

AN ANALYSIS OF SUPPLY CHAIN OF MAIZE MARKETING AND POSSIBILITY OF ITS VALUE ADDITION IN ODISHA

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Report submitted to the
Ministry of Agriculture and Farmers Welfare, Government of India
Agro-Economic Research Centre
For the state of Andhra Pradesh, Telangana and Odisha
(Ministry of Agriculture & Farmers Welfare, Government of India)
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POSSIBILITY OF ITS VALUE ADDITION IN ODISHA STATE**

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Preface

The present study is undertaken to examine “An Analysis of Supply Chain of Maize Marketing and Possibility of its Value Addition in Odisha State”. Maize is the most important cereal crop in Odisha after rice, mostly grown in tribal districts during Kharif in un-irrigated uplands with poor management practice. Even though the production has increased 1.85 lakh MT to 6.57 lakh MT between 2001-02 to 2015-16. The districts of Nabarangpur, Gajapati, Rayagada, Ganjam and Koraput contributed for about 91.34% of total maize production of the state. Nabarangpur and Gajapati districts ranked 1st and 2nd place in maize production and the share was 75.69% (2015-16) in the state. The growth trends (CAGR) were also estimated in area, production and productivity reported a positive trend constituted to be 6.68% and 5.14%, 9.61% and 6.45%, 3.90% and 1.73% exhibited in the sample districts of Nabarangpur and Gajapati (1997-98 to 2015-16).

Markets of maize are also under developed and under utilized in the state, 90 percent is exported to processing units, which are in the states of Chattisgarh, Andhra Pradesh, Karnataka and West Bengal. There is no facility of mandi exclusively for maize marketing or any government agency for procurement of maize produce. As a result the farmers are being exploited by the traders and moneylenders. The study examined that there are four marketing channels appeared for maize marketing and the highest maize produce sold to the wholesale traders at farm gate due to payment of loans to private traders and urgent family needs. The government should either procure the maize crop or to establish the government agency can avoid private traders in the market chain. Besides, extension of storage facilities and increase the credit access from financial institutions at low rate interest for small and marginal farmers to promote producer companies value chain and Agro processing industries are made to upliftment of maize farmers income and avoid middlemen in the market chain. Finally the government has to promote infrastructural facilities, industrial support and fiscal incentives to boost the value addition in maize processing industries in Odisha.

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CHAPTER - I

AN ANALYSIS OF SUPPLY CHAIN OF MAIZE MARKETING AND POSSIBILITY OF ITS VALUE ADDITION IN ODISHA STATE

1.1 Introduction:

Maize also known as corn is a cereal grain that was first grown by people in Central America. India produces about 2 percent worlds maize produce and it is commonly called as queen of coarse cereals. Maize is the most versatile crop. Predominantly Kharif crop with 85 percent of grown area cultivated in India. Maize is the third most important cereal crop in India next to rice and wheat and playing an important role towards food and nutritional security of the country. Maize crop is cultivated throughout the year in most of the Indian states and in all types of agro-ecological regions, for various purposes that include fodder for animals, sweet corn, baby corn, green cobs and popcorn in peri urban areas. corn flour is being used in Preparation of various Asian dishes. It accounts for 9 percent of total food grain production in the country. The cultivation of maize crop in India has slowly increased over the last six and half decades from 3.16 million hectares to 8.69 million hectares between 1950-51 and 2015-16. The production and productivity of maize crop also increased significantly from 0.01 million MT to 21.81 million MT and 390 KG/ha to 2509 kg/ha in India respectively (1950-51 to 2015-16). The importance of maize in India is due to diversity of uses and the consumption that can be broadly divided into three categories viz., feed, food and industrial non-food crops. The most important use and demand driver of maize is poultry, pig, fish, feed, which accounts 52 percent of total maize consumption cattle feed and starch accounts for 11 percent. The food consumption accounts for 24 percent, seed and brewery industry (1%). (Nirupama et.al.2012).

Maize crop cultivation has picked up during the 1980's after adoption of HYV seeds. The northern states of India i.e., Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh, Himachal Pradesh, Jammu & Kashmir and Punjab which together account for two third of total area and output of the Maize crop ,whereas Karnataka, Andhra Pradesh and Telangana states are the major maize producing states in south India. There are many other uses of maize and the series as a basic raw material to thousands of industrial products that may include oil, starch, alcoholic beverages, pharmaceutical, food sweetness, food cereals, cosmetic and film, gum, textiles, package and paper industries, besides maize production also contributes good value to Indian economy. Among Indian states Odisha occupied 13th rank in terms of area and 10th in terms of production respectively (2014-15).In Odisha there are five major maize grown districts which are

Nabrangpur, Gajapathi, Koraput, Rayagada and Ganjam, which contributed about 91.34 percent of the total maize production of the state. Almost 92 percent of the total maize is produced in Kharif season and 90% of the produce is sold outside the state

ODISHA:

The state of Odisha is situated in the Eastern coast of Indian Peninsula by the Bay of Bengal consisting 4:2 crore population is divided into ten Agro-climatic zones depending upon the soil types topology. Agriculture is the chief occupation in Odisha, about 76% of the total working population is engaged in agriculture and agriculture related industries. The state having Geographical area of 1,55,000 square kilometers and the area wise the state occupies 9th position in Indian states. The total cropped area in the state is 87,46,000 hectares and out of that 18,79,000 hectares (21.48%) are under irrigation. About 78.52 percent of cropped area is un irrigated and it depends on rainfall. Majority of farmers are small and marginal constituting more than 90 percent of farmers having limited purchasing power with low levels of literacy. The State Gross Domestic Product (SGDP) has been declining over the years and this sector continues to be vital for the state economy. About 60 percent of population of the state draws its subsistence fully or partially from the agriculture sector. This sector suffers from frequent natural calamities like cyclone, drought and flash floods. Major food grains in the state are cereals and pulses which are rice, maize, ragi, wheat, jowar, bajra and small millets grown in the state. Kharif is the main cropping season and Rice is the principal crop, comprising more than 75 percent of cropped area in the state. The state contributes one tenth of the total rice production in the country and the other important crops produced in the state are maize, pulses, about 11 percent of cropped area cultivating Arhar, moong, biri, kulthi, cowpea, field pea, gram and lentil. Oilseeds (groundnut, til, mustard and Niger) and fibers (Jute, mesta and coconut), sugarcane, vegetables and spices, Mango, banana, coconut and cashew nut are the main horticultural crops and the state is one of the largest producer of vegetables in the country.

Maize crop is produced in the southern part of the state, which is the important coarse cereal crop after rice. It is grown in tribal districts during kharif season. Among the districts, Nabarangpur and Gaiapati districts ranked 1st and 2nd place in maize. Production and the production share was 75.69 percent of the total maize production in the state (2015-16). The state's maize cultivation has picked up during the 1980's and the area production and productivity has been increasing due to suitable Agro-climatic conditions, availability of High

yielding Variety (HYV) seeds and increasing price realization at farm level has a potential to shifting cultivation from other crops towards maize crop.

The huge maize crop production has substantially increased, the surplus of maize production is transported to other neighbouring states like Andhra Pradesh, Chhattisgarh, West Bengal and Karnataka. About 95 percent of produce is sold outside the state, as the state has no major maize based processing units either for live stocks or value added products for human being. There is no direct marketing practice by the Government and the trade was performed through the private traders at farm gate, who generally prefer their interest first, which adversely affects the producers income in the state. The Nabarangpur district is the only district operating the maize marketing at regulated Market yards during the year 2003-04. The farmers are not getting remunerative price in the local markets due to monopoly of local traders. The local maize trader of the District is procuring maize from their door points instead of Regulated Market Yards.

1.2 Review of Literature:

Wokab (1998) revealed that traditional maize farming practices are no longer capable of meeting maize production requirements with the growth of population in African nations. In Africa among other crops, maize crop is identified as a strategic commodity for achieving food security and poverty reduction.

An ICRA report projected an annual demand growth rate of 8 to 10% for the broiler and 4 to 5% for the egg industry in the long run implying a raising demand for maize as a feed. At an annual production of about, 23 million tonnes' maize is the third most produced grain in India after wheat and rice. Over the past ten years, maize has been the fastest growing grain crop throughout the globe.

Traditionally, most of the maize went to livestock and feed but modern technology has helped it to find new uses in food industry with animal protein and starch driving global demand today. International maize trade is now larger than the international rice trade" says Samir Shah.

Chaudary said the demand for maize is spiraling in India. Historically, demand for the grain has been driven by the poultry and starch industries. However, with changing food habits, the demand for food additives derived from maize is also growing. The demand for starch is strong and is growing at 10 to 12 percent every year due to raising consumption in the food and

pharmacy industry. We process around 6,00,000 tonnes of maize every year into starch and are exploring expansion options.

Parado and Kumar (2000) predicted that maize crop area would grow further to meet future food, feed and other demands, especially in view of the booming livestock and poultry producing sectors in the country. Since opportunities are limited for further expansion of Maize area, future increase in maize supply will be achieved through the intensification and commercialization of current maize production systems.

Suguna Poultry, the country's biggest broiler chicken producer has a separate division to produce maize. It procures over 8,00,000 tones of maize annually for feed requirements. Maize is preferred in poultry feed because of its easy availability. India has grown to be the fifth largest egg producer globally and 18th largest producer of broiler chicken producer. "Maize has greater calorific value, is rich in Amino acids and has less toxins compared to grains like millet and broken rice", says company officials. Wheat is better than maize as a feed but it is costlier by over 20 per cent, he added.

Accordingly, to Rajkumar and S.S. Hahal published paper titled an economic analysis of Maize marketing in Punjab. They examined the selling behaviour of farmers and to examine the marketing cost, margin of middlemen and producers share in consumers rupee in various marketing channels and to examine the efficiency of maize marketing system in Punjab. The major finding of the study is that none of the selected farmers sold his produce to the government agencies in the regulated markets. This happened due to the reason that food procurement agencies are not buying maize in the regulated markets as compared to the MSP for maize. This calls for an effective price policy for maize. Which go a long way to make the maize crop remunerative enough to compete with its competing crops. There is also a need to evolve high yielding varieties of maize, which will help to raise returns per unit of land area by enhancing the productivity.

Adoption of improved seed is concerned KACIBA, et.al. (2000) explored that the farmers' physical and capital endowment has no significant influence on the extent of adoption of new seed intensity of extension service was the major factor that positively influenced the adoption of improved maize seeds. The probability of adopting improved maize seeds for farmers in the low lands which generally receive lower rainfall was higher

by 25 per cent than the intermediate altitude areas of Tanzania. This implies that the demand of improved seed in dry land is higher than the rain fed regions.

Smale and Jayne (2003) stated that maize success in the future will continue to depend on strategic seed improvement. Since maize will crucial part of the food security equation even while the agricultural economies of the diversify, continued investments in both maize research and market institutions.

Thanh Ha, et.al (2004) found that the maize production has risen sharply since 1990 in Vietnam, when the government began to strongly support and promote maize hybrid technology. Vietnamese farmers have also widely adopted high-yielding hybrid maize varieties. That was timely response of Vietnam's growing live stock and poultry industry which in turn generate, an increasing demand for more maize to be used as feed. The lion's share of the production is demanded by feed industry and the development of this sector is mainly enthused by improved seed.'

Maize occupies a place of pride among the Coarse Cereal crops in India. The use of Maize is food, fodder, poultry feed and raw material for starch industry adds to the importance of this crop. The main aim of efficient marketing is to raise the producers share in consumers' rupee as well as to make the commodity available to consumer at reasonable price (Pant and Hada, 2004).

Viswanathan in Karnataka state (2005) focuses on the harvesting constraints on the maize crop in Haver' and Davanagere districts of Karnataka using 2005-06 data of the two districts, threshing of maize due to the lack of labour was found to be one of the most important constraints of maize crop in the state. The results of the study revealed that among traditional methods of threshing, bare hand reparation and hand beating was adopted by 62.50 and 26.67 percent of farmers respectively. Whereas, in case of mechanical threshing methods, maize thresher and sheath removal maize thresher were found to be adopted by 34.17 and 27.50 per cent of farmers.

Accordingly to Joshi, et.al. (2005), Maize yield improvement in recent years credited to adoption of modern maize varieties. The southern state of Karnataka is categorized as nontraditional maize growing area, which are mostly commercial and more favorable production environments. They realized that hybrids outperformed local and composite cultivators both in terms of yield. Hybrids are popular

mostly in Andhra Pradesh and Karnataka, where the seed sector is stray. The crop is suitable for dry land farming.

The study WASIM (2007) revealed that the influence of HYV seed on population, yield and area for major food crops in Punjab of Pakistan was found to be mixed. Area and yield growth for wheat was remarkable. However, the adoption of HYV has helped to accelerate the growth rate of production and yield of maize for few periods from 1965 to 1978 out of the forty years period taken for the study in Punjab of Pakistan from 1951-52 to 1994-95.

In Haryana, Yadav, et al. (2011) found that with the reduction of ground water, the farmers are shifting from unprofitable rice cultivation towards maize cultivation as it can be managed with 3-4 light irrigations. They also explored the role of HYV seed in Maize crop cultivation, but the state faced the shortage of good hybrid seed. Similarly, Karnataka is found to be a dry land farming state and shortage of water or rainfall is also one of the most important factors responsible for switching over many of the farmers from rice to maize cultivation in the state (Singha and Naphade 2012).

Every part of the maize plant has economic value, the grains, leaves, stalk, tassel and cob can all be used to produce a variety of food and non-food products. In India not only production and consumption of maize has been raising consistently, but also the consumption pattern has also changed over the years (Kumar et al., 2012)

Maize offers a good quality fodder along with good quantity of bio mass. In the peri urban region, particularly around highly populated cities, baby corn has emerged as a good source of income for the farmers within 2 months after its sowing, along with a good quality of green fodder during the lean season (Chanhary et al., 2012)

Noted expert on maize and India maize development association. SIAM DASS (2013-14) told that almost a decade back industrial use of maize was 5 to 6% and that for feed meal was less than 50%, but now the demand has grown exponentially as India's poultry and livestock industry is raising almost 10 percent per annum.

Union agriculture and farmers welfare minister Radha Mohan Singh spoke at the Indian maize summit, organized by the federation of Indian chambers of commerce and industry (FICCI) and national commodity and derivatives exchange (NCDEX) in New Delhi (2015). According to him maize productivity in India has increased 4.8 times, maize farming improved 2.9 times and its yield enhanced 14 times since 1950 due to the efforts of farmer

scientists and also the policy makers. the ministry also said that the union government is encouraging cultivation of maize in the country through national food security mission(NSFM)and offering subsidies on maize seeds at Rs.50 per kg on hybrid seeds.

Hindu daily news paper published(22.4.2017)Indian agriculture in recent years, maize crop production has been expanding steadily since 2006-07 (15.1 million tonnes)and touched 24.2 million tonnes in 2014-15.again the production has reached a new height of 26.15mt in this year 2016-17 due to south-west monsoon is the key to higher production, exceeded the annual target of 24.5mt.the Indian maize market is passing through an unexciting phase recorded harvests in 2016-17 covering kharif and rabi seasons have augmented the availability of the maize production this year for the user industries such as starch and animal feed.

According to NCOMM special report 2017.the united states produces more than 35 percent of the world's maize harvest. Other top producing countries are China, Brazil, Mexico Argentina and India. India produces about 2 percent of the worlds maize production.

1.3. Objectives of the Study:

1. To study acreage production and productivity of maize in the states
2. to estimate the cost of production of maize in the study area
3. to identify the supply chain of maize marketing in the study area
4. to explore the possibility of processing/value addition of maize in the states
5. to identify the constraints in production, efficient marketing and processing of maize and suggest policy measures.

1.4 Need and Scope of the Study:

Among several crops maize is the second important crop after rice in the state of Odisha. The majority of maize crop production marketed by the private traders. There is no direct marketing of maize produce in regulated markets by the government. The state has no maize based processing industry and value added products for human being .so the private traders sell the produce in to outside state. Therefore, it has incurred high transport cost that has largely affected the farmers' income. Out of its marketing which adversely affects the producers share either declining or stagnant of the farmers income.so there is need to study its supply chain and possibility of processing units in the state itself. Therefore, the study will have a greater

inference concerning income and employment of the farmers understands the trading volumes and prevalent marketing practices. Thus the study has highly desired to benefit the farmers.

1.5. Methodology:

The present study is conducted in the state of Odisha “An Analysis of Supply Chain of Maize Marketing and Possibility of its Value Addition”. The study would be based on both primary and secondary level data. The secondary data would be taken from various issues of statistical abstracts published by Directorate of Economics and Statistics, Bhubaneswar, Government of Odisha. State of Indian agriculture, agricultural statistics at a glance 2014 and data taken from the state regulated market committee (RMC) from the sample districts of Nabarangpur and Gajapathi.

Primary data will be obtained by following stratified random sampling method was employed. At first, all districts (30) of Odisha state was categorised. According to study, coordinator has given instructions about the selection of districts. The second criteria for selection of the district will be based on larger the area and the higher production of maize crop taken together. Among thirty districts in Odisha two districts Nabarangpur and Gajapathi were selected. Nabarangpur is located in the Eastern Ghat high land and the Gajapathi district is in North Eastern Ghat. At the next stage, one block was selected from each sample district and each block two villages/clusters of villages were selected from each of the sample districts.

From Nabarangpur district one block “Umerkote” was selected for this study as it was the important and major maize growing block of the district. From this block six villages were chosen for conducting house hold survey. The sample villages are 1. Umerkote 2) Bhimini 3) Indirapur 4) Naiguda 5) UV2 Naikguda 6. UV3 Dongriguda. From these villages 100 maize crop grown farmer households were interviewed and collected required data. The other sample district was Gajapathi, from which Mohana block was selected. From this block, five villages were selected 1. Pindiki, 2) Chandragiri 3) Chandiput 4) Kampaguda and 5)Sinkulopodhara and 100 sample households were surveyed. The selection of blocks and sample villages were made under the consultation with the district level agricultural officers and marketing department. The household survey was conducted with the coordination of marketing department of the sample districts. The entire field study was conducted based on the structured questionnaire sent by the coordinator. The sample will be broadly drawn on probability proportion method. While selecting the households from each selected village an appropriate number of farmers representing different four farm categories. Viz., Marginal (<1ha), small (1 to 2 ha), medium (2

to 4 ha) and large (above 4 ha) have taken for household survey. The reference year of the study for the household survey was on 2016-17 in the state of Odisha.

A sample of 100 maize crop growers was drawn from each selected block following the probability proportional to size of sample technique. The details which is given in table-1. As such the number of marginal, small, medium and large farmers selected from each village, block from the sample districts of Nabarangpur and Gajapathi districts in Odisha state respectively.

Table 1
Selection of villages and samples

S.No	State –Odisha								Total Number
I	Agro-climatic sub-zone - I				Agro-climatic sub-zone - II				
II	Navarangapur – I				Gajapathi - II				
III	Umerkote – I				Mohana – II				
IV	V/CVs – I		V/CVs – II		V/CVs – III		V/CVs -IV		
	Name	No	Name	No	Name	No	Name	No	
1	Umerkote	11	Naikguda	10	Pindiki	35	Kampaguda	33	
2	Bhamani	36	UV2Naikguda	17	Chandragiri	5	Sinkulipodhara	15	
3	Indirapur	14	UV3Dongriguda	12	Chandiput	12			
V		61 Hhs		39 Hhs		52 Hhs		48 Hhs	200 Hhs.

Besides, nine case studies were prepared from Commission gents cum wholesale traders and one co-operative society of maize in close periphery of the sample districts respectively. Regarding the marketing of maize through different marketing channels were collected from various interest groups by personal interview method. The information relating to the sources of maize supply, costs incurred, prices realized margins retained, problems faced in the marketing of maize by the farmers and traders besides various issues identified in marketing of maize in the sample districts of Odisha state.

1.6. Organization of the Report:

The present study divided into six chapters. The introductory chapter presents the background of the study, need and scope of the study. Review of literature and objectives of the study. It is also presented the data and methodology used for selection of districts/blocks/sample villages and sample size and organization of the report.

Chapter two presents Macro overview of maize crop area, production and productivity of Odisha and major Indian states. It also analyse growth trends (CAGR) of area production and

yield under maize crop in Indian and major states (1990-91 to 2015-16) and estimated three sub periods and total period. Further major maize grown districts in Odisha state area, production and yield growth trends were discussed during the years 1996-97 to 2015-16 and sub periods were also estimated and discussed.

Chapter three covers Agro-based industries and present status of food processing industries in Odisha. The Odisha state food processing policy 2016 has also discussed. The government assistance, intervention of agro based industries and incentives for development analysed. The challenges and outlook of Agro-processing industries are also presented in Odisha state.

Chapter four discussed the socio-economic back ground of sample households including details of operational land holding, cropping pattern, irrigation facilities and the maize crop season wise utilization seeds and other inputs for maize crop. Total input costs and gross and net returns per household for different land holding groups has been discussed. Borrowing details and the purpose of credit of sample household are also discussed.

Chapter five dealt the supply chain of maize marketed surplus of average size of land holding of sample farmers. The disposal of maize market in various marketing channels i.e. price-spread, marketing efficiency and the various constraints of production and marketing of maize crop faced by sample farmers. The suggestions were also made in favour of production and marketing of sample households. Some case studies were collected from the village traders, wholesale traders and one cooperative society from selected districts.

Chapter six presents the Conclusions and Policy Recommendations emerged in the study.

* * * * *

CHAPTER - II

GROWTH TRENDS OF MAIZE IN ODISHA STATE

INTRODUCTION:

This chapter discusses the growth trends of maize crop in major Indian states are also examined extensively in Odisha state. Section one presents the overview of time series data of area, production and yield under maize crop in India during 1990-91 to 2015-16. The total study period categorized in to three sub periods and estimated the Compound Annual Growth Rates (CAGR) of area, production and productivity of maize crop. Section two presented the growth trends of major maize growing states in India of selected periods. The third section also presented the area, production and yield Compound Annual Growth Rates (CAGR) of major maize producing districts in Odisha during 1996-97 to 2015-16 and the sample districts of Nabarangpur and Gajapathi growth trends were also discussed extensively in this chapter.

SECTION - I

The study growth trends in maize crop could be found relevant. Maize is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Table 2.1 presented the time series data of area, production and productivity of maize crop in India during 1990-91 to 2015-16 and estimations were also made into two types 1) the Annual Growth rates and 2) Compound Annual Growth rates. The maize crop growth rates have been changing frequently year after year in India. The fluctuations might be due to fluctuation in rainfall. Although The area production and productivity of maize have been steadily increasing in India since 1990-91. The area has increased from 5.9 to 8.7 million hectares, production from 8.9 million ton to 21.8 million ton and productivity increased 1518 kg/ha to 2509kg/ha during the period 1990-91 to 2015-16. The increase has been rapid in the last 10 years as a result of increase in productivity and expansion of area. The maize crop total period Compound Annual Growth Rates (CAGR) were categorised into four periods. i.e.1990-1991 to 1999-2000, 2000-2001 to 2009-2010, 2010-2011 to 2015-16 and the total period 1990-91 to 2015-16. The 1st period (1990-91 to 1999-2000) the maize crop of area, production and productivity growth rates (CAGR) have been shown significant at, 0.94, 3.23 and 2.21 percent respectively, where as in the second period (2000-2001 to 2009-10) the CAGR trends were also reported significant at 1.64, 1.01 and 6.11 percent respectively. The second period Yield Growth Rate reported to be highest 6.11 percent comparatively area growth 1.64 percent and production growth 1.01 percent under Maize crop in India. Further in the third period (2010-11 to 2015-16) the CAGR trends were also positive in respect of area 0.74, production 1.22 and yield 0.44 per cent respectively. Where as the total period (1990-91 to 2015-16) in India maize grown area, production and

productivity CAGR reported to be significant growth and the production had increased at the highest Growth Rate of 4.43 percent, which might be due to combined effect of increase in area and productivity at a rate of 2.02 and 2.42 per cent respectively. Therefore on an overview it can be observed that the estimations of sub periods and total period growth trends of area, production and productivity under Maize crop found to be significant growth in India. (1990-91 to 2015-16).

Table 2.1
Maize area production and yield in India

Year	Area (000' Ha)	% of Change	Production (000'Tonnes)	% of Change	Yield (kg/Ha)	% of Change
1990-91	5900	1.72	8960	34.94	1518	32.46
1991-92	5860	-0.68	8060	-10.04	1376	-9.35
1992-93	5960	1.71	9990	23.95	1676	21.80
1993-94	6000	0.67	9600	-3.90	1602	-4.42
1994-95	6142	2.37	8880	-7.50	1570	-2.00
1995-96	5980	-2.64	9530	7.32	1595	1.59
1996-97	6265	4.77	10770	13.01	1720	7.84
1997-98	6322	0.91	10820	0.46	1711	-0.52
1998-99	6200	-1.93	11150	3.05	1797	5.03
1999-2000	6421	3.56	11510	3.23	1792	-0.28
2000-01	6610	2.94	12040	4.60	1822	1.67
2001-02	6582	-0.42	13160	9.30	2000	9.77
2002-03	6635	0.81	11152	-15.26	1681	-15.95
2003-04	7343	10.67	14984	34.36	2041	21.42
2004-05	7430	1.18	14172	-5.42	1907	-6.57
2005-06	7588	2.13	14710	3.80	1938	1.63
2006-07	7894	4.03	15097	2.63	1912	-1.34
2007-08	8117	2.82	18955	25.55	2335	22.12
2008-09	8174	0.70	19731	4.09	2414	3.38
2009-10	8262	1.08	16720	-15.26	2021	-16.28
2010-11	8553	3.52	21726	29.94	2540	25.68
2011-12	8782	2.68	21759	0.15	2482	-2.28
2012-13	8673	-1.24	22258	2.29	2575	3.75
2013-14	9066	4.53	24259	8.99	2682	4.16
2014-15	9185	1.31	24173	-0.35	2631	-1.90
2015-16	8691	-5.38	21810	-9.78	2509	-4.64
1990-91to 1999-00	0.94		3.23		2.21	
2000-01 to 2009-10	1.64		1.01		6.11	
2010-11 to 2015-16	0.74		1.22		0.44	
1990-91to 2015-16	2.02		4.43		2.42	

Source: Directorate of Economics & Statistics, DAC&FW

SECTION-II

The study has taken up time series data and estimated the growth trends of area, production and yield under maize crop in Indian states. In India maize crop stand up as the third cash crop after rice and wheat. Every part of the maize plant has economic value, the grains, leaves, stalk, tassel and cob can be used to produce a variety of food and non-food

products. Table 2.2 presented the acreage of maize crop in major producing states in India and estimations of Annual Compound Growth Rates (CAGR). The largest maize crop grown area revealed in Indian states presented Karnataka is the highest (2015-16) followed by Madhya Pradesh, Maharashtra, Rajasthan, Bihar and Uttar Pradesh. About 71 percent of Maize produced in Kharif season and the states are Karnataka, Madhya Pradesh, Tamilnadu, Maharashtra, Telangana, Uttar Pradesh and Rajasthan. Whereas Bihar, Andhra Pradesh and Tamilnadu are the states largest area grown under Rabi. Rabi is the primary crop of Bihar and Andhra Pradesh and the state of Tamilnadu only produces 40 per cent in Rabi season. Among major maize grown states in India, Odisha state reported maize crop grown area was (56,000 ha) in 2015-16. Table 2.2 presented area under maize crop in major states in India. It was observed that the area under maize crop Karnataka indicated highest among sixteen maize grown states in India followed by Madhya Pradesh and Maharashtra respectively (2015-16). The total estimated period (26 years) categorised into three sub periods and total period, estimated Compound Annual Growth Rates (CAGR) in 16 major maize grown states in India. Among 16 states the acreage under Maize crop CAGR reported to be highest in Tamilnadu, (12.46%) followed by Karnataka (9.79%), Maharashtra (8.90%) and Andhra Pradesh (4.15%) in the first period (1990-91 to 1999-2000). Where as in the second period (2000-01 to 2009-10) CAGR reported to be highest in West Bengal (13.17%), Tamilnadu (12.25%), Maharashtra (10.25%) and Karnataka(8.37%) and the third period (2010-11 to 2015-16) CAGR under maize grown area reported to be highest in West Bengal (12.32%), Tamilnadu (7.91%), Madhya Pradesh (6.59%) and Jharkhand (6.12%) respectively. Among 16 major maize grown states in India the total period (1990-91 to 2015-16) area reported to be significant growth in the state of Tamilnadu (8.84%) followed by Maharashtra (7.64%), Karnataka (6.31%) and West Bengal (5.48%) in India. The area of all estimated periods under maize crop reported to be significant trend in the states of Tamilnadu, Maharashtra, Jharkhand and Chattisgarh in India.

Similarly, a continuous growth trend in Maize production has also been observed in Table 2.3. This table presented the major maize producing states in India and presented the estimations of Compound Annual Growth Rates (CAGR) from 1990-91 to 2015-16. Time series data was presented of 16 Indian states. Karnataka state is the leading producer of Maize production (32.69 lakh tonnes) followed by Madhya Pradesh (25.80), Bihar (23.99), Tamilnadu (23.89), Maharashtra (15.11), Andhra Pradesh (14.14), Uttar Pradesh (12.55) and Rajasthan (12.10 lakh tonnes) in India (2015-16). The total estimated period (26 years) categorised into three sub periods and total period. The 1st period (1990-91 to 1999-2000) the CAGR of maize production found to be the highest in Tamilnadu (12.35%) followed by Maharashtra (10.29%), Karnataka (9.59%) and Andhra Pradesh (9.34%). Where as in the second period (2000-2001 to

2009-10) the production growth trend registered the highest in Tamilnadu state (25.12%) followed by West Bengal (18.95%), Maharashtra (15.76%), Odisha (13.05%), Andhra Pradesh (9.92%) and Karnataka (8.61%). Further in the third period (2010-11 to 2015-16) production growth found to be the highest in Madhya Pradesh (17.29%), followed by West Bengal (16.02%), Tamilnadu (15.13%), Bihar (9.16%) and Jarkhand (7.81%). The total period (1990-91 to 2015-16) production growth trend was reported to be highest in the state of Tamilnadu (13.28%) followed by Maharashtra (9.21%), West Bengal (8.40%), Karnataka (6.41%) and Andhra Pradesh (6.33%). The states of Tamilnadu, Jharkhand, Chattisgarh and Bihar production reported significant trend in all estimated sub periods including total period in India. Such increase in production of maize mainly due to increase in yield due to the adoption of modern varieties of maize seeds and other infrastructural facilities provided by the government. In addition to implementation of ISOPOM, projects like “Sunshine” in Gujarat. The Golden Rays project in Rajasthan, project golden days in Odisha, Makka Vikas Paroyojana in Madhya Pradesh etc.,

It can be observed that the maize productivity also varies widely across the state in India. Table 2.4 shows the productivity growth rates (CAGR) under maize crop in India. The table reveals the Compound Annual Growth rates in three different periods and total period i.e. 1990-91 to 1999-2000, 2000-2001 to 2009-10, 2010-11 to 2015-16 and 1990-91 to 2015-16. Over a period of 26 years it was observed from the time series data inspite of small fluctuations yield kg per hectare under maize crop has increased in most of the years. So the maize yield improved significantly in major maize producing states in India. Based on time series data in 2015-16 highest yield per hectare reported the state of Tamilnadu 6549 kg/ha followed by Andhra Pradesh 6069, West Bengal and Bihar 4615, Karnataka 2773 and Madhya Pradesh 2350 kg/ha. The total period (1990-91 -2015-16) divided into three sub periods and estimated the CAGR of yield under maize crop. During the Ist period (1990-91to 1999-2000) the yield growth rate (CAGR) increased in all 16 major maize crop producing states in India except Jammu & Kashmir and TamilNadu. The highest yield growth rate was found to be Madhya Pradesh (11.00%) followed by Andhra Pradesh (5.17%), Odisha(3.99%), Punjab and Gujarat states (2.67%). On the other hand in the second period (2000-2001 to 2009-10) the yield growth rate reported highest in Tamilnadu state (14.77%) followed by Odisha(8.32%), West Bengal (6.07%) and Maharashtra (6.06%). Further the third period (2010-11 to 2015-16). The maize crop yield kg per hectare growth rate found to be highest in Madhya Pradesh (10.66), Bihar (7.67%),

Table 2.2
Area under maize crop in major states in India

(Area '000 Hectares)

	Andhra Pradesh	Bihar	Chhattisgarh	Gujarat	Himachal Pradesh	Jammu & Kashmir	Jharkhand	Karnataka	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamilnadu	Uttar Pradesh	West Bengal
1990-91	309	665	-	369	319	298	-	252	877	109	167	188	984	28	1085	65
1991-92	317	689	-	344	310	295	-	279	878	117	178	177	949	34	1067	48
1992-93	322	698	-	368	310	296	-	315	908	176	67	189	954	43	1073	54
1993-94	304	722	-	371	315	299	-	318	904	230	61	194	921	38	1091	52
1994-95	321	890	-	372	312	295	-	344	858	246	47	174	927	47	1080	44
1995-96	333	718	-	378	308	304	-	365	857	232	44	171	911	47	1090	45
1996-97	361	780	-	399	307	305	-	446	847	332	58	166	928	49	1066	35
1997-98	396	705	-	400	312	311	-	561	861	241	52	165	975	58	1063	44
1998-99	399	711	-	408	305	311	-	512	852	278	51	154	951	56	996	39
1999-00	452	737	-	391	300	317	-	606	905	281	54	163	934	116	956	35
2000-01	528	621	93	383	298	330	90	669	840	330	54	165	971	82	908	35
2001-02	428	594	94	444	301	327	140	580	854	326	51	165	1018	73	931	33
2002-03	526	604	94	465	300	330	134	650	860	371	43	152	984	121	755	28
2003-04	721	616	99	485	299	321	187	618	910	369	56	154	1111	160	947	56
2004-05	657	614	97	460	324	323	191	850	896	428	65	154	1042	190	876	47
2005-06	758	649	99	498	295	321	181	936	862	473	64	148	1004	203	814	51
2006-07	725	642	97	520	299	324	241	961	861	580	61	154	1028	198	872	85
2007-08	786	640	106	424	300	302	237	1113	880	672	74	153	1051	224	838	77
2008-09	852	641	100	499	298	316	216	1069	841	655	67	151	1053	287	799	91
2009-10	783	632	102	497	295	311	163	1240	832	794	81	139	1097	244	709	98
2010-11	744	646	103	501	296	308	215	1288	831	891	117	133	1143	231	754	89
2011-12	864	675	104	516	294	314	216	1349	863	881	103	126	1046	281	787	98
2012-13	972	686	107	458	294	311	249	1322	845	822	94	129	986	291	736	106
2013-14	1006	732	111	461	293	299	257	1377	868	1001	95	130	927	345	767	129
2014-15	303	707	122	382	293	299	270	1337	1132	1077	92	126	891	322	717	152
2015-16	233	702	115	387	296	306	288	1179	1098	1007	56	115	881	364	679	156
1990-91to 1999-00	4.15	0.70	0.00	1.44	-0.44	0.79	0.00	9.79	-0.23	8.90	-15.49	-2.06	-0.21	12.46	-1.02	-5.73
2000-01 to 2009-10	5.98	0.69	1.13	1.76	-0.15	-0.71	4.78	8.37	-0.17	10.52	5.13	-1.31	0.84	12.25	-1.86	13.17
2010-11 to 2015-16	-17.48	1.75	3.10	-6.14	-0.08	-0.64	6.12	-1.15	6.59	4.07	-10.43	-2.01	-5.35	7.91	-2.14	12.32
1990-91to 2015-16	3.59	-0.36	1.49	1.06	-0.28	0.11	4.78	6.31	0.34	7.64	-0.30	-1.66	0.25	8.84	-1.95	5.48

Source: Directorate of Economics & Statistics, DAC&FW

Table 2.3
Production of maize crop in major states in India

(Production '000 Tonnes)

	Andhra Pradesh	Bihar	Chhattisgarh	Gujarat	Himachal Pradesh	Jammu & Kashmir	Jharkhand	Karnataka	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamilnadu	Uttar Pradesh	West Bengal
1990-91	646	1038	-	530	655	446	-	637	1237	135	207	336	1303	44	1432	82
1991-92	635	1277	-	351	580	504	-	855	863	129	165	347	767	54	1164	144
1992-93	856	1161	-	557	642	491	-	977	1428	276	63	434	1010	70	1645	135
1993-94	776	1423	-	384	670	559	-	947	1332	390	62	359	925	61	1329	165
1994-95	859	1462	-	331	637	468	-	988	837	378	35	324	675	74	1441	143
1995-96	877	1369	-	374	661	536	-	1142	1150	338	47	307	812	75	1428	107
1996-97	1190	1670	-	618	589	454	-	1385	946	503	72	352	1029	80	1536	84
1997-98	1083	1306	-	658	621	441	-	1511	1135	298	64	345	1232	95	1647	130
1998-99	1383	1528	-	696	671	532	-	1671	1233	511	66	352	1032	88	1013	121
1999-00	1472	1566	-	504	681	471	-	1603	1425	433	81	420	969	184	1381	70
2000-01	1581	1497	126	289	684	526	114	2136	1218	303	69	461	1016	140	1473	88
2001-02	1457	1488	70	885	768	538	209	1452	1681	587	47	449	1481	118	1516	86
2002-03	1486	1350	123	793	483	465	241	1343	1494	744	42	310	871	192	836	55
2003-04	2477	1474	135	832	730	533	300	1210	1866	752	79	459	2071	251	1319	127
2004-05	2064	1466	132	413	736	492	286	2512	1253	753	106	422	1263	295	1494	140
2005-06	3087	1361	106	560	543	454	239	2728	1249	996	102	403	1102	241	1054	128
2006-07	2462	1715	119	363	695	487	296	2719	840	1150	103	481	1116	759	1164	254
2007-08	3621	1455	166	583	863	475	358	3254	1133	1790	147	521	1955	811	1209	244
2008-09	4152	1714	140	739	677	633	304	3029	1144	1560	135	514	1828	1258	1198	344
2009-10	2762	1479	143	533	543	487	191	3013	1045	1828	175	475	1146	1144	1039	385
2010-11	3956	1440	186	820	671	528	262	4444	1052	2602	299	491	2053	1028	1114	352
2011-12	3658	1611	172	786	715	505	322	4085	1287	2433	212	502	1667	1695	1308	364
2012-13	4855	2476	208	791	657	512	452	3475	1514	1824	228	475	1755	946	1234	417
2013-14	4862	2112	229	681	652	531	517	3985	1534	2729	264	507	1502	1855	1306	522
2014-15	1938	2340	230	631	579	360	476	4214	2128	2202	188	460	1551	2068	1279	663
2015-16	1414	2397	194	572	671	479	375	3269	2580	1511	111	424	1210	2383	1255	720
1990-91 to 1999-00	9.34	3.46	0	4.16	0.52	-0.08	0.00	9.59	1.03	10.29	-12.50	0.52	0.25	12.35	-0.39	-2.92
2000-01 to 2009-10	9.92	1.03	3.83	-1.14	-0.27	0.22	4.50	8.61	-4.78	15.76	13.05	2.27	2.63	25.12	-2.55	18.95
2010-11 to 2015-16	-14.81	9.16	3.33	-7.27	-1.80	-3.88	7.81	-3.64	17.29	-6.76	-12.85	-2.57	-8.48	15.13	1.58	16.02
1990-91 to 2015-16	6.33	2.24	5.38	1.75	0.16	-0.02	5.61	6.41	1.80	9.21	4.39	1.59	2.55	13.28	-0.80	8.40

Source: Directorate of Economics & Statistics, DAC&FW

Tamilnadu (7.33%) and Andhra Pradesh (5.43%). The total period (1990-91 to 2015-16) the yield growth rate reported highest in the states of Tamilnadu (6.78%) followed by Odisha (4.07%), Chattisgarh (3.90%) and Andhra Pradesh (3.75%) in India. The maize crop yield growth indicated the states of Tamilnadu and Odisha have noticed high growth in respect of yield per hectare, Andhra Pradesh, Karnataka, Chattisgarh, Gujarat, Jharkhand and Rajasthan have grasped a medium growth in yield with medium instability.

On an overview, it can be observed that the maize crop grown area, production and productivity growth trends found to be significant in the states of Tamilnadu, Jharkhand, Chattisgarh and Bihar of all estimated periods and total period in India due to expansion of maize grown area, the use of adoption of single cross hybrid seeds and increase yield rate are the major factors to increase the maize production in India. The maize crop has gained tremendous importance due to rising demand for diversified sectors including food, feed and ethanol production.

SECTION-III

Maize is the most important coarse cereals in the state of Odisha. The crop is mostly grown in Tribal districts during Kharif in un-irrigated uplands with poor management practices and more as subsistence crop. The percentage share of irrigated area under principal crops in the state was 28.30 percent as against in all India share of 44.90 percent. The share of agriculture sector in Odisha GSDP is around 15.04 percent. This sector provides employment directly or indirectly to more than 60 percent of population. The government of Odisha implemented a PPP (Public Private Partnership) project in the state centred around the promotion of hybrid maize under the “Bringing Green Revolution in Eastern India” programme announced by the central government in 2010. Special programme for popularization of hybrid Maize has been taken up in 20 districts. Therefore, the maize grown area, production and productivity have been increasing in most of the districts. Among major maize grown districts in the state are the districts of Nabarangpur, Gajapathi, Rayagada and Koraput. These four districts total maize grown area and production constituted to be 81.74 percent of total maize crop in the state. The cropping area of maize has been gradually increasing, whereas crops like millets, rice and vegetables are in diminishing trend due to inadequate irrigation facilities and the farmers are getting huge amounts of money from maize. Among the districts Nabarangpur and Gajapathi occupied the 1st and 2nd place regarding highest area and production of maize crop in Odisha. Therefore the two districts selected as a sample districts for household survey.

Table 2.4
Major state wise yield of maize crop in India

(Yield Kg./Hectare)

	Andhra Pradesh	Bihar	Chhattisgarh	Gujarat	Himachal Pradesh	Jammu & Kashmir	Jharkhand	Karnataka	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamilnadu	Uttar Pradesh	West Bengal
1990-91	2087	1561	-	1437	2053	1497	-	2525	N.A	1244	1238	1787	1325	1593	1320	1263
1991-92	2001	1854	-	1020	1871	1709	-	3066	N.A	1105	928	1960	808	1608	1091	3006
1992-93	2660	1663	-	1516	2068	1658	-	3100	N.A	1567	940	2296	1058	1626	1533	2518
1993-94	2553	1972	-	1035	2129	1871	-	2984	N.A	1692	1018	1851	1005	1620	1218	3153
1994-95	2678	1643	-	890	2039	1586	-	2873	N.A	1535	752	1862	728	1583	1335	3238
1995-96	2632	1908	-	991	2146	1764	-	3129	N.A	1455	1054	1795	891	1600	1310	2376
1996-97	3296	2140	-	1549	1918	1490	-	3109	1116	1516	1242	2120	1109	1641	1441	2420
1997-98	2735	1851	-	1646	1990	1418	-	2691	1319	1237	1228	2091	1264	1636	1549	2998
1998-99	3466	2148	-	1705	2201	1710	-	3262	1446	1837	1300	2286	1085	1585	1017	3148
1999-00	3257	2125	-	1289	2272	1485	-	2644	1574	1541	1500	2577	1038	1587	1445	1986
2000-01	2994	2413	1346	753	2293	1592	1267	3193	1449	920	1267	2794	1047	1717	1622	2501
2001-02	3404	2504	743	1995	2550	1648	1495	2502	1968	1804	909	2721	1454	1616	1628	2595
2002-03	2825	2236	1304	1706	1612	1412	1799	2068	1738	2005	984	2039	885	1582	1107	1996
2003-04	3436	2390	1369	1717	2444	1658	1604	1957	2052	2038	1420	2981	1863	1568	1392	2275
2004-05	3142	2386	1365	898	2272	1526	1497	2955	1398	1759	1631	2740	1211	1552	1705	2977
2005-06	4073	2098	1076	1124	1839	1413	1315	2915	1450	2106	1602	2723	1098	1189	1295	2533
2006-07	3396	2671	1225	698	2326	1505	1230	2829	976	1983	1677	3123	1086	3838	1335	2968
2007-08	4607	2274	1567	1375	2873	1569	1509	2924	1288	2664	1987	3405	1860	3627	1443	3166
2008-09	4873	2676	1402	1481	2273	2005	1407	2833	1361	2382	2007	3404	1736	4389	1499	3783
2009-10	3527	2341	1399	1072	1839	1566	1168	2430	1256	2302	2157	3417	1044	4685	1465	3942
2010-11	5317	2230	1807	1637	2263	1712	1215	3450	1266	2920	2549	3692	1796	4458	1477	3977
2011-12	4234	2386	1654	1523	2432	1608	1492	3028	1492	2762	2063	3984	1594	6042	1662	3722
2012-13	4995	3611	1936	1727	2233	1648	1812	2629	1790	2219	2408	3682	1780	3252	1677	3947
2013-14	4833	2884	2062	1477	2228	1776	2012	2894	1767	2727	2771	3900	1621	5372	1703	4059
2014-15	6396	3313	1886	1652	1979	1204	1763	3152	1880	2045	2053	3651	1740	6423	1784	4351
2015-16	6069	3416	1693	1478	2270	1566	1304	2773	2350	1500	1991	3687	1374	6549	1848	4615
1990-91to 1999-00	5.17	2.84	0.00	2.67	0.99	-0.85	0.00	0.21	11.00	2.28	3.99	2.67	0.50	-0.03	0.61	1.59
2000-01 to 2009-10	4.14	0.33	2.69	-2.46	-0.14	0.94	-1.80	0.52	-4.63	6.06	8.32	3.64	2.00	14.77	-0.51	6.07
2010-11 to 2015-16	5.43	7.67	0.39	-1.19	-1.70	-3.27	2.61	-2.63	10.66	-10.58	-3.04	-0.61	-3.17	7.33	3.79	3.61
1990-91to 2015-16	3.75	2.48	3.90	0.80	0.44	-0.14	0.73	-0.06	1.32	2.63	4.07	3.25	2.38	6.78	1.20	2.59

Source: Directorate of Economics & Statistics, DAC&FW

NABARANGPUR:

Nabarangpur was constituted as a district on 2nd October 1992 based predominantly on agriculture. About 90 percent of population here depends on farming to earn their living crops like paddy, maize, sugarcane, groundnut, biri, mung, arhar, ragi and sesame that are grown in the district. Due to lack of irrigation facilities most of the agriculture is rainfed. The district is located in south western corner of Odisha which, falls under east coast plains and hills as per the GOI's Agro-climatic zonal planning. As per 2011 census the total population of Nabarangpur district is 20.20 lakhs. The density of population per sqkm is 231 and the literacy percentage of the district is 46.4. The Net Sown Area was 239 thousand hectares. Maize is being grown extensively in UMERKOTE, RAYAGHAR and JHARIGAN blocks. The industrial scenario of the district is not very satisfactory. There is huge potential for maize processing industries and the district is not connected with railway routes. The cultivation of maize was started 30-35 years back by the Bengali refugees, who came to this area during the Indo-Pak war of 1971. Under their entrepreneurship it got promoted to such an extent that now it is supposed to cover more than 50 thousand hectares¹. In this district initially, only, the Bengalis were cultivating to a limited extent, but they gradually encouraged the locals to adopt maize cultivation as for the Bengali promoters. It was not simply a cultivation, but a business in which they also acted as middleman or bulk suppliers, linking the local production with the other states. For the locals maize meant a better income, which lured them to this. In Nabarangpur alone constituting 42 percent of maize area in the state. The crop area has been increasing with highest grown area of 77,828 hectares during the year 2010-11. Further the grown area slightly declined to 23,509 hectares in the year 2015-16. The CAGR were also estimated in three periods i.e.1997-98 to 2005-06, 2006-07 to 2015-16 and total period 1997-98 to 2015-16. All these three estimated periods reported positive growth.

GAJAPATHI:

Gajapathi district came into being with effect from 2nd October 1992. Prior to it was a part of Ganjam district. It is one of the Southern located districts in Odisha. The agricultural strategy of Gajapathi district comes under North Eastern Ghat Agro-climatic zone. The geographical situation of the district is characterized by undulated topography with hilly terrain. Where the rain water is carried through hill streams and nallas. The actual average annual rain fall of the district was 1293.2mm during 2011. The district as an area of 4325 Sqkms and 5.78 lakh of population as per 2011 census. The density of population of the district is 134 per Sq.km. The literacy percentage of the district covers 53.5 against 72.9 of the state. Net Area Sown was 56 thousand hectares. Paddy and maize are the major cereal crops and the major

Table 2.5
Trends in District wise area of Maize in Odisha State

District	(Hectares)																	
	Anugul	%	Balangir	%	Balangir	%	Boudh	%	Cuttack	%	Deogarh	%	Dhenkanal	%	Gajapati	%	Ganjam	%
1997-98	974		857		40		374		21		286		113		5212		574	
1998-99	1095	12.42	643	-24.97	28	-30.00	480	28.34	46	119.05	252	-11.89	92	-18.58	5993	14.98	660	14.98
1999-00	4730	331.96	3140	388.34	1070	3721.43	990	106.25	1330	2791.30	930	269.05	2740	2878.26	4700	-21.58	8750	1225.76
2000-01	1059	-77.61	661	-78.95	31	-97.10	541	-45.35	101	-92.41	303	-67.42	159	-94.20	5176	10.13	642	-92.66
2001-02	983	-7.18	524	-20.73	33	6.45	322	-40.48	23	-77.23	255	-15.84	76	-52.20	4771	-7.82	761	18.54
2002-03	942	-4.17	601	14.69	54	63.64	434	34.78	5	-78.26	151	-40.78	60	-21.05	8575	79.73	572	-24.84
2003-04	922	-2.12	592	-1.50	62	14.81	344	-20.74	17	240.00	271	79.47	167	178.33	10558	23.13	673	17.66
2004-05	1182	28.20	732	23.65	76	22.58	435	26.45	14	-17.65	246	-9.23	154	-7.78	11235	6.41	1355	101.34
2005-06	990	-16.24	812	10.93	77	1.32	404	-7.13	33	135.71	168	-31.71	178	15.58	8198	-27.03	642	-52.62
2006-07	995	0.51	728	-10.34	52	-32.47	342	-15.35	49	48.48	240	42.86	120	-32.58	9288	13.30	1013	57.79
2007-08	1034	3.92	760	4.40	51	-1.92	451	31.87	30	-38.78	136	-43.33	106	-11.67	7945	-14.46	862	-14.91
2008-09	910	-11.99	947	24.61	116	127.45	333	-26.16	25	-16.67	124	-8.82	72	-32.08	6704	-15.62	459	-46.75
2009-10	803	-11.76	985	4.01	132	13.79	362	8.71	31	24.00	71	-42.74	48	-33.33	9063	35.19	1072	133.55
2010-11	982	22.29	1555	57.87	152	15.15	391	8.01	37	19.35	218	207.04	258	437.50	9358	3.25	928	-13.43
2011-12	889	-9.47	1029	-33.83	122	-19.74	411	5.12	17	-54.05	104	-52.29	80	-68.99	10311	10.18	1292	39.22
2012-13	1154	29.81	932	-9.43	126	3.28	275	-33.09	11	-35.29	105	0.96	164	105.00	11105	7.70	1010	-21.83
2013-14	546	-52.69	1400	50.21	109	-13.49	185	-32.73	5	-54.55	44	-58.10	36	-78.05	11836	6.58	760	-24.75
2014-15	590	8.06	1344	-4.00	131	20.18	212	14.59	3	-40.00	51	15.91	129	258.33	14924	26.09	621	-18.29
2015-16	482	-18.31	1471	9.45	271	106.87	164	-22.64	3	0.00	56	9.80	41	-68.22	15011	0.58	938	51.05
1997-98 to 2005-06	-8.63		-8.88		-17.35		-4.91		-26.13		-10.27		-19.25		9.96		-14.22	
2006-07 to 2015-16	-6.21		6.71		11.76		-8.25		-22.49		-14.05		-3.22		7.64		-0.46	
1997-98 to 2015-16	-6.01		1.43		-2.63		-4.96		-18.81		-10.33		-13.24		5.14		-6.65	

Source: Directorate of Economics & Statistics, DAC&FW

Contd...

Table -2.5
Trends in District wise area of Maize in Odisha State

(Hectares)

District	Jajapur	%	Jharsu guda	%	Kalahandi	%	Kandhamal	%	Kendujhar	%	Khordha	%	Koraput	%	Malkangiri	%
1997-98	35		1		1946		4548		4510		111		3909		1111	
1998-99	27	-22.86	10	900.00	1914	-1.64	4167	-8.38	4232	-6.16	5	-95.50	3663	-6.29	1037	-6.66
1999-00	1690	6159.26	550	5400.00	6770	253.71	15510	272.21	24270	473.49	1560	31100.00	18820	413.79	16230	1465.09
2000-01	135	-92.01	4	-99.27	1514	-77.64	4738	-69.45	7256	-70.10	9	-99.42	4456	-76.32	1089	-93.29
2001-02	10	-92.59	3	-25.00	1679	10.90	2832	-40.23	3974	-45.23	2	-77.78	3244	-27.20	1138	4.50
2002-03	165	1550.00	4	33.33	1463	-12.86	3960	39.83	3564	-10.32	15	650.00	4115	26.85	1007	-11.51
2003-04	47	-71.52	2	-50.00	1799	22.97	17834	350.35	4418	23.96	2	-86.67	3741	-9.09	785	-22.05
2004-05	182	287.23	3	50.00	1422	-20.96	3938	-77.92	3584	-18.88	13	550.00	2853	-23.74	741	-5.61
2005-06	123	-32.42	7	133.33	1420	-0.14	4149	5.36	3127	-12.75	7	-46.15	2963	3.86	889	19.97
2006-07	45	-63.41	5	-28.57	1411	-0.63	3464	-16.51	3069	-1.85	11	57.14	2856	-3.61	908	2.14
2007-08	28	-37.78	3	-40.00	1430	1.35	3751	8.29	3060	-0.29	7	-36.36	3562	24.72	905	-0.33
2008-09	24	-14.29	2	-33.33	1296	-9.37	3587	-4.37	2051	-32.97	12	71.43	2723	-23.55	756	-16.46
2009-10	47	95.83	12	500.00	1719	32.64	2901	-19.12	2413	17.65	2	-83.33	3278	20.38	784	3.70
2010-11	44	-6.38	78	550.00	2676	55.67	3425	18.06	3728	54.50	60	2900.00	5000	52.53	1286	64.03
2011-12	31	-29.55	19	-75.64	2755	2.95	3188	-6.92	2044	-45.17	47	-21.67	5903	18.06	1009	-21.54
2012-13	317	922.58	64	236.84	2701	-1.96	2377	-25.44	2427	18.74	27	-42.55	6621	12.16	1001	-0.79
2013-14	35	-88.96	51	-20.31	3827	41.69	2042	-14.09	1429	-41.12	25	-7.41	5379	-18.76	1031	3.00
2014-15	45	28.57	35	-31.37	3979	3.97	1780	-12.83	1977	38.35	6	-76.00	5468	1.65	611	-40.74
2015-16	22	-51.11	15	-57.14	1254	-68.48	1274	-28.43	1238	-37.38	17	183.33	3311	-39.45	616	0.82
1997-98 to 2005-06	-15.16		-28.07		-10.22		0.39		-12.95		-30.47		-11.53		-20.44	
2006-07 to 2015-16	7.26		14.00		8.44		-9.39		-7.45		4.93		5.72		-2.00	
1997-98 to 2015-16	-12.29		-9.24		0.51		-7.57		-10.30		-19.04		-2.04		-11.57	

Source: Directorate of Economics & Statistics, DAC&FW

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Table -2.5
Trends in District wise area of Maize in Odisha State

District	(Hectares)															
	Mayurbhanj	%	Nabarangpur	%	Nayagarh	%	Nuapada	%	Rayagada	%	Sambalpur	%	Sonepur	%	Sundargarh	%
1997-98	1686		20517		597		564		3721		107		0		837	
1998-99	1687	0.06	19929	-2.87	354	-40.70	491	-12.94	3423	-8.01	131	22.43	3	0.00	542	-35.24
1999-00	10520	523.59	22610	13.45	3320	837.85	2240	356.21	10580	209.09	1200	816.03	410	13566.67	7310	1248.71
2000-01	2352	-77.64	18391	-18.66	606	-81.75	440	-80.36	3861	-63.51	132	-89.00	14	-96.59	701	-90.41
2001-02	1886	-19.81	23348	26.95	612	0.99	425	-3.41	3746	-2.98	65	-50.76	1	-92.86	708	1.00
2002-03	1752	-7.10	10071	-56.87	417	-31.86	531	24.94	3895	3.98	110	69.23	11	1000.00	626	-11.58
2003-04	2271	29.62	19807	96.67	501	20.14	548	3.20	2992	-23.18	114	3.64	5	-54.55	836	33.55
2004-05	2110	-7.09	26657	34.58	449	-10.38	452	-17.52	3625	21.16	91	-20.18	7	40.00	778	-6.94
2005-06	1705	-19.19	33020	23.87	577	28.51	353	-21.90	3107	-14.29	59	-35.16	12	71.43	566	-27.25
2006-07	1257	-26.28	30473	-7.71	568	-1.56	279	-20.96	3349	7.79	70	18.64	11	-8.33	669	18.20
2007-08	1336	6.28	43189	41.73	547	-3.70	285	2.15	3769	12.54	72	2.86	26	136.36	722	7.92
2008-09	795	-40.49	40823	-5.48	518	-5.30	235	-17.54	3925	4.14	74	2.78	21	-19.23	482	-33.24
2009-10	870	9.43	52142	27.73	451	-12.93	269	14.47	3221	-17.94	35	-52.70	4	-80.95	440	-8.71
2010-11	2117	143.33	77828	49.26	651	44.35	598	122.30	4421	37.26	106	202.86	19	375.00	1134	157.73
2011-12	1047	-50.54	66759	-14.22	602	-7.53	428	-28.43	4051	-8.37	105	-0.94	8	-57.89	586	-48.32
2012-13	1257	20.06	56965	-14.67	377	-37.38	831	94.16	3779	-6.71	64	-39.05	86	975.00	685	16.89
2013-14	1650	31.26	58753	3.14	302	-19.89	565	-32.01	4234	12.04	241	276.56	17	-80.23	614	-10.36
2014-15	976	-40.85	52847	-10.05	299	-0.99	391	-30.80	4669	10.27	43	-82.16	22	29.41	457	-25.57
2015-16	745	-23.67	23509	-55.51	321	7.36	291	-25.58	3945	-15.51	34	-20.93	10	-54.55	545	19.26
1997-98 to 2005-06	-9.10		4.34		-11.35		-10.56		-6.54		-18.71		-24.40		-15.58	
2006-07 to 2015-16	-1.39		1.18		-6.94		5.83		2.23		2.83		4.82		-2.03	
1997-98 to 2015-16	-8.13		6.68		-6.79		-4.47		-1.16		-10.00		-9.56		-8.75	

Source: Directorate of Economics & Statistics, DAC&FW

irrigation projects namely Ramsagar, Sita Sagar and Krishna sagar. The irrigation potential of the district during kharif and Rabi are 24482 hectares and 9415 hectares respectively. The district having 34 nos. of small scale industries and the capital investment about Rs.671 lakhs. Besides various kinds of hand crafts works like horn work and cane work developed by skilled workers and artisans of the district.

Among the major maize grown districts, crop area reported to be highest in Nabarangpur 23,509 hectares followed by Gajapathi (15,011), Rayagada (3945) and Koraput (3311) hectares. Table 2.5 shown the annual and Compound Growth Rates in district wise area of maize in Odisha state. The CAGR in the first period (1997-98 to 2005-06) have registered the significant growth 9.96 and 4.34 percent in the districts of Gajapathi and Nabarangpur. Whereas the second period 2006-07 to 2015-16 the growth reported to be highest in Jharsuguda 14.00% and Balangir 11.76%, but these two districts having small extent of maize crop area. The Gajapathi and Nabarangpur districts having large extent of area and the CAGR also reported positive trend that is 7.64 and 1.18% in the second period. The total period (1997-98 to 2015-16) growth trend 6.68 and 5.14 percent reported from the districts of Nabarangpur and Gajapathi. Among 23 districts in the state of Odisha the major maize grown area growth trends have been changing frequently. The sample districts of Nabarangpur and Gajapathi, reported positive and significant trend (CAGR) in area under Maize crop during all estimated periods of 1997-98 to 2005-06, 2006-07 to 2015-16 and total period 1997-98 to 2015-16 respectively.

Table 2.6 presented the district-wise growth trends of maize production in Odisha state. The time series data of maize production indicated (1997-98 to 2015-16) the highest 2,43,887 tonnes during 2010-11 later the the production has changed and declined in Nabarangpur district. Presently in 2015-16 the highest maize produced districts are Nabarangpur 52260 tonnes followed by Gajapathi 31748, Koraput 7026 and Rayagada 6417 tonnes in Odisha state. The total study period was divided into three periods and estimated the production growth rates. The first period (1997-98 to 2005-06) the highest CAGR found to be the districts of Gajapathi 14.44% and Nabarangpur 8.70% whereas in the second period (2006-07 to 2015-16) growth reported to be 8.11 and 2.39 percent in the districts of Gajapathi and Nabarangpur. The total period (1997-98 to 2015-16) production growth achieved a significant highest growth 9.61 percent and 6.45% in Nabarangpur and Gajapathi districts respectively in Odisha state..

Table 2.7depicted the maize crop productivity and its CAGR in Nabarangpur district. The productivity of maize (yield) has increased 1716kg/ha to 2223kg/ha from the year 1997-98 to 2015-16. The yield CAGR was also reported positive growth in all estimated periods. The

first period (1997-98 to 2005-06) CAGR of maize yield was 3.14 percent and the second period also reported the positive trend 1.05 percent. The total period maize productivity (1997-98 to 2015-16) has also exhibited considerable positive growth of 3.90 percent in the year 1997-98 to 2015-16 in Nabarangpur district.

Further the table shown the study district, Gajapati is also one of the major maize producing district and this district reported the significant increase in the yield growth rate. The first period (1997-98 to 2005-06) maize yield growth was 4.76 percent and the second period was also reported positive trend 0.32 percent. The total period (1997-98 to 2015-16) yield Growth Rate was found to be 1.73 percent in Gajapati district.

It may be observed that among the 25 districts of maize growth trends of area, production and productivity have been changing in all estimated periods i.e. (1997-98 to 2005-06) (2006-07 to 2015-16) and (1997-98 to 2015-16) except the districts of Nabarangpur and Gajapati. Where as the selected districts of Nabarangpur and Gajapati the growth trends of area, production and yield under maize crop registered the significant positive growth in all estimated periods against the other major maize grown districts in the state of Odisha during the period (1997-98 to 2015-16).

Table -2.6
Trends in District wise Production of Maize in Odisha State

(Tonnes)																		
District	Anugul	%	Balangir	%	Balangir	%	Boudh	%	Cuttack	%	Deogarh	%	Dhenkanal	%	Gajapati	%	Ganjam	%
1997-98	699		550		27		249		12		278		57		5637		602	
1998-99	648	-7.30	307	-44.18	19	-29.63	362	45.38	24	100.00	197	-29.14	56	-1.75	7801	38.39	773	28.41
1999-00	2840	338.27	2910	847.88	1800	9373.68	1510	317.13	1570	6441.67	1440	630.96	1650	2846.43	5130	-34.24	9970	1189.78
2000-01	724	-74.51	288	-90.10	40	-97.78	422	-72.05	84	-94.65	209	-85.49	139	-91.58	6502	26.74	719	-92.79
2001-02	339	-53.18	228	-20.83	30	-25.00	102	-75.83	7	-91.67	120	-42.58	38	-72.66	6686	2.83	907	26.15
2002-03	607	79.06	218	-4.39	69	130.00	308	201.96	2	-71.43	113	-5.83	35	-7.89	10802	61.56	608	-32.97
2003-04	568	-6.43	288	32.11	95	37.68	263	-14.61	12	500.00	220	94.69	122	248.57	17506	62.06	774	27.30
2004-05	872	53.52	373	29.51	125	31.58	313	19.01	21	75.00	206	-6.36	135	10.66	17350	-0.89	1534	98.19
2005-06	783	-10.21	431	15.55	99	-20.80	291	-7.03	33	57.14	112	-45.63	160	18.52	12964	-25.28	817	-46.74
2006-07	719	-8.17	383	-11.14	59	-40.40	239	-17.87	74	124.24	225	100.89	97	-39.38	14256	9.97	1377	68.54
2007-08	701	-2.50	539	40.73	58	-1.69	439	83.68	44	-40.54	103	-54.22	97	0.00	13870	-2.71	1205	-12.49
2008-09	621	-11.41	664	23.19	153	163.79	309	-29.61	48	9.09	106	2.91	78	-19.59	10330	-25.52	613	-49.13
2009-10	496	-20.13	672	1.20	155	1.31	282	-8.74	61	27.08	68	-35.85	42	-46.15	11523	11.55	1610	162.64
2010-11	891	79.64	1202	78.87	206	32.90	386	36.88	73	19.67	267	292.65	437	940.48	14377	24.77	1467	-8.88
2011-12	793	-11.00	657	-45.34	159	-22.82	357	-7.51	41	-43.84	118	-55.81	89	-79.63	19916	38.53	2384	62.51
2012-13	1125	41.87	1194	81.74	185	16.35	220	-38.38	16	-60.98	127	7.63	297	233.71	21257	6.73	1727	-27.56
2013-14	603	-46.40	2829	136.93	189	2.16	145	-34.09	8	-50.00	64	-49.61	45	-84.85	13521	-36.39	1366	-20.90
2014-15	612	1.49	1955	-30.89	168	-11.11	154	6.21	11	37.50	85	32.81	166	268.89	16029	18.55	1051	-23.06
2015-16	564	-7.84	1382	-29.31	390	132.14	100	-35.06	2	-81.82	86	1.18	49	-70.48	31748	98.07	1877	78.59
1997-98 to 2005-06	-6.78		-15.00		-18.07		-10.16		-26.54		-16.44		-15.75		14.44		-13.79	
2006-07 to 2015-16	-0.27		16.24		13.98		-9.86		-19.98		-7.56		1.31		8.11		3.49	
1997-98 to 2015-16	-2.66		6.53		-3.78		-6.19		-16.91		-10.30		-7.07		6.45		-3.04	

Source: Directorate of Economics & Statistics, DAC&FW

Contd....

Table -2.6
Trends in District wise Production of Maize in Odisha State

District	(Tonnes)															
	Jajpur	%	Jharsuguda	%	Kalahandi	%	Kandhamal	%	Kendujhar	%	Khordha	%	Koraput	%	Malkangiri	%
1997-98	16		1		1494		4598		2915		47		4314		1158	
1998-99	26	62.50	8	700.00	1441	-3.55	5212	13.35	2636	-9.57	4	-91.49	4006	-7.14	1062	-8.29
1999-00	1120	4207.69	880	10900.00	7760	438.51	21920	320.57	42020	1494.08	1200	29900.0	16620	314.88	14830	1296.42
2000-01	75	-93.30	3	-99.66	1116	-85.62	6053	-72.39	5644	-86.57	5	-99.58	4982	-70.02	1066	-92.81
2001-02	8	-89.33	4	33.33	968	-13.26	1218	-79.88	2342	-58.50	2	-60.00	2880	-42.19	987	-7.41
2002-03	117	1362.50	19	375.00	970	0.21	4644	281.28	2284	-2.48	10	400.00	4073	41.42	653	-33.84
2003-04	22	-81.20	2	-89.47	1210	24.74	22279	379.74	3637	59.24	1	-90.00	3536	-13.18	716	9.65
2004-05	110	400.00	9	350.00	1102	-8.93	3583	-83.92	3426	-5.80	17	1600.00	3160	-10.63	679	-5.17
2005-06	117	6.36	8	-11.11	931	-15.52	3734	4.21	2096	-38.82	8	-52.94	3232	2.28	852	25.48
2006-07	24	-79.49	5	-37.50	906	-2.69	2728	-26.94	2517	20.09	17	112.50	3250	0.56	875	2.70
2007-08	20	-16.67	4	-20.00	1080	19.21	3687	35.15	2600	3.30	7	-58.82	4813	48.09	1049	19.89
2008-09	34	70.00	2	-50.00	1110	2.78	3825	3.74	1442	-44.54	21	200.00	3406	-29.23	862	-17.83
2009-10	59	73.53	11	450.00	1527	37.57	2445	-36.08	2371	64.42	2	-90.48	4313	26.63	808	-6.26
2010-11	50	-15.25	148	1245.45	3414	123.58	4141	69.37	5878	147.91	131	6450.00	8451	95.94	1543	90.97
2011-12	27	-46.00	48	-67.57	3079	-9.81	4049	-2.22	2643	-55.04	87	-33.59	10514	24.41	1185	-23.20
2012-13	223	725.93	138	187.50	3504	13.80	2192	-45.86	3627	37.23	74	-14.94	11505	9.43	1045	-11.81
2013-14	28	-87.44	111	-19.57	5849	66.92	1972	-10.04	2559	-29.45	67	-9.46	10776	-6.34	1279	22.39
2014-15	32	14.29	119	7.21	4818	-17.63	1808	-8.32	3468	35.52	10	-85.07	11038	2.43	730	-42.92
2015-16	21	-34.38	54	-54.62	1249	-74.08	1366	-24.45	2053	-40.80	48	380.00	7026	-36.35	736	0.82
1997-98 to 2005-06	-13.95		-27.45		-14.58		-1.85		-18.14		-29.10		-10.88		-21.14	
2006-07 to 2015-16	5.80		19.62		13.37		-7.63		1.67		9.17		11.14		-0.63	
1997-98 to 2015-16	-10.92		-5.22		3.62		-8.74		-9.73		-12.40		3.80		-9.97	

Source: Directorate of Economics & Statistics, DAC&FW

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Table -2.6
Trends in District wise Production of Maize in Odisha State

(Tonnes)

District	Mayurbhanj	%	Nabarangpur	%	Nayagarh	%	Nuapada	%	Rayagada	%	Sambalpur	%	Sonepur	%	Sundargarh	%
1997-98	1144		35208		482		307		3867		63		0		717	
1998-99	969	-15.30	36226	2.89	271	-43.78	263	-14.33	3417	-11.64	90	42.86	3	#DIV/0!	521	-27.34
1999-00	11460	1082.66	35570	-1.81	3090	1040.22	3710	1310.65	10700	213.14	1810	1911.11	340	11233.33	13010	2397.12
2000-01	1837	-83.97	33232	-6.57	557	-81.97	206	-94.45	4206	-60.69	95	-94.75	7	-97.94	655	-94.97
2001-02	1101	-40.07	24571	-26.06	291	-47.76	197	-4.37	3070	-27.01	42	-55.79	1	-85.71	514	-21.53
2002-03	1073	-2.54	10741	-56.29	325	11.68	157	-20.30	4005	30.46	101	140.48	5	400.00	461	-10.31
2003-04	1907	77.73	39639	269.04	420	29.23	324	106.37	2569	-35.86	82	-18.81	2	-60.00	729	58.13
2004-05	1754	-8.02	62371	57.35	425	1.19	211	-34.88	3716	44.65	75	-8.54	6	200.00	708	-2.88
2005-06	1330	-24.17	69523	11.47	632	48.71	197	-6.64	2903	-21.88	46	-38.67	13	116.67	586	-17.23
2006-07	955	-28.20	69561	0.05	530	-16.14	145	-26.40	3090	6.44	76	65.22	8	-38.46	714	21.84
2007-08	1098	14.97	110049	58.21	616	16.23	164	13.10	3919	26.83	65	-14.47	20	150.00	917	28.43
2008-09	764	-30.42	104311	-5.21	586	-4.87	152	-7.32	4596	17.27	80	23.08	12	-40.00	558	-39.15
2009-10	844	10.47	143387	37.46	465	-20.65	146	-3.95	3172	-30.98	34	-57.50	2	-83.33	512	-8.24
2010-11	3119	269.55	243887	70.09	1021	119.57	677	363.70	4916	54.98	131	285.29	28	1300.00	1725	236.91
2011-12	1291	-58.61	157511	-35.42	985	-3.53	338	-50.07	4904	-0.24	119	-9.16	8	-71.43	822	-52.35
2012-13	2296	77.85	169573	7.66	492	-50.05	887	162.43	4425	-9.77	75	-36.97	158	1875.00	1077	31.02
2013-14	2856	24.39	210988	24.42	471	-4.27	688	-22.44	5770	30.40	264	252.00	17	-89.24	1141	5.94
2014-15	1521	-46.74	135773	-35.65	526	11.68	440	-36.05	6506	12.76	50	-81.06	17	0.00	928	-18.67
2015-16	1250	-17.82	52261	-61.51	573	8.94	374	-15.00	6417	-1.37	34	-32.00	86	405.88	1234	32.97
1997-98 to 2005-06	-11.14		8.70		-10.42		-19.97		-7.58		-22.23		-24.55		-20.71	
2006-07 to 2015-16	7.05		2.39		-0.75		12.93		7.32		3.58		19.65		5.33	
1997-98 to 2015-16	-4.18		9.61		-2.40		-4.50		1.23		-11.14		-1.47		-8.07	

Source: Directorate of Economics & Statistics, DAC&FW

SUMMARY:

The study found that the Compound Annual Growth Rates (CAGR) under maize crop in the 1st period (1990-91 to 1999-2000) area, production and productivity reported significant at 0.94, 3.23 and 2.21 percent respectively, the 2nd period (2000-2001 to 2009-10) found to be significant growth at 1.64, 1.01 and 6.11 percent and the third period (2010-11 to 2015-16) (6 years) also indicated positive trend at 0.74, 1.22 and 0.44 percent respectively. Among the three sub periods the second period yield growth reported to be highest 6.11 percent against the area 1.64 percent and production 1.01 percent due to HYV seeds. Whereas in the total period (1990-91 to 2015-16) in India maize grown area, production and yield growth reported significant trend in production at 4.43 percent, which might be due to combined effect of increase in area and productivity at a rate of 2.02 and 2.42 percent respectively. Among Indian states(16 states) Karnataka is the highest grown area followed to Madhya Pradesh, Maharashtra and Rajasthan (2015-16). In the 1st period (1990-91 to 1999-2000) acreage under maize crop reported to be highest in Tamilnadu (12.46%) followed by Karnataka (9.79%), Maharashtra (8.90%) and Andhra Pradesh (4.15%). The second period (2000-01 to 2009-10) found to be highest growth in West Bengal (13.17%), Tamilnadu (12.25%), Maharashtra (10.25%) and Karnataka (8.37%). The third period (2010-11 to 2015-16) 6 years area growth trend highest in West Bengal (12.32%), Tamilnadu (7.91%), Madhya Pradesh (6.59%) and Jharkhand (6.12%). Where as the total period maize grown area reported highest in the states of Tamilnadu (8.84%) followed by Maharashtra (7.64%), Karnataka (6.31%) and West Bengal (5.48%) respectively.

Karnataka state is the leading producer of maize crop followed by Madhya Pradesh, Bihar, Tamilnadu and Maharashtra in India (2015-16). The study observed that the 1st period CAGR of maize production found to be highest in the state Tamilnadu (12.35%) followed by Maharashtra (10.29%) and Karnataka (9.59%), the second period (2000-01 to 2009-10) production trend registered highest in Tamilnadu (25.12%), West Bengal (18.95%), Maharashtra (15.76%) and Odisha (13.05%). The third period the state of Madhya Pradesh (17.29%) reported highest growth rate followed by West Bengal (16.02%), Tamilnadu (13.28%), Maharashtra (9.21%). Therefore significant growth trends was observed in the states of Tamilnadu, Jharkhand, Chattisgarh and Bihar in all study periods under maize production in India, due to adoption of HYV seeds and extension of infrastructural facilities besides implementation of ISOPOM and other centrally sponsored schemes by the government.

Further the yield growth of maize crop in the 1st period (1990-91 to 1999-2000) found to be significant growth in most of the states. The second period (2000-01 to 2009-10) the states of Tamilnadu (14.77%), Odisha (8.32%) and West Bengal (6.07%) got the highest growth

whereas in the third period Madhya Pradesh (10.66), Bihar (7.67%) and Tamilnadu reported highest growth. The total period (1990-91 to 2015-16) highest yield growth trend reported that the states of Tamilnadu (6.78%), Odisha (4.07%) and Chattisgarh (3.90%) respectively. The states of Tamilnadu and Odishas noticed that the highest yield growth than other 16 states in India. On an overview it can be observed that the maize crop grown area, production and productivity growth trends found to be significant of all estimated periods in the states of Tamilnadu, Jharkhand, Chattisgarh and Bihar in India (1990-91 to 2015-16).

Nabarangpur, Gajapathi, Rayagada and Koraput are the major maize grown districts in Odisha and the production constituted to be 81.74% of total production of maize crop in Odisha state. The districts of Nabarangpur and Gajapathi selected for household survey, while the two districts having largest area and highest production in the state. The study period (1997-98 to 2015-16) divided into two sub periods 1997-98 to 2005-06 and 2006-07 to 2015-16. The first period area found to be significant growth at 9.96% in Gajapathi and 4.34 in Nabarangpur districts and the second period also indicated positive trend. The total period (1997-98 to 2015-16) area growth registered at 6.68% and 5.14% in the districts of Nabarandpur and Gajaptahi. Whereas, production growth rate found to be 14.44% and 8.70% in 1st period, 8.10% and 2.39% in 2nd period of Gajaptahi and Nabarangpur in the state. The production growth trend found to be 9.61% and 6.45% of the sample districts of Nabarannpur and Gajaptahi in total period. Similarly the yield growth exhibited significant growth 3.14%, 4.76% and 10.05%, 0,32% reported in 1st and 2nd periods of Nabarangpur and Gajapathi districts. The total period the maize yield growth has also exhibited considerable positive growth of 3.90% in Nabarangpur and 1.73% in Gajapathi districts respectively.

Table -2.7
Trends in District wise Yield of Maize in Odisha State

District	(Kg/Ha)																	
	Anugul	%	Balangir	%	Balangir	%	Boudh	%	Cuttack	%	Deogarh	%	Dhenkanal	%	Gajapati	%	Ganjam	%
1997-98	718		642		675		666		571		972		504		1082		1049	
1998-99	592	-17.55	477	-25.70	679	0.59	754	13.21	522	-8.58	782	-19.55	609	20.83	1302	20.33	1171	11.63
1999-00	600	1.35	927	94.34	1682	147.72	1525	102.25	1180	126.05	1548	97.95	602	-1.15	1091	-16.21	1139	-2.73
2000-01	683	13.83	436	-52.97	1300	-22.71	780	-48.85	829	-29.75	690	-55.43	871	44.68	1256	15.12	1120	-1.67
2001-02	344	-49.63	435	-0.23	900	-30.77	317	-59.36	309	-62.73	469	-32.03	493	-43.40	1401	11.54	1191	6.34
2002-03	644	87.21	363	-16.55	1272	41.33	709	123.66	380	22.98	745	58.85	585	18.66	1260	-10.06	1062	-10.83
2003-04	616	-4.35	487	34.16	1527	20.05	764	7.76	694	82.63	813	9.13	733	25.30	1658	31.59	1150	8.29
2004-05	738	19.81	510	4.72	1650	8.06	719	-5.89	1464	110.95	836	2.83	876	19.51	1544	-6.88	1132	-1.57
2005-06	791	7.18	530	3.92	1279	-22.48	720	0.14	994	-32.10	667	-20.22	896	2.28	1581	2.40	1272	12.37
2006-07	722	-8.72	526	-0.75	1131	-11.57	700	-2.78	1508	51.71	937	40.48	812	-9.38	1535	-2.91	1359	6.84
2007-08	677	-6.23	709	34.79	1129	-0.18	973	39.00	1473	-2.32	754	-19.53	919	13.18	1746	13.75	1398	2.87
2008-09	683	0.89	701	-1.13	1322	17.09	928	-4.62	1908	29.53	852	13.00	1085	18.06	1541	-11.74	1335	-4.51
2009-10	618	-9.52	683	-2.57	1172	-11.35	779	-16.06	1961	2.78	951	11.62	883	-18.62	1271	-17.52	1502	12.51
2010-11	907	46.76	773	13.18	1355	15.61	986	26.57	1976	0.76	1223	28.60	1695	91.96	1536	20.85	1580	5.19
2011-12	892	-1.65	639	-17.34	1303	-3.84	869	-11.87	2400	21.46	1130	-7.60	1118	-34.04	1932	25.78	1845	16.77
2012-13	975	9.30	1281	100.47	1466	12.51	798	-8.17	1445	-39.79	1207	6.81	1809	61.81	1914	-0.93	1710	-7.32
2013-14	1104	13.23	2020	57.69	1734	18.28	784	-1.75	1620	12.11	1457	20.71	1250	-30.90	1142	-40.33	1797	5.09
2014-15	1037	-6.07	1455	-27.97	1279	-26.24	728	-7.14	3500	116.05	1661	14.00	1288	3.04	1074	-5.95	1692	-5.84
2015-16	1169	12.73	940	-35.40	1438	12.43	607	-16.62	700	-80.00	1539	-7.34	1188	-7.76	2115	96.93	2001	18.26
1997-98 to 2005-06	1.89		-4.06		6.83		-3.20		6.69		-4.93		5.70		4.76		1.08	
2006-07 to 2015-16	6.70		10.72		3.05		-2.48		1.43		8.00		4.52		0.32		4.12	
1997-98 to 2015-16	3.78		6.20		1.85		-0.27		7.05		3.53		5.53		1.73		3.50	

Source: Directorate of Economics & Statistics, DAC&FW

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Table -2.7
Trends in District wise Yield of Maize in Odisha State

District	(Kg/Ha)															
	Jajapur	%	Jharsuguda	%	Kalahandi	%	Kandhamal	%	Kendujhar	%	Khordha	%	Koraput	%	Malkangiri	%
1997-98	457		1000		768		1011		646		423		1104		1042	
1998-99	963	110.7 2	800	-20.00	753	-1.95	1251	23.74	623	-3.56	800	89.13	1094	-0.91	1024	-1.73
1999-00	663	-31.15	1600	100.00	1146	52.19	1413	12.95	1731	177.85	769	-3.88	883	-19.29	914	-10.74
2000-01	553	-16.59	825	-48.44	737	-35.69	1277	-9.62	778	-55.05	522	-32.12	1118	26.61	979	7.11
2001-02	790	42.86	1200	45.45	576	-21.85	430	-66.33	589	-24.29	950	81.99	888	-20.57	867	-11.44
2002-03	712	-9.87	4750	295.83	663	15.10	1173	172.79	641	8.83	660	-30.53	990	11.49	648	-25.26
2003-04	468	-34.27	800	-83.16	672	1.36	1249	6.48	823	28.39	500	-24.24	945	-4.55	912	40.74
2004-05	607	29.70	3133	291.63	775	15.33	910	-27.14	956	16.16	1285	157.00	1107	17.14	916	0.44
2005-06	947	56.01	1086	-65.34	656	-15.35	900	-1.10	670	-29.92	1071	-16.65	1091	-1.45	958	4.59
2006-07	542	-42.77	0	0	642	-2.13	788	-12.44	820	22.39	1555	45.19	1138	4.31	963	0.52
2007-08	704	29.89	1467	#DIV/0 !	755	17.60	983	24.75	850	3.66	957	-38.46	1351	18.72	1160	20.46
2008-09	1417	101.2 8	850	-42.06	856	13.38	1066	8.44	703	-17.29	1775	85.48	1251	-7.40	1140	-1.72
2009-10	1251	-11.71	917	7.88	888	3.74	843	-20.92	983	39.83	750	-57.75	1316	5.20	1031	-9.56
2010-11	1134	-9.35	1897	106.87	1276	43.69	1209	43.42	1577	60.43	2180	190.67	1690	28.42	1200	16.39
2011-12	874	-22.93	2500	31.79	1117	-12.46	1270	5.05	1293	-18.01	1857	-14.82	1781	5.38	1174	-2.17
2012-13	705	-19.34	2148	-14.08	1297	16.11	922	-27.40	1494	15.55	2748	47.98	1738	-2.41	1044	-11.07
2013-14	803	13.90	2171	1.07	1528	17.81	966	4.77	1791	19.88	2684	-2.33	2003	15.25	1240	18.77
2014-15	704	-12.33	3397	56.47	1211	-20.75	1016	5.18	1754	-2.07	1717	-36.03	2019	0.80	1195	-3.63
2015-16	941	33.66	3567	5.00	996	-17.75	1072	5.51	1658	-5.47	2806	63.42	2122	5.10	1195	0.00
1997-98 to 2005-06	1.61		9.54		-3.12		-2.96		-1.73		7.84		-0.03		-1.81	
2006-07 to 2015-16	-0.92		18.11		6.20		1.55		9.64		8.53		6.89		1.52	
1997-98 to 2015-16	2.19		4.60		3.43		-0.52		4.95		8.69		4.82		1.73	

Source: Directorate of Economics & Statistics, DAC&FW

Contd..

Table -2.7
Trends in District wise Yield of Maize in Odisha State

District	(Kg/Ha)															
	Mayurbhanj	%	Nabarangpur	%	Nayagarh	%	Nuapada	%	Rayagada	%	Sambalpur	%	Sonepur	%	Sundargarh	%
1997-98	679		1716		807		544		1039		589		0		857	
1998-99	574	-15.46	1818	5.94	766	-5.08	536	-1.47	998	-3.95	687	16.64	1000	#DIV/0	961	12.14
1999-00	1089	89.72	1573	-13.48	931	21.54	1656	208.96	1011	1.30	1508	119.51	829	-17.10	1780	85.22
2000-01	781	-28.28	1807	14.88	919	-1.29	468	-71.74	1089	7.72	716	-52.52	529	-36.19	935	-47.47
2001-02	584	-25.22	1052	-41.78	475	-48.31	463	-1.07	820	-24.70	646	-9.78	900	70.13	726	-22.35
2002-03	613	4.97	1067	1.43	780	64.21	296	-36.07	1028	25.37	914	41.49	427	-52.56	737	1.52
2003-04	840	37.03	2001	87.54	839	7.56	592	100.00	859	-16.44	720	-21.23	480	12.41	872	18.32
2004-05	831	-1.07	2340	16.94	946	12.75	467	-21.11	1025	19.32	827	14.86	843	75.63	910	4.36
2005-06	780	-6.14	2105	-10.04	1094	15.64	558	19.49	934	-8.88	778	-5.93	1075	27.52	1036	13.85
2006-07	759	-2.69	2283	8.46	933	-14.72	521	-6.63	923	-1.18	1080	38.82	736	-31.53	1067	2.99
2007-08	822	8.30	2548	11.61	1125	20.58	574	10.17	1040	12.68	901	-16.57	758	2.99	1270	19.03
2008-09	961	16.91	2555	0.27	1131	0.53	648	12.89	1171	12.60	1081	19.98	552	-27.18	1157	-8.90
2009-10	970	0.94	2750	7.63	1031	-8.84	542	-16.36	985	-15.88	960	-11.19	600	8.70	1163	0.52
2010-11	1473	51.86	3134	13.96	1568	52.09	1132	108.86	1112	12.89	1234	28.54	1463	143.83	1521	30.78
2011-12	1233	-16.29	2359	-24.73	1636	4.34	789	-30.30	1211	8.90	1133	-8.18	988	-32.47	1403	-7.76
2012-13	1826	48.09	2977	26.20	1306	-20.17	1067	35.23	1171	-3.30	1175	3.71	1835	85.73	1572	12.05
2013-14	1731	-5.20	3591	20.62	1561	19.53	1217	14.06	1363	16.40	1096	-6.72	982	-46.49	1858	18.19
2014-15	1558	-9.99	2569	-28.46	1758	12.62	1126	-7.48	1393	2.20	1172	6.93	750	-23.63	2032	9.36
2015-16	1678	7.70	2223	-13.47	1784	1.48	1284	14.03	1626	16.73	997	-14.93	8610	1048.00	2264	11.42
1997-98 to 2005-06	1.13		3.14		2.71		-6.59		-1.20		-0.41		7.47		-2.47	
2006-07 to 2015-16	9.13		1.05		6.63		10.08		5.26		0.99		26.73		8.20	
1997-98 to 2015-16	5.90		3.90		5.20		3.94		2.32		2.29		12.62		4.66	

Source: Directorate of Economics & Statistics, DAC&FW

CHAPTER – III

STATUS OF FOOD PROCESSING INDUSTRIES IN THE STATE

3.1 Back Ground:

Odisha is primarily an agrarian economy. The cropped area is about 87.46 lakh hectares out of which 18.79 lakh hectares are irrigated. The state's economy witnessed high growth rates between 2004-05 to 2015-16. With Gross State Domestic Product (GSDP) expanding at a Compound Annual Growth Rate (CAGR) of 10.25 percent. The State leads in iron, steel, ferroalloy and aluminium production and has a strong base for coal based power generation. The area under agriculture is comparatively more in the coastal districts of Odisha i.e. Cuttack, Balasore, Jaipur, Ganjam, Bhadrak, Jagitsingpur, Kendrapara, Nayagar, Puri, Kurdah and so on. The major crops cultivated in the state are pulses, rice maize, oilseeds, turmeric, raselle, sugarcane, and jute. Cash crops like cotton, rubber, coconut, tea and groundnut have a great economic value in other parts of Odisha. Odisha ranks fourth in jute production in India after West Bengal, Bihar and Assam. The jute mill at Dhanmandal in Jaipur district is the most important. Horticulture also contributes heavily to the agrarian economy of Odisha. It mainly produces Cashew, Mango, Banana and Tamarind etc. The primary industries in Odisha are manufacturing and the industrial sector GSDP was estimated at 36.56% and the service sector contributed 43.53% to the GSDP in 2015-16. There is tremendous scope for agro-based industries such as coconut-oil, edible oil milling, non-edible oil, cattle, poultry and dehydration vegetables, maize milling, rice milling, sugar milling, mushroom cultivation, potato chips and paper mills and so on. Cheap unskilled labour force is available in the districts as more than 80% of the total population of the state lives in rural areas. Skilled labour force also available in adequate number to work in the industries. The agriculture and allied sector have contributed about 17% to the Gross State Domestic Product (GSDP).

3.2. Agro-Based Industries:

The Agro-food processing industry in Odisha is at a beginning stage under unorganized private sector. In Odisha first agro-based industry is the sugar mill industry. Basically all sugar factories are raw material oriented and the oldest sugar factory in the state is at ASKA. At the end of the seventh plan three sugar factories were operational at ASKA. Bargarh and Rayagada. Another industry, which constitutes an important part in Odisha's economy, is the rice mills. The state has abundant rice mills in almost all its districts. The coastal districts of Balaswar, Sambalpur, and Cuttack have many rice mills, whereas the maximum number of rice mills are found in the district of Koraput. Textile industry is also one of the oldest industries of Odisha. Some of the cotton spinning mills operating in Odisha is at Khurda. Jarsuguda, Tora, Bargarh

and Govindpur. Handlooms of Odisha are one of the most exported commodities of the State. Excellent artistic and superior craftsmanship makes the handloom industry of Odisha widely popular. Tassar variety of silk is produced in huge quantity and the state of Odisha only ranks second after Bihar. In old Mayurbhanj, Koraput, Sambalpur and Sundargarh districts, Tassar variety of silk is manufactured.

Moreover fisheries have emerged as one of the most important components of the economy of the state. Prawn production is one of the most significant aspects of Odisha Pisciculture. The Odisha Shrimp Seed Production Centre (OSSPC) was started with the motive of research and development of shrimp culture. There is an excess demand for the fish produced in Odisha are exported to UK, Germany, Belgium, Netherlands, Spain, USA, China, Hongkong, Japan, Thailand and Singapur. The main fishing centres in Odisha are Puri, Jagasingpur, Balasore, Kendrapara, Bhadrak and Ganjam. Post harvest infrastructure is necessity to preserve the marine catches for domestic and export markets. Export of pomfret sea fish, ribbon fish, sole fish in frozen form is gradually rising. To increase the export of fisheries, preservation facilities at production centres are very important. Post harvest infrastructure like cold storages, chilled rooms, ice plants, processing plants etc. are available at only few areas which are mostly located at distant places.

There are several key players in Agro-based industry. The Nayagarh Sugar Complex Limited (NSCL) established in 2004 in the Nayagarh district of Odisha produces white crystal sugar molasses, fly ash etc., ASKA cooperative Sugar industries limited is one of the oldest sugar mills in Odisha located in Ganjam district. Sakti Sugars Limited with one cooperative factory in Cuttack and the other in the Dhenakal district is one of the largest white Crystal Sugar Producers in Odisha. There are many prominent fertilizer plants in the state. The Rourkela Fertilizer Plant (RFP) located in Rourkela which is a public sector undertaking producer as improved quality of Nitrogeneous Fertilizers. Another key player is the OSWAL chemicals and Fertilizers limited, who produces agro-based products and Nitrogenous fertilizers. Paradeep phosphates Limited (PPL) is Joint venture with the Government of India and the Republic of Nauru produces phosphoric fertilizers.

Orissa Agro industries corporation was originally incorporated on 20-12-1961 as “Odisha small scale industries Corporation Limited and it was renamed as “Odisha Agro Small Industries Corporation Limited” during 1968, subsequently the activities relating to agricultural aspect got separated from small industries activities and the corporation was again renamed as “Orissa Agro Industries Corporation Limited (OAIC).

A very important industrial body in the state is the Odisha Agro Industries Corporation Limited (OAIC) was incorporated as a government company with equity participation from the Central Government and the Government of Odisha in 1968. This corporation comes under the administrative control of Agricultural Department, Government of Odisha. It is engaged in carrying out different programmes like State agriculture, Forest and environment, fisheries, animal resource development and rural development. The main aim is to promote, establish execute and operate the schemes relating to industries based on agriculture, water resources, horticulture, sericulture, Fruits, flower, herbs and roots farming and grading, fishery, dairy, poultry and cattle breeding. Some of its activities are like providing farming equipment's to the farmers, to develop the irrigation facilities to non-irrigated agricultural lands, selling of improved agricultural implements, selling of storage bins, manufacturing and selling of bio-fertilizers, compound feed for cattle, poultry and duck. Till date the OAIC has sold out 8266 tractors, 3968 power tiller, 141722 P.P. equipments and 42402 storage bins have been sold to the farmers under centrally sponsored schemes as well as other programmes of the governments. In addition the corporation has also supplied agriculture implements worth about Rs. 2005.56 lakhs to the farmers.

Besides the Odisha Agro industries Corporation was incorporated with a view to bringing in a change in the agriculture status of the state by introducing mechanized cultivation and promoting Agro-industries prior to 1971-72. The agro wing of Agro and small industries corporation confined its activities to import and sale of tractors, tractor drawn implements and spare parts of imported tractors. Today the corporation has thirteen district level offices, thirty branch offices, two custom hiring units and three implement production units. Two cattle feed and poultry feed factories. This corporation is also rendering the most needed services to the farmers and is one of the most useful agencies of the state engaged in development of agriculture. Besides all the present activities of the corporation grouped into five categories 1. Supply of Agro inputs to the farmers in remote areas such as supply of fertilizers, pesticides, bio-fertilizers to the farmers. 2. Supply of all kinds of Agro machineries and implements like tractors, sprayers, duster, threshers etc. 3. Installation of Dug-wells and shallow tube-wells and execution of Small River lift irrigation projects, through providing bank loans, subsidies from DRDA. 4. Manufacturing and sale of cattle and poultry feed and supply the same to the farmers. 5. Promotion of food processing industry in the state and the corporation has been recognized as the Nodal agency of Government of Odisha for promotion of food processing industry in the state.

The state has a vast potential for agro and food processing industries. This sector has been identified as a prominent thrust area. Agro industries constitute an important and crucial

segment of the industrial sector. Promotion and growth of this sector has been a cardinal feature of government policy. This sector plays a crucial role in the process of economic development in general and industrial development in particular by means of value addition, creating employment, removing regional disparities and contribution to export. The government has framed an agricultural policy with the aim of increasing investment in agriculture, bringing about shift from subsistence to commercial agriculture and thus providing status of industry to agriculture.

During 1990 to 2001 the total number of small scale industrial units setup in the state is 30361 out of which 3104 are agro-based industries. This constitute about 10.22 percent of the total investment of the units Rs.1,11,192.90 lakhs, out of which the agro-based industries comprising Rs.12,858.64 lakhs which is 11.56 percent of the total investment. Similarly the employment position during the period for the state as a whole is 1,70,312 persons. Out of which Agro-based industries occupies 27,431 persons, which is 16.11 percent. The Agro-produce processing units covered the major share and having 1914 units, which is 61.11 percent of the total number of Agro-industrial units setup during the period. The Agro-Produce manufacturing units placed in the second position with 924 units which is 28.77% the total units. The Agro-inputs manufacturing units which have played the role of mechanization of agriculture and increasing the productivity covers 174 units with an investment of 1,607.75 lakhs and finally Agro-services centre is in significant. It has achieved meagre and this category has 92 units with an investment of 116.81 lakhs.

Many trading activities are also undertaken by OAIC. This corporation has a dealership of tractors, power tillers, tyres etc., It also hires out machinery like Bull dozers and other agricultural machinery to farmers as per their demand. The OAIC under takes dynamic activity under this scheme it install engines, pump sets on Dug-wells and shallow tube-wells.

This corporation has also taken steps for establishment of five projects on food processing in Odisha. All five projects have been established as joint venture companies. So it is clear that the corporation is engaged in manufacturing as well as non-manufacturing activities (trading) for the development of agriculture in the state. Some of the major brands are already present at the Kurdha Food Park and enjoying the environment of ease of doing business in the state. Some of them are Britannia Industries Ltd, Parle Agro and Anmol Biscuits etc.,

It has been observed that increasing labour force, lower capital formation, very small per capita availability of cultivable land, pre dominant presence of marginal and small farmers, credit problems, lack of extension services and lack of entrepreneurship among technically sound and skilled person, infrastructural bottle necks and overall lack of an industrial congenial

atmosphere with active support of promotional and marketing agencies and financial institutions are the main reason for industrial backwardness.

Odisha – Potential Agro and Food Processing clusters:

1. ANGUL – one of the major rice producing districts of Odisha. Government of Odisha is planning a mango Agro-Economic zone in this district.
2. Balasore and Bhadrak: Major marine fish producing districts. The state having 480 km of coastline and is the 4th largest in India in shrimp production 0.61 lakh MT, amongst the 6th largest fishing producing states 4,67 lakh MT.
3. Bargarh: Significant production of sugarcane, vegetables, grounds and paddy.
4. Dhenkanal: Significant production of Mangoes, maize, sunflowers, vegetables, cashews and mushrooms. The Government of Odisha planning to establish a Mango AE2 in this district.
5. Ganjam: Major producer of cashew, tamarind, paddy, groundnut, sugarcane, oilseeds, ragi, moong, biri, fish, meat, milk and vegetables.
6. Khurda and Puri: Emerging as a good processing hub. It possess as fish, cashew, eggs, poultry, milk and vegetables.
7. Kalhandi and Balangir: Major producer of turmeric, ginger, potato, maize, horticultural crops like mango, jack fruit and pineapple.
8. Koraput: Possess fruit producing clusters and is major producer of ginger and kewda.
9. Rayagada: Resource rich interms of cashew, tamarind, eggs, fruits and vegetables.
10. Sambalpur: Major producer of paddy and pulses, vegetables, chilli and fruit crops including mango, banana and litchi.
11. Nabarangpur: Major producer of maize, paddy, ragi, pulses cashew and wheat.

3.3 Present Status of Food Processing:

There is a vast untapped potential for food processing industry in Odisha. Government of Odisha plans to augment the growth of food processing from 0.7% to 10% by 2017 and 25% by 2025. The total agricultural crop production in Odisha has nearly doubled from 46.32 lakh million tonne in 2002-03 to 87.47 lakh million tonnes in 2009-10. Where as Food production has witnessed an upward trend in production since 2002-03 at 33.55 lakhs MT to reach 75.51 lakh MT in 2009-10. The state has recorded growth in the food grain production to 107 lakh MT with 25 lakh MT surplus during 2014-15 over 2016-17. To boost the food processing sector, the state government has initiated several measures to provide incentives, under industrial policy

resolution (IPR) 2009, agro-processing sector has been declared as the Thrust Sector". Due to the pro active measures taken by the government, 9476 micro, small and medium Enterprises (MSMES) have been setup under food and allied category in the state at an investment of Rs.321 crore. These units have been able to generate employment for 66,803 persons. The fourth largest producer of shrimp at 6 lakh tonnes and it is 6th largest producer of fish, besides the state is 3rd largest producer of cashew. Although Odisha is the country's leading producer of rice, maize, pulses, vegetables, oilseeds, cotton, groundnut, coconut, jute, spices, tomato fruits and milk. The total milk production stood at 19.39 lakh MT (2015-16).

Food processing industries have now grown to a significant level in the state as four mega food parks have already been implemented in the state. There are six large sugar mills in the state. The sugar mills are located at ASKA (Ganjam), Baragarh, Nayagarh, Baramb (Cuttack), Deogoan (Balangir) and Haripur (Dhenkanal). Under the marine sector there are 559 marine fishermen villages with a population of 173197 who depend on the marine resources for their livelihood. There are 64 fish landing centres which include 4 fishing harbours and 16 jetties. At present Odisha has 22 exporters who process the marine produce in 19 modern processing plants spread throughout the coastal districts of Odisha. Out of these 19 processing plants, 5 are European approved standard and few of them are highly international standard to meet the requirement of international market. Rice mill are an important agro-based industry in Odisha. However leading the state with the maximum number of rice mills is the district of Koraput. The other food processing industries are beverages, oil processing, agro-product industries etc.

Although the food-processing sector still remains largely untapped because of high packing costs, cultural preference for fresh food, seasonality of raw materials, lack of adequate infrastructural facilities and quality control mechanism. Odisha has an ample opportunity in food processing and service sector. As a result there is a need to diversify the sector by providing greater incentives as well as creating conducive environment for more investments and exports. According to government estimates as on 2013-14 Odisha has approximately 127284 enterprises engaged in the food and allied sector generating over 1.47 lakh employment opportunities with an investment of more than Rs.1557.86 crore. The capital city has attracted highest investment in the sector by receiving investment to the tune of Rs.163 crore followed by Bargarh with Rs.128.02 crores the districts of Cuttck, Ganjam and Kalhandi districts received an investment of Rs.150 crore, each in the sector (2013-14). The Odisha government considering the importance of food processing sector and the state government had notified a separate food processing policy in 2013. Itself providing incentives to units willing to setup food processing

investments in the state. To provide filup to the food processing industry, the policy provides of one time capital grant towards development of food parks. Plans to request major players to food processing industries to promote investment in this sector. They will be contracted for setting up manufacturing base in this state.

Moreover Odisha is emerging as a prominent player in the production of maize in India. It produces around 6.57 lakh MT of maize (2015-16) and majority of maize produced by high yielding variety seeds, which covers 90% of the total area under maize. Despite the rapid growth of production, the maize industry in Odisha is yet to witness its potential in terms of value addition currently as much as 80% of maize is shipped outside of Odisha, and maize has to be stored in warehouses located outside the state. Markets of maize are also under developed and underutilized. Currently, food and feed processors a major buyer of maize, exist mainly outside the state. Majority of produce is exported to processing units in states like processors in Chattisgarh, Andhra Pradesh, Madhya Pradesh, Gujarat, Karnataka and West Bengal. About 8% of maize grown in Odisha is processed with in the state. Very low quantity of maize is retained by farmers for own consumption and for seed purposes.

Besides concerned efforts will be made by the government for sitting up of industries based on Maize which is available in Nabarangapur district. Maize is the main crop of Nabarangpur, Gajapathi, Koraput, Rayagada and Ganjam districts and it is grown abundantly by the tribal farmers around 91.34% of maize production in the state (2015-16). As a measure of that direction Jharigan and Umerkote blocks of the district are major maize growing blocks of the districts. The state government is established two special mandis at a cost of Rs.150.00 lack each for maize at Umerkote and Raighar in the district for the benefits of tribals. Industrial policy resolution 2015, Government of Odisha declares food processing, as one of the priory sectors. Considering the immense potential of growth and employment in the food processing sector and in order to provide renewed impetus. The Government of Odisha is bringing out Odisha food processing policy 2016 with an objective to provide required infrastructural and institutional support and fiscal incentives to boost value addition in the sectors.

There are about 43 units in Odisha state, which are involved in primary processing on custom basis or in value addition segment. There are 4 corn flake units and only 5-6 oil producing units in the state. The feed producers in the state include large scale players such as Godavari Agro vet, Eastern Hatcheries, Pashupathi feeds, Amrit Feeds, etc. and only they annually process around 50000 MT of maize animal feed. There are no units producing industrial or consumer products like alcohol, starches, sweeteners, ethanol with in the state. The

state food processing sector provides a lot of opportunities to all three small, medium and large industries. The state processing sector has attracted investments worth Rs.3116 crore in the last year.

Odisha Food Processing Policy 2016:

The Odisha food processing policy 2016 aims to increase the glow of investments in the sector across the value chain from farm to market increase shelf life and reduce wastage of farm produce. The policy provides fiscal and non-fiscal incentives, infrastructure development, skill development, cluster approach for development of the sector. The policy also aims creation of infrastructure, such as warehouses, cold storage and primary processing centres etc. along with an enabling eco system MSME Department has been designated as the nodal agency for administration the policy. The state is giving various fiscal benefits like capital investment subsidy (CIS) of upto 5 crores and upto 1 crore for Human Resource Development.

Odisha is host to a large number of food processing companies and the sector is in its growth stage. An indicative of key companies and their district of presence in the state are:

- | | | |
|-----------------------------------|---|--|
| 1. Fruit and fruit based products | : | PARLE, AGRO, Khorda, Hindustan Coca Cola Beverage Ltd., Bhubaneswar
Nayak Foods, Agro-Tech Pvt Ltd, Bhadrak |
| 2. Ready to eat Products | : | Britannia Industries Ltd. Khorda
India Nissan Foods Pvt., Ltd, Khorda
Om Oil & Flour Mills Ltd., Cuttack |
| 3. Oil and Oil Seed Processing | : | Balagopal Food Products Pvt. Ltd. Argarh
SNM Business Pvt. Ltd, Balasore |
| 4. Sea Food & Sea Food Processing | : | Magnum Sea Foods Ltd., Kurda
Blue Wren Sea Foods Ltd., Bhubaneswar
Falcon Marine Exports Ltd., Bhubaneswar |

The state having 86 industrial areas and Agro expert zone, 126 cold storage and fish units and two mega parks, one sea food park and one rice technology park. So the number of industrial areas and food parks are available in the state for investors to setting up food processing units in the state. The key food parks in the state are 1) MITS Mega food Park (Rayagada), 2) Mega Food Park (IDCO), Khurda, and 3) Sea Food Park (Deras). The Industrial Park was established that Rice Technology Park at Bhadrak and medium size food parks at Ganjam, Kalhandi, Dhankanal, Balasore and Baragarh. The state government has plans for developing centres of excellence for Agro-marine products. We could emerge as one amongst the key states in the food processing sector contributing significantly to the country's exports of

agricultural and processed food exports. A dedicated policy of food processing sector providing a wide range of incentives such as capital grant for Mega Food Parks interest subsidies and power subsidy etc., The government of India provides a financial assistance of Rs. 50.00 crores to the Mega Food Park to develop industrial plots for lack of food processing units, Rice Processing Complex, Dry ware House, Cold storage, multi fruit processing facility and other food processing facilities etc., The food park will benefit the farmers, growers, processors and consumers of Odisha and also provide employment.

At present, the state government is in the process of setting up sea food park at Dera. The sea food park currently being developed by the Odisha Industrial Infrastructure Development Corporation is at a cost of Rs.134 crores for food processing industry.

3.4 Government Interventions/Assistance:

The state government has framed several policies with an aim to attract new investments in different sectors of the state. The government of Odisha gives utmost priority to agro based and food processing industries. The state has many investment opportunities in the sectors like fishing and fish processing, setting up of infrastructures like cold storages, ice plants, lift irrigation, storage godowns and so on. Further investment should be made in setting up of agro-based industries to add value to the agriculture produce like maize in Odisha.

Micro, Small and Medium Enterprises Department (MSMED) policy 2009, state agriculture policy 2013 and the Government of Odisha has brought out a new policy of Food Processing policy 2013. Which provides for a host of fiscal incentives like 25% capital investment subsidy. Entry Tax exemption for MSMEs on raw materials and plant M/C Electricity duty exemption, Reimbursement on quality certification, VAT reimbursement for units set up in Mega Food Parks etc., Further Incentives are also being disseminated under Industry Policy Resolution, 2017, so that the entrepreneur of the state can avail maximum benefits

The National Mission on Food Processing (NMFP) scheme has boosted the food processing sector on all fronts. However, the GOI has discontinued it on 1-4-2015. During the period 2012-13 to 2014-15, 34 Food Processing industries were assisted under NMFP with Rs.1,197.33 lakh, two refer vehicles were assisted with Rs. 41.14 lakhs. One infrastructure project for conducting diploma course as food processing technology was assisted with Rs.50.00 lakh. More than 250 Awareness Programmes were organized across the state. However, the food processing in Odisha is yet to exploit full potential of all agro-horticultural produce. Odisha has the potential to attract investment in the coming years and generate employment to the rural people. The food-processing sector has a potential to grow at a Compound Annual

Growth Rate (CAGR) of 11%. Incentives are also being disseminated under industrial policy resolution 2017.

The State Government plans to formulate Odisha Agri business food processing policy. The government has started that the proposed policy 2025, will help to promote the sector in the state. The financial benefits proposed in the draft vision document 1) Abolition of entry tax 2) Lowering per unit power cost on supplies to agribusiness and good processing establishments like cold storages, processing units by amending state electricity regulations etc. This document envision a well-developed agri- business infrastructure with market linkages to reduce the high level of wastages, maximum value addition double the farmers income, interest subsidy and power subsidy. So food processing sector has been considered one of the priority areas of investment.

3.5 Challenges and Outlook:

Odisha is the country's leading producer of rice, maize, pulses, vegetables, oilseeds, cotton, groundnut, coconut, jute, spices, potato and fruits. The agro and food processing industry is at a nascent stage under the unorganized private sector. Besides, the food- processing sector still remains largely untapped because of the major challenges hampering the growth of processing sector in the state.

1. Lack of adequate infrastructure
2. Seasonality of raw materials production
3. Small farm holdings and limited resource availability with farmers
4. Exploitation of middlemen in market chain
5. Inadequate marketing and storage facilities
6. In efficient supply chain due to large number of intermediaries
7. Uncertainty about market stability and non-remunerative prices for farmers
8. Insurance schemes for farmers while natural disasters.
9. Lack of government procurement facilities in the market
10. Lack of credit access to food processing industries and farmers
11. Frequent occurrences of natural calamities

There is a need to diversity the sector by fully harnessing its potentialities providing greater incentives as well as creating conducive environment for more investments and exports in favour of Agro based industries in Odisha state.

1. The State Government needs to setting up an autonomous organization on promotion of food processing industries and dedicated food processing cell in Directorate of Industries and District Industrial Centres.
2. The Government should bring about regulatory markets, government support in the form of MSP, procurement by the government and extend access to institutional credit support.
3. Establish maize-dryer, primary processing centre for maize at Mandis by Government.
4. Efficient marketing such as producer companies, value chain, Agro processing and Agri-business are important for marginal and small farmers.
5. The government can promote the post-harvest and market infrastructure. It cover aspects of primary processing of maize including weighing, cleaning, grading, sorting and drying and packaging etc,.
6. Price support of the agriculture produce would also play a crucial role in ensuring remunerative income to the farmers.
7. Strengthened the Research and Development facilities.

Summary:

During 1990-2001 the small scale industries in the state is 30361 out of which 3104 (10.22%) are agro-based industries. The total investment of the units found to be 1,11,192.90 lakhs and the agro based industries comprising Rs.12,858.64 (11.56%) lakhs. Agro services centre is in significant and has 92 units wit an investment of 116.81 lakhs. Some of the major brands are already present at the Khurda Food Park (Britania Industries Ltd., Parle Agro and Amul Biscuits etc,.

The study found that the state has recorded growth in the food production 107 lakh MT with 25 lakh MT as surplus during 2014-15. So the state government had taken pro active measures to setup 9746 micro, small and medium (MSMES) industries with as investment of Rs.321 crores. There was 64 fish land centres with include 4 fishing harbours and 6 jetties. The state has 22 exporters who process the marine produce, as 19 modern processing plants and 5 are European approved standard. The other food processing industries are beverages, Oil processing, Agro produce industries etc., As on 2013-14 the government of Odisha having approximately 127284 enterprises engaged in the food and allied sectors generating over 1.47 lakh employed with an investment of more than 1557.86 crores.

Further the state of Odisha is a prominent producer of Maize, produced 6.57 lakh MT (2015-16), The markets of maize are under developed and under-utilized. Majority of produce

(80%) is exported to processing units, which are in the states of Chattisgarh, Madhya Pradesh, Gujarat, Karnataka and West Bengal. Nabarangpur is the major maize grown district in the state. The government established two special mandis at a cost of 150.00 lakh each for maize at Umarkote and Raigarh. The Odisha Food Processing Policy 2016, bringing out with the objective to provide infrastructural and industrial support and fiscal incentives to boost the value addition in the sector. There are about 43 feed processors in the state. Godavari agro.vet, Eastern Hatcheries, Pasupati feeds, Amrit feeds are the major units and they annually process around 50000 MT of maize for animal feed. 34 processing industries were assisted under National Mission of Food Processing (NMFP) with 1197.33 lakhs.

Although the food processing industry still remains largely un tapped due to major challenges prevent the growth of processing sector in the state are:

1. Lack of adequate infrastructure infrastructure
2. Lack of credit access to food processing industries and farmers
3. In adequate marketing and storage facilities.
4. In efficient supply chain due to large number of intermediaries
5. Lack of government procurement facilities in the market
6. Small farm holdings and limited resource availability with farmers
7. Exploitation of middlemen in market chain
8. Recurrence of natural calamities

Therefore the government should create good environment for more investments in favour of Agro-based industries in the state 1)Establish an autonomous organization on promotion of food processing industries. 2)To bring about regulatory markets. 3) Procurement agency by the government 4) Access to institutional credit support. 5) Efficient marketing support like producer companies, value chain Agro-processing and Agri-business etc.

Finally identified the discussions of stakeholders and wholesale traders have expressed about marketing problems under maize crop. 1) lack of storage capacity in the market 2) lack of infrastructure in the market. 3) poor road connectivity with villages. 4) The harvest places are hill track and forest areas. 5) Lack of government procurement agencies. 6) Lack of banking facilities in the market yard. 7) Lack of market information.

CHAPTER – IV

SOCIO-ECONOMIC CHARACTERISTICS OF SAMPLE AREA AND THE HOUSEHOLDS

The fourth chapter divided into eight sections. The first section discusses general characteristics of sample farmers. The second section describes the socio-economic characteristics of sample households, educational status and caste composition. The third section explains the details of operational land holding of the sample farmers include farmers size group like marginal, small, medium and large farmer groups. The fourth section analyses the cropping pattern of the sample farmers of both irrigated and un irrigated area of major crops. The fifth section explains the sources of irrigation of different farm groups. The sixth section explains season wise usage of inputs and profitability of maize. The seventh section discussed season wise variety of seeds used by the sample farmers for maize crop and the eighth section explained the borrowings details of sample farmers and purpose of borrowings of sample households in selected districts of Odisha state.

SECTION – I

General Characteristics of Sample Households:

Table 4.1 reported the general characteristics of sample households under maize crop. Overall the average age of respondents was 42.87 years. Across the farm size groups the respondent average age was found to be highest 45.02 years from marginal farmer group followed by 42.33, 42.03 and 41.81 years from large, medium and small respondents. Out of 200 sample households 98 percent of farmers reported from male respondents and 2 percent from female respondents of the total sample. Among farm size groups found that 100 percent male farmers responded from small farmer group followed by 98.33% marginal, 97.44% and 90.48% are from medium and large farmer groups. On the whole the average family size of households reported to be 5.02 members and it varied among the farm size groups. The average household size under medium farmer reported highest 5.26 members, 2.56 members engaged fully under farming followed by 2.45, 2.43 and 2.41 members from marginal, large and small farmer groups. In the case of farming, experience of all sample farmers reported between 20 to 26 years respectively.

Table 4.1
General characteristics of sample farmers

Sl. No	Particulars	Marginal	Small	Medium	Large	Overall
1	Average age of respondents (Years)	45.02	41.81	42.03	42.33	42.87
2	Male respondents (% to the total)	98.33	100.00	97.44	90.48	98.00
3	Average family members engaged fully in farming (No.)	2.45	2.41	2.56	2.43	2.46
4	Average years of farming experience (Years)	26.37	23.49	22.97	20.43	23.93
5	Average family size (No.)	4.98	4.89	5.26	5.19	5.02

Source: Primary Survey

SECTION – II

Socio-Economic Characteristics of the Sample Households:

The efficiency and success of any farming household is influenced to a significant degree by the socio-Economic back ground and demographic features of the households. Education level of the farmer made to know the farm ability, production techniques, land use pattern, cropping pattern and government policies. The 200 sample households have been grouped as per their size of operational holding groups. Marginal farm households had operational holding upto 2.5 acres, small farmer had from 2.5 to 5 acres, medium farm households from 5 to 10 acres and large farmer households had their operational holding above 10 acres.

A sample of 200 households were taken from two districts i.e. Nabarangpur and Gajapati of Odisha state, for conducting field survey. The educational profile of sample households has been discussed in Table 4.2. Regarding educational status, illiterates constituted to be highest 33 percent of total sample farmers followed by higher primary 31.50 and secondary 23.00 percent respectively. Across the farm size groups illiterates constituted to be 50 percent from marginal farmer and least 20.51 percent from medium farmers. On the other hand out of 200 sample farmers above 31.50 percent found to be higher primary. Medium and large farmers constituted to be 33.33 percent each and 31.25 and 30.00 percent reported from small and marginal farmers' group. On the whole 3 percent of farmers are graduates and the farmer size groups, medium farmers found that the highest 7.69 percent graduates followed by 4.76, 1.67 and 1.25 percent from large, marginal and small farmer no sample farmer was reported to study the post-graduation from the sample districts of Odisha state. Therefore, the education levels of 200 sample households under maize crop constituted above 97 percent are under graduates and 3 percent from graduates.

Table 4.2
Education level of sample farmers (% of farmers)

Sl. No	Education level	Marginal	Small	Medium	Large	Overall
1	Illiterates	50.00	28.75	20.51	23.81	33.00
2	Primary (1 to 4)	5.00	15.00	7.69	4.76	9.50
3	Higher primary (5 to 9)	30.00	31.25	33.33	33.33	31.50
4	Secondary (10)	13.33	23.75	30.77	33.33	23.00
5	Graduation	1.67	1.25	7.69	4.76	3.00
6	Post-Graduation	0.00	0.00	0.00	0.00	0.00
7	Others	0.00	0.00	0.00	0.00	0.00
	Total	100.00	100.00	100.00	100.00	100.00

Source: Primary Survey

Table 4.3
Distribution of sample farmers based on their social category
(% of farmers)

Sl. No	Particulars	Marginal	Small	Medium	Large	Overall
1	General	11.67	6.25	10.26	42.86	12.50
2	OBC	18.33	15.00	7.69	9.52	14.00
3	SC	45.00	65.00	56.41	23.81	53.00
4	ST	25.00	13.75	25.64	23.81	20.50
	Total	100.00	100.00	100.00	100.00	100.00

Source: Primary Survey

Table 4.3 presented the social category of sample farmers. The study covered all caste composition of households, such as general, OBC, SC and ST. Out of 200 sample households 12.5 percent of households covered from general category followed by 14%, 53% and 20.50% covered from OBC, Scheduled Caste and Scheduled Tribe categories of households. On the whole, the highest 53% of sample farmers belonged to SC category. According to availability of households from the sample villages of Nabarangpur and Gajapathi districts. Among the farmers groups SC category indicated the largest number from marginal (45%), small (65%) and medium farmer groups (56%) whereas in the large farmers highest percentage of sample found to be 42.86% from general category and the second place reported 23.81% of farmers belonged to Scheduled Caste category.

Table 4.4
Occupational distribution of the sample farmers

(% farmers)

Sl. No	Particulars	Main					Subsidiary				
		Marginal	Small	Medium	Large	Overall	Marginal	Small	Medium	Large	Overall
1	Agriculture & allied	59 (98.33)	78 (97.50)	37 (94.87)	19 (90.48)	193 (96.50)	1 (1.67)	2 (2.50)	2 (5.13)	2 (9.52)	7 (3.50)
2	Agricultural labour	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	9 (4.50)	7 (11.67)	13 (16.25)	1 (2.56)	0 (0.00)	21 (10.50)
3	Self-employed in small scale industries	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
4	Self-employed in services	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (3.33)	1 (1.25)	1 (2.56)	1 (4.76)	5 (2.50)
5	Non-agricultural casual labour	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (1.25)	0 (0.00)	0 (0.00)	1 (0.50)
6	Salaried work	0 (0.00)	1 (1.25)	2 (5.13)	0 (0.00)	3 (1.50)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
7	Household	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
8	Pensioner	1 (1.67)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.50)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
9	Other (business)	0 (0.00)	1 (1.25)	0 (0.00)	2 (9.52)	3 (1.50)	0 (0.00)	1 (1.25)	1 (2.56)	0 (0.00)	2 (1.00)
	Total	60 (100.0)	80 (100.0)	39 (100.0)	21 (100.0)	200 (100.0)	10 (16.67)	18 (22.50)	5 (12.82)	3 (14.29)	36 (18.00)

Source: Primary Survey

The sample 200 maize crop households were selected from the districts of Nabarangpur and Gajapathi of Odisha state. Table 4.4 discussed the occupational distribution of sample households. The sample households occupation divided into two parts one is main occupation and the second subsidiary occupation. The occupational distribution classified into nine sub categories. Out of 200 sample households under maize crop 193 farmers expressed agriculture and allied activity is the main occupation, and the remaining 7 households reported the subsidiary activity is the main and 3 households each from salaries work and business and one household belonged to pensioner. Among farmer groups the highest number (78) farmers reported from small farmers having agriculture and allied activity is the main occupation followed by marginal, medium and large farmer groups constituted to be 59,37 and 19 farmer households. Moreover, 36 households were engaged in subsidiary activities along with agriculture and allied activities. 21 sample households were working as the agriculture labour followed by self-employed (5), business (2), non-agriculture casual labour (1) of the total sample farmers.

Therefore occupational distribution of 200 sample households, highest 96.50 percentage of households working under farming and also it is the main occupation and all farm size groups indicated the same trend. Moreover 36 households were also reported subsidiary activities and (21) households expressed agriculture labour is the subsidiary activity.

SECTION – III

Details of operational land holdings:

Majority of the farmers are marginal and small farmers and most of the farmers are cultivating over the encroached forest land. Maize is cultivated in uplands in the last one decade. The cropping area of maize has gradually been increasing whereas crops like millets, rice and vegetables are in diminishing trend. As told by the respondents, they are getting huge amount of money from maize crop, which is the main reason for adopting of maize cultivation of the sample districts of Nabarangpur and Gajapathi of Odisha state.

Table 4.5 shows that the average operational land holdings of the sample farmers. It is observed from the table that the average per household own land was 4.12 Acres. Among the farm size groups: marginal farmer average operational own land found to be 1.89 acres followed by 3.48, 5.72 and 9.91 acres of small, medium and large farmers. On the whole per household average leased-in land was 1.96 acres and the farm size groups, the marginal farmer has not reported the leased-in-land but the small farmer average leased in land reported to be 0.46 acres followed by 1.72 acres and 11.76 acres from medium and large farmer group. There was absence of the un-cultivated and leased out land expressed by all groups of sample farmers. Therefore the average Net Operated Area found to be 1.89, 3.94, 7.44 and 21.67 acres reported from marginal, small, medium and large group farmers. Further the table revealed on irrigated and un-irrigated operational land area of sample households. The irrigated and un-irrigated average operational land per household found to be 14.8 and 85.2 acres. Among the farm size groups average per household irrigated crop area of marginal farmer was 4.76 percent followed by 8.88, 19.76 and 18.4 percent in small, medium and large farmer. On the other hand per household the share of un-irrigated operational land holding was 85.2 percent and the highest area reported to be 95.24 percent from marginal farmer and 91.12%, 80.24% and 81.96 percent of small, medium and large farmer. Moreover per acre rental value of irrigated leased-in land found to be Rs.6000 and Rs.3500 rent per acre of un-irrigated lands of sample farmers. Therefore, in adequate irrigation facilities are the main reason expressed by most of the sample farmers and depends on rainfall.

Table 4.5
Average operational land holdings of the sample framers

(in acres)

Sl. No.	Particulars	Marginal	Small	Medium	Large	Overall
1	Owned land	1.89	3.48	5.72	9.91	4.12
2	Uncultivated/Fallow	0	0	0	0	0
3	Leased-in	0	0.46	1.72	11.76	1.76
4	Leased-out	0	0	0	0	0
5	Net Operational Area(1-2+3-4)	1.89	3.94	7.44	21.67	5.88
6	% Irrigated	4.76	8.88	19.76	18.04	14.8
7	% Un-Irrigated	95.24	91.12	80.24	81.96	85.2
	Total	100	100	100	100	100
8	Rental Value of leased-in Irrigated land (Rs/acre)	-	-	-	-	6000
9	Rental Value of leased-out Irrigated land (Rs/acre)	-	-	-	-	-
10	Rental Value of leased-in Un-Irrigated land (Rs/acre)	-	-	-	-	3500
11	Rental Value of leased-out Un-Irrigated land (Rs/acre)	-	-	-	-	-

Source: Primary Survey

SECTION –IV

Cropping Pattern:

Cropping pattern means area under cultivation of major crops. Crop wise total area and its percentages were estimated against the total Gross Cropped Area (GCA). The farmer size groups have been presented (both irrigated and un-irrigated) in table 4.7. It is evident from the table that the total area under field crops like maize and paddy reported to be highest percentage of area grown against total cropped area of sample farmers. Out of the total cropped area of 1286.27 acres, 78.24 percent area grown under maize crop and the remaining area is covered by paddy, ragi, blackgram, vegetables and mirchi of sample farmers. Across the farmer groups marginal and small farmers reported 78.72 percent area grown under maize crop followed by other crops paddy, ragi, blackgram, vegetables and mirchi accounting for 16.16, 0.11, 4.59, 0.43 percent of area respectively. In the case of medium farmers also reported highest area 73.87 percent under maize crop and the remaining crops reported 24.08, 0.31, 1.73 percent of area grown under paddy, ragi and vegetable crops. The large farmers out of 499.50 acres of total cropped area reported the highest percentage area grown under maize crop (80.58 percent) followed by paddy 17.82 percent, vegetables 0.60 percent and mirchi 1.00 percent respectively.

Table 4.6
Cropping pattern of Sample Farmers during 2016-17
 (Area in acres & % in parenthesis)

Sl. No	Crops	Irrigated			Un-Irrigated			Total		
		Marginal & Small	Medium	Large	Marginal & Small	Medium	Large	Marginal & Small	Medium	Large
1	Maize	34.50 (66.35)	64.82 (79.22)	92.50 (78.72)	334.30 (80.26)	170.30 (72.02)	310 (81.15)	368.80 (78.72)	235.12 (73.87)	402.50 (80.58)
2	Paddy	16.00 (30.77)	17.00 (20.78)	25.00 (21.28)	59.70 (14.33)	59.65 (25.23)	64 (16.75)	75.70 (16.16)	76.55 (24.08)	89.00 (17.82)
3	Ragi	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.50 (0.12)	0.00 (0.00)	0.00 (0.00)	0.50 (0.11)	0.00 (0.00)	0.00 (0.00)
4	Black gram	1.50 (2.88)	0.00 (0.00)	0.00 (0.00)	20.00 (4.80)	1.00 (0.42)	0.00 (0.00)	21.50 (4.59)	1.00 (0.31)	0.00 (0.00)
5	Veg	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	2.00 (0.48)	5.50 (2.33)	3.00 (0.79)	2.00 (0.43)	5.50 (1.73)	3.00 (0.60)
6	Mirchi	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	5.00 (1.31)	0.00 (0.00)	0.00 (0.00)	5.00 (1.00)
	Total (%)	52.00 (100.00)	81.82 (100.0)	117.50 (100.0)	236.45 (100.00)	236.45 (100.00)	382.00 (100.0)	468.50 (100.00)	318.27 (100.0)	499.50 (100.0)

Source: Primary Survey

* () brackets in figures indicated the % of sample farmers

Further the table 4.7 indicated separately both irrigated and un-irrigated area of major field crops. The share of irrigated area reported to be meagre to total area of the sample farmers. In the case of irrigated area under marginal and small farmers was only 52 acres remaining 236.45 acres are un-irrigated. The share of field crops irrigated area reported to be the highest share 66.35 per cent area grown under maize, 30.77 and 2.88 percent reported from paddy and blackgram crops. Whereas medium farmers total irrigated area was 81.82 acres and major share obtained 79.22 percent area grown under maize crop and paddy 20.78 percent area and the large farmers reported the irrigated area was 117.50 acres and 78.72 percent under maize crop and paddy area found to be 21.28 percent respectively. Therefore the maize produce has given higher returns than other crops in the sample districts of the state.

In the case of total un-irrigated cropped area reported to be 416.50 acres by marginal and small farmers and the highest share 80.26 percent cultivated under maize crop followed by 14.33, 0.12, 4.80 and 0.48 percent area cultivated under paddy, ragi, blackgram and vegetable crops. On the other hand large farmers total un-irrigated area was 382.00 acres and the largest share indicated under maize crop 81.15 percent followed by 16.75, 0.79 and 1.31 percent area reported from paddy, vegetables and mirchi crops respectively.

Overall out of 1286.27 acres of total cropped area 78.24 percent grown under maize crop and irrigated area was reported to be 19.0 percent of total area therefore, maize crop grown in un-irrigated area due to inadequate irrigation facilities of the sample districts. (hill- track and forest area).

SECTION – V

Sources of Irrigation:

Adequate irrigation potentiality is one of the important parameters for intensive use of available land resources. Table 4.6 indicates the percentage of irrigated area under different irrigated sources of sample farmers, such as open well, bore well, canal, tank and others. There are only two different irrigated sources, such as bore well and canal. The table 4.6 reported that out of 200 sample farmers only 27 sample farmers (13.50%) having irrigated area under bore well and canal. Across the farm size groups only 5 percent of marginal farmers having irrigation. Out of which 3.33 percent and 1.67 percent of farmers having bore well and canal irrigation. Where as in the small farmers group about 10 per cent of sample farmers found to be irrigated area, of which 3.75 and 6.25 per cent of sample farmers crop area grown under bore well and canal irrigation. Out of 39 medium farm category sample farmers found to be only 28.21 per cent of farmers having irrigation facilities, 10.26 and 17.95 percent of farmers having bore well and canal irrigation. In the case of large sample farmers 23.81 percent of farmers having irrigated by canals, 9.52 and 14.29 percentage of farmers having bore well. Therefore bore well and canal provided main source of irrigation of sample farmers.

Table 4.7
Sources of irrigation of the sample farmers

		(% of farmers)				
Sl.No	Particulars	Marginal N-60	Small N-80	Medium N-39	Large N-21	Overall N-200
1	Open/ Dug well	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
2	Bore well	2 (3.33)	3 (3.75)	4 (10.26)	2 (9.52)	11 (5.50)
3	Canal	1 (1.67)	5 (6.25)	7 (17.95)	3 (14.29)	16 (8.00)
4	Tank	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
5	Others	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	Total	3 (5.00)	8 (10.00)	11 (28.21)	5 (23.81)	27 (13.50)

Source: Primary Survey

SECTION – VI

Season-wise Usage of Inputs and Probability of Maize:

The cost of maize cultivation is very high as the cultivators are using inputs mainly such as hybrid varieties of seeds and chemical fertilizers. Information regarding maize crop input costs and returns per household for different land holding groups of sample farmers has been presented in Table 4.8. The table shows that overall average per household and per acre input costs value or total paid out costs to be Rs.13046. On the other hand, average per household and per acre gross returns was Rs.20420 and the net returns Rs.7374 in Kharif season.

Table 4.8
Input use, output and returns per acre realized by Sample farmers for Maize during Kharif Season

Sl. No	Particular	Marginal	Small	Medium	Large	Overall
	Input use and their costs					
1	Ploughing and sowing charges (only machinery)	1500	1700	1850	1800	1680
2	Seed cost/ purchase of seedlings	2100	2250	2100	2400	2192
3	Organic/FYM	100	200	280	200	186
4	Chemical fertilizers	1650	1800	1980	2600	1874
5	Plant protection chemicals	86	105	155	215	121
6	Irrigation charges	55	75	100	150	82
7	Harvesting & threshing charges	2100	2150	2125	2200	2135
8	Hired labour charges (including ploughing charges till planting, cost or sowing/ transplanting)	1000	690	1200	1320	949
9	Imputed value of family labour	2400	1650	1450	1020	1770
10	Hired labor (amount paid)	1200	1900	2100	2250	1766
11	Maintenance costs on assets used for the reference crop	0	250	540	840	294
	Total paid-out costs including imputed value of own labor	12191	12770	13880	14995	13046
	Returns					
1	Output (Main product)	19705	18552	19873	22741	20420
2	By product	0	0	0	0	0
3	Gross returns	19705	18552	19873	22741	20420
4	Net returns	7514	5782	5993	7746	7374
5	CB Ratio	1:0.62	1:0.45	1:0.43	1:0.52	1:0.57

Source: Primary Survey

Among input costs, per acre like seed cost reported to be highest Rs.2192 followed by harvesting & threshing charges (Rs.2135) and chemical fertilizers (Rs.1834). Therefore the average household total cost per acre found to be Rs. 13046. Across the land holding groups per household total paid out costs positively related according to farm size increases. The estimations were made in the Table 4.8 average household per acre total cost reported from marginal to large farmer group was Rs.12,191 to 14,995. Further net returns per household per acre reported the lowest in small farmers Rs.5782 and highest Rs.7746 of large farmer group.

Thus on the whole average household per acre total paid out costs reported to be highest under large farmer followed by medium marginal and small farmer due to paid out costs of chemical fertilizers. Seed costs, harvesting, threshing and hired labour charges. Where as the product value per acre reported to be highest Rs.22,741 from large farmer and lowest Rs.18552 from small farmer. Therefore, average household per acre highest net returns received from the large and marginal farmer group under maize kharif season.

Table 4.9

Input use, output and returns per acre realized by Sample farmers for Maize during Rabi Season

Sl. No	Particular	Marginal	Small	Medium	Large	Overall
	Input use and their costs					
1	Ploughing and sowing charges (only machinery)	1868	1803	1765	2056	1903
2	Seed cost/ purchase of seedlings	2463	1876	1917	2313	2139
3	Organic/FYM	533	333	394	264	347
4	Chemical fertilizers	2106	2721	2693	2920	2610
5	Plant protection chemicals	112	171	243	849	460
6	Irrigation charges	0	200	245	388	208
7	Harvesting & threshing charges	2261	2136	1772	2054	2317
8	Hired labour charges (including ploughing charges till planting, cost or sowing/ transplanting)	1038	1292	1374	1386	1472
9	Imputed value of family labour	2771	1569	1158	1096	1649
10	Hired labor (amount paid)	1090	1581	1896	2100	1667
11	Maintenance costs on assets used for the reference crop	0	360	700	900	1023
	Total paid-out costs including imputed value of own labor	14242	14042	14157	16325	15794
	Returns					
1	Output (Main product)	22050	23420	24050	27985	24376
2	By product	0	0	0	0	0
3	Gross returns	22050	23420	24050	27985	24326
4	Net returns	7808	9378	9893	11660	8532
5	CB Ratio	1:0.55	1:0.67	1:0.70	1:0.71	1:0.54

Source: Primary Survey

During the Rabi season the average per household and per acre input costs, gross and Net returns of sample farmers under maize crop presented in Table 4.9. The farmer paid-out costs like charges of ploughing and sowing, seed, fertilizer and chemicals, irrigation charges, harvesting and threshing, hired labour, Family labour costs and the gross returns net returns were also estimated in overall and different farmer groups. Average sample farmer per acre total cost found to be Rs.15,794. The highest cost spent on fertilizers and chemicals (Rs.2610) followed by the costs incurred harvesting and threshing charges (Rs.2317), seed cost (2139), ploughing and sowing charges (Rs.1903) and the hired labour wages (Rs.1667). Therefore, total input cost found to be Rs.15794 and the output value found to be Rs.24376. There was no by product value. So per household per acre Gross returns (Rs.24,376). On the whole average per household and per acre net returns value found to be Rs.8532. Among the size groups per household and per acre total paid out costs under maize crop reported to be highest Rs16,325 from larger farmer group while the highest costs paid on chemical and fertilisers, ploughing and

sowing and hired labour charges against the other farmer groups of marginal, small and medium groups under maize crop in Rabi season. Whereas the output value and Net Returns reported highest Rs.27985 and Rs.11660 under large farmer group. The farm size increases the output value also increased from marginal to large farmer group. The Gross returns and net returns also increased as land size increased among the farm size groups.

To meet the paid out costs more than 95% of marginal and small farmers are completely dependent on money lenders for investment on Maize cultivation. Among the farm size groups the land size increases the total costs are also increased. On the other hand gross returns and net returns are also reported highest under large farmers group due to these farmers sale at high price of his produce against marginal and small farmers. The marginal and small farmers sale their maize produce at farm gate at low price to the village traders. The large farmers are sale their produce to the wholesalers directly at high price.

SECTION – VII

Season wise variety of seeds used:

Seed plays a pivotal role in increasing production and productivity. Steps are being taken to supply good quantity of seeds to the farmers at the door step through LAMPCS/PACS/Approved private dealer of the district. The sale of seeds will be made through DBT. Maize is the kharif crop, most of the farmers' cultivated High Yielding Variety (HYV) seeds and very few farmers cultivated with the use of local maize seeds.

Table 4.10

Season wise variety of seeds used by Sample Farmers for Maize crop during 2016-17

Season	Varieties	Rate of Application (In kg/Acre)	Yield Rate (Qtl./Acre)
Kharif, 2016			
i	Hy Shell	7.0	23.0
ii	Kaveri	7.5	21.0
iii	Pioneer	7.6	20.9
iv	DKC-9126	7.7	20.6
v	900 M-Gold	7.0	22.0
Rabi, 2016-17			
i	Kaveri	8.0	30.0
ii	Pioneer-3396	8.0	25.0
iii	DKC-9081	8.0	24.0
iv	PAC-751	7.0	25.0

Source: Primary Survey

Table 4.10 presents the season wise variety of seeds used by maize crop. The table explained various varieties of maize crop seeds used by sample farmers during the year 2016-17. Under the kharif season (2016) different variety of maize seeds were used for maize production like Hyshell, kaveri, pioneer, DKC-9126 and 900M-Gold. All seeds are HYV and the farmers are utilizing 7 to 8 kg per hectare. In kharif season production nearly 20-23 quintals per acre reported by sample farmers. Whereas in Rabi season (2016-17) the small extent of area cultivated under Rabi season and the same variety of seeds were sown (Kaveri, pioneer-3396, DKC-9081 and PAC-751). The utilization of seeds per acre reported slightly higher than Kharif crop. The maize production also reported more than the kharif maize production as on average nearly 24 quintals to 30 quintals per acre.

The sample districts of Gajapathi and Nabarangpur implemented of Pradhana Mantri Fasal Bima Yojana (PMFBY) for kharif season, which is compulsory for all farmers. Special efforts would be made to ensure maximum coverage of SC/ST women farmer under the scheme. Crop insurance was implemented at various stages. Sum insured per hectare for both loaner and non-loaner farmers will be equal to the scale of finance as decided by the district level technical committee for maize crop was Rs.37500/- and premium subsidy 2% of sum insured or actual rate whichever is less. Difference between actual rate and farmers premium will be subsidized by the state government and Government of India on 50:50 basis.

SECTION – VIII

Details of Agricultural Credit Availed:

Financial institutions have been playing the dominant role in farm production. Table 4.11 depicted the borrowing details of sample farmers, per household loan amount found to be the highest borrowed from the non-financial institutions. On the whole per households loan amount found to be Rs.19,020 from financial institutions. The major financial institutions are commercial banks, co-operative banks, Regional Rural banks and Self-Help Groups in the sample districts. Among the financial institutions per household highest amount of credit reported to be Rs.8745 from Commercial Banks (CBs) followed by Rs.6270, Rs.2,490 and Rs.1515 in Co-operative Banks, Self Help Groups and Regional Rural Banks (RRBs). Whereas of all farmer groups per household credit taken from financial institutions found to be highest Rs.34,762 from large farmers followed by Rs.33179, Rs.14,738 and Rs.10,017 reported from medium, small and marginal farmer group. Commercial banks are only provide the biggest loan amount per household to all farm groups. The large farmer group borrowed the highest amount from commercial Bank. So per household institutional credit amount is the major financial source and the borrowing amount indicated progressive trend from small farmer to large farmer group.

On the other hand Non-Financial institutions are (1) money lenders and 2) Traders and Commission agents are played a major role to provide credit to producers of our sample districts. On the whole per household total loan amount found to be Rs.34,005/- from non-financial institutions. Major non-financial institutions are traders/commission agents and moneylenders. The average household taken loan amount reported Rs.28910 from Commission Agents/Wholesalers. Across the farm size groups per household highest amount of credit Rs.1,13,810 obtained from traders/commission agents reported from large farmers group. The total credit per household both financial and non-financial institutions found to be Rs.53025. Across the farmer groups per household borrowed loan indicated the positive trend from marginal farmer to large farmer group. 4 percent rate of interest collected from financial institutions whereas 14 percent rate from non-financial institutions from the farmers.

Table 4.11
Borrowing details of Sample Farmers during the reference period

Sources	Marginal	Small	Medium	Large	Overall
(In Rs/Hh)					
Institutional					
i. CBs	4017	6263	15436	19286	8745
ii. Co-operative Banks	2000	4088	12615	15000	6270
iii. RRBs	417	1725	3590	0	1515
iv. SHGs	3583	2663	1538	476	2490
Total	10017	14738	33179	34762	19020
In %	4	4	4	4	4
Non-Institutional					
i. Money Lenders (local)	3667	5988	8205	0	5095
ii. Traders/Commission Agents	8483	18513	35949	113810	28910
iii. Friends / Relatives/Neighbours					
Total	12150	24500	44154	113810	34005
In %	14	14	14	14	14
Grand Total	22167	39238	77333	148571	53025

Source: Primary Survey

Table 4.12 provides the information regarding the purpose of credit of sample households. The purpose of credit classified into two ways 1) productive and 2) non-productive uses. The productive use consisting in to three categories. 1) Crop cultivation 2) Purchase of farm implements and 3) purchase of live-stock. Overall highest 62 percent of farmers borrowed 54.60 percent of loan amount for crop cultivation. On the other side, the non-productive purpose also categorised into three sub categories i.e. 1. Consumption expenditure 2) family obligations and 3) other non-farm activities. Out of 200 sample households 182 farmers (91%) borrowed loan and the remaining 18 farmers (9%) expressed that they have not taken loan from financial

and non-financial institutions. On an average household maximum credit amount 54.60% spent on agricultural purposes reported by 62 percent of farmers followed by 5.50 percent of farmers purchased 7.50% of amount for farm implements and 3 percent of farmers in 2.17% of amount spent on purchase of live-stock. On the other hand, non-productive expenditures, such as consumption expenditure, family obligations and other non-farm activities. Average household the major amount Rs.16.92% spent mainly on family obligations expressed by 9.5 percent of farmers followed by 7.5% of farmers spent on non-farm activities and 5.6% of farmers reported on consumption expenditure. Across farm size groups per household borrowed loan mainly on crop cultivation similarly as the farm size increases the utilization of borrowing loan amount also increased for crop cultivation purposes. This indicates that there is a positive trend of all sample farmers between the area and purpose of borrowings on crop cultivation. Among the farmer groups, per household indicates the highest amount taken from large farmers (66.99%) for crop cultivation followed by family obligation (12.34%) and non-farm activities (12.02%) respectively. Therefore, all farmer groups except large farmer expressed above 60 percent of sample farmers borrowed loans on the purpose of crop cultivation.

Table 4.12
Purpose of borrowings during the reference period

(% of farmers & % of amount (Rs/Hh))

Sl. No	Purpose	Marginal	Small	Medium	Large	Overall
1	Crop cultivation	60.00* (55.64)	63.75* (50.14)	64.10* (45.95)	54.14* (66.99)	62.00* (54.60)
2	Purchase of farm implements	0.00* (0.00)	6.25* (9.56)	7.69* (7.46)	14.29* (8.65)	5.50* (7.50)
3	Purchase of livestock	5.00* (7.14)	2.50* (1.59)	2.56* (2.82)	0.00* (0.00)	3.00* (2.17)
4	Consumption expenditure	5.00* (7.89)	6.25* (8.60)	12.82* (17.24)	0.00* (0.00)	6.50* (8.44)
5	Family obligations	8.33* (16.17)	11.25* (17.33)	10.26* (21.55)	4.76* (12.34)	9.50* (16.92)
6	Non-farm activities	6.67* (13.16)	10.00* (12.77)	2.56* (4.97)	9.52* (12.02)	7.50* (10.38)
7	Others	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

Source: Primary Survey

Note: * indicates percentage of borrowing farmers

() in the figures indicates percentage of amount (Rs/Hh).

Summary:

The study examined the general characteristics of sample households. The average family size found to be 5.02 members. 2.46 members were fully engaged under farming. The average farming experience reported 23.93 years. Illiterates constituted to be highest 33 percent followed by higher primary 31.50%, secondary 23.00% graduation and 3% of farmers were graduates. About social category highest 53% household covered scheduled caste followed by 20.50% ST, 14% OBC and 12.50%, General category. Among the farmer groups, SC category indicated highest sample households from marginal (45%), small (65%) and medium farmers (56.41%) and 42.86% general category from large farmers. Out of 200 sample farmers 96.50% farmers expressed agriculture is the main occupation. 3.50% members engaged in salaried work and business.

The study found average household own land was 4.12 acres, and the farm size groups 1.89 acres found to be marginal, 3.48, 5.72 and 9.91 acres constituted small, medium and large farmers. Over all per household acreage leased-in-land was 1.96 acres. Leased out and un-cultivated land was not found from the sample farmers. So the net operated area was 5.88 acres. Per household irrigated 14.8% and un- irrigated area 85.2% of total net operated area. Whereas per acre rental value Rs.6,000 and Rs.3,500 of irrigated and un-irrigated under maize crop. Out of 200 sample farmers only 27 farmers (13.50%) having irrigated area. The total cropped area 1286.27 acres of which 78.24% grown under maize crop and the remaining area is covered by paddy, blackgram, ragi, vegetables etc. The largest area 499.50 acres grown under large farmer groups constituted 80.58% area grown under maize crop due to inadequate irrigation facilities such as hill track and forest area of our study districts.

The study examined the average per household per acre highest input costs found to be seed cost Rs. 2192 followed by Rs.2195 harvesting and threshing and Rs.1874 chemical fertilizers. So the average household per acre total cost Rs.13046, the gross returns Rs. 20,420 and net returns reported to be Rs.7374 in kharif season. Among the farmers group the cost of cultivation increased as farm size increased but the gross returns and net returns per acre reported highest in large and marginal farmers. Under Rabi season, average sample farmer per acre total cost found to be Rs.15,794 and the total output value Rs.24376 and net returns Rs.8532. Among the farm size groups highest costs found Rs.16,325 from large farmer and the gross return and net returns are increased according to farm size increased in rabi season. The maize production per acre found to be 22 to 23 quintals in kharif and 24 to 30 quintal in rabi season.

The average household taken loan Rs.19020 from financial institutions and the commercial banks (CBs) provide the highest loan amount Rs.8745 than other institutional sources like cooperatives, RRBs and SHGs. Across the farmers group the average large farmer borrowed the highest amount Rs.34,762 at the 4% rate of interest. In the case non-financial institutions commission agents provide the highest loan Rs.28,910 for agriculture purposes. The total non-institutional loan amount per household was 34,005 at 14 percent of interest. Average household total loan amount both financial and non-financial institutions found to be Rs.53,025. Among the farmer groups average household borrowing loan (institutional and non-institutional) was increased as land size increases from marginal to large farmer group. Overall, above 62% sample farmers borrowed 54.60% loan on the purpose of crop cultivation. Whereas 54.14% of large farmer borrowed maximum 66.99% amount for crop cultivation. So the major portion of borrowings spent on crop cultivation expressed by all sample farmers groups.

* * * * *

CHAPTER - V

SUPPLY CHAINS OF MAIZE MARKETING

This chapter has been examined the selected farmer groups of average maize grown area, production, consumption and Marketed Surplus (marginal, small, medium and large). The disposal of maize production through different marketing channels were also discussed. The study has been estimated marketing channels of maize production, producers price, traders sale price, total marketing cost, net margins received by various intermediaries and value added of the produce marketing efficiency of maize produce in various channels are also examined. The study collects the production and marketing constrains of maize crop from sample farmers and also made suggestions to overcome the production and marketing constrains of the farmers.

5.1 Marketed Surplus of Maize by Average Size of Holdings:

Marketed surplus of food grains depends on the size of family, socio-economic conditions, consumption habits of the producers' family and nature of the crop. The socio-economic factors such as land holding size, cropping pattern, crop production, marketing facilities and market prices. The marketed surplus refers to the actually marketed quantities of produce or the actual quantity, which enters into the market. Consumption of maize produce depends on producers' needs and necessities and also his production levels. Maize is used for food, feed in kind wages and after meeting the domestic demand. The balance quantity is sold to different buying agencies having easy access to the growers. So the marketed surplus depends on all consumption factors of sample households and retention of crop. Table 5.1 presented the Marketed Surplus of maize by average size of holding of selected farmers. Out of 200 sample households, average household area and production found to be 5.03 acres and 87.62 quintals of maize. The average household family consumption and labour payment in kind was 0.27 quintals and 1.58 quintals. Therefore the total consumption per household was 1.85 qtls and the marketed surplus reported to be 85.78 qtls. Further the estimations were also made average size of holdings of all selected farmer groups. Among the four farmer groups marketed surplus of maize produce has been increased from marginal to large farmer group. The average area and production of marginal farmer was 1.89 acre and 31.75 quintals, whereas the total consumption reported to be 0.20 quintals only for family consumption. Therefore, Marketed Surplus of the marginal farmer reported to be 31.55 qtls. The average household of large farmer total consumption was 9.07 qtls. which indicates the total consumption of maize produce reported to be higher in the average large farmer than other farmer groups and the marketed surplus 354.43 Quintals, indicated highest marketed surplus against the marketed surplus of other farm groups.

Table 5.1
Marketed surplus of Maize by Average Size of holding of Selected Farms

Sl. No	Particulars	Marginal	Small	Medium	Large	Overall
1	Maize Area(Acre)	1.89	3.19	6.03	19.17	5.03
2	Production (In Qtl.)	31.75	48.63	105.03	363.50	87.62
3	Family Consumption (In Qtl.)	0.20	0.25	0.30	0.50	0.27
4	Payment in kind of Labour (In Qtl.)	0.00	1.31	0.77	8.57	1.58
5	Miscellaneous (In Qtl.)	0.00	0.00	0.00	0.00	0.00
6	Total Consumption (In Qtl.) (3 to 5)	0.20	1.56	1.07	9.07	1.85
7	Marketed Surplus (In Qtl.) (2-6)	31.55	47.06	103.96	354.43	85.78

Source: Primary Survey

5.2 Disposal of Maize and Possible Supply Chains:

A sample of 200 maize growers was selected from Nabarangpur and Gajapathi districts in different farmer groups like marginal (60), small (80), medium (39) and large(21) respectively. The post harvesting activities of maize production is completely traditional and local processing limits itself maximum to sun drying of maize followed by deseeding and cleaning of the production. The local farmers normally report to sell the dried maize. These farmers do not have any clear idea about the end use of this maize. All most all the harvest is purchased by the local traders. There is no facility of mandi or any government structure. As a result of this, the farmers are being exploited by the traders and money lenders. In order to study marketing channels price spread, marketing costs and marketing margins retained by different intermediaries. Marketing of maize through different marketing channels were also examined of the sample farmers and various interest groups by personal interview methods. The information relating to the source of maize supply, costs incurred, price realized margins retained, problems faced in the marketing of maize.

Marketing Channels:

The main marketing channels of maize were identified based on maize sold by the selected producers. The prevailing marketing channels along with the percentage of quantity of maize produce sold through each channel were examined. Table 5.2 presented disposal of maize through different marketing channels. The results of the study examined the present channels existed for maize in the selected districts of Nabarangpur and Gajapathi of Odisha state. The table 5.2 reveals that the disposal of maize through different marketing channels. The marginal farmers sold 57.12% of maize produce sold to village traders, 33.56% to commission agents cum wholesalers and 9.33% to poultry farms. Whereas the small farmer marketed surplus of maize was 3764.80 qtls and 21.42% sold to outside village traders, 53.67% to wholesalers and 24.93% to maize stockers. The medium farmers marketed surplus of maize was 4054.44 qtls. of which 10.46% went to mandis 54.11% to commission agent, 20.85% to outside wholesaler and 14.58%

to maize processor. The large group farmers' total marketed surplus was 7442.82 quintals. Out of which 18.12% to outside village trader 38.30% to wholesalers, 13.97% to maize stocker and remaining 29.12% of produce to Agro-bio tech companies, which are existing in outside the state. Therefore on the whole maize produce, among marketing channels the highest marketed surplus of maize produce reported to be 7737.79 qtls (45.10%) sold to wholesalers and commission agents followed by village traders 21.34% outside wholesalers (outside state) (17.48%) and 16.08% to biotech companies or maize processors of neighbouring states.

Table 5.2
Disposal of Maize through different Marketing Channels

Sl. No	Farm Sizes	No.	Channels						
			I	II	III	IV	V	VI	VII
1	Marginal	60	1081.10 (57.11)	635.29 (33.56)	176.61 (9.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
2	Small	80	806.3 (21.42)	2020.6 (53.67)	937.9 (24.91)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
3	Medium	39	424.2 (10.46)	2193.9 (54.11)	845.36 (20.85)	590.98 (14.58)	0 (0.00)	0 (0.00)	0 (0.00)
4	Large	21	1348.53 (18.12)	2888.0 (38.30)	1039.3 (13.96)	2167.2 (29.12)	0 (0.00)	0 (0.00)	0 (0.00)
5	Overall	200	3660.13 (21.34)	7737.79 (45.10)	2999.17 (17.48)	2758.18 (16.08)	0 (0.00)	0 (0.00)	0 (0.00)

Source: Primary Survey

In parenthesis percentage figures are shown the marked surplus of maize produce.

Marketing Channels of Maize in Odisha

1. Farmer → Village Trader (petty) → Wholesaler → poultry farms
2. Farmer → Outside Village Trader → Wholesaler/Commission Agent → Maize stockers
3. Farmer → Mandis → Commission Agent/Wholesale traders → Outside wholesalers → Maize Processor/
4. Farmer → Outside Village Trader → Wholesaler → Agro-Biotech company

The study identified that there are four marketing channels existed for maize marketing in the selected districts of Nabarangpur and Gajapathi of Odisha state.

Of these entire channels commission agent cum wholesaler appeared in all four channels. Outside village traders appeared in two channels and the other village trader, mandis appeared in one channel. Therefore the Commission Agent cum Wholesaler played an important role in majority of the marketing channels. The study of marketing costs and margins are of inevitable importance particularly useful for both producer sellers and consumers because the farmers are

interested in getting the highest price for their produce. Consumers are also interested in paying low price as possible. Thus the sale and purchase aspect of the produce is also important.

5.3 Price Spread:

Table 5.3 presented the price spread of maize through different marketing channels. Marketing costs, margins and producers share in consumers rupee in different marketing channels are presented in the table.

Channel I:

Farmer – Village Trader (Petty) – Wholesaler – Poultry Farms

In this channel the producer sold maize directly to village trader at Rs.1080 per qtl, who in turn sold it to wholesaler Rs.1220 per qtl and the wholesaler sold the produce the poultry farms at Rs.1445 per qtls. Therefore, the producer share in consumers rupee was 74.74 percent. The price spread of Rs.365 was composed of marketing cost and marketing margins of the intermediaries involved in this channel. The marketing costs incurred by farmer, village trader and wholesaler respectively. In this channel the marketing cost incurred by village trader and wholesale trader were found to be Rs.60 and Rs.165 per qtl respectively and the marketing margin of village trader and wholesaler was found to be Rs.55 and Rs.85 per qtl respectively. Net price received by the producer was Rs.1080 per qtl.

Channel II:

Farmer – Outside Village Trader – Wholesaler/commission Agent – Maize Stocker

In this channel, two intermediaries were involved, which were outside village trader and wholesaler cum commission agent in the marketing of maize produce. It was observed that after purchasing the maize produce from farmer was Rs.1135 per qtl. out of which marketing cost of outside village trader and wholesale trader was Rs.72 and Rs.170 whereas the margin retained by village trader and wholesale trader/commission agent was Rs.60 and Rs.87. The farmers share in consumers' rupee found to be 74.48 percent.

Channel III :

Farmer – Mandis – commission Agent/Wholesale traders – Outside State wholesaler – Maize processor

The producer sold the maize at mandi at the rate of Rs.1195 to commission agent – cum-wholesaler, who further sold it to maize stocker. The commission agent cum wholesaler marketing costs and net margin involved Rs.56 and Rs.68. Therefore the wholesale price was 1319. per qtl. Again the outside the state wholesaler transport cost and Net margin found to be Rs.156 and Rs.96 respectively. Therefore the price of the maize produce per qtl was Rs.1571 of the owner of maize processor.

Channel IV:**Farmer – Outside Village Trader – Wholesaler – Agro Bio Tech company**

In this channel farmer sold maize produce to outside village trader who further sold it to wholesaler again the produce sold it to Agro-bio-tech companies. The price at which maize was sold to Rs.1140 (75.60%) per qtl. The marketing cost and Net margin of the outside village trader was Rs. 58(3.5%) and Rs.63 (4.18%) respectively. Then the price of wholesaler was Rs.1261. the wholesaler marketing cost including transport etc., and Net margin incurred Rs.145 (9.65%) and Rs.102 (6.76%) respectively. Therefore, the price of the Agro-Bio-tech company was Rs.1608. The producers share in consumer price was 75.60% respectively.

Table 5.3
Price spread of Maize through different Marketing Channels (in Rs)

Sl. No	Particulars	Channels						
		I	II	III	IV	V	VI	VII
1	Net price received by producer	1080 (74.74)	1135 (74.48)	1195 (76.07)	1140 (75.60)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
2	Producer's sale price	1080 (74.74)	1135 (74.48)	1195 (76.07)	1140 (75.60)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
3	Cost increased by Traders/Middlemen	60 (4.15)	72 (4.72)	56 (3.56)	58 (3.85)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
4	Net margin Traders/Middlemen	55 (3.81)	60 (3.94)	68 (4.33)	63 (4.18)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
5	Cost incurred by Wholesalers	165 (11.42)	170 (11.15)	156 (9.93)	145 (9.62)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
6	Wholesaler's Net Margin	85 (5.88)	87 (5.71)	96 (6.11)	102 (6.76)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
7	Wholesaler's sale price to Processors/Exporters	1445 (100.0)	1524 (100.0)	1571 (100.0)	1508 (100.0)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

Source: Primary Survey

5.4 Marketing Efficiency:

The market information was taken from the market functionaries traders and retailers through personal interview. The study was conducted to understand the nature of marketing channels, marketing costs, margins, price spread and producers share in the consumer rupee under maize marketing.

Marketing cost was calculated by summing up the costs of transportation, labour and overhead costs per qtl of maize marketing by market functionaries. (Acharya and Agarwal 2007)

Marketing margins was calculated by subtracting the sum of purchase price and marketing cost from the selling price per qtl of maize marketing. (Acharya and Agarwal 2007)

Price spread was calculated by the subtracting to producers net selling price from the consumers purchase price (Acharya and Agarwal 2007)

Marketing efficiency in this context may be turned as pricing efficiency of the market system. The relationship between marketing cost and marketing margins.

The marketing efficiency was estimated by using the following methods.

1. Conventional Method:

The conventional method, which is considered as the price, spread and the total marketing cost in delivering the product to the final consumer. Conceptually, efficiency of any activity or process is defined as the ratio of output to input if 'O' and 'i' are respectively output and input of the marketing system and 'E' is the index of marketing efficiency then

$$E = \frac{O}{i}$$

2. Shepherd's Approach:

Shepherd's has suggested that the ratio of total value of goods marketing to the marketing cost may be used as a measure of efficiency. The higher the ratio, higher the efficiency and vice-versa. This method eliminates the problem of measurement of value added. This formula is

$$ME = \frac{V}{i}$$

ME denotes index of Marketing Efficiency.

V = denotes value of the goods sold or price spread by the consumer (Retail price)

Limitation of this method is that it does not take into consideration the price received by the farmer.

3. Acharya's Method:

According to Acharya, an ideal measure of marketing efficiency, particularly for comparing the efficiency of alternative markets/channels, should be such which takes into account the items such as total marketing costs (MC), Net Marketing Margin (MM), Prices received by the farmer (FP) and prices paid by the consumers (RP). The formula is

$$MMM = FP / (MC + MM)$$

Farmers are interested to raise their revenue through various ways. Of them, simple and viable way is the increasing returns by way of increasing marketing efficiency. But marketing efficiency depends upon various controllable and uncontrollable factors. Generally the length of the channel will be deciding factor for computing the marketing efficiency of maize production.

In the study area, it was found that there are four major channels for marketing of maize production and the efficiency of their four channels have been analysed. The marketing efficiency of maize produce through different channels has been depicted in the Table 5.4.

Table 5.4
Marketing Efficiency of Maize through different Marketing Channels
(In Rs/Qtl)

Sl. No	Particulars	Channels						
		I	II	III	IV	V	VI	VII
1	Trader's sale price or Processor's purchase price (RP)	1445	1524	1571	1508	0.00	0.00	0.00
2	Total marketing cost (MC)	225	242	212	203	0.00	0.00	0.00
3	Total Net Margins of Intermediaries(MM)	140	144	164	165	0.00	0.00	0.00
4	Net price received by producers (FP)	1080	1135	1195	1140	0.00	0.00	0.00
5	Value Added (1-4)	365	389	376	368	0.00	0.00	0.00
6	Index of Marketing Efficiency							
	a. Conventional Method ($5 \div 2$) E	1.62	1.61	1.77	1.81	0.00	0.00	0.00
	b. Shepherd Method ($1 \div 2$) ME	6.42	6.30	7.41	7.43	0.00	0.00	0.00
	c. Acharya's Method ($4, \{2+3\}$) MME	2.96	2.94	3.18	3.10	0.00	0.00	0.00

Source: Calculated on the basis of Acharya & Agrawal, 1999 on Agricultural Marketing in India, Oxford & IBM Publishing Co. Pvt. Ltd., New Delhi.

Table 5.4 indicates that according to conventional method, the Marketing Efficiency(M) in channel IV (1.81 ratio) than the channel III (1.77 Ratio) channel I (1.62 Ratio)and Channel II (1.61 Ratio).

According to Shepherd's method, the Marketing Efficiency (ME) is higher in channel IV (7.43% Ratio) than that of channel III (7.41 Ratio), Channel I (6.42 Ratio) and Channel II (6.30 Ratio)

According to Acharya's method, the Marketing Efficiency (MME) is higher in channel III (3.18 Ratio) than that of Channel IV (3.10 Ratio), Channel I (2.96 Ratio) and Channel II (2.94 Ratio).

It is concluded that the higher marketing margins taken away by the market intermediaries in Channel III and channel IV resulted in poor efficiency in marketing of maize produce.

5.5. Production Constraints Perceived by the Farmers:

Table 5.5 revealed the sample farmers stated major constraints faced in production of maize crop. There are three major production constraints expressed i.e. low level of credit facilities, low extension services and lack of irrigation facilities, which are accounting about 83.12%, 82.00% and 69.00% of sample farmers. Moreover animal problem 54.37%, low quality seed 48.00%, high fertilizer cost 46.50 and the scarcity of labour 35.00%. Out of 200 sample farmers above 70% of sample farmers reported lack of credit facilities, low level of extension services followed by inadequate irrigation facilities and low quality of seed are the major constrains for maize production reported in selected districts of Nabarangour and Gajapathi in Odisha state.

Table 5.5**Major problems faced in Production of Maize Crop (% of farmers)**

Sl. No	Problems	Marginal	Small	Medium	Large	Overall
1	Lack of Irrigation	61.67	76.25	64.10	71.43	69.00
2	High Fertilizer Cost	46.67	48.75	41.03	47.62	46.50
3	No Crop Insurance	0.00	6.25	25.64	47.62	12.50
4	Low Quality Seed	53.33	52.50	41.03	28.57	48.00
5	Pest Problem	6.67	16.25	51.28	57.14	24.50
6	Low level of Credit facilities	85.50	87.00	81.00	79.00	83.13
7	Labour Problem	0.00	36.25	58.97	85.71	35.00
8	Wide Animal Problem	48.33	53.75	48.72	66.67	54.37
9	Low Soil Fertility	31.67	30.00	46.15	47.62	35.50
10	low extension service	70.00	87.50	89.74	80.95	82.00

Source: Primary Survey

5.6 Marketing Constraints Perceived by the Farmers:

Table 5.6 presented in major problems faced in marketing of maize crop. Major marketing problems under maize produce found to be storage facilities, low Minimum Support Price (MSP), lack of government procurement agencies followed by non-availability of Mandis in short distance from the villages or harvesting places and transport problems. All farmer groups expressed the same marketing problems. 90% marginal and small group farmers reported that lack of government purchasing agency is the major problem. Above 80 percent of farmers expressed, low MSP and inadequate storage facilities are major marketing problems. Among farmer groups 90% marginal and small farmer group expressed that low level of MSP and lack of government agencies are the major marketing problems of maize crop. Whereas the medium farmers 89.74% reported lack of storage facilities followed by lack of Government Procurement Agency (84.62%), low MSP (82.05%) and transport problems (64.10%). Further, the large farmer group informed that highest 90.48% of farmers, lack of storage facilities, low MSP 80.95% and lack of government purchasing agencies (71.43%) are major marketing problems under maize production in Nabarangpur and Gajapathi district in Odisha state.

The maize farmers alleged that they were forced to sell the crop below MSP. The rates offered by the traders at low rates when they had paid us in advance at the time of sowing. The Odisha state Agriculture Marketing Board (OSAMB) or RMC has done nothing to purchase maize produce from the cultivators in the state. Therefore the private traders and Money lenders played a vital role to buy the maize produce due to debt payments and urgent need.

Table 5.6**Major problems faced in Marketing of Maize crop (% of farmers)**

Sl.No	Problems	Marginal	Small	Medium	Large	Overall
1	Low MSP	88.33	90.00	82.05	80.95	87.00
2	Transporting Problem	56.67	50.00	64.10	71.43	57.00
3	Local Traders (Middle Man)	81.67	80.00	35.90	38.10	67.50
4	No Storage Facility	86.67	87.50	89.74	90.48	88.00
5	Mandi is very long distance	80.00	68.75	56.41	52.38	68.00
6	Lack of Govt Purchase agencies	90.00	90.00	84.62	71.43	87.00

Source: Primary Survey

5.7. Farmers Suggestions to Overcome Production Problems:

The government have been to protect and encourage the maize grown producers through introduction of subsidies, and fix Minimum Support Price (MSP) at the beginning of season is very important. The crop productivity also depends on utilization of inputs such as HYV seeds availability, irrigation facilities, fertilizers that are to provide by the government agencies at a subsidy price. The extension of credit facilities are also important input played a vital role to promote maize production.

Table 5.7 shows the suggestions to overcome the production problems. Out of 200 sample farmers the highest 98% of farmers expressed that the supply of fertilizers and HYV seed through cooperatives, followed by 90% farmers informed to extend the extension services 87% farmers expressed to provide Agriculture loans through co-operative banks or financial institutions and also 79.50% farmers suggested to provide irrigation facilities. These are the major suggestions to overcome the production problems expressed by them. Highest share from all farmer groups have suggested to supply of fertilizers and HYV seed through cooperative societies is the major suggestion to increase the maize production followed by extend the extension services are important and constitute 88.33% marginal, 93.75% small, 89.74% medium and 80.95% large farmers group. Credit facilities through government financial institutions expressed by 90% farmers from marginal and small and 84.62% medium and 71.43% from large farmers are suggested to overcome the production problems.

5.8. Farmers Suggestions to Overcome Marketing Problems:

Table 5.8 depicted that the suggestions made by the selected maize producers to overcome the marketing problems. Out of 200 sample farmers, all sample farmers from all farm groups have suggested that government procurement agency is need to remove the private traders. Further 92.50% of farmers expressed to provide storage facilities, followed by 91% to

Table 5.7
Suggestions to overcome the Production problems (% of farmers)

Sl.No	Suggestions	Marginal	Small	Medium	Large	Overall
1	Provide Irrigation Facility	68.33	86.25	76.92	90.48	79.50
2	Quality Seeds Supply	75.00	63.75	51.28	47.62	63.00
3	Fertilizers and Seeds Supply Through Primary Co-Operative Society	100.00	100.00	92.31	95.24	98.00
4	Provide Agri Loans through Banks and Co-operative Society	90.00	90.00	84.62	71.43	87.00
5	Provide fencing Facility	25.00	22.50	24.10	36.19	26.95
6	Provide Extension service	88.33	93.75	89.74	80.95	90.00

Source: Primary Survey

fix high MSP, 83% suggested to arrange maize purchase centres through agri-markets every 30km and 79.50% farmers expressed free transport system. Among the farmer groups marginal group farmers expressed government purchasing agency, free transport facility, storage facility and high price (MSP) are the major suggestions constituted 100%, 95%, 91.67% and 90% of farmers. Whereas the small farmer group 100 % farmers suggested government purchasing agency is needful followed by 93.75% both storage facilities and MSP. The medium farmers suggested 100% coted to government purchase agency, 94% provide polythene covers and 89.74% expressed to provide storage facilities. The large farmers group expressed above 90 percent sample farmers suggest to high MSP, government purchasing agency, storage facilities and provide polythene covers are major requirements to overcome the marketing problems.

Major findings of the study, that none of the selected farmers sold his produce to the government agencies in the regulated markets. This happened due to the reason that food procurement agencies are not buying maize in the regulated markets and most of the selected farmers sold their produce at farm gate. Sometimes the MSP for maize is lower than the private market. So this calls us for an effective price policy for maize. There is a need to evolve high yielding varieties (HYV) of maize which, will help to raise returns per acre of land area by changing the productivity of maize crop in the state.

The sample districts of Nabarangpur and Gajapathi about the maize marketing private traders and moneylenders played a vital role to purchase the maize production due to debt payments and urgent need. The marginal and small farmers have debt from the village traders. Therefore un-regulated private marketing system exploited by the farmers to great extent through low price, grading and weighing of produce at the time of sale. Therefore, there is needful to

procure the maize by the government agencies. Government should fix MSP of maize before the season, extend the credit facilities and establish the mandis near the harvesting places or villages.

Table 5.8

Suggestion to overcome the Marketing problems (% of farmers)

Sl.No	Suggestions	Marginal	Small	Medium	Large	Overall
1	High Price	90.00	93.75	87.18	90.48	91.00
2	Govt Purchase Directly	100.00	100.00	100.00	100.00	100.00
3	Provide Polyether Covers (Tarapalins)	51.67	87.50	94.87	95.24	79.00
4	Provide Storage Facility	91.67	93.75	89.74	95.24	92.50
5	Provide Free Transport Facility	95.00	80.00	71.79	47.62	79.50
6	Maize Purchase Centre Provide through Agri Markets every 30 Km	88.33	86.25	86.92	67.00	83.00

Source: Primary Source

CASE STUDIES BY STAKE HOLDER:

To understand the problems faced by different crop stakeholders (farmers), field survey was made of 200 sample farmers under maize in the districts of Nabarangpur and Gajapathi in Odisha state. The farmers opinions about production and marketing of maize through group discussions. Majority of sample farmer responded to about marketing problems due to inadequate institutional credit facilities at right time, lack of government support for marketing, the farmers were forced to dispose of their produce at farm gate even at a lowest paid by the local traders-cum-money lenders. The non-availability of upto date market information is also problem to get low price. They are forced to sell at lower prices due to payment of loan to local traders and commission agents. Moreover non-availability of storage godowns, poor transport facilities etc. thus they are compel to sell the maize. Therefore the government have provide assured market in the farm of procurement operations under maize crop.

Case studies of retailers and wholesalers of maize produce:

The study team discussed with retailers, wholesalers and the Cooperative Society in the districts of Nabarangpur and Gajapathi for identifying issues in marketing of maize produce.

Jagannadh Agencies: Mr. Mahaveer Yadav, wholesale trader, Umerkot in Nabarngpur district, he has 15 years of trading experience both maize and other agricultural commodities. The year 2015-16 50,000 tonnes of maize was purchased at farm gate from village traders, the price at Rs.1250-to Rs.1370 per quintal of maize was resaled to wholesalers outside the states in Andhra Pradesh, Culcutta and Chattisgarh and major processing unit such as Pasupati feeds, which is located in Cuttack in Odisha state.

2. Balaji traders: Mr. Chandki Ram Ywadav, Petty trader at Dhodra village, he bought the maize produce at farm gate and has 12 years trading experience. He has purchased both Kharif and Rabi seasons through-out the year at a price of maize Rs.1150 to 1250 per quintal and resaled to wholesale traders at Cuttack he has own godowns at Dhodra village to keep main produce whenever the price was low. He took loan of 25 lakhs from Axis Bank for trading of maize produce and expected maximum profit Rs.50 per quintal.

3. Saraswathi Traders: Mr. Niranjan Bhatto wholesale trader in Nabarangpur district, his total turnover of maize produce was Rs.70 crore during the year 2016-17 and 25 years of trading experience of maize. He is exporter of maize produce to other states such as Cargil India Private Limited, Bengalore. Ruchi Soya Industries Limited, Indore, GLENCORE INDIA Pvt. Ltd., Bombay.

4. OM Shanthi Traders: Balya Krishna Bhotto is a licenced trader in Padalaguda in Nabarangour district. He started maize trading on 1995, purchased from commission agents and retailers. Total turnover nearby 90 crores in 2015-16 and it declined 70 cores in 2016-17 due to low level of exports. He resale the maize produce to traders in other states such as Tamilnadu and Calcutta for poultry feed and Bio-tech company of Andhra Pradesh. The price per quintal of wholesaler Rs.1600-1700.

5. Gangotri Traders: Mr. Sivaram Patro is the proprietor and registered trader at R.Udaigiri village at Gajapathi district. He started trading in 2007 and 90 percent of maize produce bought from village traders and petty traders, his total turnover 80 lakhs during the year 2014-15, Rs.120 lakhs and 160 lakhs turnover in 2015-16 and 2016-17. The price of the maize produce depends on moisture. Again the produce resold to wholesale traders to Pasupathi traders, Cuttack, General traders Berhampur, Pretty enterprises, Berhampur, VAN Murthy & Sons, Berhampur, Eastern hatchery-Cuttack, Maruthi poultry form in Berhampur. Total transactions were made openly through payment is account pay.

6. Susantho General Stores: Susant Kumar Samantra is the proprietor and licence trader, V. Udaigiri Block in Gajapathi district. He started maize trading on 2013 as a petty trader and bought the maize produce at farm gate. The total turnover was 100 MT in 2015-16 and 120 MT in 2016-17. In turn he sold the total produce to wholesale trader of U.A Narasimhamurthy and General traders at Berhampur district. He bought the produce at farm gate at price was Rs.1250/- per quintal.

7. Trinath Traders: Mr. Mahindra proprietor and licenced trader of R. Udaigiri block at Gajapathi district. He started maize trade on 2012 bought maize produce at farm gate and door purchase from the farmers. The farmer price was Rs.1270 and depends on moisture of maize

produce. He sold the produce to commission agents and wholesale traders. Who are Sivasankar traders, Rao and Pusti, Sripusti all are wholesale traders in Berhampur district. He borrowed loan amount was 20 lakhs for trading of maize produce.

Farmer Friend: The government of Odisha appointed Mr. Kumuda Ranjan Patro as a farmer friend of Luhagudi village, Mohan block in Gajapathi district. The study team interviewed him about his duties. He expressed that dissemination of development programmes of agriculture crops like paddy, maize, millets and oilseeds. He advised the farmers for utilization of fertilizers, pesticides, organic manures and availability of marketing facilities. Distribution of all types of seeds fertilizers and pesticides and guide of all allied activities like dairy, poultry and other related activities in the village.

Case Study: Tibetan Co-operative Society:

Multipurpose Tibetan Co-operative Society Ltd., was established in 1966 at Chandragiri Block in Gajapathi district. Mr. TSERING PHUNTSOK is the present secretary, main objective is raising the living standard of the society members. The society total membership of above 2000. There was 1800 acres of cultivable land and maize is main crop cultivated and millet to some extent. The society served to the members such as provide maize seeds, fertilizers, pesticides and other agricultural inputs to the farmer members on credit basis. Moreover, the total maize produce procured by the society. The society gradually sold the maize produce in the open market to wholesalers as and when the market price is attractive, so as to earn maximum returns on the same. Whenever, was the price was low per quintal the society stocked all the maize produce and sold it at higher prices. The society has six godowns to keep the maize produce.

The secretary has expressed that there are two major problems 1) Labour scarcity and 2) non-availability of HYV maize seeds are the major production problems. He has given one important suggestion that the establishment the maize processing unit by the government, which is useful to the maize farmers and traders in Chandragiri block of Gajapathi district.

Discussions were held with farmers, wholesale traders, retailers and associations etc., at different places in Nabarangpur and Gajapathi districts. The issues identified as per the discussions in marketing problems of maize produce.

1. Lack of storage capacity (godowns) in market yards.
2. Lack of infrastructure in the market for auction.
3. Poor road connectivity with villages.
4. Lack of market information

5. Lack of Government procurement agency
6. Lack of Banking facilities in the markets.

Due to lack of these facilities, traders and producers face these problems in trading and have to depend on local agents for procurement of produce, thus both farmers and traders are suffering losses.

SUMMARY:

The study found that the post harvesting activities of maize crop production is completely traditional and all most all the harvest is selling to the private traders. There is no facility of mandis and any government agency had not been purchased. As a result the traders and moneylenders in selected districts of Nabarangpur and Gajapathi of Odisha state are exploiting the farmers. Average sample farmer marketed surplus found to be 85.78 quintals and the highest consumption reported 9.07 quintals from large farmer.

The study discussed the various marketing channel of maize produce and the percentage of quantity sold through each channel was examined. There are four marketing channels appeared for maize marketing and the highest maize produce sold to the wholesale traders at farm gate. On the whole the highest 45% produce sold to wholesalers and commission agents, next to village traders (21.34%), outside wholesalers (other states) 17.48 and 16.08% to bio tech companies in neighbouring states. Among farmer groups the average marginal farmer 57.12% of maize produce sold to the village traders, the small farmer 53.67% to wholesaler, the medium farmer 54.11% sold to wholesaler/commission agent and large farmer 38.30% sold to wholesalers. Overall, the highest marketed surplus of maize sold to be 7737.79 qtls (45.10%) to wholesalers and commission agents. Therefore, the commission agent cum wholesaler played an important role against other marketing channels.

The marketing costs and margins are inevitable importance particularly for both producer sellers and consumers, because the farmer is interested in getting the highest price for their produce. Among four marketing channels, the first channel the maize producer net price received Rs. 1080 per quintal, 2nd channel Rs.1135, 3rd channel Rs. 1195 and 4th channel Rs.1140 respectively. Conventional and Shepherd method marketing efficiency found to be highest in channel IV and Acharya's method is in channel III. Therefore, higher marketing margins taken away by the market intermediaries in channel III and IV resulted in poor efficiency in marketing of maize produce.

There are three major production constraints under maize crop i.e. low level of credit facilities, low extension services and lack of irrigation facilities reported by 83.1%, 82.12%,

82.00% and 69.00% of sample farmers. The major marketing constraints found to be the storage facilities, low MSP, lack of government procurement agencies constituted 88%, 87% and 68% of sample farmers expressed. Majority of sample farmers recommended to increase production through extend irrigation facilities, extend the credit facilities and supply of HYV seeds, fertilizers and pesticides at a subsidy prices through government agencies will promote the maize production. In the case of marketing constrains all farmer groups (100%) suggested that government purchasing agency is essential to protect the producers income and it will remove the private traders followed by 92.5% of farmers suggested storage facilities 91% to fix the high MSP than private markets and 83% to arrange maize purchasing centres through agri markets near the harvesting places.

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CHAPTER VI

CONCLUDING REMARKS AND POLICY RECOMMENDATIONS

6.1 Background:

Maize is the third largest food crop produced and consumed in India after rice and wheat. It is the most versatile crop and cultivated throughout the year in most of its states for various purposes. Its area slowly expanded over the last six and half decades from 3.16 mil ha. to 8.69 mil. Ha. The production and productivity of maize crop also increased significantly from 0.01 mil MT to 21.81 mil MT and 390kg/ha to 2509 kg/ha. in India respectively (1950-51 to 2015-16). Among Indian states Odisha occupied 13th rank in terms of area and 10th rank in terms of production (2014-15) and the crop is produced in the southern part of the state, which is the important coarse cereal crop after rice. It is grown in tribal districts as a subsistence crop during kharif season. Major maize growing districts are Nabarangpur, Gajapati, Rayagada, Ganjam and Koraput contributed for about 91.34% of total maize production in the state. On the other hand Nabarangpur and Gajapati districts ranked 1st and 2nd place in maize production and the production share was 75.69% of total maize production in the state (2015-16) due to availability of high yielding variety seeds, provide incentives and subsidies, through state and central government schemes over increasing price realization at farm level. Therefore the study examined the growth trends, Agro-based industries, Gross and Net returns of the maize produce, available marketing channels, production and marketing constraints and suggestions were made in the maize producers.

6.2 Objectives and Methodology:

1. To study acreage production and productivity of maize in the states.
2. To estimate the cost of production of maize in the study area.
3. To identify the supply chain of maize marketing in the study area.
4. To explore the possibility of processing/value addition of maize in the states.
5. To identify the constraints in production, efficient marketing and processing of maize and suggest policy measures.

Methodology:

The present study is conducted in the state of Odisha “An Analysis of Supply Chain of Maize Marketing and Possibility of its Value Addition”. The study would be based on both primary and secondary level data. The secondary data would be taken from various issues of statistical abstracts published by Directorate of Economics and Statistics, Bhubaneswar, Government of Odisha. State of Indian agriculture, agricultural statistics at a glance 2014 and

data taken from the state regulated market committee(RMC)from the sample districts of Nabarangpur and Gajapathi.

Primary data will be obtained by following stratified random sampling method was employed. The study, co-ordinator has given instructions about the selection of districts. The second criteria for selection of the district will be based on larger the area and the higher production of maize crop taken together. Among thirty districts in Odisha two districts Nabarangpur and Gajapathi were selected. Nabarangpur is located in the Eastern Ghat high land and the Gajapathi district is in North Eastern Ghat. At the next stage, one block was selected from each sample district and each block two villages/clusters of villages were selected from each of the sample districts.

From Nabarangpur district one block “Umerkote” was selected for this study as it was the important and major maize growing block of the district.. From this block six villages were chosen for conducting house hold survey. The sample villages are 1. Umerkote 2) Bhimini 3) Indirapur 4) Naiguda 5) UV2 Naikguda 6. UV3 Dongriguda. From these villages 100 maize crop grown farmers were interviewed and collected required data from the sample households. The other sample district Gajapathi, from which Mohana block was selected. From this block, five villages were selected 1. Pindiki, 2)Chandragiri 3) Chandiput 4) Kampaguda and 5)Sinkulopodhara and 100 sample households were surveyed. The total sample was 200 households. The selection of blocks and sample villages were made under the consultation with the district level agricultural officers and marketing department. The household survey conducted with the coordination of marketing department of the sample districts. The entire field study conducted based on the structured questionnaire sent by the coordinator. The sample will broadly draw on probability proportion method. While selecting households from each selected village an appropriate number of farmers representing different four farm categories. Viz., Marginal (<1ha), small (1 to 2 ha), medium (2 to 4 ha) and large (above 4 ha) have taken for household survey. The reference year of the study for the household survey was on 2016-17 in the state of Odisha.

Besides, nine case studies were prepared from the Commission agents cum wholesale traders and one co-operative society of maize in close periphery of the sample districts respectively. Regarding the marketing of maize through different marketing channels examined from various interest groups by personal interview method. The information relating to the sources of maize supply, costs incurred, prices realized, margins, retained, problems faced in the marketing of maize by the farmers and traders of the sample districts of Odisha state.

6.3 Summary of Findings:

In this study estimated the growth trends of maize crop in-terms of area, production and productivity in India (1990-91 to 2015-16). The production registered highest Compound Annual Growth Rate (CAGR) at 4.43 percent, which might be due to combined effect on increase in area and productivity at the rate of 2.02 and 2.42 percent in India. Moreover among maize grown states in (16 states) Tamilnadu state reported highest growth in area (8.84%) followed by Maharashtra (7.64%), Karnataka (6.32%), and West Bengal (5.48%). The production growth Tamilnadu is the highest (13.28%) followed by Odisha (4.07%) and Chattisgarh (3.90%), and about yield Tamilnadu (6.78%) and Odisha (4.07%) reported highest growth in India. On an overview, it can be observed that the maize grown area, production and productivity growth trends (CAGR) found to be significant in the states of Tamilnadu, Jharkhand, Chattisgarh and Bihar. Among Indian states, Odisha occupied 13th rank in terms of area and 10th in terms of production (2014-15). The state having five major maize growing districts Nabarangpur, Gajapathi, Koraput, Rayagada and Ganjam which contributed about 91.34% of total maize produce in the state. Nabarangpur and Gajapathi districts played a vital role ranked 1st and 2nd place in production, and the share was 75.69% of total maize production in the state. The two districts selected for household survey. The CAGR of are production and productivity exhibited considerable growth constituted 6.68% and 5.14%, 9.61% and 6.45% and 3.90% and 1.73% of Nabarangpur and Gajapathi districts during the period 1997-98 to 2015-16, due to increase in area and yield level, utilization of high yielding variety seeds.

The study found that food-processing sector in Odisha state, still remains largely untapped due to inadequate infrastructural facilities, predominant presence of marginal and small farmers, credit problems and lack of entrepreneurship. However, the state has recorded in food production 107 lakh MT with 25 lakh MT as surplus during 2014-15. The state government has taken pro-active measures, as on 2013-14 the government of Odisha having 127284 engaged in food and allied sectors generating 1.47 lakh employed with an investment of more than Rs.1557.86 crores.

Maize is the most important cereal crop in Odisha after rice produced 6.57 lakh MT (2015-16). The markets are under developed and under utilized. So majority of maize produce (80%) exported to processing units, which are outside the states of Chattisgarh, Madhya Pradesh, Gujarat, Karnataka, Andhra Pradesh and West Bengal. The Odisha food processing policy 2016 bringing out with the objective to provide infrastructural, industrial support and fiscal incentives to boost up the value addition in the sector. The sector was a potential to grow CAGR of 11% incentives also being disseminated under industrial policy resolution 2017.

The study observed into the main characteristics related to population of sample households (200) and their demographic profile analysed that the average size of household was 5.02 members, 2.46 members were fully engaged under farming. 33% of farmers illiterates, 55% are under graduates and 3% graduates. About social category highest 53% households covered scheduled caste category. The average land owned by the farmer was 4.12 acres and the Net Operated Area was 5.88 acres. Per household ratio of Net Irrigated and un-irrigated area found to be 14.8:85.02. Out of 200 sample farmers, 27 farmers having irrigated area of which 16 farmers had canal and 11 farmers had borewell. The total cropped area was 1286.27 acres and 78% area grown under maize crop due to lack of irrigation facilities such as hill track and forest area of our study districts (Nabarangpur and Gajapathi).

On the whole average household per acre total costs found to be Rs.13,046 the Gross returns and the net returns were Rs.20,470 and Rs.7,374 under maize crop in Kharif season. Among farmer groups total paid out costs increased as farm size increased except marginal farmer. Whereas the gross returns and net returns reported to be highest Rs.22,741 and Rs.7,746 from marginal farmer. Under Rabi season, average household per acre total cost under maize crop reported Rs.15,794 total output value and net returns were Rs.24,376 and Rs.8,532. Among farmer groups the average household per acre paid out costs increased as farm size increases except the small farmer. The gross returns and net returns increased as farm size increased of all farm groups under Rabi season.

The study examined that there was four marketing channels appeared for maize produce and the highest produce 45% sold to be whole salers/commission agents at farm gate by the producers next to village traders 21.34%. The wholesale trader played a prominent role in marketing of maize than other market players. The maize producer net price received Rs.1080 per quintal in the 1st channel followed by Rs.1135, Rs.1195 and Rs.1140 per quintal in second, third and fourth channel. The study found that the conventional and shepherd method indicated Channel IV and the Acharya's method is in Channel III are most efficient in maize marketing against channel I and II.

Majority of sample farmers expressed production problems were low level of credit accessibility of financial institutions, lack of irrigation facilities and low extension services. On the other hand marketing problems were inadequate storage facilities, lock of government procurement agency and low MSP. They have suggested to overcome the production problems 1) extension of irrigation facilities 2) more access to institutional credit 3) Supply of subsidy inputs through government agencies 4) Extend the new farm technologies. In the case of marketing 1) government procurement agency is needful to protect the producers income and

reduce the middlemen (private traders) 2) Extent the storage facilities, 3) To fix higher MSP and 4) establish maize purchasing centres or collection centres near the harvesting places.

Observations at Field Survey:

1. Private traders and moneylenders played a vital role to buy the maize produce due to urgent cash needs and debt payments of the farmers. Moreover, the government agencies are not procuring maize produce in the state. Therefore un-regulated private marketing system exploited by the farmers to a great extent through low price, weighing, grading of produce at the time of sale.
2. The marginal and small farmers are unable to transport their produce to the markets because transportation, packing, loading and un-loading is big task, more expensive and lack of marketing knowledge.
3. The farmers alleged that they were forced to sell the crop below MSP. The rates offered by the traders at low and they had paid us in advance at the time of sowing. The Odisha State Agriculture Marketing Board (OSAMB) or RMC has done nothing to purchase maize from the maize cultivators in the state.
4. Marginal and small farmers have debt from the village traders. Therefore, they are selling maize produce to village traders/private agencies at farm gate.
5. The maize crop production has substantially increased, even though the state has no major maize based processing units either for livestock or value added products for human being.
6. About 80% of produce is transported to other neighbouring states like Andhra Pradesh, Chattisgarh, West Bengal and Karnataka having maize processing centres.

6.3.1 Growth Trends of Maize in the State:

The growth trends have been examined for maize crop in terms of area, production and productivity (1990-91 to 2015-16). The Compound Annual Growth Rates (CAGR) under maize area, production and yield found to be in the 1st period (1990-91 to 1999-2000) significant at 0.94, 3.23 and 2.21 percent respectively. The 2nd period (2000-2001 to 2009-10) CAGR found to be significant growth at 1.64, 1.01 and 6.11 percent. The third period (2010-11 to 2015-16) the CAGR of (6 years) also reported positive trend at 0.74, 1.22 and 0.44 percent respectively. The second period CAGR of yield growth reported to be highest 6.11 percent against the area 1.64 percent and production 1.01 percent due to HYV seeds. Whereas in the total period (1990-91 to 2015-16) in India maize grown area, production and yield of CAGR reported significant in production at 4.43 percent, which might be due to combined effect of increase in area and productivity at a rate of 2.02 and 2.42 percent respectively. Among Indian states (16 states) Karnataka is the highest grown area followed by Madhya Pradesh, Maharashtra and Rajasthan (2015-16). On the other hand the CAGR in the 1st period (1990-91 to 1999-2000) reported to be

highest in Tamilnadu (12.46%) followed by Karnataka (9.79%), Maharashtra (8.90%) and Andhra Pradesh (4.15%). Whereas in the second period (2000-01 to 2009-10) found to be highest CAGR in West Bengal (13.17%), Tamilnadu (12.25%), Maharashtra (10.25%) and Karnataka (8.37%). The third period 2010-11 to 2015-16 maize area highest growth in West Bengal (12.32%), Tamilnadu (7.91%), Madhya Pradesh (6.59%) and Jharkhand (6.12%). The total period growth reported highest in the states of Tamilnadu (8.84%) followed by Maharashtra (7.64%), Karnataka (6.31%) and West Bengal (5.48%) respectively.

Karnataka state is the leading producer of maize crop followed by Madhya Pradesh, Bihar, Tamilnadu and Maharashtra in India (2015-16). The study observed that the 1st period (1990-91 to 1999-00) CAGR of maize production found to be the highest in the state Tamilnadu (12.35%) followed by Maharashtra (10.29%) and Karnataka (9.59%), the second period (2000-01 to 2009-10) of production growth trend highest in Tamilnadu (25.12%), West Bengal (18.95%), Maharashtra (15.76%) and Odisha (13.05%). The third period (2010-11 to 2015-16) growth reported highest in Madhya Pradesh (17.29%) followed by West Bengal (16.02%) and Tamilnadu (13.28). Therefore significant growth trend was observed in the states of Tamilnadu, Jharkhand, Chattisgarh and Bihar in all study periods in Indian states due to adoption of HYV seeds and extension of infrastructural facilities besides implementation of ISOPOM and other centrally sponsored schemes by the government.

Among major Indian states, the yield CAGR of maize crop in the 1st period (1990-91 to 1999-2000) found to be significant growth in most of the states. The second period (2000-01 to 2009-10) the states of Tamilnadu (14.77%), Odisha (8.32%) and West Bengal (6.07%) got highest growth whereas in the third period Madhya Pradesh (10.66), Bihar (7.67%) and Tamilnadu reported highest growth. The total period (1990-91 to 2015-16) highest growth reported in the states of Tamilnadu (6.78%), Odisha (4.07%) and Chattisgarh (3.90%) respectively. The states of Tamilnadu and Odishas noticed that the highest yield growth than other states in India. On an overview, it can be observe that the maize crop grown area, production and productivity growth trends found to be significant of all estimated periods in the states of Tamilnadu, Jharkhand, Chattisgarh and Bihar in India (1990-91 to 2015-16).

Odisha is the most important state in the production of maize in India. Nabarangpur, Gajapathi, Rayagada and Koraput are the major maize grown districts in Odisha and the production constituted to be 81.74% of total production of maize crop. The districts of Nabarangpur and Gajapathi selected for household survey, while the two districts having largest area and highest production in the state. The study period (1997-98 to 2015-16) divided into two

sub periods 1997-98 to 2005-06 and 2006-07 to 2015-16. The first period CAGR of area under maize crop found to be significant growth at 9.96% in Gajapathi and 4.34 in Nabarangpur districts and the second period also indicated positive trend. The total period (1997-98 to 2015-16) area growth registered at 6.68% and 5.14% in the districts of Nabarandpur and Gajaptahi. Whereas production growth found to be both 1st and 2nd period 14.44% and 8.70% and 8.10 % and 2.39% of Gajaptahi and Nabarangpur. The total period (1997-98 to 2015-16) production growth trend registered at 9.61% and 6.45% of the sample districts of Nabarannpur and Gajaptahi. Similarly the yield CAGR exhibited significant growth 3.14%, 4.76% and 10.05%, 0,32% reported in 1st and 2nd periods of sample districts. The total period the maize yield growth had also exhibited considerable growth of 3.90% in Nabarangpur and 1.73% in Gajapathi districts respectively.

It may be observe that among the major maize grown districts in Odisha, the selected districts of Nabarangpur and Gajapathi played a vital role rearing area, production and productivity growth trends registered positive trend in all estimated periods against the other major maize producing districts in the state of Odisha.

6.3.2: Status of Food Processing Industries in the State:

The study identified during 1990-2001 the small scale industries in the state is 30361 out of which 3104 (10.22%) are agro- based industries. The total investment of the units found to be 1,11,192.90 lakhs and the agro based industries comprising Rs.12,858.64 (11.56%) lakhs. Agro services centre is significant and has 92 units with an investment of 116.81 lakhs. Some of the major brands are already present at the Khurda Food Park (Britania Industries Ltd., Parle Agro and Amul Biscuits etc.,. Although the food-processing sector still remains largely untapped, due to seasonality of raw materials, in adequate infrastructural facilities, predominant presence of marginal and small farmers, credit problems and lack of entrepreneurship are the main reasons for industrial backwardness in the state.

However, the state has recorded growth in food production 107 lakh MT with 25 lakh MT as surplus during 2014-15. Therefore, the state government had taken pro-active measures to setup 9746 micro, small and medium (MSMES) industries with as investment of Rs.321 crores. There was 64 fish land centres with include 4 fishing harbours and 6 jetties. The state has 22 exporters who process the marine produce, as 19 modern processing plants and 5 are European approved standard. The other food processing industries are beverages, Oil processing, Agro produce industries etc., As on 2013-14 the government of Odisha having approximately 127284 enterprises engaged in the food and allied sectors generating over 1.47 lakh employed with an investment of more than Rs. 1557.86 crores.

Further, the state of Odisha is a prominent producer of Maize, produced 6.57 lakh MT (2015-16). The markets of maize are under developed and under-utilized. Majority of produce (80%) has been exported to processing units, which are in the states of Chattisgarh, Madhya Pradesh, Gujarat, Karnataka and West Bengal. About 8% processed in the state and very low quantity of maize retained for the purpose of own consumption and seed purpose. Nabarangpur is the major maize grown district in the state. The government established two special mandis at a cost of 150.00 lakh each for maize at Umarkote and Raigarh. There are about 43 feed processors in the state. Godavari agro.vet, Eastern Hatcheries, Pasupati feeds, Amrit feeds are the major units and they annually process around 50000 MT of maize for animal feed. 34 processing industries were assisted under National Mission of Food Processing (NMFP) with 1197.33 lakhs.

6.3.3 Socio-Economic Characteristics of Sample Households:

The study examined the general characteristics of sample households. The average family size found to be 5.02 members. 2.46 members were fully engaged under farming. The average farming experience reported 23.93 years. The educational status illiterates constituted to be highest 33 percent followed by higher primary 31.50%, secondary 23.00% and graduation 3% of farmers. About social category highest 53% household covered scheduled caste followed by 20.50% ST, 14% OBC and General category 12.50%. Among the farmer groups, SC category indicated highest sample households from all farmer groups. Out of 200 sample farmers 96.50% farmers expressed agriculture is the main occupation. 3.50% members engaged in salaried work and business.

On the whole average household own land was 4.12 acres, and the farm size groups 1.89 acres found to be marginal, 3.48, 5.72 and 9.91 acres constituted small, medium and large farmers. Over all per household leased-in-land was 1.96 acres. Leased out and un-cultivated land was not found from the sample farmers. So the net operated area was 5.88 acres. Per household net irrigated and un-irrigated area found to be 14.8% and 85.2% of total net operated area. Whereas per acre rental value Rs.6,000 and Rs.3,500 of irrigated and un-irrigated lands under maize crop. Out of 200 sample farmers only 27 farmers (13.50%) have irrigated land. In 1286.27 acres of total cropped area, 78.24% grown under maize crop and the remaining area is covered by paddy, blackgram, ragi, vegetables etc., Among farmer groups the largest area 499.50 acres grown under large farmer groups constituted 80.58% area grown under maize crop, due to inadequate irrigation facilities such as hill track and forest area of our study districts.

Average per household per acre highest input costs found to be seed cost Rs. 2192 followed by Rs.2135 harvesting and threshing and Rs.1874 chemical fertilizers and so on. Overall, average household per acre total input cost found to be Rs.13046, the gross and net returns were Rs. 20,470 and 7374. Among farmer groups total paid put cost increased as farm size increases from marginal to large farmer except marginal farmer. Whereas the gross and net returns lowest Rs.5782 and highest returns Rs.7746 of small and large farmer group under Rabi average household per acre total cost reported Rs.15794, gross and net returns found to be Rs.24,326 and 8,532. Among the land holding groups except the small farmers, the other three groups total paid out costs increased as farm size increased. The gross and net returns area also increased in all farm groups in the same line. The maize production per acre found to be 22 to 23 quintals in kharif and 24 to 30 quintal in rabi season.

The average household borrowed total loan Rs.19020 from financial institutions and the Commercial Banks (CBs) provide the highest loan amount Rs.8745 than other institutional sources like cooperatives, RRBs and SHGs. The average large farmer borrowed the highest loan amount Rs.34,762 from commercial Bank. In the case non-financial institutions commission agents provide the highest loan Rs.28,910 per household for agriculture purposes. The total non-institutional loan amount per household was 34,005 at 14 percent rate of interest. Per household total loan amount both financial and non-financial institutions found to be Rs.53,025. Among the farmer groups the average household borrowing loan amount (institutional and non-institutional) was increased as land size increases from marginal to large farmer group. Overall, above 62% sample farmers borrowed 54.60% loan on purpose of crop cultivation. Whereas 54.14% of farmers borrowed highest 66.99% amount from large farmers for crop cultivation. So the major portion of borrowings spent on crop cultivation expressed by all sample farmer groups.

6.3.4 Supply Chain of Maize Marketing:

The study discussed the various marketing channels of maize produce and the percentage of quantity sold, through each channel was examined. There are four marketing channels were appeared for maize marketing and the highest maize produce sold to the wholesale traders at farm gate. On the whole the highest 45% produce sold to wholesalers and commission agents, next to village traders (21.34%), outside wholesalers (other states) 17.48 and 16.08% to bio tech companies in neighbouring states. Among farmer groups the average marginal farmer 57.12% of highest maize produce sold to the village traders, the small farmer 53.67% to wholesaler, the medium farmer 54.11% sold to wholesaler/commission agent and large farmer 38.30% sold to wholesalers. Overall, the highest marketed surplus of maize sold to be 7737.79 qtls (45.10%) to wholesalers and commission agents. Therefore the commission agent cum wholesaler played an

important role against other marketing channels of the study districts of Nabarangpur and Gajapathi districts of Odisha state.

The marketing costs and margins are of inevitable importance, whereas particularly for both producer sellers and consumers, because the farmer is interested in getting the highest price for their produce. Among four marketing channels, the first channel maize producer net price received was Rs. 1080 per quintal followed by Rs.1135, Rs. 1195 and Rs.1140 per quintal received by second, third and fourth channel respectively. Moreover, marketing efficiency was estimated by using conventional method, Shepherd method and Acharya's method. Conventional and Shepherd method marketing efficiency found to be highest in channel IV and the Acharya's method is in channel III. Therefore higher marketing margins taken away by the market intermediaries in channel III and IV resulted in poor efficiency in marketing of maize produce.

Out of 200 sample farmers there were three major production constraints expressed i.e. low level of credit facilities, low extension services and lack of irrigation facilities, reported by 83.1%, 82.95%, and 69.00% of sample farmers. In the case of marketing constraints found to be the storage facilities, low MSP, lack of government procurement agencies constituted 88%, 87% and 68% of sample farmers expressed under maize crop. Suggestions for more production, such as extension of irrigation facilities, extend the credit facilities and supply of HYV seeds, fertilizers and pesticides at a subsidy prices through government agencies will promote the maize production. Regarding marketing constraints, all farmer groups' cent percent suggested that the government-purchasing agency is essential to protect the producers' income. It will reduce the private traders besides 92.5% of farmers suggested to extend the storage facilities followed by 91% to fix the high MSP than private market and 83% recommended to establish maize purchasing centres at agri markets near the harvesting places.

6.4 Policy Suggestions:

1. To overcome the existing traditional practices, the government should develop the new technologies and set up many post-harvest infrastructural facilities to farmers such as storage, sorting, cleaning and grading purposes at free cost for preventing wastage of maize produce at post-harvest stage of maize crop.
2. The government put price Support Scheme (MSP) and government procurement agency would play a crucial role to avoid private traders and make remunerative price to the farmers.
3. To increase the accessibility of easy and timely institutional credit a low rate of interest for small and marginal farmers.

4. The government should establish maize collection centres with required infrastructure facilities at nearest maize harvesting centres. These collection centres would be link to wholesale markets.
5. The efficient marketing would promote innovative approaches such as producer companies, value chain and Agro-processing industries are made to benefit the maize farmers and avoid middlemen in the market chain.
6. There is also need to establish the maize processing units, supply of high yielding variety seeds and input subsidies of maize crop by the government agencies, which will help to enhancing productivity, reduce the cost of cultivation and increase the net returns per acre of land.
7. The government has to promote infrastructural facilities, industrial support and fiscal incentives to boost the value addition in maize processing industries in Odisha.

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