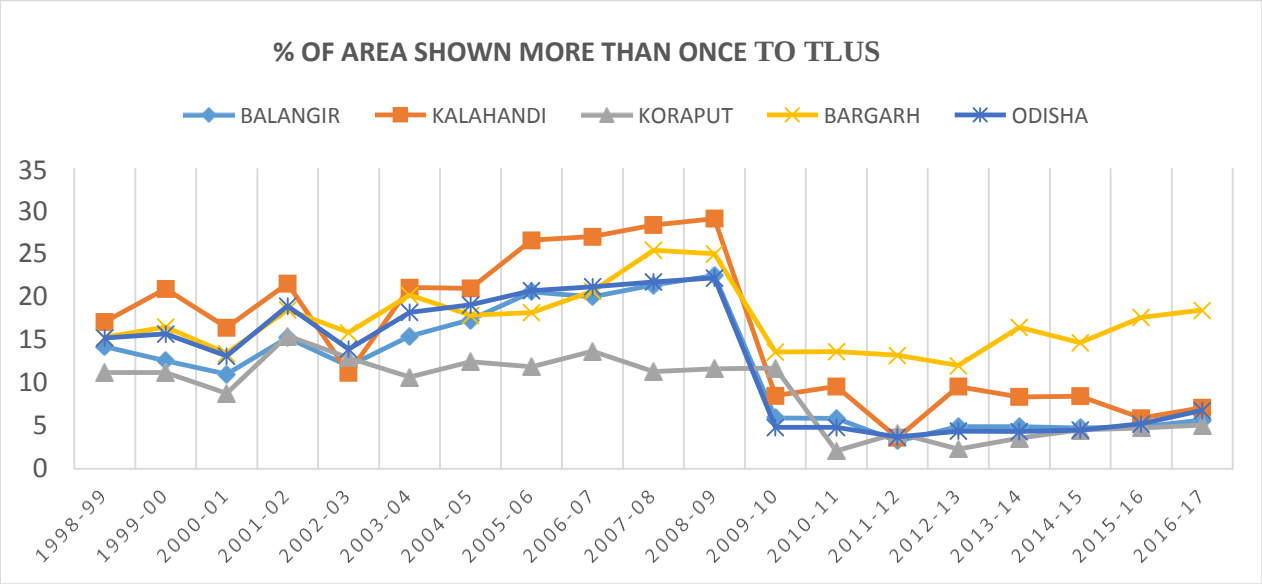
Table 3.3 Area Shown More Than Once as a percentage of TLUS

| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 14.23 | 17.14 | 11.22 | 15.33 | 15.26 |
| 1999-00 | 12.60 | 20.98 | 11.22 | 16.53 | 15.73 |
| 2000-01 | 11.04 | 16.48 | 8.80 | 13.45 | 13.16 |
| 2001-02 | 15.30 | 21.61 | 15.50 | 18.54 | 18.97 |
| 2002-03 | 11.98 | 11.20 | 12.94 | 15.87 | 13.95 |
| 2003-04 | 15.48 | 21.14 | 10.68 | 20.24 | 18.25 |
| 2004-05 | 17.36 | 21.04 | 12.50 | 17.90 | 19.13 |
| 2005-06 | 20.63 | 26.67 | 11.91 | 18.21 | 20.79 |
| 2006-07 | 20.06 | 27.08 | 13.71 | 20.71 | 21.23 |
| 2007-08 | 21.44 | 28.44 | 11.32 | 25.48 | 21.78 |
| 2008-09 | 22.53 | 29.18 | 11.68 | 25.06 | 22.26 |
| 2009-10 | 5.93 | 8.52 | 11.72 | 13.62 | 4.82 |
| 2010-11 | 5.86 | 9.61 | 2.09 | 13.66 | 4.83 |
| 2011-12 | 3.23 | 3.61 | 4.16 | 13.23 | 3.71 |
| 2012-13 | 4.91 | 9.59 | 2.31 | 12.04 | 4.40 |
| 2013-14 | 4.92 | 8.39 | 3.56 | 16.49 | 4.35 |
| 2014-15 | 4.77 | 8.46 | 4.53 | 14.70 | 4.50 |
| 2015-16 | 4.89 | 5.90 | 4.77 | 17.64 | 5.24 |
| 2016-17 | 5.69 | 7.12 | 5.09 | 18.49 | 6.81 |
| SOURCE : Calculated area Data From Directorate Of Economics And Statistics (DSE), GOI | | | | | |

Data from table 3.3 shows that the share of area shown more than once has been increased continuously for four district and Odisha state from 1998-99 to 2008-09. Period during 1998-99 to 2008-09 the share of area shown more than once has been increased from 14.23 to 22.53 percent in Balangir district, 17.14 to 29.18 percent in Kalahandi district, 11.22 to 11.68 in Koraput district, 15.33 to 25.06 in Bargarh district and 15.26 to 22. 26 in Odisha. But it has been shown from the above table that after 2008-09 there has been sharp declined in the share of area shown more than once of these district and Odisha. During 2008-09 to 2016-17 the share of area shown more than

once has declined from 22.53 to 5.69 in Balangir district, 29.18 to 7.12 percent in Kalahandi district, and 11.68 to 5.09 percent in Koraput district, 25.06 to 18.49 percent in Bargarh district and 22.26 to 6.81 percent in Odisha. The declined rate of Balangir, Kalahandi and Koraput district is more than the declined rate of Bargarh district in the share of area shown more than once during 2008-09 to 2016-17.

Graph 3.3: The Share of Area Shown More Than Once to TLUS




From the above graph 3.3 it can be observed that all the districts have experienced an increase in the share of area shown more than once of from 1998-99 to 2008-09, Kalahandi being the district with largest share of the area shown more than once followed by Bargarh and Balangir and the same has declined continuously after 2008-09 to 2016-17 for the districts like Balangir, Kalahandi, Koraput and Odisha. Bargarh has also experienced the decline after 2008-09 to 2014-15 but less than other districts and then increased in 2015-16 and 2016-17. From period 1998-99 to 2008-09 Kalahandi has the highest share of area shown more than once than other districts whereas after 2008-09 Bargarh is the district with larger share while Koraput remains to be at the bottom throughout the period.

3.2.4 Irrigated Area (IA)

Table 3.4: IA as a percentage of GCA

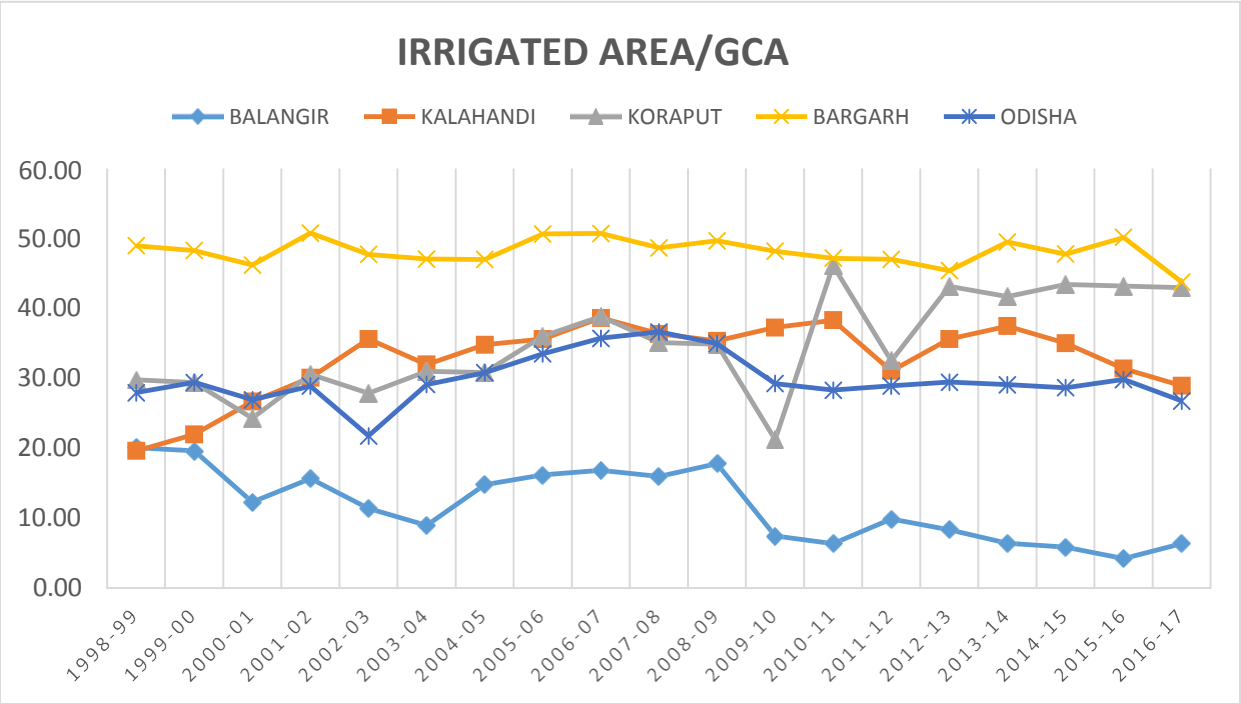
| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 20.11 | 19.67 | 29.83 | 49.05 | 27.99 |
| 1999-00 | 19.66 | 22.03 | 29.42 | 48.37 | 29.47 |
| 2000-01 | 12.30 | 26.73 | 24.33 | 46.29 | 26.97 |
| 2001-02 | 15.66 | 30.14 | 30.60 | 50.87 | 28.94 |
| 2002-03 | 11.40 | 35.69 | 27.91 | 47.81 | 21.80 |
| 2003-04 | 8.98 | 32.04 | 31.02 | 47.15 | 29.16 |
| 2004-05 | 14.78 | 34.87 | 30.87 | 47.07 | 30.85 |
| 2005-06 | 16.20 | 35.70 | 36.05 | 50.71 | 33.56 |
| 2006-07 | 16.87 | 38.71 | 38.92 | 50.81 | 35.77 |
| 2007-08 | 15.98 | 36.41 | 35.17 | 48.75 | 36.70 |
| 2008-09 | 17.80 | 35.41 | 34.91 | 49.76 | 35.03 |
| 2009-10 | 7.44 | 37.34 | 21.25 | 48.28 | 29.29 |
| 2010-11 | 6.38 | 38.38 | 46.21 | 47.27 | 28.35 |
| 2011-12 | 9.88 | 31.14 | 32.54 | 47.10 | 28.95 |
| 2012-13 | 8.35 | 35.69 | 43.21 | 45.48 | 29.51 |
| 2013-14 | 6.39 | 37.54 | 41.74 | 49.59 | 29.13 |
| 2014-15 | 5.88 | 35.09 | 43.50 | 47.87 | 28.70 |
| 2015-16 | 4.22 | 31.45 | 43.25 | 50.24 | 29.86 |
| 2016-17 | 6.37 | 29.01 | 43.04 | 43.85 | 26.80 |

Source: Calculated area Data from Directorate Of Economics And Statistics (DSE), GOI

Data from table 3.4 shows that, Balangir district has experienced a declining trend in the IA as a percentage of GCA., the decline was less up to 2008-09 but the decline has increased from 17.80 percent in 2008-09 to 6.37 percentage in 2016-17. Except few years Kalahandi and Koraput district have experienced an increase in the share of IA to GCA. for Kalahandi it is from 19.67 in 1998-99 to more than 30 percentages in recent years and for Koraput the share is 29.83 percentages in 1998-99 to 43.04 percentages in 2016-17. The share of Irrigated Area is 49.05 percentages in 1998-99 to 43.85 percentages in 2016-17 in Bargarh district and the same has increased from 27.99 to

35.03 percentages from 1998-99 to 2008-09 and then declined to 26.80 percentages in 2016-17 for Odisha.

Graph 3.4: Share of Irrigated Area to GCA




Trends line from graph 3.4 shows that over the period of time Bargarh District is the only district having around half of the GCA irrigated, while district like Kalahandi and Koraput experienced increase in the share of Irrigated area to GCA but still below the area covered by Bargarh. District Balangir and state Odisha have enjoyed slight increase in the share of irrigated area to GCA from 1998-99 to 2008-09 and after 2008-09 to 2016-17 decline continuously. The decline in share of irrigated area to GCA is sharp for Balangir whereas the decline for Odisha is marginal.

### 3.2.5 FALLOW LAND

Data from table 3.5 shows that, during 1998-99 to 2008-09 the Fallow Land as a share of LUS has increased from 3.35 to 5.33 percent in Balangir district, 4.31 to 2.40 percent in Kalahandi district, 2.28 to 4.20 in Koraput district, 0.17 to 9.25 in Bargarh district and 4.55 to 5.17 in Odisha. The increase in Fallow Land as a share of LUS is less for four district and Odisha state during 1998-99 to 2008-09 periods. But it has increased rapidly after 2008-09 for the four districts and state Odisha.

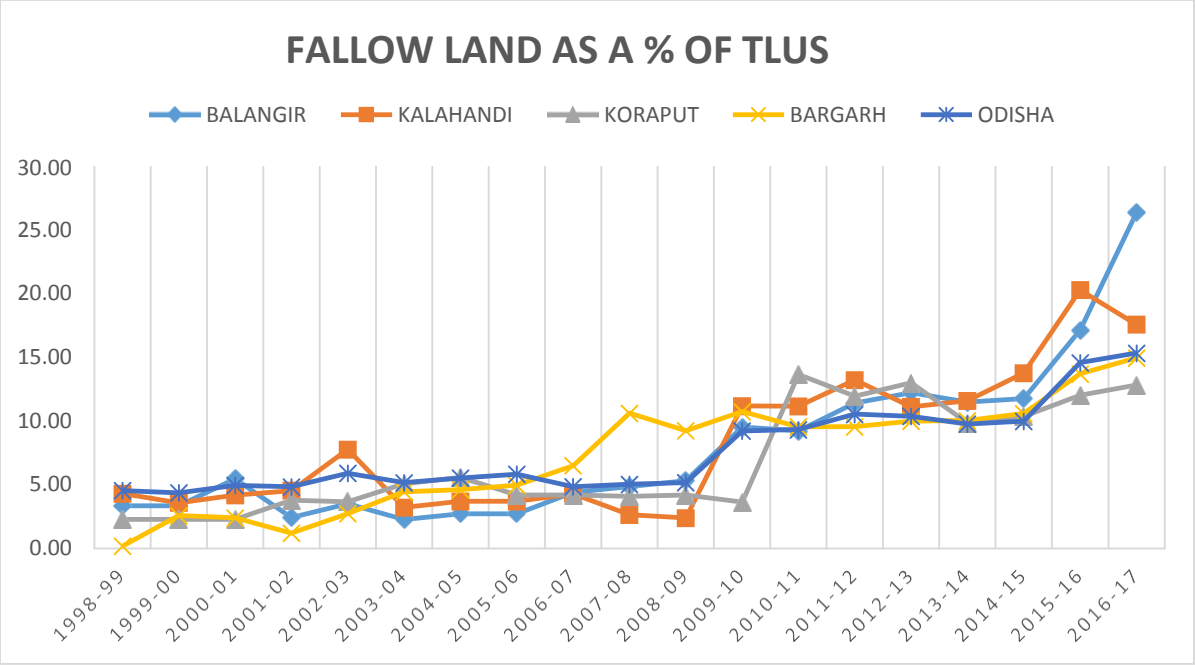
During 2008-09 to 2016-17 the Fallow Land as a share of LUS has continuously increased from 5.33 to 26.37percent in Balangir district, 2.40 to 17.59 percent in Kalahandi district, and 4.20 to 12.83 percent in Koraput district, 9.25 to 14.96 percent in Bargarh and 5.17 to 15.34 in Odisha. The increased share of Balangir, Kalahandi district is more than Bargarh district. Balangir district has the highest share of land being kept as fallow.

Table 3.5: Fallow Land as a share of TLUS

| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 3.35 | 4.31 | 2.28 | 0.17 | 4.55 |
| 1999-00 | 3.35 | 3.59 | 2.28 | 2.57 | 4.37 |
| 2000-01 | 5.48 | 4.19 | 2.28 | 2.40 | 4.95 |
| 2001-02 | 2.44 | 4.55 | 3.80 | 1.20 | 4.84 |
| 2002-03 | 3.50 | 7.78 | 3.67 | 2.74 | 5.90 |
| 2003-04 | 2.28 | 3.23 | 5.06 | 4.45 | 5.16 |
| 2004-05 | 2.74 | 3.71 | 5.57 | 4.62 | 5.52 |
| 2005-06 | 2.74 | 3.71 | 4.18 | 4.97 | 5.83 |
| 2006-07 | 4.41 | 4.29 | 4.18 | 6.51 | 4.85 |
| 2007-08 | 4.87 | 2.65 | 4.09 | 10.62 | 5.04 |
| 2008-09 | 5.33 | 2.40 | 4.20 | 9.25 | 5.17 |
| 2009-10 | 9.53 | 11.20 | 3.63 | 10.75 | 9.22 |
| 2010-11 | 9.24 | 11.17 | 13.67 | 9.55 | 9.33 |
| 2011-12 | 11.43 | 13.23 | 11.95 | 9.56 | 10.54 |
| 2012-13 | 12.24 | 11.13 | 13.00 | 10.00 | 10.37 |
| 2013-14 | 11.49 | 11.60 | 9.84 | 10.04 | 9.77 |
| 2014-15 | 11.77 | 13.78 | 10.36 | 10.59 | 9.98 |
| 2015-16 | 17.16 | 20.31 | 12.04 | 13.71 | 14.59 |
| 2016-17 | 26.37 | 17.59 | 12.83 | 14.96 | 15.34 |

Source: Calculated area Data from Directorate Of Economics And Statistics (DSE), GOI

Graph 3.5: Fallow Land as a share of TLUS




From the above graph 3.5 it can be observed that all the districts have experienced an increase in the share of fallow land throughout the study period 1998-99 to 2016-17. There is slight increase in the share of fallow land s a share of LUS from 1998-99 to 2008-09 and the same has increased at a higher rate after 2008-09. The amount of land left idle is highest for the districts Balangir, followed by Kalahandi, Bargarh and Koraput.

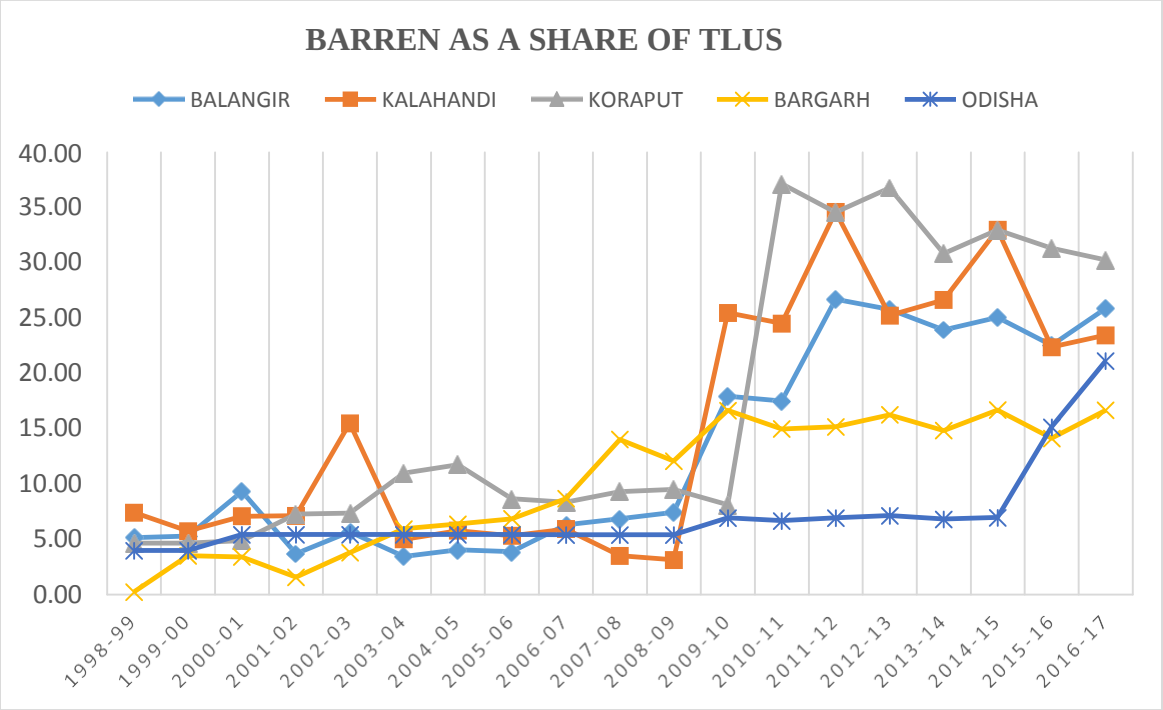
### 3.2.6 BARREN LAND

Data from table 3.6 shows that, during 1998-99 to 2008-09 the Barren Land as a share of LUS has increased from 5.15 to 7.41 percent in Balangir district, 7.42 to 3.13 percent in Kalahandi district, 4.63 to 9.51 in Koraput district, 0.23 to 12.07 in Bargarh district and 3.97 to 5.39 in Odisha. There is marginal increase in Barren Land as a share of LUS for the four district and Odisha state during 1998-99 to 2008-09 periods. But after 2008-09 there has been continuous increase in Barren Land as a share of LUS of these district and state. During 2008-09 to 2016-17 the Barren Land as a share of LUS has increased from 7.41 to 25.86 percent in Balangir district, 3.13 to 23.45 percent in Kalahandi district, and 9.51 to 30.25 percent in Koraput district, 12.7 to 16.67 percent in Bargarh and 5.39 to 21.12 in Odisha. The share of barren land for Balangir, Kalahandi and Koraput district is more than the share of Bargarh district.

Table 3.6: Barren Land as a share of TLUS

| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 5.15 | 7.42 | 4.63 | 0.23 | 3.97 |
| 1999-00 | 5.28 | 5.73 | 4.63 | 3.51 | 3.97 |
| 2000-01 | 9.31 | 7.09 | 4.87 | 3.41 | 5.41 |
| 2001-02 | 3.68 | 7.12 | 7.27 | 1.56 | 5.41 |
| 2002-03 | 5.67 | 15.49 | 7.37 | 3.79 | 5.41 |
| 2003-04 | 3.44 | 4.99 | 10.98 | 5.93 | 5.41 |
| 2004-05 | 4.04 | 5.78 | 11.74 | 6.37 | 5.41 |
| 2005-06 | 3.85 | 5.32 | 8.66 | 6.85 | 5.41 |
| 2006-07 | 6.28 | 5.92 | 8.35 | 8.68 | 5.39 |
| 2007-08 | 6.84 | 3.51 | 9.31 | 14.03 | 5.39 |
| 2008-09 | 7.41 | 3.13 | 9.51 | 12.07 | 5.39 |
| 2009-10 | 17.94 | 25.49 | 8.12 | 16.65 | 6.93 |
| 2010-11 | 17.49 | 24.53 | 37.14 | 14.99 | 6.67 |
| 2011-12 | 26.69 | 34.63 | 34.58 | 15.18 | 6.92 |
| 2012-13 | 25.79 | 25.25 | 36.78 | 16.25 | 7.12 |
| 2013-14 | 23.93 | 26.66 | 30.85 | 14.85 | 6.80 |
| 2014-15 | 25.05 | 33.00 | 32.98 | 16.70 | 6.95 |
| 2015-16 | 22.54 | 22.39 | 31.32 | 14.13 | 15.14 |
| 2016-17 | 25.86 | 23.45 | 30.25 | 16.67 | 21.12 |
| Source: Calculated area Data from Directorate Of Economics And Statistics (DSE), GOI | | | | | |

Graph 3.6: Barren Land as a share of TLUS




From the above graph 3.6 it can be observed that all the districts have experienced an increase in the share of barren land throughout the study period 1998-99 to 2016-17. There is slight increase in the share of barren land s a share of LUS from 1998-99 to 2008-09 and the same has increased at a higher rate after 2008-09. The amount of barren land is highest for the districts Koraput followed by Kalahandi and Balangir. The share of barren land for the state of Odisha is more or less constant and below 10 percentages until 2014-15 and after 2014-15 it has increased for consecutive years. Bargarh is the district with lowest share to barren land among all the other above considered districts.

### 3.3 Land Holding

The dominance of small and marginal farmers in the land holding structure is one of the factors that causes low agricultural growth in the nation as well as in Odisha. Since these parts of the population are overburdened by capital and other economic limitations, they are deprived of the advantages of modern agricultural methods and rely primarily on traditional technologies, which is one of the primary causes of low agricultural production and productivity.

Table 3.7: Land Use Pattern

| ROUNDS | TYPES OF HOLDING | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|---|
| ROUND 55 1999-2000 | MARGINAL | 88.2 | 78 | 80.6 | 70.9 | 79.1 |
| | SMALL | 5.6 | 10.2 | 5.5 | 13.5 | 9.3 |
| | SEMI-MEDIUM | 4.1 | 4.6 | 8.8 | 7.8 | 4.8 |
| | MEDIUM | 0.7 | 5.5 | 3.7 | 6.6 | 5.1 |
| | LARGE | 1.4 | 1.7 | 1.4 | 1.2 | 1.7 |
| | | | | | | |
| ROUND 60 2004-05 | MARGINAL | 78.9 | 76.9 | 73.7 | 72.3 | 80.8 |
| | SMALL | 10.5 | 9 | 10.8 | 11.5 | 8.6 |
| | SEMI-MEDIUM | 8.7 | 8.6 | 9.5 | 8.3 | 5.1 |
| | MEDIUM | 0.9 | 4.8 | 4.2 | 6.1 | 4.2 |
| | LARGE | 1 | 0.7 | 1.8 | 1.8 | 1.3 |
| | | | | | | |
| ROUND 64 2007-08 | MARGINAL | 83.5 | 84.5 | 85.8 | 74 | 80.6 |
| | SMALL | 8.6 | 9.1 | 7.4 | 11 | 9.5 |
| | SEMI-MEDIUM | 4 | 3.5 | 2.6 | 7 | 2.9 |
| | MEDIUM | 3.2 | 2.5 | 3.8 | 6.2 | 4.7 |
| | LARGE | 0.7 | 1.1 | 1.2 | 1.8 | 2.3 |
| ROUND 68 2011-12 | MARGINAL | 82.6 | 74.8 | 78.5 | 72.9 | 77.6 |
| | SMALL | 9.1 | 19.5 | 11.9 | 10.2 | 10.6 |
| | SEMI-MEDIUM | 6.6 | 4.4 | 6.5 | 9.5 | 6.5 |
| | MEDIUM | 0.9 | 0 | 1.6 | 5.5 | 4.3 |
| | LARGE | 0.8 | 1.3 | 1.2 | 1.6 | 0.9 |
| SOURCE : data calculated from different NSSO rounds | | | | | | |

NSSO: National Sample Survey organization

Marginal Holdings: less than 1 hectare

Small Holdings: 1.01 to 2.00 hectares

Semi-Medium Holdings: 2.01 to 4.00 hectares

Medium Holdings: 4.00 to 8.00 hectares

Large Holdings: greater than 8.00 hectares

Data from table 3.7 shows the trends of changes in the structure of landholdings in Balangir, Bargarh, Kalahandi, Koraput district and for Odisha. From different employment unemployment rounds of National Sample Survey Organization (NSSO) it can be observed that there is not much change in the structure of land holdings, out of the total land holders marginal land holders constitute more than 80 percentages in Balangir districts, 75-80 percentages in Kalahandi districts, around 80 percentages in Koraput, 70-73 percentages in Bargarh districts and around 80 percentages for the state Odisha. Farmers having less than 4 hectors of Land that is up to semi-medium holders constitute more than 95 percentages in the overall structure in the districts of Balangir, Kalahandi, Koraput and 90-95 percentages in Bargarh and Odisha. In the recent year Balangir has the highest number of Marginal holders constituting 82.6 percentages followed by Koraput and Kalahandi.

As compare to Kalahandi, Balangir and Koraput (KBK) districts Bargarh has more number of medium and large land holders constituting nearly around 8 percentages against below 5 percentages of KBK districts. In case of marginal and small holders Bargarh constitutes the lowest number of farmers as against all the KBK districts. Even the KBK district is falling marginally short in overall Odisha too. Where KBK has slight higher share of farmers under marginal and small holders and less share of farmer constituting medium and large size of land. Thus, comparing to Bargarh and Odisha KBK district is always falling behind over the last two decades.

A number of small and marginal farmers dominate the agricultural economy of Odisha. Over the years, marginal farmers have been holding nearly 80% of total holdings. Comparatively, the semi medium farmers are operating dominant portion of land in the state. The proportion of number of large farmers operating more than 8 hectares of land is very small in the state.

The fragmentation and small and marginal size of land holdings is one of the bottleneck coming in front of the higher rate of agricultural development in Odisha. As because of the small size of holdings farmers are deprived of the use of modern technology that could help in reducing cost of cultivation, saving labor power and boost the yield rate.

The trends of land holdings is very much rigid in Odisha along with the four districts, where nearly 80 percentages of farmers are small and marginal farmers while farmers with higher hectare of land constitute very small share among farmers.

### 3.4 LITERACY AND POPULATION:

Table 3.8: Total, Rural and Urban population:

| | | | PERCENTAGE OF TOTAL POPULATION | | | |
|---|---|---|---|---|---|---|
| **DISTRICTS** | **TOTAL POPULATION** | | **RURAL** | | **URBAN** | |
| **YEAR** | **2001** | **2011** | **2001** | **2011** | **2001** | **2011** |
| **BALANGIR** | 1,337,194 | 1648997 | 88.46 | 88.03 | 11.54 | 11.96 |
| **KALAHANDI** | 1,335,494 | 1576869 | 92.49 | 92.26 | 7.50 | 7.73 |
| **KORAPUT** | 1,180,637 | 1379647 | 83.2 | 83.60 | 16.80 | 16.39 |
| **BARGARH** | 13,46,336 | 1,481,255 | 89.33 | 89.86 | 10.74 | 10.13 |
| **ODISHA** | 36,804,660 | 41,974,218 | 85.15 | 83.31 | 14.95 | 16.68 |
| Source: Census Of India (2001 and 2011) | | | | | | |

Data from table 3.8 shows the total and rural-urban areas population in the districts of Odisha. In the state of Odisha 85.15% of population is living in the rural areas and 14.95 % in urban areas in 2001. In 2011 the rural population decreased to 88.31 % and urban population as a percentage of total population increased to 16.68%. The highest percentage of rural population (2001) is in the districts of Kalahandi (92.49%), followed by Bargarh (89.33%), Balangir (88.46) and lowest in the districts of Koraput (83.2). The rural population in 2011 is highest in the districts of Kalahandi (92.26%) followed by Bargarh (89.86), Balangir (88.03), and lowest in the districts of Koraput (83.60). The rural population has increased in the districts of Koraput and Bargarh from 2001 to 2011 and in case of other districts and Odisha it has decreased. The urban population has increased from 2001 to 2011 in the districts of Balangir and Kalahandi as well as in the states of Odisha. In the 2011 the highest urban population is in the districts of Koraput (16.39) followed by Balangir (11.96), Bargarh (10.13) and lowest in Kalahandi (7.73). the urban population is decreasing in the districts of Bargarh and Koraput and its rural population is increasing.

Table 3.9: Percentage of Schedule Caste (SC) and Schedule Tribe (ST) population:

| DISTRICTS ↓ | TOTAL POPULATION | | % OF SC TO TOTAL | | % OF ST TO TOTAL | |
|---|---|---|---|---|---|---|
| YEAR → | 2001 | 2011 | 2001 | 2011 | 2001 | 2011 |
| BALANGIR | 1,337,194 | 1,648,997 | 16.92 | 17.90 | 20.62 | 21.05 |
| KALAHANDI | 1,335,494 | 1,576,869 | 17.70 | 18.17 | 28.64 | 28.50 |
| KORAPUT | 1,180,637 | 1,379,647 | 13.04 | 14.24 | 49.62 | 50.56 |
| BARGARH | 1,346,336 | 1,481,255 | 18.81 | 20.17 | 16.70 | 18.98 |
| ODISHA | 36,804,660 | 41,974,218 | 16.52 | 17.12 | 22.13 | 22.85 |
| Source: Census Of India (2001 and 2011) | | | | | | |

Data from table 3.9 shows the share of SC and ST population in the districts of Odisha. The share of SC population has increased from 2001 to 2011 in the above 4 districts of Odisha as well as in Odisha. Also, the percentage of ST population has increased from 2001 to 2011 in the above mention districts and Odisha, except for Kalahandi (2001= 28.64%, 2011= 28.50%). The SC population is highest in the districts of Bargarh (20.17%) followed by Kalahandi (18.17%), whereas the ST population is highest in the districts of Koraput (50.56%) followed by Kalahandi (28.50%), Balangir (21.05%) and Bargarh (18.97%) in 2011.

Table 3.10: Literacy (Total and ST)

| DISTRICTS ↓ | TOTAL LITERACY | | ST LITERACY | |
|---|---|---|---|---|
| YEAR → | 2001 | 2011 | 2001 | 2011 |
| BALANGIR | 54.93 | 64.72 | 43.64 | 54.93 |
| KALAHANDI | 46.2 | 59.22 | 34.17 | 49.29 |
| KORAPUT | 36.2 | 49.21 | 18.68 | 35.36 |
| BARGARH | 64.13 | 74.62 | 50.21 | 64.86 |
| ODISHA | 63.09 | 72.87 | 39.6 | 54.24 |
| INDIA | 64.84 | 74.04 | 46.96 | 58.96 |
| Source: Population Census Of India (2001 and 2011) | | | | |

Data from table 3.10 shows the literacy rate in 2001 and 2011 in the selected districts of Odisha, Odisha and India. The literacy rate of India and Odisha has increased from 2001 to 2011. The total literacy as well as the ST literacy has increased from 2001 to 2011 in the four districts of Odisha. The ST literacy is highest in the districts of Bargarh (64.86%) followed Balangir (54.93%), Kalahandi (49.29%) and lowest in Koraput (35.36%). The three KBK districts having lowest ST literacy rate than the non-KBK districts.

### 3.5 WORKING POPULATION:

"Work was defined as participation in any economically productive activity. Such participation was physical or mental in nature. Work involved not only actual work but also effective supervision and direction of work. According to this definition, the entire population has been classified into three main categories, i.e., Main workers, Marginal workers and Non- workers (Census of India)."

Main workers are those who has been engaged in any economically productive activity for at least 183 days (i.e., six months or more) for the reference period. Whereas the Marginal worker is one who has not work for 183 days in the reference period and the Non-worker are those who has not done any work at all in the reference period.

On the basis of Industrial Category of worker, the main worker is divided into four categories, that is.,

I. Cultivator: "person engaged in cultivation of land owned or held from Government or held from private persons or institutions for payment in money, kind or share."
II. Agricultural laborers: person working for wage in money, kind or share in other's field.
III. House-hold industry workers: "an industry conducted by one or more members of the household at home or within the village in rural areas and only within the precincts of the house where the household lives in urban areas."
IV. Other workers: all those workers other than cultivators or agricultural labourers or household industry workers.

Table 3.11: Working and non-working population:

| DISTRICTS ↓ | MAIN WORKER | | MARGINAL WORKER | | NON-WORKING | |
|---|---|---|---|---|---|---|
| YEAR → | 2001 | 2011 | 2001 | 2011 | 2001 | 2011 |
| BALANGIR | 351,689 | 402,227 | 208,061 | 318,374 | 777,444 | 928,396 |
| KALAHANDI | 382,050 | 376,757 | 238,900 | 375,173 | 714,544 | 824,939 |
| KORAPUT | 353,367 | 396,460 | 217,068 | 296,946 | 610,202 | 686,241 |
| BARGARH | 384,710 | 474,390 | 208,820 | 287,702 | 752,806 | 719,163 |
| ODISHA | 9,589,269 | 10,707,543 | 4,687,219 | 6,834,046 | 22,537,172 | 24,432,629 |
| Source: Population Census Of India (2001 and 2011) | | | | | | |

Data from table 2.4 shows the working population of Odisha and of Balangir, Kalahandi, Koraput, Bargarh districts of Odisha in the year 2001 and 2011. The number of main worker has increased from 2001 to 2011 in all the districts and in Odisha except the Kalahandi district. The number of marginal worker and non-working population have increased from 2001-2011 in all the study regions except Bargarh district.

Table 3.12: Working and non-working populations as a percentage of total populations:

| | PERCENTAGE OF TOTAL POPULATION | | | | | |
|---|---|---|---|---|---|---|
| DISTRICTS ↓ | MAIN WORKER | | MARGINAL WORKER | | NON-WORKING | |
| YEAR → | 2001 | 2011 | 2001 | 2011 | 2001 | 2011 |
| BALANGIR | 26.30 | 24.39 | 15.56 | 19.31 | 58.13 | 56.30 |
| KALAHANDI | 28.61 | 23.89 | 17.88 | 23.79 | 53.5 | 52.31 |
| KORAPUT | 29.93 | 28.74 | 18.39 | 21.52 | 51.68 | 49.74 |
| BARGARH | 28.57 | 32.03 | 15.51 | 19.42 | 55.91 | 48.55 |
| ODISHA | 26.05 | 25.51 | 12.74 | 16.28 | 61.23 | 58.21 |
| Source: Population Census Of India (2001 and 2011) | | | | | | |

Data from table 3.12 shows the working and non-working population as a percentage of total population in the year 2001 and 2011. Even though the number of main worker has increased in 2011 as compare to 2001 in absolute numbers, it's percentage to total population has declined in the KBK region and in Odisha and has increased in the Bargarh. In terms of marginal worker, the percentage has increased in all the regions with Kalahandi having the highest percentage (23.79%) followed by Koraput (21.52%). In all the regions, almost half or more than half of the population are not engaged in any kind of economically productive activity. The percentage of non-working population has declined in all the study regions in the year 2011 with Bargarh having the lowest percentage (48.55%) of non-working population among all the study districts.

Table 3.13: Share of main worker in different sector:

| | **PERCENTAGE OF MAIN WORKER** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **DISTRICTS** ↓ | **CULTIVATOR** | | **AGRICULTURAL LABOURER** | | **H-H INDUSTRY** | | **OTHER** | |
| **YEAR** → | **2001** | **2011** | **2001** | **2011** | **2001** | **2011** | **2001** | **2011** |
| **BALANGIR** | 40.58 | 33.10 | 22.31 | 26.83 | 4.96 | 4.16 | 32.15 | 35.91 |
| **KALAHANDI** | 39.99 | 29.97 | 33.12 | 38.19 | 3.02 | 2.44 | 23.87 | 29.41 |
| **KORAPUT** | 42.05 | 40.55 | 22.63 | 22.49 | 2.11 | 1.96 | 33.21 | 35.00 |
| **BARGARH** | 41.35 | 36.57 | 27.58 | 32.13 | 7.84 | 7.35 | 23.23 | 23.94 |
| **ODISHA** | 35.82 | 30.63 | 21.88 | 22.61 | 4.22 | 4.12 | 38.08 | 42.64 |

Source: Population Census Of India (2001 and 2011)

Data from table 3.13 shows the share of different types of worker in main worker. The share of cultivator and house-hold industry worker has declined in all the study regions where as the share of agricultural laborer and other workers has increased in 2011. Koraput has the highest percentage of people engaged as cultivator (40.55 %) as compare to other, while the percentage of worker in terms of agricultural laborer is highest in Bargarh (32.13%). Bargarh has the highest percentage of people working as house-hold industry worker (7.35%) and Kalahandi has the highest percentage of other workers (35.00%) respectively.

### 3.6 Summary:

In this chapter, we discussed some general characteristics of Odisha's agrarian economy. The following main points can be noted here from the preceding discussion on the state's profile of agricultural sector:

- The trends of land utilization in Odisha along with four districts follows a similar trend. Up to 2008-09 there is marginal increase in the share of GCA, NCA, area shown more than once to total land underutilization, but after 2008-09 in the share of GCA, NCA, area shown more than once to total land underutilization have undergone a gradual decline.
- The rate of decline differs from district to district, but KBK is the region with highest fluctuation in the share of land under statistics as compare to Bargarh and Odisha.
- The share of fallow land and Barren land have followed a complete opposite direction of change as against GCA, NCA, etc. up to 2008-09 the share of barren land and fallow land to LUS was more or less constant but after 2008-09 there is a continuous hike. Balangir is the district registering the highest share of fallow land.
- The trends of land holdings is very much rigid in Odisha along with the four districts, where nearly 80 percentages of farmers are small and marginal farmers while farmers with higher hectare of land constitute very small share among farmers.
- Odisha economy is dominated by rural population, where the rural population is more than 85%. The population of KBK region is tribal based where the tribal population constitute near to 40% of the total population of the districts.
- The total literacy as well as the ST literacy has increased from 2001 to 2011 in the four districts of Odisha. The ST literacy is highest in the districts of Bargarh (64.86%) followed Balangir (54.93%), Kalahandi (49.29%) and lowest in Koraput (35.36%). The three KBK districts having lowest ST literacy rate as well as overall literacy rate than Bargarh and Odisha.
- Even though the number of main worker has increased in 2011 as compare to 2001 in absolute numbers, it's percentage to total population has declined in the KBK region and in Odisha and has increased in the Bargarh. In terms of marginal worker, the percentage has increased in all the regions and almost half or more than half of the population are not

engaged in any kind of economically productive activity. The percentage of non-working population has declined in all the study regions in the year 2011 with Bargarh having the lowest percentage (48.55%) of non-working population among all the study districts.

With this background of KBK, Bargarh and Odisha's agro-economic profile, we proceed to next chapter to analyze the present status of agriculture in the state, which is based mainly on secondary sources of data.

# CHAPTER 4

# STATUS OF AGRICULTURE IN ODISHA

## 4.1 Introduction

Rural population and traditional farming methods dominate the economy of Odisha. Odisha is endowed with enormous natural resources that are unexploited. Agricultural activities have traditionally been the primary source of subsistence but the agricultural economy fails to flourish because of absence of proper involvement and technological intervention. Most of the products produced in various hilly and plain region are generally sold as primary products on local markets and therefore do not add significant value to the product, **Dr. G. Karthikeyan (2016).** Agricultural development and its associated activities are essential to Odisha's socio-economic development as more than 70 percent of the rural population rely on agriculture for their livelihood and subsistence.

## 4.2 Cropping Pattern

This section attempts to define different aspects of area under food grains and non-food grain crops cultivated in the state and in the district Balangir, Kalahandi, Koraput and Bargarh. Cropping pattern is the proportion of area under various crops at a point of as it changes over space and time. The cropping patterns of a region are closely influenced by the geo-climatic, socio-economic, historical and political factors (Hussain, M. 1996). In the simple word cropping pattern means the production of area under various crops at a point of time. It is dynamic concept because no cropping pattern can be said to be ideal for all times to a particular region. It changes in space and time with a view to meet requirements and is governed largely by the physical as well as cultural and technological factors. The change in cropping pattern in particular span of time clearly indicates the changes that have taken place in the agricultural development. These changes are brought about by socioeconomic influence. The most significant determinants of crop selection are crop yield and cropping intensity. If crop yield level rises, then these crops attract a large portion of region in a cropping season. However, if cropping intensity rises, crop diversification occurs.

Table 4.1: Crop Average Area during 1998-99 to 2016-17

| | BALANGIR | | KALAHANDI | | KORAPUT | | BARGARH | | ODISHA | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1998-07 | 2008-17 | 1998-07 | 2008-17 | 1998-07 | 2008-17 | 1998-07 | 2008-17 | 98-07 | 2008-17 |
| MAIZE | 0.74 | 0.46 | 1.32 | 1.12 | 4.39 | 2.62 | 0.27 | 0.08 | 2.10 | 1.85 |
| RAGI | 0.83 | 0.22 | 1.39 | 0.46 | 18.16 | 15.21 | 0.02 | 0.00 | 2.26 | 1.20 |
| RICE | 50.19 | 63.22 | 49.25 | 75.13 | 34.74 | 55.55 | 69.88 | 83.46 | 52.15 | 76.21 |
| WHEAT | 0.37 | 0.09 | 0.22 | 0.04 | 0.06 | 0.01 | 0.19 | 0.04 | 0.20 | 0.05 |
| **TOTAL CEREAL** | **52.92** | **66.05** | **52.52** | **77.47** | **60.71** | **78.19** | **70.42** | **83.77** | **57.24** | **80.10** |
| GREENGRAM | 2.77 | 4.19 | 2.59 | 3.66 | 0.30 | 0.17 | 3.48 | 4.06 | 0.36 | 0.05 |
| URAD | 1.97 | 2.40 | 0.55 | 0.33 | 0.47 | 0.85 | 1.74 | 2.16 | 1.56 | 0.19 |
| KHARIF | 12.70 | 13.96 | 11.26 | 9.19 | 1.62 | 3.07 | 2.48 | 0.84 | 5.28 | 6.59 |
| RABI | 10.13 | 2.48 | 12.03 | 3.62 | 5.08 | 0.80 | 11.27 | 8.19 | 12.25 | 4.61 |
| **TOTAL PULSES** | **27.57** | **23.04** | **27.93** | **13.27** | **7.47** | **4.89** | **18.97** | **15.25** | **19.46** | **11.45** |
| CHILIES | 0.92 | 0.09 | 0.46 | 0.05 | 1.10 | 0.11 | 0.83 | 0.07 | 0.92 | 0.10 |
| GINGER | 0.03 | 0.00 | 0.02 | 0.00 | 0.45 | 0.09 | 0.13 | 0.02 | 0.17 | 0.02 |
| TURMERIC | 0.01 | 0.00 | 0.12 | 0.02 | 0.54 | 0.10 | 0.06 | 0.00 | 0.29 | 0.03 |
| GARLIC | 0.07 | 0.01 | 0.11 | 0.01 | 0.08 | 0.01 | 0.08 | 0.01 | 0.14 | 0.02 |
| CORIANDER | 0.07 | 0.01 | 0.21 | 0.02 | 0.12 | 0.02 | 0.13 | 0.02 | 0.22 | 0.03 |
| **TOTAL C&S** | **1.10** | **0.11** | **0.92** | **0.10** | **2.29** | **0.33** | **1.22** | **0.12** | **1.74** | **0.20** |
| SUGARCANE | 0.55 | 0.20 | 2.21 | 2.13 | 1.35 | 1.33 | 0.36 | 0.15 | 0.40 | 0.25 |
| POTATO | 0.01 | 0.01 | 0.36 | 0.09 | 0.06 | 0.32 | 0.08 | 0.10 | 0.09 | 0.12 |
| TOTAL VEGETABLE | 4.68 | 0.71 | 3.69 | 0.45 | 6.85 | 1.24 | 2.40 | 0.30 | 6.71 | 1.03 |
| **TOTAL FOOD CROP** | **86.71** | **95.44** | **87.63** | **96.54** | **85.87** | **89.54** | **89.86** | **94.95** | **88.99** | **96.11** |
| GROUNDNUT | 2.33 | 1.73 | 2.14 | 1.00 | 0.13 | 0.23 | 7.34 | 4.32 | 2.69 | 1.42 |
| SESAMUM | 0.01 | 0.02 | 2.18 | 0.36 | 0.15 | 0.16 | 0.02 | 0.02 | 3.19 | 0.93 |
| RAPSEED AND MUSTARD | 5.46 | 1.36 | 1.76 | 0.42 | 0.67 | 0.10 | 1.27 | 0.37 | 1.27 | 0.36 |
| NIGER SEED | 0.82 | 0.51 | 1.33 | 0.89 | 11.54 | 9.62 | 0.63 | 0.24 | 1.53 | 0.74 |
| SUNFLOWER | 0.23 | 0.07 | 0.30 | 0.04 | 0.07 | 0.01 | 0.09 | 0.01 | 0.11 | 0.02 |
| OTHER | 0.55 | 0.26 | 0.02 | 0.00 | 0.75 | 0.17 | 0.33 | 0.06 | 1.07 | 0.24 |
| **TOTAL OILSEEDS** | **9.40** | **3.95** | **9.30** | **3.06** | **13.31** | **10.31** | **9.66** | **5.01** | **9.87** | **3.71** |
| TOBACCO | 0.04 | 0.00 | 0.08 | 0.00 | 0.46 | 0.07 | 0.11 | 0.01 | 0.06 | 0.01 |
| COTTON | 2.75 | 0.58 | 2.74 | 0.40 | 0.14 | 0.00 | 5.28 | 2.70 | 0.52 | 0.08 |
| SANHEMP | 0.58 | 0.06 | 0.11 | 0.01 | 0.05 | 0.01 | 0.37 | 0.03 | 0.12 | 0.01 |
| MESTA | 0.53 | 0.05 | 0.11 | 0.01 | 0.36 | 0.02 | 0.48 | 0.05 | 0.30 | 0.03 |
| TOTAL FIBRES | 3.85 | 0.69 | 3.00 | 0.43 | 0.36 | 0.02 | 3.90 | 1.90 | 1.08 | 0.17 |
| **TOTAL NON FOOD CROP** | **13.29** | **4.56** | **12.37** | **3.29** | **14.13** | **9.43** | **10.14** | **4.69** | **11.01** | **3.62** |

Source: calculated from data obtained from Directorate of Economics and Statics, Government of India

Data from table 4.1 shows the cropping pattern for Balangir, Kalahandi, Koraput and Bargarh districts and for the state Odisha as well from the year 1998-99 to 2016-17. Data has been calculated by obtaining average for period 1998-99 to 2006-07 and from 2007-08 to 2016-17. The average share of total food crop has increased from 1998-99:2006-07, to 2007-08: 2016-17. It has increased from 86.71% to 95.44 % for Balangir, 87.63% to 96.54% for Kalahandi, 85.87% to 89.54% for Koraput, 89.86% to 94.95% for Bargarh and 88.99% to 96.11% for Odisha respectively. While the share of total non-food crop has declined from 13.29% to 4.56 % for Balangir, 12.37% to 3.29% for Kalahandi, 11.43% to 9.43% for Koraput, 10.14% to 4.69% for Bargarh and 11.01% to 3.62% for Odisha respectively. Among the food crop cereal has been the major component throughout the period followed by pulses. The share of cereal has increased by a large proportion whereas the share of pulse and all other food crop has declined after 2008-09. Under cereal, rice has the maximum share among all other cereal crop. The share of rice has been increased throughout the period where as the share of all other cereal like maize, ragi, wheat have declined. Rice constituted for more than 75-80% in cropping pattern under cereal. After 2008-09 share of all other crops except rice have declined by a large margin. Under non-food crop, oilseeds constitute the maximum share.

The cropping pattern of Balangir, Kalahandi, Koraput, Bargarh and of Odisha has revealed that the share of food crop has been increasing and the share of non-food crop is declining. Out of the total food crop rice has the major share in every study region followed by pulses. After 2008-09 the share of all other crops except rice has undergone a continuous decline. Looking at the individual crops, rice dominates the cropping pattern of Odisha. In present scenario, rice occupies more than 75% of the GCA in the state. It is evident from Table 4.1 that Agriculture in Odisha is cereal based. Total food grains accounts for about 90 percent of GCA. However, due to declining share of oilseeds, fiber, tobacco and other crops, the share of total non-food grains in the GCA also have witnessed a gradual decline

Herfindahl index has been used to study crop diversification. It is defined as: $\mathrm{HI} = \sum_{i=1}^{n} p_i^2$, where $p_i$ is the proportion of area under $i^{th}$, $p_i = {A_i}/{\sum^{n}_{i=1} A_i}$ , in which $A^i$ is the area under $i^{th}$ crop and $\sum_{i=1}^{n} A_i$ denotes the total cropped area. The Herfindahl index value ranges from 0 to 1; the value 1 indicates perfect specialization and 0 indicates perfect diversification. The value of HI indicates that higher is the value less will be the crop diversification and vice versa.

Table 4.2: Districts wise Crop Diversification Index in Odisha

| | HI INDEX | | | | |
|---|---|---|---|---|---|
| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
| 1998-99 | 0.35 | 0.34 | 0.39 | 0.52 | 0.39 |
| 1999-00 | 0.42 | 0.34 | 0.46 | 0.56 | 0.40 |
| 2000-01 | 0.41 | 0.40 | 0.43 | 0.56 | 0.43 |
| 2001-02 | 0.34 | 0.35 | 0.40 | 0.52 | 0.37 |
| 2002-03 | 0.38 | 0.43 | 0.40 | 0.57 | 0.40 |
| 2003-04 | 0.38 | 0.37 | 0.38 | 0.56 | 0.38 |
| 2004-05 | 0.37 | 0.37 | 0.38 | 0.55 | 0.37 |
| 2005-06 | 0.36 | 0.37 | 0.38 | 0.53 | 0.36 |
| 2006-07 | 0.34 | 0.35 | 0.38 | 0.53 | 0.36 |
| 2007-08 | 0.35 | 0.35 | 0.37 | 0.53 | 0.36 |
| 2008-09 | 0.34 | 0.35 | 0.37 | 0.53 | 0.36 |
| 2009-10 | 0.54 | 0.73 | 0.66 | 0.75 | 0.70 |
| 2010-11 | 0.50 | 0.71 | 0.65 | 0.74 | 0.69 |
| 2011-12 | 0.50 | 0.67 | 0.69 | 0.76 | 0.73 |
| 2012-13 | 0.49 | 0.65 | 0.67 | 0.77 | 0.70 |
| 2013-14 | 0.52 | 0.67 | 0.66 | 0.75 | 0.72 |
| 2014-15 | 0.54 | 0.66 | 0.67 | 0.76 | 0.72 |
| 2015-16 | 0.59 | 0.69 | 0.68 | 0.79 | 0.73 |
| 2016-17 | 0.60 | 0.71 | 0.69 | 0.80 | 0.73 |

Source: Calculated from area data obtained from published source of Directorate of Economics and Statistics, Government of India

Note: List of crops taken here cover 95-98 percentage of GCA in the districts of Odisha.

The computed values of HI index are presented in table 4.2 district-wise for Balangir, Kalahandi, Koraput, Bargarh and for state of Odisha from period 1998-99 to 2016-17. During the period 1998-99 to 2008-09 except Bargarh the cropping pattern in the state and in the other three districts have been relatively diversified with only marginal changes in the importance of a few crops. All these three districts and the state Odisha have depicted HI index value closer to 0.40 (i.e. relatively less specialized); while Bargarh has depicted a score of HI index value higher than 0.5 (i.e. relatively specialized than other three KBK districts and Odisha). From period 1998-99 to 2008-09 it has been found that Balangir is the least specialized districts with a HI index value of 0.36 followed by Kalahandi, Koraput. Whereas Bargarh is more specialized. After 2008-09 there is a clear trends of increase in the HI values of all the districts and all the districts except Balangir have depicted HI index value greater than 0.6. A comparison of HI values for the periods 1998-99 to 2008-09 and 2008-09 to 2016-17 reveals that except Balangir, all other districts have experienced a significant degree of crop specialization. All the KBK districts have a HI index value less than the state index, whereas Bargarh is the highly specialized district with a HI index value near to 0.8 and Balangir is the least specialized districts with a HI index value near to 0.6.

The extent of crop diversification differs across districts, with crop yield and crop intensity based on agro-climatic conditions as well as similarly significant variables. In this context, the above tables demonstrate that there has been a significant proportion of total food grains in the gross cropped region, showing reverse diversification occurrence, i.e. crop specialization. It is seen that under total food grain crops, not a single district has less than 90% of gross crop region. It implies that there is crop specialization in all the studied districts and state Odisha. Odisha is basically a mono-crop (rice) state, there has been a move towards specialization rather than diversification as a result of agricultural development in the state.

### 4.3 Use of Modern Firm input

Rice productivity is affected by many factors such as proper fertilizer use, modern high yielding seed varieties, modern technology, irrigation infrastructure, etc. Soil quality and other agro-climatic conditions also influence paddy output. Many earlier studies have highlighted the significance on rice output of new agricultural technology such as HYV seeds, tractors, power-

tillers, chemical fertilizers, other contemporary agricultural inputs, etc. The present study has considered the use of fertilizer, irrigation and tractors as a proxy of modern input.

### 4.3.1 fertilizer consumption

The major share of all land uses are dominated by agriculture today. As a consequence, it has a basic function to play in preserving the landscape and protecting the environment. Developing the use of fertilizers and pesticides has dramatically improved the effectiveness of food production and has in reality more than quadrupled food production in the last century. They also decreased the price and increased the range of products available.

The significance of chemical fertilizer has improved with the growth of scientific agriculture and the introduction of modern technology. Mere implementation of organic matter does not meet the nutrient demands of the plant and must therefore be made up by applying fertilizers. The plants and their varieties differ in nutrient requirement and a must is a balanced application of plant nutrient to reap the advantages of the complete potential. Nitrogen, phosphorus, and potash known as NPK are the three main components. There is a certain percentage in which the crops require these components. The crops and their varieties vary in nutrient requirement and a necessity is a balanced application of plant nutrient to reap the full potential benefits. The three primary elements are nitrogen, phosphorus, and potash known as NPK. There is a certain proportion where these elements are required by the plants.

Table 4.3.1: Average intake of fertilizer (kg/ha)

| DISTRICTS ↓ / YEAR → | 1998-99<br>2002-03 | 2004-05<br>2007-08 | 2008-09<br>2012-13 | 2013-14<br>2016-17 |
|---|---|---|---|---|
| BALANGIR | 20.66 | 28.98 | 46.08 | 45.22 |
| KALAHANDI | 35.37 | 46.24 | 61.35 | 53.84 |
| KORAPUT | 16.47 | 25.64 | 43.10 | 49.67 |
| BARGARH | 102.20 | 104.15 | 117.49 | 114.60 |
| ODISHA | 38.85 | 45.67 | 61.20 | 59.65 |

Source: Data calculated obtained from India stat, Department of Agriculture, Odisha

Table 4.3.2: consumption of fertilizer (kg/hec)

| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 19.09 | 26.51 | 14.21 | 113.14 | 39.5 |
| 1999-00 | 22.17 | 28.54 | 15.24 | 118.03 | 42.12 |
| 2000-01 | 21.69 | 41.51 | 16.81 | 90.81 | 37.3 |
| 2001-02 | 22.65 | 48.79 | 19.73 | 99.37 | 40.87 |
| 2002-03 | 17.71 | 31.53 | 16.39 | 89.64 | 34.49 |
| 2003-04 | 21.27 | 36.39 | 19.21 | 98.14 | 39.51 |
| 2004-05 | 25.36 | 45.06 | 21.32 | 97.51 | 42.18 |
| 2005-06 | 30.98 | 46.72 | 27.45 | 121.14 | 46.95 |
| 2006-07 | 32.11 | 49.98 | 29.17 | 96.96 | 47.32 |
| 2007-08 | 35.16 | 53.04 | 31.056 | 107.03 | 52.42 |
| 2008-09 | 42.97 | 61.97 | 37.99 | 105.42 | 62.01 |
| 2009-10 | 48.23 | 55.98 | 41.33 | 112.17 | 59.78 |
| 2010-11 | 46.17 | 68.48 | 46.31 | 118.11 | 62.85 |
| 2011-12 | 49.45 | 57.43 | 46.86 | 127.92 | 62.65 |
| 2012-13 | 43.58 | 62.92 | 43.02 | 123.83 | 58.74 |
| 2013-14 | 45.83 | 56.04 | 49.06 | 109.87 | 57.11 |
| 2014-15 | 43.1 | 54.47 | 43.6 | 120.51 | 56.1 |
| 2015-16 | 47.53 | 58.37 | 54.75 | 126.18 | 65.91 |
| 2016-17 | 44.42 | 46.49 | 51.27 | 101.81 | 59.49 |

Source: India stat, Department of Agriculture, Odisha

Data from above table 4.3.1 exhibits that in comparison to the state and Bargarh district, the average fertilizer consumption per hectare is very low in Kalahandi, Balangir and Koraput districts. The average consumption in Odisha during 1998-99 to 2002-03 has been recorded as 38.85 kg/hectare, where fertilizer applied in Bargarh is more than 102 kg / hectare, whereas average consumption in the KBK districts is less than the state average and very less than Bargarh, causing sluggish productivity growth in KBK and increased development in Bargarh.

Interestingly, average fertilizer consumption per hectare have increased from 2002-03 to 2007-08, from about 20.66 kg / ha to about 28.98 kg / ha for Balangir, from 35.37 kg/ha to 46.24 kg/ha for Kalahandi, from 16.47 kg/ha to 25.64 kg/ha for Koraput, 102.20 kg/ha to 104.5 kg/ha for Bargarh and from 38.85 kg/ha to 45.67 kg/ha respectively. The same has again increased for all the four districts and for the state as well in 2012-13 but has declined in the year 2016-17 from 46.08 kg/ ha to 45.22 kg/ha for Balangir, from 61.35 kg/ha to 53.84 kg/ha for Kalahandi, from 117.49 kg/ha to 114.60 kg/ha for Bargarh and from 61.20 kg/ha to 59.65 kg/ha for Odisha respectively expect Koraput experiencing an increase in the average consumption from 43.10 kg/ha to 49.67 kg/ha. Despite the continuous increase in the dosage of fertilizer use, the KBK regions are still lagging behind the average domestic fertilizer use per hectare, currently around 60 kg / hectare and way behind Bargarh. In this context, it is worth mentioning that the economic factors along with the climatic factor plays a vital role in the use of expensive chemical fertilizers.

### 4.3.2 : Use of Tractors

Farm mechanization is very important in order to enable farmers to undertake timely and quality agricultural operations, reducing cost of agricultural production and increase productivity along with reducing the drudgery of labor associated with agricultural activities. Farmers are provided at the subsidized prices with different modern farm implements. The trends show a huge increase in requirements for enhanced agricultural machinery and equipment that increase the state's agricultural power input.

The use of modern technology is very slow in KBK districts. Fragmented and small land holdings has been the bottleneck in using the modern technology intensively. The Ministry of Agriculture, Odisha have taken measures to obtain tractors, power tillers and other farm equipment under multiple schemes taken up under “Popularization of Agriculture Implements, equipment and diesel pump sets” under State Sector Schemes and Rastriya Krisi Vikash Yojana (RKVY), National Food Security Mission (NFSM) and Sub Mission on Agriculture Mechanization schemes under Central Sector Schemes to popularize modern farm equipment and machineries with a view to boosting agricultural mechanization. As per the available data the use of tractors has increased in the second decade of 21$^{st}$ century as compare to the first decade in Odisha.

Table 4.3.3: Numbers of Tractors Per ‘000 Ha

| YEAR/DISTRICTS | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 0.05 | 0.03 | 0.06 | 0.05 | 0.07 |
| 1999-00 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| 2000-01 | 0.04 | 0.03 | 0.04 | 0.04 | 0.04 |
| 2001-02 | 0.03 | 0.02 | 0.02 | 0.03 | 0.02 |
| 2002-03 | 0.06 | 0.04 | 0.07 | 0.05 | 0.06 |
| 2003-04 | 0.04 | 0.03 | 0.07 | 0.04 | 0.13 |
| 2004-05 | 0.08 | 0.06 | 0.10 | 0.07 | 0.18 |
| 2005-06 | 0.09 | 0.06 | 0.10 | 0.09 | 0.18 |
| 2006-07 | 0.19 | 0.14 | 0.19 | 0.14 | 0.28 |
| 2007-08 | 0.22 | 0.15 | 0.25 | 0.21 | 0.38 |
| 2008-09 | 0.32 | 0.25 | 0.40 | 0.31 | 0.34 |
| 2009-10 | 0.37 | 0.35 | 0.45 | 0.46 | 0.53 |
| 2010-11 | 0.88 | 0.68 | 1.18 | 0.76 | 1.12 |
| 2011-12 | 1.16 | 1.10 | 1.92 | 1.17 | 2.30 |
| 2012-13 | 1.24 | 1.03 | 1.60 | 1.41 | 2.59 |
| 2013-14 | 1.32 | 1.09 | 1.69 | 1.36 | 2.84 |
| 2014-15 | 1.35 | 1.20 | 1.68 | 1.13 | 2.48 |
| 2015-16 | 1.48 | 1.46 | 1.75 | 1.62 | 2.96 |
| 2016-17 | 1.57 | 1.38 | 1.66 | 1.94 | 3.23 |

Source: data calculated obtained from published series of agricultural abstract of Odisha, Ministry of Agriculture and Food Production, Government of Odisha.

Data from table 4.3.3 shows that availability of number of tractors per ‘000 ha of area under rice from the period 1998-99 to 2008-09. It can be observed that starting from 1998-99 till 2010-11 tractors used per ‘000 ha of land is less than .5 in all the four districts and for the state Odisha as well. However, after 2009-10 the same has increased and the number of tractor available for ‘000 ha of land is near to 2 tractors for Bargarh where as it is 1.57 tractors for Balangir, 1.38 tractors for Kalahandi, 1.66 tractors for Koraput and 3.23 tractors for Odisha in the year 2016-17. The use of tractors has been increasing throughout the period. But the rate of increase in the first half of

the study period is quite slow as compare to the second half. Even though the numbers of tractors have increased for all the four districts it is still less than the state availability.

### 4.4: Cultivation of Rice

Growth and development of rice cultivation are still very important in Odisha, as it provides basic food to more than 25 million people along with generating income and employment. Production of rice is one of the vital segment of the state's economy.

Table 4.4.1: Area Under Rice in '000 hectares

| | AREA UNDER RICE IN '000 HECTARES | | | | | AS % SHARE OF GCA | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | BLGR | KLND | KRPT | BRGH | ODISHA | BLGR | KLND | KRPT | BRGH | ODISHA |
| 1998-99 | 210.82 | 226.63 | 128.74 | 299.70 | 4446.71 | 49.24 | 46.65 | 33.20 | 69.07 | 52.79 |
| 1999-00 | 219.22 | 226.02 | 132.31 | 302.89 | 4601.81 | 52.60 | 43.18 | 35.81 | 70.85 | 53.99 |
| 2000-01 | 214.77 | 265.64 | 152.44 | 293.82 | 4433.52 | 55.56 | 53.80 | 36.96 | 71.57 | 56.28 |
| 2001-02 | 208.00 | 262.00 | 141.00 | 306.00 | 4500.00 | 47.85 | 48.98 | 35.86 | 68.41 | 51.14 |
| 2002-03 | 210.00 | 247.00 | 127.00 | 306.00 | 4273.00 | 51.70 | 58.83 | 34.99 | 72.38 | 54.42 |
| 2003-04 | 224.00 | 273.00 | 125.00 | 313.00 | 4501.00 | 51.43 | 50.45 | 33.45 | 71.35 | 52.12 |
| 2004-05 | 231.00 | 267.00 | 132.00 | 297.00 | 4492.00 | 51.77 | 49.89 | 34.74 | 70.13 | 51.53 |
| 2005-06 | 229.00 | 288.00 | 138.00 | 290.00 | 4479.00 | 48.93 | 49.37 | 34.86 | 68.59 | 50.17 |
| 2006-07 | 214.00 | 262.00 | 132.00 | 300.00 | 4451.00 | 46.46 | 45.70 | 34.11 | 68.39 | 49.67 |
| 2007-08 | 216.00 | 273.00 | 130.00 | 301.00 | 4452.00 | 46.32 | 45.64 | 33.37 | 68.10 | 49.38 |
| 2008-09 | 215.00 | 268.00 | 131.00 | 305.00 | 4455.00 | 45.51 | 44.26 | 33.18 | 68.28 | 49.11 |
| 2009-10 | 221.00 | 280.00 | 117.00 | 312.00 | 4365.00 | 63.90 | 82.93 | 58.15 | 85.10 | 79.22 |
| 2010-11 | 212.00 | 276.00 | 134.00 | 303.00 | 4226.00 | 61.99 | 81.48 | 57.36 | 84.14 | 77.84 |
| 2011-12 | 174.00 | 214.00 | 118.00 | 306.00 | 4005.00 | 64.75 | 78.18 | 59.43 | 85.84 | 80.66 |
| 2012-13 | 178.00 | 252.00 | 131.00 | 320.00 | 4278.00 | 63.83 | 77.41 | 56.72 | 86.51 | 79.37 |
| 2013-14 | 204.00 | 249.00 | 133.00 | 325.00 | 4180.00 | 66.02 | 78.87 | 58.47 | 84.80 | 80.89 |
| 2014-15 | 206.00 | 237.00 | 135.00 | 307.00 | 4166.00 | 68.75 | 77.31 | 60.05 | 85.30 | 80.54 |
| 2015-16 | 192.00 | 199.00 | 122.00 | 307.00 | 3942.00 | 70.98 | 80.64 | 61.02 | 87.74 | 82.07 |
| 2016-17 | 197.64 | 220.80 | 124.99 | 278.98 | 3962.78 | 71.34 | 83.71 | 65.32 | 88.19 | 83.85 |
| 1998-17 | 209.29 | 251.90 | 130.76 | 303.86 | 4326.83 | | | | | |

Source: Calculated from area data obtained from published source of Directorate of Economics and Statistics, Government of India

Table 4.4.1 shows the area under rice and share of area under rice to GCA from 1998-99 to 2016-17. It can be observed from the above table that up to 2008-09 the share of rice under GCA below 50% for KBK districts and the state while the same is around 70% in Bargarh districts. After 2008-09 the share of area under rice has increased and in 2016-17 it has reached to 71.34% in Balangir, more than 80% in Kalahandi and Odisha, 65.32% in Koraput and near to 90% in Bargarh district respectively.

In terms of area under rice for all the four districts and Odisha it can be seen that there is not much change in the area under rice. The average area under rice from period 1998-99 to 2016-17 is 209.29'000 ha for Balangir, 251.90'00 ha for Kalahandi, 130.76'000ha for Koraput, 303.86'000 ha for Bargarh and 4326.83'000 ha for Odisha respectively.

While the share of area under rice to GCA is increasing after 2008-09 but the area under rice has not changed much. From this it can be assumed that all the four districts along with Odisha are experiencing declining in the GCA. Even if there is declining in the GCA, area under rice has been more or less same or increased marginally but not declined implying to a declining in the share of area under other crops.

### 4.4.1: Area under Rice Irrigated

The development of irrigation and water resources is essential to agricultural advancement and overall economic development. The improvement of food grain growth has become the need of the hour as the world, especially the developing nations, has been overburdened with population explosion. Indeed, "irrigation forms the datum line for sustained successful agriculture (Somashekhar and Kumar, 2006)." Irrigation has a great significance in an agrarian economy, which makes agriculture independent of the vagaries of monsoon. Irrigation plays a two-fold role in agriculture. Irrigation, on the one side, stimulates agricultural productivity and, on the other, helps to soothe agricultural output by decreasing reliance on rainfall. High-value crops also substitute low-value crops with the availability of guaranteed irrigation, which eventually leads to an increase in the value of agricultural production (Dutta, 2011).

Table 4.4.2: Area under rice under irrigated area

| | RICE IRRIGATED AREA ('000 HECTARE) | | | | | % SHARE OF TOTAL RICE AREA UNDER IRRIGATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
| 1998-99 | 43.11 | 66.29 | *40.96* | 168.50 | 1691.75 | 20.45 | 29.25 | 31.82 | 56.22 | 38.04 |
| 1999-00 | 53.59 | 96.21 | 47.96 | 157.83 | 1874.12 | 24.45 | 42.57 | 36.25 | 52.11 | 40.73 |
| 2000-01 | 28.53 | 113.24 | 48.98 | 158.35 | 1676.10 | 13.28 | 42.63 | 32.13 | 53.89 | 37.81 |
| 2001-02 | 34.85 | 122.18 | 57.15 | 168.67 | 1817.39 | 16.75 | 46.63 | 40.53 | 55.12 | 40.39 |
| 2002-03 | 29.73 | 87.48 | 47.97 | 181.62 | 1264.29 | 14.16 | 35.42 | 37.77 | 59.35 | 29.59 |
| 2003-04 | 17.94 | 131.78 | 46.67 | 176.63 | 1769.38 | 8.01 | 48.27 | 37.34 | 56.43 | 39.31 |
| 2004-05 | 38.87 | 148.45 | 45.51 | 169.20 | 1967.33 | 16.83 | 55.60 | 34.48 | 56.97 | 43.80 |
| 2005-06 | 41.16 | 138.82 | 44.00 | 168.64 | 1913.76 | 17.97 | 48.20 | 31.88 | 58.15 | 42.73 |
| 2006-07 | 40.70 | 157.32 | 47.82 | 184.27 | 2090.62 | 19.02 | 60.05 | 36.23 | 61.42 | 46.97 |
| 2007-08 | 40.10 | 154.95 | 44.28 | 190.93 | 2067.74 | 18.56 | 56.76 | 34.06 | 63.43 | 46.45 |
| 2008-09 | 45.94 | 150.12 | 42.38 | 194.73 | 2082.91 | 21.37 | 56.01 | 32.35 | 63.85 | 46.75 |
| 2009-10 | 38.08 | 124.20 | 46.54 | 168.35 | 1464.16 | 28.18 | 44.36 | 39.78 | 53.96 | 33.54 |
| 2010-11 | 35.18 | 127.62 | 43.62 | 162.00 | 1401.84 | 27.16 | 46.24 | 32.56 | 53.46 | 33.17 |
| 2011-12 | 31.03 | 83.04 | 49.95 | 160.35 | 1327.65 | 26.34 | 38.80 | 42.33 | 52.40 | 33.15 |
| 2012-13 | 29.40 | 116.67 | 47.82 | 148.70 | 1366.66 | 21.15 | 15.51 | 15.37 | 46.47 | 31.22 |
| 2013-14 | 34.18 | 117.05 | 44.51 | 181.87 | 1378.91 | 22.05 | 47.01 | 33.46 | 55.96 | 32.99 |
| 2014-15 | 32.70 | 105.96 | 50.68 | 166.11 | 1389.28 | 21.31 | 44.71 | 37.54 | 54.11 | 33.35 |
| 2015-16 | 34.51 | 76.37 | 56.22 | 168.10 | 1329.19 | 22.35 | 38.38 | 46.08 | 54.75 | 33.72 |
| 2016-17 | 35.23 | 81.05 | 58.16 | 160.45 | 1223.39 | 22.65 | 36.71 | 46.53 | 57.51 | 30.87 |

Source: Calculated from area data obtained from published source of Directorate of Economics and Statistics, Government of India

Table 4.4.2 shows the irrigated area under rice in ‘000 ha and share of area under rice to rice irrigated area from 1998-99 to 2016-17. It can be observed from the above table that up to 2008-09 the share of area under rice to rice irrigated area has increased for all the four districts and for Odisha. But after 2008-09 there is the declining trend in the same for all the region expect Koraput. Out of the total area under rice, less than 50% of area is getting irrigation for KBK districts and the state while the same is around 60-65% in Bargarh districts. After 2008-09 the share of area under irrigation has decreased and in 2016-17 it has reached to 36.71% in Kalahandi, 46.53% in Koraput and less than 60% in Bargarh, less than 30% in Balangir district and 30.87% in the state Odisha respectively. All the KBK district are left with less than 50% of irrigation to the area under rice while Bargarh has still more than 50% of the area cultivated under irrigation facility. It can be seen here that the area KBK is heavily dependent on rainfall whereas the irrigation facility generated from Mahanadi river and Hirakudh dam has been enjoyed by the farmers of Bargarh district reduce the dependence of rainfall for cultivation.

### 4.4.2 : Production of Rice

Rice is India's most important food crop covering about one-fourth of the total crop area and supplying food to about half of the Indian population. Rice is the pre-eminent crop of India and is the staple food of the individuals of the country's eastern and southern areas. India is the world's second biggest rice producer and consumer after China and accounts for 21 percent of the world's total rice production. In Odisha rice accounts for two-third of the total cropped area.

Table 4.4.3: production of rice in ‘000 tonnes

| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 164.39 | 161.43 | 197.41 | 486.33 | 5391.32 |
| 1999-00 | 271.38 | 275.82 | 185.33 | 649.06 | 5187.04 |
| 2000-01 | 76.98 | 341.99 | 227.72 | 355.93 | 4613.38 |
| 2001-02 | 321.00 | 363.00 | 213.00 | 606.00 | 7220.00 |
| 2002-03 | 162.00 | 209.00 | 184.00 | 493.00 | 4278.00 |
| 2003-04 | 324.00 | 357.00 | 199.00 | 646.00 | 6801.00 |
| 2004-05 | 251.00 | 288.00 | 209.00 | 527.00 | 6536.00 |
| 2005-06 | 301.00 | 307.00 | 223.00 | 550.00 | 6858.00 |
| 2006-07 | 315.00 | 289.00 | 221.00 | 604.00 | 6823.00 |
| 2007-08 | 390.00 | 356.00 | 245.00 | 634.00 | 7540.00 |
| 2008-09 | 307.00 | 345.00 | 209.00 | 624.00 | 6812.00 |
| 2009-10 | 339.00 | 425.00 | 156.00 | 681.00 | 6913.00 |
| 2010-11 | 398.00 | 635.00 | 250.00 | 695.00 | 6824.00 |
| 2011-12 | 74.00 | 205.00 | 172.00 | 649.00 | 5806.00 |
| 2012-13 | 633.00 | 655.00 | 242.00 | 952.00 | 9496.00 |
| 2013-14 | 651.00 | 620.00 | 355.00 | 741.00 | 7610.00 |
| 2014-15 | 641.00 | 551.00 | 275.00 | 898.00 | 9840.00 |
| 2015-16 | 181.00 | 222.00 | 240.00 | 592.00 | 5874.00 |
| 2016-17 | 436.54 | 525.56 | 316.21 | 679.94 | 9794.31 |

Source: Calculated from data obtained from published source of Directorate of Economics and Statistics, Government of India

Data from table 4.4.3 exhibits the production of rice in ‘000 tonnes for the district Balangir, Kalahandi, Koraput, Bargarh and for the state Odisha from the period 1998-99 to 2016-17. The production of rice has been increasing for all the four districts and Odisha except few years. In the year 1998-99 the production of rice was below 200’000 tonnes for KBK districts and near to 490’000 tonnes for Bargarh district and the same has increased to 436.54 ‘000 tonnes for Balangir, 525.56’000 tonnes for Kalahandi, 316.21 ’000 tonnes for Koraput and 679.94 ’000 tonnes for for Bargarh district in the year 2016-17.

### 4.5: Yield of Rice

The productivity of a crop per unit of land is the highest performance indicator for a crop in a region. On the basis of different factors like soil quality, rainfall, irrigation etc., the total cropped area under rice production varies from region to region.

Table 4.5: Yield of Rice in kg/hec

| YEAR | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|
| 1998-99 | 779.77 | 712.32 | 533.36 | 1622.74 | 1251.95 |
| 1999-00 | 1237.93 | 1220.33 | 1043.21 | 2142.89 | 1153.65 |
| 2000-01 | 358.43 | 874.19 | 493.83 | 1211.39 | 990.70 |
| 2001-02 | 543.27 | 385.50 | 510.64 | 1980.39 | 1584.40 |
| 2002-03 | 295.24 | 441.30 | 551.18 | 1284.31 | 753.72 |
| 2003-04 | 446.43 | 530.77 | 592.00 | 2063.90 | 1516.19 |
| 2004-05 | 865.80 | 1078.65 | 583.33 | 1774.41 | 1039.82 |
| 2005-06 | 1014.41 | 1065.97 | 615.94 | 1896.55 | 1541.10 |
| 2006-07 | 1047.20 | 1103.05 | 674.24 | 2013.33 | 1519.80 |
| 2007-08 | 1105.56 | 1304.03 | 884.62 | 2106.31 | 1669.20 |
| 2008-09 | 1127.91 | 1287.31 | 954.20 | 2045.90 | 1502.94 |
| 2009-10 | 1339.37 | 1517.86 | 1033.33 | 2182.69 | 1527.52 |
| 2010-11 | 1877.36 | 2300.72 | 1865.67 | 2293.73 | 1555.10 |
| 2011-12 | 1425.29 | 1957.94 | 1457.63 | 2120.92 | 1684.98 |
| 2012-13 | 774.79 | 871.01 | 778.14 | 1034.78 | 874.69 |
| 2013-14 | 1191.18 | 1489.96 | 1369.17 | 2280.00 | 1803.25 |
| 2014-15 | 1111.65 | 1324.89 | 1037.04 | 2925.08 | 2296.47 |
| 2015-16 | 1094.27 | 1115.58 | 1367.21 | 1928.34 | 1542.29 |
| 2016-17 | 1208.76 | 1380.25 | 1529.88 | 2437.24 | 2045.03 |
| 1998-17 | 991.82 | 1155.88 | 940.77 | 2018.15 | 1492.25 |

Source: Calculated from area data obtained from published source of Directorate of Economics and Statistics, Government of India

Table 4.6 shows yield of rice in kg/ha from 1998-99 to 2016-17. It can be observed from the above table that up to 2004-05 the yield of rice in kg/ha for KBK districts is less than 1000 kg/ha while the same is more than 1000 kg/ha for the state and in Bargarh districts. After 2005-06 the yield of rice in kg/ha has increased and in 2016-17 it has reached more than 1200 kg/ha in Balangir, more than 1300 kg/ha in Kalahandi, more than 1500 kg/ha in Koraput and more than 2000 kg/ha in Bargarh district and Odisha respectively. The average yield of rice has been recorded less than 1000 kg/ha for Balangir and Kalahandi districts, less than 1500 kg/ ha for Koraput and Odisha and greater than 2000 kg/ha for Bargarh district. The average yield of all the KBK district is less than the state average whereas Bargarh has higher average yield than the state Odisha as well.

### 4.6: Analysis of Growth Patterns: APY

In this section, an effort has been made to evaluate the development trends of the area, production and yield of rice over the years. Both state level and district level (KBK and Bargarh) analyses has been conducted to have an understanding of the recent growth trends of the component. Table 4.6: Compound Annual Growth Rate (CAGR) of Area, Production and Yield of rice

| DISTRICTS | YEARS → | 1998-03 | 2003-08 | 2008-13 | 2013-17 |
|---|---|---|---|---|---|
| BALANGIR | AREA | 0.00 | -0.01 | -0.04 | -0.01 |
| | PRODUCTION | -0.18 | 0.04 | 0.16 | -0.10 |
| | YEILD | -0.18 | 0.20 | 0.07 | 0.00 |
| KALAHANDI | AREA | 0.02 | 0.00 | -0.01 | -0.03 |
| | PRODUCTION | -0.08 | 0.00 | 0.14 | -0.04 |
| | YEILD | -0.09 | 0.20 | 0.08 | 0.02 |
| KORAPUT | AREA | 0.00 | 0.01 | 0.00 | -0.02 |
| | PRODUCTION | -0.07 | 0.04 | 0.03 | -0.03 |
| | YEILD | 0.01 | 0.08 | 0.04 | 0.03 |
| BARGARH | AREA | 0.00 | 0.01 | -0.01 | -0.04 |
| | PRODUCTION | -0.04 | 0.00 | 0.09 | -0.02 |
| | YEILD | -0.05 | 0.00 | 0.13 | 0.02 |
| ODISHA | AREA | -0.01 | 0.00 | -0.01 | -0.01 |
| | PRODUCTION | -0.09 | 0.02 | 0.07 | 0.07 |
| | YEILD | -0.10 | 0.02 | 0.10 | 0.03 |

Source: Calculated from area data obtained from published source of Directorate of Economics and Statistics, Government of India

The CAGR of APY of rice are presented in table 4.6. the whole study period has been divided into four sub-periods, i.e., 1998-03, 2003-08, 2008-13 and 2013-17 each five years and CAGR is calculated to understand the growth patterns.

Data from table 4.6 reveals that the CAGR of area under rice have witnessed a positive but marginal growth rate in the first two periods, but after 2008-09 the same has witnessed negative growth of area over the years for all the four districts and for Odisha. Various factors like decline in the share of GCA, increase in the share of fallow land and barren land, industrialization, etc. are responsible for such negative growth of area under agriculture.

We have seen from the table 4.1 that after 2008-09 the share of rice to total GCA has increased continuously but from table 4.6 it has become clear that after 2008-09 the share of rice to GCA has not increased rather the share of GCA to total land under statistics have declined and it may be concluded that the share of land that has declined after 2008-09 could have been used to produce crops other than rice and thus there share has declined giving rise to crop specialization of rice.

As far as compound annual growth rate of rice production is concerned, all the four districts and Odisha have experienced marginally negative growth rate in the period 1998-03 and then experienced positive growth for next two periods i.e., 2003-08 and 2008-13 and then undergone a negative growth rate Notably, Balangir district (0.16) has experienced a positive growth rate higher than Bargarh, Odisha and other KBK districts in the period 2008-13 followed by Kalahandi (0.14). All the districts other than Koraput (0.03) has higher growth rate than Odisha (0.07).

In terms of CAGR of yield of rice, it has been observed that all the four districts along with Odisha have experienced positive growth rate in all the three sub-periods except the first period i.e., 1998-03. Bargarh (0.13) growth rate is higher than that of all other region in the period 2008-13.
Increase in the CAGR of production and yield of rice in the later phase of first decade and earlier phase of second decade of 21$^{st}$ century may be attributed to the factors like increase in the use of firm mechanization, increase in the use of fertilizer, crop specialization etc.

### 4.7: Agricultural Development Index (ADI)

The yield rates of rice have been evaluated in Section 4.7. One significant remark was that in Bargarh and the KBK districts there are broad inter-district variations in rice productivity. Analysis of inter-district disparities between KBK and Bargarh Districts is provided in this section. The Agricultural Development Index (ADI) was constructed after Singha (2011) and Barah et al. (2001) with four factors, i.e., yield, irrigation, fertilizer and tractors. The ADI is calculated by summing up the factor indexes (FI) of the individual factors. As there are four factors, if a district performs the best in all respects, then, the highest ADI score of a district will be 0.16. A unit with higher ADI ranking indicates it have managed its resources better and vice versa. Total rice productivity registered the highest yield in 2007-08 since 1998, and 2016-17 after 2008-09. Therefore, the year 2007-08 and 2016-17 is considered here for constructing ADI.

ADI is constructed by using the following formula

ADI= $\sum_{i=1}^{n=4} FI_i$ * N/100, where N is the numbers of factors under consideration.

Where,

$$FI = \frac{\text{Value of factor} - \text{Minimum value of factor across the district}}{\text{Range of value of factors across the districts}}$$

Table 4.7: District Level Disparity in ADI

| | 1998-99 to 2007-08 | | 2008-09 to 2016-17 | |
|---|---|---|---|---|
| DISTRICTS ↓ | TOTAL FI | ADI | TOTAL FI | ADI |
| BALANGIR | 1.42 | 0.06 | 1.93 | 0.07 |
| KALAHANDI | 1.57 | 0.06 | 2.08 | 0.08 |
| KORAPUT | 1.69 | 0.07 | 2.10 | 0.08 |
| BARGARH | 2.05 | 0.08 | 2.64 | 0.11 |
| ODISHA | 1.98 | 0.08 | 2.20 | 0.09 |

Source: Calculated data obtained from published source of Directorate of Economics and Statistics, Government of India

In the year 2007-08, there was a yield gap of 1000 kg/Ha between the highest total rice yield of 2106 kg/ha (Bargarh) and the lowest total rice yield of 884 kg/ha (Koraput) where as it was 1303 kg/ha for Kalahandi. All the three KBK districts has yield rate lower than the state rate in both the year 2007-08 and 2016-17. Bargarh is the district having higher yield rate than the state and all the three KBK districts. It is very crucial fact that the area under rice irrigated is also less for KBK districts than Odisha and Bargarh.

From Table 4.7 it is seen that there is no district under developed category with ADI score more than 0.10 in the first half of the study period. With ADI score 0.08, Bargarh and Odisha registered top (moderately developed) in the overall agricultural development index. KBK is the districts with ADI score less than the state and Bargarh index i.e., 0.06 for Balangir and Kalahandi each and 0.07 for Koraput district respectively. The difference between the maximum attainable ADI score (0.16) and the actual score attained by Bargarh and Odisha (0.08) is less wide than KBK region.

The average performance of the agricultural sector in the KBK region is stagnant at about ADI score of 0.08 out of the maximum score of 0.16, while the best-performed district Bargarh is utilizing only about 75 percent of the available agricultural resources in 2016-17.

It is important to mention that Agricultural Development Index based on the above DI value presented in table 4.8, all the four districts are experiencing positive changes but the changes in KBK district is less than the state and Bargarh's index. This implies that there have been changes in agricultural development of the state as a whole and among the four districts, but the rate of development is very slow in KBK region as compare to Bargarh districts.

**4.8: Effects of Modern Firm Inputs On Yield of Rice**

The yields of rice are affected by many like irrigation, fertilizer, modern equipment, HYV seeds, marketing and storage conditions, transportation systems, price movements, weather, etc. In the regression model, however, owing to the lack of precise and meaningful information on each factors, only three independent factors have been regarded, i.e., use of tractors, the area under irrigation and fertilizer implementation, which are likely to affect overall yield of rice.

The model applied here is known as the double log model or log linear model. Which is expressed as

$$\ln Y_t = \alpha + \beta_2 \ln F_t + \beta_3 \ln I_t + \beta_4 \ln T_t + \mu_t \quad \text{(i)}$$

Where ln=natural log and μ=residual term. The dependent variable, Yt is yield of rice in kg per hectare at time t. The area coverage under Irrigation (It) have been measured in thousand hectares. Ft, is the application of fertilizer measured in kg per hectare. The period of estimation is 19 years from 1998-99 to 2016-17.

The above model (i) is derived by taking ln of the rice yield function on each side of the Cobb-Douglas production function. The Cobb-Douglas function for yield of rice function is given by:

$$\mathbf{Yt = A}\ F_t^{\beta 2} I_t^{\beta 3} T_t^{\beta 4} \qquad \textbf{(ii)}$$

It is important to note that model (i) is linear within the parameters α and β, linear with the logarithms of variable Yt, Ft, It, and Tt and thus can be estimated with the OLS Regression (Ordinary Least Squares). The partial elasticity of the dependent variable with respect to the independent variables is measured in slope co-efficient ß. However, the function of the rice yield (ii) is non-linear in the parameters.

Generally, yield of rice tends to improve with suitable fertilizer implementation, greater area coverage under tractors and systematic irrigation. Therefore, it is expected that the estimated coefficients of the independent variables are positive. The estimated results of the OLS method are presented in Table 4.9. To understand the possible influence of fertilizer, irrigation and tractors, separate estimations have been done for each of the districts and for the state. The interpretations of estimated co-efficient of variables are given below:

Table 4.8: Estimated coefficients of the yield function of rice in Odisha, KBK and Bargarh districts (1998-99 to 2016-17)

| Inputs | Parameters | BALANGIR | KALAHANDI | KORAPUT | BARGARH | ODISHA |
|---|---|---|---|---|---|---|
| **Constant** | **α** | 1.81<br>(1.26) | 2.91<br>(2.43) | 1.56<br>(0.95) | 2.63<br>(1.82) | 1.51<br>(1.45) |
| **Fertilizer** | **β2** | 0.53<br>(3.93)* | 0.59<br>(3.62)* | 0.68<br>(5.27)* | 0.90<br>(4.84)* | 0.72<br>(3.17)* |
| **irrigation** | **β3** | 0.49<br>(2.31)** | 0.47<br>(2.29)** | 0.40<br>(1.70)** | 0.65<br>(2.59)** | 0.54<br>(1.23)** |
| **Tractor** | **β4** | 0.48<br>(2.75)** | 0.57<br>(2.59)** | 0.50<br>(2.40)** | 0.71<br>(2.67)** | 0.62<br>(1.97)** |
| **$R^2$** | | 0.71 | 0.64 | 0.68 | 0.78 | 0.72 |
| **d.f.** | | 18 | 18 | 18 | 18 | 18 |
| **F stat.** | | 22.8 | 17.21 | 16.36 | 18.30 | 21.05 |
| **Prob. F stat** | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **D-W Stat** | | 1.41 | 1.21 | 1.48 | 1.24 | 1.3 |
| **Prob.B-G test** | | 0.22 | 0.23 | 0.21 | 0.20 | 0.24 |
| **Prob. J-B test** | | 0.96 | 0.67 | 0.63 | 0.61 | 0.68 |
| **Prob. B-P-G test** | | 0.24 | 0.21 | 0.19 | 0.22 | 0.2 |

Notes: t statistic values are in brackets, d.f. refers to degree of freedom, * and ** denote statistical significance at 1 % and 5% level respectively

**Fertilizer:**

The effect of implementation of fertilizer (kg / ha) on rice yield is discovered to be positive and statistically significant at a 1 percent level of significance. The estimated result shows that, increase in the application of fertilizer by 1% led to an increase yield of rice of 0.53% for Balangir, 0.59% for Kalahandi, 0.68% for Koraput, 0.90% for Bargarh and 0.72% for the state Odisha during the study period.

**Irrigation:**

The impact of expansion of area under systematic irrigation on yield of rice is found to be significantly positive. As per the estimated result 1 percent increase in the area under systematic irrigation led to, an increase in the yield of rice by 0.49% for Balangir, 0.47% for Kalahandi, 0.40% for Koraput, 0.65% for Bargarh and 0.54% for the state Odisha during the study period assuming that other things remaining constant.

**Tractors:**

The impact of use of tractors on yield of total rice is found to be positive and statistically significant at 5 percent level of significance. The estimated result shows that if tractors available for agriculture expands by 1 percent, the yield of rice goes up by about 0.48 percent for Balangir, 0.57% for Kalahandi, 0.50% for Koraput, 0.71% for Bargarh and 0.62% for the state Odisha (i.e., by less than 1 percent for each of the four districts and Odisha).

## 4.9: Major Findings

This chapter discussed the status of agriculture in Odisha, KBK and Bargarh district. The whole analysis has been carried out based on the available secondary data. Following main findings can be drawn:

- Rice is still the dominant crop, occupying about more than 70 percent in total area under rice in Odisha. Odisha is showing a trend of mono-crop state.
- The share of GCA is continuously declining after 2008-09, whereas the share of area under rice is stagnant. Implying there is the gradual decline in the share of other crops to GCA resulting in crop specialization as against crop diversification.
- All the KBK districts have a HI index value less than the state index, whereas Bargarh is the highly specialized district with a HI index value near to 0.8 and Balangir is the least specialized districts with a HI index value near to 0.6.
- Despite the continuous increase in the dosage of fertilizer use, the KBK regions are still lagging behind the average domestic fertilizer use per hectare, currently around 60 kg / hectare and way behind Bargarh (110kg/ha)

- There lies a wide gap in between the yield of rice kg/ha in between KBK and Bargarh districts. All the three KBK districts has an average yield rate (about 1100kg/ha) lower than the state rate (about 1500kg/ha). Bargarh is the district having higher yield rate (more than 2000kg/ha) than the state and all the three KBK districts.
- The use of tractors has been increasing throughout the period. But the rate of increase in the first half of the study period is quite slow as compare to the second half. Even though the numbers of tractors have increased for all the four districts it is still less than the state availability. The rate of farm mechanization is very slow in the KBK region as compare to the Bargarh district and the state.
- All the KBK district are left with less than 50% of irrigation to the area under rice while Bargarh has still more than 50% of the area cultivated under irrigation facility, showing the dependency of farmers on rainfall.
- In terms of growth rate of rice yield, Odisha along with the four districts have witnessed higher growth rate in the second half as compared to the first half of the study period. Growth rate of rice in Bargarh district is higher than all the KBK districts.
- There exists disparity among the districts in agricultural development. The rate of growth of agricultural development for KBK (0.9) is very slow as compare to Bargarh (0.11) in terms of ADI score.
- Modern farm inputs like irrigation and fertilizer application and tractor depict positive relation with the yield of rice.
- Though there is the development of agricultural sector in Odisha, reagion like KBK are still lagging behind the state level growth and way far behind than Bargarh.

# CHAPTER 5

# SUMMARY AND CONCLUSION

## 5.1 Summary:

The importance of agriculture in the economic growth of any country, rich or poor, is borne out by the fact that it is the primary sector of the economy which provides the basic ingredients, necessary for the existence of mankind and also provides most of the raw materials which when transformed into finished products serve as basic necessities of the human race. Agriculture and allied sector important sources of raw materials for industries even as they generate demand for many industrial products like pesticides, fertilizer, agricultural implements and a verity of consumer goods. However, though there has been large growth and development in other sectors, the agriculture sector still continues to be mainstay of livelihood for human being. Growth of the agricultural sector is vital not only achieving food security and reduction of poverty in rural areas, but also sustaining growth of the rest of the economy.

The dissertation began with a profile of agricultural economy of Assam in chapter 3. The trends of land utilization in Odisha along with four districts follows a similar trend. Up to 2008-09 there is marginal increase in the share of GCA, NCA, area shown more than once to total land under-utilization, but after 2008-09 in the share of GCA, NCA, area shown more than once to total land underutilization have undergone a gradual decline while the share of fallow land and Barren land have followed a complete opposite direction of change as against GCA, NCA, etc. up to 2008-09 the share of barren land and fallow land to LUS was more or less constant but after 2008-09 there is a continuous hike. Balangir is the district registering the highest share of fallow land. The rate of changes differs from district to district, but KBK is the region with highest fluctuation in the share of land under statistics as compare to Bargarh and Odisha.

We have witnessed the trends of land holdings is very much rigid in Odisha along with the four districts, where nearly 80 percentages of farmers are small and marginal farmers while farmers with higher hectare of land constitute very small share among farmers. Odisha economy is dominated by rural population, where the rural population is more than 85%. The population of KBK region is tribal based where the tribal population constitute near to 40% of the total population of the districts. Even though the number of main worker has increased in 2011 as

compare to 2001 in absolute numbers, it's percentage to total population has declined in the KBK region and in Odisha and has increased in the Bargarh. In terms of marginal worker, the percentage has increased in all the regions and almost half or more than half of the population are not engaged in any kind of economically productive activity. The percentage of non-working population has declined in all the study regions in the year 2011 with Bargarh having the lowest percentage (48.55%) of non-working population among all the study districts.

### 5.2: Summary of Major Findings

In Chapter 4, we examined the present status of agriculture in Odisha, KBK and Bargarh district. The main objective was to examine the changing cropping pattern, change in the area, production and productivity of rice.

The analysis reveals that Rice is still the dominant crop, occupying about more than 70 percent in total area under crops in Odisha. Odisha is showing a trend of mono-crop state. The share of GCA is continuously declining after 2008-09, whereas the share of area under rice is stagnant. Implying there is the gradual decline in the share of other crops to GCA resulting in crop specialization as against crop diversification.

All the KBK districts have a HI index value less than the state index, whereas Bargarh is the highly specialized district with a HI index value near to 0.8 and Balangir is the least specialized districts with a HI index value near to 0.6.

Despite the continuous increase in the dosage of fertilizer use, the KBK regions are still lagging behind the average domestic fertilizer use per hectare, currently around 60 kg / hectare and way behind Bargarh (110kg/ha).

There lies a wide gap in between the yield of rice kg/ha in between KBK and Bargarh districts. All the three KBK districts has an average yield rate (about 1100kg/ha) lower than the state rate (about 1500kg/ha). Bargarh is the district having higher yield rate (more than 2000kg/ha) than the state and all the three KBK districts.

The use of tractors has been increasing throughout the period. But the rate of increase in the first half of the study period is quite slow as compare to the second half. Even though the numbers of tractors have increased for all the four districts it is still less than the state availability. The rate of

farm mechanization is very slow in the KBK region as compare to the Bargarh district and the state.

All the KBK district are left with less than 50% of irrigation to the area under rice while Bargarh has still more than 50% of the area cultivated under irrigation facility, showing the dependency of farmers on rainfall.

In terms of growth rate of rice yield, Odisha along with the four districts have witnessed higher growth rate in the second half as compared to the first half of the study period. Growth rate of rice in Bargarh district is higher than all the KBK districts.

There exists disparity among the districts in agricultural development. The rate of growth of agricultural development for KBK (0.9) is very slow as compare to Bargarh (0.11) in terms of ADI score. Modern farm inputs like irrigation and fertilizer application and tractor depict positive relation with the yield of rice. Though there is the development of agricultural sector in Odisha, region like KBK are still lagging behind the state level growth and way far behind than Bargarh. "The new agricultural technology has made a differential impact on the different farm size groups. Such differences are caused due to the difference in the ownership and access of different resources of agricultural production. Therefore, the process of technological transformation has suffered from region bias, class bias and crop bias. By and large, the latter two are the result of differences in the adoption of new agricultural technology among different farm sizes."

### 5.3 Conclusion

The prevalence of poor economic conditions of farmers are the stumbling block for modern crop. This, prevents the workforce from agriculture to non-agriculture and the issue of absentee land tenancy and the sub-optimal use of land for cultivation. The current crop patterns of the state, which are both irrigated and rain-fed, are mainly cereal based.

Regional inequality in India has been escalating in recent years and those regions which are already disparate in terms of poverty; income levels, consumption expenditure and access to basic services have further drifted over time. To bridge this gap, governments have periodically formulated various policies and direct public investment as an instrument to rectify the situation.

Development Disparity Economic and social disparities may lead to social instability eventually damaging economic development. Development in the true sense of the term should deal with reducing the socio-economic disparities. Development disparities have many causes. With the passage of time, a variety of factors have combined that has led regional disparity in growth to emerge in such a big way.

Study from different scholars, analysis carried out in chapter 3 and chapter 4 reveals that the Region KBK is still lagging behind by the district Bargarh and from the overall state average as well in every aspect. Starting from literacy to contribution to GSDP, though the region KBK is developing, but the development process is very slow as compare to the state and Bargarh. The dosage of fertilizer consumption has increased for all the four districts but the rate of consumption of fertilizer for KBK region is nearly half of the consumed fertilizer by Bargarh, i.e., Bargarh is using more than 100 KG/ha while KBK is stuck around 50-60 KG/ha.

In terms of yield of rice KG/ha, Bargarh has registered a yield rate of more than 2000 KG/ha while the region KBK has a yield rate of around 1000 KG/ha. Irrigation facility is much advantage in Bargarh, irrigating nearly 60% of the area cultivated due to the availability of perennial Mahanadi river, Hirakudh Dam and Bargarh canal that has irrigation connectivity to all over Bargarh whereas despite having many dams canal in KBK due to improper channelization of water there is scarcity of water and they depend heavily on rainfall.

The numbers of tractors used for agricultural purposes has grown rapidly after 2008-09 but here also the KBK region is falling behind. As all these factors have been proved as playing significant role in the growth of agricultural sector, KBK is lagging behind.

Thus there exist a differences in the agricultural growth performance in the KBK region and Bargarh region, the region KBK is also lagging behind the state average as well.

**Policy Suggestion:**

It may be recommended to the government of Odisha that it is high time to give some prior importance to the backward KBK region so that it will help in balancing the overall growth reducing poverty and inequality. The policy that can be recommended are as follows:

Due to extension of agriculture, farmers, as people, as well as contact with the outside world and their informative practices, are well known to change over the years. Today, unlike two decades ago, they need extension facilities. As the farm sector gradually splits into two segments-commercial and subsistence-it will be necessary to embrace distinct working models for the expansion scheme. Extension machinery must be reinforced by the reconstruction and refurbishment of current extension staff.

As agriculture changes, farmers need to take a number of complex decisions. Some of these are as follows.

i. Strategy to alter the system of agriculture. (e.g. from crop specialization to mixed agriculture diversification).
ii. Identification of products having good demand in the market.
iii. Taking collective decisions on resource use and marketing.

This is a chronic issue which mainly impacts the small and marginal farmers. In order to avoid this, an impetus should be made to improve skills in order to make agriculture feasible. Land policy reforms must be implemented to ensure that uncultivated and uncultivated land can be grown. Additionally, farm mechanization particularly for small business enterprises is necessary to be promoted with a major focus on the construction of customized recruitment center that will make agriculture feasible by decreasing labor burdens and farming costs. Adequate planning for multi-enterprises to ensure that farmers from crop failure.

Inadequate expansion of the irrigation infrastructure would never result in increased rice production and productivity. However, if easy access to assured irrigation facility, access to subsidized modern agricultural inputs would be provided and the other infrastructure would be developed (e.g. market, cold storage, electricity, all weather highways etc.) then there is every chance of increase in production and productivity. This calls for a thorough research of the status of the rice cultivation, limitations in modern agricultural methods and different aspects of Odisha's slow and stagnant growth cycle.

In the rain fed areas there is always a scope for improving production and productivity is. There is an urgent need to switch for an oil seed (Groundnut, Sesamum) based / pulse system, cropping system and vegetable based cropping system. But also rough regions (Rain fed Uplands & Infertile

Suns) are found in the rain-fed area in which harder plants such as Finger Millet and other millets may be taken up. The finger millet is a prevalent food for tribal peoples and resource poor State farmers.

Crop diversification from Paddy to Non-Paddy Crops (Pulses, Oilseeds, Vegetables, Maize & Cotton) in interior districts during Kharif and taking up low- duty crops such as pulses, oilseeds, small millets instead of Paddy under residual soil moisture in rabi, scientific watershed management and adoption of agri-horti system of cropping in rain fed areas, development of agro-entrepreneurship like dairy, bee keeping, mushroom cultivation, etc. utilizing the waste land area are some other steps which could be taken up for enhancing production and productivity

**Study Limitations:**

While conducting the study there are certain areas like data related to source of irrigation, use HYV seeds, modern firm inputs like power tillers, electricity consumption, etc. were not available at the district level. Which could have been incorporated in the work to have a better insight.

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