Report No. 47

An Analysis of Supply Chain of Maize Marketing and Possibility of its Value Addition in Bihar

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Preface

The study on Maize in Bihar is a proposed study, assigned to us by our sponsoring division of the Directorate of Economics & Statistics, Ministry of Agriculture & Farmers Welfare, Government of India under the annual work plan year 2017-18. Maize is a commodity of high economic significance in the country. Its demand and production are increasing more rapidly as compared to other major agricultural commodities. Bihar occupied 5th rank in terms of area (8.07%) and 3rd in terms of production (10.99%) in 2015-16 at all-India level.

Its cultivation had picked-up during the 80s after the adoption of HYV seeds. It has emerged as an important crop in the non-traditional season and non-traditional areas. Cultivation during winter (rabi) is becoming a common practice in Peninsular India, as well as in north-eastern plains, which include Bihar too. Cultivation of maize in rabi season started in mid 60s in some pockets of Bihar. As of now, of the total maize production in the state, rabi produces 55.4 per cent followed by summer (28.4%) and kharif (16.2%). Due to befitting production and yield rate of maize in the state, Bihar had been awarded **Krishi Karman Award in 2016-17.** Moreover, a structural change in maize production and its dynamic market have led change in maize eco-system in Bihar. Participation of national players and a few multinationals in marketing of maize have changed the total scenario of maize farmers, traders and other stakeholders.

The study reveals that due to intense efforts of the farmers and government interventions as well, the yield rate of maize in the state has doubled the All-India average but the share of the producer in consumer's rupee has either shrunk or stagnated or under the MSP for the last few years, mainly due to marketing inefficiencies and insignificant level of processing. So, a study relating to supply chain of maize marketing and possibility of its value addition in the state was inevitable. The study has greater implications in regard to income and employment of farmers along with the maize road in Bihar. Simultaneously, it has inter-ministerial significance *(like; railways for ease of transportation, food-processing for value addition; trade and commerce for trade of maize and its value added products being used by Animal Husbandry, Fisheries and Dairy sectors, which make available quality poultry feed; Industries for ease of business doing, including Agriculture and Farmers Welfare at its Centre stage).*

Since this is the outcome of a team work and co-operation by various sources at different levels, so we deem it our duty to appreciate and acknowledge their help. First of all, we are grateful to the Research Advisory council (RAC) of the MoA, & FW, GoI, headed by Hon'ble Secretary, DAC & FW for granting approval to this study during its meeting held on 5th September, 2017. We express our gratitude to Dr. P C Bodh, Advisor, MoA & FW, GoI and Dr. Avinash Kishore (IFPRI, New Delhi) for their valuable suggestions in designing the study plan. The author was highly benefited from the discussions with Prof. S S Mandal, Principal Scientist, AICRP on Maize, BAU, Sabour and Scientists of ICAR's Maize Research Station, Begusarai (Bihar). We are extremely grateful for overwhelming support extended by our Hon'ble Vice-Chancellor, Prof. Nalini Kant Jha. We are personally grateful to Directors, (Agriculture and Food Processing, Government of Bihar), DAOs of Katihar and Samastipur districts and BAOs of sampled blocks for providing us all necessary information, data and extended field level co-operation. We sincerely thank DPM (JEEViKA) - Katihar, Associate (Techno Serve India, Purnea), selected maize processors, traders and the respondents for sparing their valuable time in discussions and co-operating in collection of information and data. We also acknowledge our thankfulness to the reviewer of the draft report, Prof. H O Sharma, JLNKV, Jabalpur (MP) for his valuable comments and suggestions. Last but not the least, we extend our sincere thanks to the members of the project team.

We do hope that the findings of the study will be highly useful to policy makers, researchers and students in sharpening their insights and help in understanding the complexities confronting the maize sector, and in formulating possible policy interventions required to overcome the challenges in production, marketing and processing in the state.

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Ranjan Kumar Sinha

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EXECUTIVE SUMMARY

Maize *(Zea mays L.)* is the *queen of cereal* and the third largest grain crop in India. As of now, it is cultivated in an area of about 9 million hectare, has an annual production of 23 million metric tons and an average national productivity of 2.57 metric tons per hectare. It is grown across wide range of environments, extending from extreme semi-arid to sub-humid and humid regions. In recent years, significant changes have occurred in maize utilization besides the production, due to increasing commercial orientation and rising demand for diversified end users. Past strategy did not explicitly recognize the need to raise farmers' income, particularly when there is dynamic market and diversified use. This is true in case of maize crop in Bihar. Marketing of maize outside the state and high transportation cost have largely affected the farmer's income out of its marketing, which have resulted to its further commercialization and doubling the production by 2025.

With this background in view, the following objectives were addressed in this study:

i. *To study growth of acreage, production and productivity of maize in the state.*
ii. *To analyze the cost of production of maize in the study area.*
iii. *To identify the different supply chain of maize marketing in the study area.*
iv. *To explore the possibility of processing/value addition of maize in the state.*
v. *To identify the constraints in production, efficient marketing and processing of maize and suggest suitable measures.*

The primary survey data collected from two sample districts viz., Samastipur and Katihar with an overall sample of 200 farmers. The growth of area, production and yield of maize are analyzed using the secondary data. The pattern of marketing, trading, markets, processing, constraints and suggestions are assessed using the primary data and case studies with different stakeholders. The reference period of the study was 2016-17.

Major Findings

- Maize is cultivated in all the 38 districts of the state in varying areas but the state's '*Maize Road*' covers 11 districts falling on north of the river Ganges and both the sides of Koshi, Gandak and Bagmati rivers. It occupied nearly 75.3 per cent of the state's total maize area and produced 79.5 per cent of the state's total maize production (2016-17). It is to be noted that Bihar has been awarded with **Krishi Karman Award** for highest maize production in the country during 2016-17.

- During 2000-01 to 2016-17 the maize area expanded from 620.5 thousand hectares to 720.9 thousand hectares in the state, indicating 16.18 per cent increase with AAGR of area of 0.98 per cent and CAGR of 0.94 per cent. The production touched to 3845.7 thousand MT from 1497.3 thousand MT, registering significant increase of 156.8 per cent during the same period. The

AAGR and CAGR were 7.47 per cent and 5.71 per cent respectively. The yield increased from 2413 kg/ha to 5335 kg/ha indicating 121 per cent increase over the two years. AAGR and CAGR of yield rates were 6.39 per cent and 4.78 per cent respectively during the period under study.

- The season wise CAGR of maize production was 6.86 per cent for kharif, 9.52 per cent for rabi, 4.87 per cent for summer and for annual 7.55 per cent during 2007-08 to 2016-17. Similarly, the season wise CAGR of maize yield was 7.79 per cent for kharif, 6.46 per cent for rabi, 4.06 per cent for summer and 6.57 per cent for annual during the same period.

- The analysis further reveals that maize area is gradually spreading to new areas and to some extend also replacing wheat, banana and a few millet crops. Substantial enhancement of yield rate had remained instrumental for significant increase in the level of production. Moreover, with rich water resources, the production and yield rate have touched a new height particularly in maize-road districts which, in turn increased the participation of national players and a few multinationals. This have led to a structural change in maize ecosystem in the state.

- Till August, 2016 there were 407 food processing units in the state and out of it 278 (68.3%) were operational. These industries have created 48,404 employment in the sector. Maize give unique position to the state in national maize market with most of the maize processing units, particular in north India, depended highly on maize from the state for a significant period of time. With the state productivity (5335 kg/ha), much higher than national productivity (2509 kg/ha) level, and area under cultivation is expected to rise. There is, thus, a large opportunities for maize processing units, which can be set up for making wide range of products like; starch, corn oil, corn flakes, corn flour, poultry feed etc.

- At present, there are 93 micro, medium and large maize processing units in the state. Out of it, 23 units have been benefited under the financial assistance program of the state department of food processing under IL&FS cluster. The Bihar Industrial Policy, 2016 has placed high importance on agro-based industries. Under the policy, food processing sector has been included as one of the ten priority sector.

- The study forms a sample of 200 farm household with an average age of 45.7 years and average family size of 6.5 members, of which 2.12 being engaged in farming. They have an experience of 21.6 years in the farming, but majority of them have studied up to secondary level (40.5%). More than half of the respondents are belong to general category (55.5%), followed by OBC (other backward classes) (31%) and scheduled castes (13.5%). The average net operational area in the study are is 6.20 acres. It is very important to note that that all most all the farmers undertake crop cultivation depending upon the

irrigation source of bore wells (98.5%). The higher proportion of irrigated land are found among medium farmers, followed by large, small and marginal farmers, as they are not ready to take any risk in the process of crop cultivation. The leased-in irrigated lands and its rental values are highest in case of medium farmers (R. 18333/acre), followed by large (Rs. 18000/acre), small (Rs. 6272/acre) and marginal (Rs. 12800/acre) farmers. The common crops grown by the sample farmers include paddy, maize, wheat, pulses, soyabean and vegetables. The cropping intensity was higher at 175 per cent for marginal & small farmers followed by medium farmers (157%) and large farmers (140%).

- As regards the total paid out costs and net returns realized by the sample maize farmers during rabi season, it is estimated at Rs. 20125/acre and Rs. 28009/acre respectively at overall farmer level. The CB ratio was 1:2.39. similarly, in case of summer maize, the total paid out costs and net returns are Rs. 18662/acre and Rs. 21078/acre respectively. The CB ratio was 1:2.13.

- As regards the financing of agriculture, a majority were found to have availed of loans from institutional sources (94.8%). It appears to be a good symptom of development. Among the institutional sources, commercial banks followed by Regional Rural Banks forms the major sources of finance, whereas among non-institutional sources, moneylenders, traders/commission agents happened to be the major sources of credit to the sample farmers. At the aggregate level, seasonal crop cultivation (8.50%) is the main purpose behind borrowing of loans, which amounts to 66.15 per cent of the total borrowings amount.

- The volume of net marketed surplus of maize was 106.05 quintal (90.22%) against the production of 117.54 qtls on overall average farm size of 2.84 acres. Among the farms, the net marketed surplus on average large farms (4.90 acres) was highest at 190.52 qtls (94.82%) followed by medium (91.54%), small (85.54%) and marginal (85.20%) farms. It is revealed that unlike other agricultural produce the net marketed of maize is quite high mainly due to low family consumption and other needs of the produce at the farmers' level.

- Some common marketing channels for marketing of maize in the study area are as below:

i. Farmer ⟶ Village Trader ⟶ Commission Agent ⟶ Wholesaler ⟶ Maize Processor
ii. Farmer ⟶ Village Trader ⟶ Commission Agent ⟶ Wholesaler ⟶ Maize Stocker
iii. Farmer ⟶ Commission Agent ⟶ Railway Point Maize Trading ⟶ Maize Processor
iv. Farmer ⟶ Mandies ⟶ Trader ⟶ Maize Processor
v. Farmer ⟶ Mandies ⟶ Trader ⟶ Maize Stocker

vi. Farmer ⟶ JEEViKA ⟶ AAPC Ltd. ⟶ NeML accredited Warehouse ⟶ Institutional Buyers/Stock and Sell at Premium

- The overall maize sold through different channels during the reference period was highest in channel-II by 44.04 per cent (9339.9 qtls) followed by channel-V (17.27%) for 3664 qtls, channel-IV (13.78%) for 2923.7 quintals, channel – VI (12.47%) for 2645 quintals, channel – III (10.64%) for 2255.7 quintals and channel – I (1.8%) for 382 quintals.

- The absolute value of marketing costs and margins varies across channels. It is apparent from the analysis that in channel – VI, the overall average producer's share in consumer's rupee was 78.28 per cent, followed by channel-II (77.20%), channel –V (71.29%), channel-IV (65.45%), channel - I (64.39%) and channel-III (64.38%). For measuring the marketing efficiency in maize, three alternate methods were also worked out. The conventional method (E) suggests that second channel was more efficient than other channels but price received by the producer in this channel was the lowest. In *Shephered's method,* marketing margins were not included as a part of marketing cost and this also suggests that the second channel was more efficient than other channels. This however ignores price received by the producer. The limitations of both these methods are considered in the modified method suggested by *Acharya.* According to *Acharya's method* (MME), the channel - VI was the most efficient over all channels.

- Among the production constraints, as perceived by the sample households were costlier of maize seeds than any other crops' seeds (38.5%) followed by pecking-up of the seeds by rats, termites and birds (37.5%), problem of drying of rabi maize (36.5%), shortage of labour due to migration as result of liquor ban in the state and subsidized grains at PDS (33.5%), lack of proper irrigation facilities (30.5%) and destruction of the crop by blue bulls and boars (27.5%).

- The marketing constraints, as perceived by the sample households were lack of storage facilities at the village or nearby area (58%) followed by taking 5 kg. of more produce at per quintal of grain due to expected weight loss arising from high moisture content in the grain (53.5%), frequent road snatchings while coming back to home after selling the produce in big mandies/markets (43.5%), harassment by traffic police (40.5%), lack of confidence on outside traders (33.5%) and absence of formal marketing agencies (20.%).

- Prominent suggestions to overcome the production constraints were rationalization of maize seeds' prices (49.5%) followed by providing tarpauling (40' X 40') to maize growing farmers for protecting the grains from pre-monsoon rains (30.5%), irrigation facilities (30%), construction of threshing floor (25%), strict vigilance over adulteration of fertilizer (19%), preventing the incidences of destroying the crop from blue bulls & boars (16%) and provision of subsidy on dryer machine (15%).

- To overcome the marketing constraints, their suggestions were procurement of maize by formal agencies (35%) followed by check on harassment by traffic police (34.5%), extending storage facilities at village/panchayat level (21%) and check on unfair means adopted by the traders by licensing them (10%).

- While recognizing the immense scope of development in production, marketing and processing of Maize in Bihar, stakeholders views are captured as case studies. These are JEEViKA in Maize Trading, Maize Procurement by Aaranyak Agri. Producer Company Limited (AAPCLtd.) with JEEViKA in the study Area, Gulab Bagh Mandi --- The Maize Hub of India, Trding of Maize at Railway Rake Points and Maize Processors. The insightful discussions with these stakeholders revealed many innovative solutions along with their operational pattern and constraints, which are **briefed as follows:**

JEEViKA

- It has successfully implemented maize farm value chain interventions in the study area, particularly in Purnea and Katihar districts since 2015-16 through producer group and women farmers producer company (WFPC). The procurement figures for 2015-16 rabi was 1014 MT, 3026 MT for 2016-17 and 13944 MT for 2017-18. Producer groups and higher federations have been highly effective in large scale aggregation and collective marketing of farmers' produce. The intervention eliminated multiple layers of intermediaries and thus, ensured better price realization and also allowed to benefit from off-season price escalation.

AAPC Ltd.

- A women farmer producer company, incorporated with the JEEViKA in 2009 aimed to organized farmers into a collective to improve their bargaining strength in the market. In 2015, the company with the support of Techno Serve India (US) and JEEViKA started maize market linkage through the producer groups formed by JEEViKA. After two years of successful intervention, it has scaled-up its achievement to 12595 MT of maize till June, 2017 against the target of 11000 MT. Besides there are many revealed advantages of AAPC Ltd, however, the major challenge is to win the confidence of the farmers.

Gulab Bagh Mandi (Purnea, Bihar)

- It is India's freest grain market and largest maize trading centre, located at Purnea in north-east Bihar. After repealing of BAPMC Act, (1960) in 2006, there is no marketing rules and regulations in the mandi. More than 100 registered traders and a few unregistered traders are engaged in trading of maize in this mandi. About 125 feed companies of eastern India are engaged in maize procurement from the mandi. Out of 10 lakh MT warehouse capacity in Bihar, 5 lakh MT is at Purnea and Gulab bagh itself. Around two million MT of maize is annually traded in this mandi. It is conducted through Adatiyas (Commission Agents) in a manner through *inbound logistics* ----

display & inspection ---- auction ---- bagging & weighing ---- payment ---outbound logistic. From the company's point of view, the key problem is the agent's control over the market, which in turn distorts the price and quality. This creates a range of supply chain issues.

Trading of Maize at Railway Rake Points

- Two traders were discussed, who are using *indents* for railway rakes since 2008. About 500 to 600 railway rakes of maize across the 11 rail rake points are exported outside the state. The railway earns about Rs. 65 to 78 lakh per rail rake. About 1.3 to 1.5 million MT maize is annually exported. Major constraints are nine hours of free loading time, recognization of maize and other agricultural commodities by the railways are at par with industrial materials, lack of basic infrastructural facilities at the railway sidings etc. To overcome these problems suggestions include 24 hours of free loading time, shifting of railway rake point from Bhagalpur to Naugachia, fixation of loading & unloading charges, reduction in demurrage charge, provisioning of basic infrastructural facilities at railway sidings etc. These efforts will ultimately enhance the marketing efficiency of maize in the state.

Maize Processors

- Two leading maize processors were discussed. About 93 maize processing units of different sizes are involved, and of them 23 have been facilitated by the State Department of Food Processing. Till 2010, apart manufacturing the distribution business was performed by these processors in the form of dealership but in post 2012-13, the *Integration Business Model (IBM)* was adopted by them, wherein manufacturing and consumption both, are doing together. They were of the view that if the maize policy is centered towards the strengthening of production chain, then there will be a great help to the poultry feed industry. Assistance in community based driers to improve the maize quality is the need of the hour, revealed in the discussions.

Policy Recommendations

- In Bihar and also in some other states, maize production is gradually shifting from rainy season to winter season (rabi). Besides, its demand and production are increasing more rapidly as compared to other major commodities. Simultaneously, it is estimated that by 2025, India would require 50 million metric tons of maize grain, of which 64 per cent would be required in the feed sector, 30 per cent in the industrial sector, 4 per cent as food and 2 per cent for seed and miscellaneous purposes. Thus, in next 7 to 8 years there is necessity and opportunity for increasing India's maize production by about 40 per cent from the current level of production of approximately 38 MMT (2016-17). To meet such target, some strong policy interventions will be required in the area of production, marketing and processing of maize in general and particularly in Bihar. These interventions may be as follows:

Production

i. Strengthening of production chain (sowing to harvesting) by way of availability of quality seeds at reasonable price, balanced use of nutrients, transplanting maize under late sown conditions etc. are to be taken care of.
ii. To address the issue of low quality maize, there is need to establish a chain of community based dryers at producer level, construction of threshing floors (10,000 sq. feet) at village level, providing tarpaulin (40' x 40') to maize farmers for preventing grains from pre-monsoonal rains etc.
iii. Aflatoxins and storage pests developed due to high moisture at harvesting, the installation of affordable community/metal silos at producer level may be made to save maize grains from pest infestation. This will simultaneously prevent the distress sale of crop at cheaper prices.
iv. Picking-up of grains before sprouting of seeds by pigeon, sparrow, rats, termites, etc may be checked in consultation with the plant protection scientists.
v. Destruction of the crop by blue bulls and boars may be checked with a co-operation of the Forest, Environment and Wildlife Management Department.

Marketing

i. To address the supply chain issues, market linkage model may be promoted or strengthened through farmers' producer company/group/organization. It will minimize the number of market functionaries or intermediaries and enhance the producer's share in consumer's rupee.
ii. The complete production-to-end user value chain needs to be strengthened. Since the price difference between the farmer's realization and the end user is about Rs. 1000 to Rs. 2000 tons of maize production, which can be eliminated by creating the business model of direct purchase by end user/industries without brokers/commission agents.
iii. The logistic for bulk handling system of maize from farm to industrial gate needs to be strengthened through development of hassle free roads (quality of roads and elimination of harassment by traffic personnel) and carriage by railways (24 hours of free loading time, reduction in demurrage charge, fairly developed basic infrastructure at railways sidings, provisioning of piecemeal loadings etc.)
iv. Improvement in market intelligence system and transparency in prices are the need of time.

Processing

i. The level of processing of maize in the state is presently quite insignificant. There is, thus, a large opportunity for maize processing units, which can be set up for making a range of products like; starch, corn oil, corn flakes, corn flour, poultry & animal feed, zeinprotien etc. So, there is need to incentivize to maize based processing industries in the state.

ii. Having potential of strong viability for maize processing units in the State Government should geared-up the process of establishment of at least one mega food park in each of the agro-climatic zones or potentially identified geographical areas. As of now, one mega food park project is being executed at Khagaria (Zone – II) by Pristine Mega Food Park Pvt. Ltd. under an agreement with MoFP& I, GoI.

iii. The state may be the *'Maize Processing Hub,'* if the maize policy is centered towards the strengthening of Maize Production Chains.

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CHAPTER – I

INTRODUCTION

1.1 Background of the Study

Maize *(Zea mays L.),* also called corn, is believed to have originated in Central Mexico 7000 years ago from a wild grass, and Native Americans transformed maize into a better source of food. Maize contains approximately 72 per cent starch, 10 per cent protein and 4 per cent fat, supplying an energy density of 365 K Cal/100 grams and is grown throughout the world, with the United States, China and Brazil being the top three maize producing countries producing approximately 682 (65%) of the 1044 million metric tons in 2018 *(USDA, 2018).* Maize can be processed into variety of food and industrial products, including starch, sweeteners, oil, beverages, glue, industrial alcohol and fuel ethanol.

Maize is called *'queen of cereal'* as it is grown throughout the year due to its photo-thermo-insensitive character and highest genetic yield potential among the cereals. It is the third largest grain crop in India, after rice and wheat. It is cultivated in an area of 8.69 million hectares, has an annual production of 21.81 million metric tons, and an average national productivity of 21.81 metric tons *(GoI, 2017).* In India, current consumption pattern of maize is poultry, pig, fish feed 52 per cent, human consumption 24 per cent, cattle feed and starch 11 per cent each and seed and brewery industry 1 per cent each. It is cultivated throughout the year in most of the states of the country for various purposes including grain, feed, fodder, green cobs, sweet corn, baby corn, pop corn and industrial products. Because of its diverse uses in the feed, industry and food sectors, maize is considered as an internationally important commodity driving world agriculture.

In recent years the maize area, production and productivity have shown steady upward trends (table 1.1), which is largely associated with significant genetic enhancement from the area of open pollinated varieties, composite breeding to

double and three way hybrids and recent development in single cross hybrids. However, with dramatic increase of maize demand in developing world, including India, the current trend daunts to keep pace . The option of further increasing maize area is limited. In India, the area of maize has been sticking to around 5 to 9 million hectare since last five decades, and the overall increase in maize is realized largely from increasing productivity in general and favourable ecologies in particular.

The table 1.1 reveals that during last six decades, the production of maize rose by more than eight times, touching 22.85 MMT in period V (2011-12 to 2015-16) from 271 MMT over the period I (1951-52 to 1955-56). This increase was due to expansion in area (143.42%) and yield (245.83%). During the period (1951-52 to 2015-16), maize area, production and yield of India registered a CAGR of 7.70 per cent, 19.34 per cent and 10.89 per cent respectively. Now, if we have a glance the growth pattern of area, production and yield of maize in India after classifying into six periods for last six decades, it is interesting to note that during the second period, the production was doubled plus. This expansion was due to expansion in area (53.94%) and yield (43.68%). In later period (III), maize production increased only by 21.42 per cent over the period-II. This period was relatively less favourable to enhance the production on the fronts of high base of both area and yield. But in period – IV, the production increased by 54.43 per cent over period – III. This substantial increase was mainly contributed by increase in yield (41.37%) during the period – IV over III. During the period – V, the production doubled over the period – IV. During this period also, there were increases in both area (38.32%) and yield (45.37%).

Table 1.1: All India Area, Production and Yield of Maize

Periods		Area (Million Hect)	Growth in Area Over the Periods (%)	Production (MMT)	Growth in Production over the Periods (%)	Yield (Kg/ha)	Growth in Yield over the Periods (%)
I.	1951-52 to 1955-56	3.648	---	2.714	---	744	---
	1956-57 to 1960-61	4.172	---	3.568	---	855	---
	1961-62 to 1965-66	4.630	---	4.592	---	992	---
II.	1966-67 to 1970-71	5.616	53.94	6.004	121.22	1069	43.68
	1971-72 to 1975-76	5.884	---	6.022	---	1023	---
	1976-77 to 1980-81	5.834	---	6.218	---	1066	---
III.	1981-82 to 1985-86	5.824	3.70	7.290	21.42	12.52	17.12
	1986-87 to 1990-91	5.840	---	8.030	---	1375	---
	1991-92 to 1995-96	5.988	---	9.212	---	1538	---
IV.	1996-97 to 2000-01	6.362	9.24	11.258	54.43	1770	41.37
	2001-02 to 2005-06	7.116	---	13.634	---	1916	---
	2006-07 to 2010-11	8.198	---	18.648	---	2275	---
V.	2011-12 to 2015-16	8.880	38.32	22.852	102.98	2573	45.37
	CAGR (%)	**7.70**	**---**	**19.34**	**---**	**10.89**	**---**

Moreover, in India, maize is grown across wide range of environments, extending from extreme semi-arid to sub-humid and humid regions. The crop is also very popular in the low and mid-hill areas of the western and north-eastern regions. Broadly, maize cultivation can be classified into two production environments: traditional maize growing areas (such as Madhya Pradesh, Bihar, Rajasthan, and Uttar Pradesh) and non-traditional maize areas (Karnataka and Andhra Pradesh). The state wise area, production and yield of maize falling under these areas are depicted in table 1.2:

Table 1.2: Area, Production and Yield of Maize during 2015-16 across the States.

Areas/States		Area Million /hec	% of All India	Production (Million Tons)	% of All India	Yield (Kg/ha)
A	Traditional Areas					
	Madhya Pradesh	1.10	12.63	2.58	11.83	2350
	Bihar	0.70	8.07	2.40	10.99	3416
	Rajasthan	0.88	10.14	1.21	5.55	1374
	Uttar Pradesh	0.68	7.81	1.26	5.76	1848
	Jharkhand	0.29	3.31	0.38	1.72	1304
	West Bengal	0.16	1.79	0.72	3.30	4615
	Sub-total	3.81	43.76	8.55	39.15	2244
B.	Non-Traditional Areas					
	Karnataka	1.18	13.57	3.27	14.99	2773
	Tamil Nadu	0.36	4.19	2.38	10.93	6549
	Telangana	0.57	6.59	1.74	7.96	3030
	Andhra Pradesh	0.23	2.68	1.41	6.48	6069
	Maharashtra	1.01	11.59	1.51	6.93	1500
	Himachal Pradesh	0.30	3.40	0.67	3.08	2270
	Gujarat	0.39	4.45	0.57	2.62	1478
	Punjab	0.12	1.32	0.42	1.94	3687
	Jammu & Kashmir	0.31	3.52	0.48	2.20	1566
	Sub-total	4.47	51.32	12.45	57.13	2785
C.	Others	0.43	4.92	0.81	3.71	1884
	Total (A+B+C)	**8.69**	**100.00**	**21.81**	**100.00**	**2509**

Source: Agricultural Statistics At a Glance 2016, MoA& FW, GoI.

Above table 1.2 suggests that the maize area, production and yield in non-traditional areas are comparatively higher than the traditional areas. In traditional areas, the crop is often grown in marginal eco-regions, primarily as a subsistence crop to meet food needs. In contrast, maize in non-traditional areas is grown for commercial purposes i.e., mainly to meet the feed requirements of the booming poultry sector *(Joshi et. Al 2005).*

There are three distinct seasons for the cultivation of maize in India: kharif, rabi in peninsular India and Bihar, and Spring in northern India. Maize is predominantly a kharif season crop but in past few years rabi maize has gained a significant place in total maize production of India. The pre-dominant rabi maize growing states are Andhra Pradesh (45.5%), Bihar (20.1%), Tamil Nadu (9.3%), Karnataka (8.5%), Maharashtra (7.7%), West Bengal (5.3%) and other states (3.6%). Of course, it has emerged as an important crop in the non-traditional season and non-traditional areas. Cultivation during winter is becoming a common practice in Pensular India (Andhra Pradesh, Karnataka and Tamil Nadu), as well as in the north-eastern plains. Karnataka (3.27 MMT), Madhya Pradesh (2.58 MMT), Bihar (2.40 MMT) and Tamil Nadu (2.38 MMT) are the four largest maize producing states closely followed by Telangana (1.74 MMT), Maharashtra (1.51 MMT) and Andhra Pradesh (1.41 MMT) during 2015-16. Cultivation of maize in winter season started in mid 60s in some pockets of Bihar and south India. Yield obtained during this season is invariably higher than kharif season due to long duration of growth and least infestation of pests and diseases. In Bihar, maize can be taken up in all the three seasons. In recent years, significant changes have occurred in maize production and utilization due to increasing commercial orientation of this crop and rising demand for diversified end users, especially for feed and industrial uses.

Production of commodities in a nation is largely determined by their demand and techno-economic competitiveness to produce and market them. In case of maize, the technological landscape for increasing maize production is largely positive as significant yield gap between realized and potential yield levels exists and enough opportunities lies in regard to increasing the production by bridging this gap.

However, another important question is whether or not there shall be enough demand pull to propel the production.

1.2 Review of Literature

In this section, various studies related to the present and future demand of maize and its production perspectives, market dynamics and need to develop production, marketing and processing segments of maize for the benefit of maize cultivators have been reviewed in a chronological order.

The last decade of the 20th century witnessed extensive economic reforms in India, which in turn, saw growing stocks of surplus wheat and rice. This, however, came at an associated cost of degradation of both soil and water resources. At the global level, prices of these two leading cereals declined sharply, including the farming community to partly diversify agriculture to sustain and augment farm income and improve the quality of soil and water resources. Maize is considered a promising option for developing agriculture in uplands of India.; It now ranks as the third most important food grain crop in India. The maize area has slowly expanded over the past few years to about 8.69 million hectare (4.33 % of the gross cropped area and 6.14% of the net sown area) in 2013-14. *Paroda& Kumar (2000)* predicted that this 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 increases in maize supply will be achieved through the intensification and commercialization of current maize production system.

Obviously, maize is the principal feed crop of the country. About 59 per cent of the total production is used as feed, while the remaining is used as industrial raw material (17%), food (10%), exports (10%), and other purposes (4%) *(Kumar et.al 2013).* It has emerged as the most produced grain in the world, surpassing rice in 1996 and wheat in 1997. Its production is increasing at double the annual rate of that of rice and three times that of wheat *(Fisher et.al 2014).*

The necessity, opportunities and challenges for doubling the Indian maize production to around 60 MMT in the next 10 years i.e., by 2028, it is important to see the drivers for future maize demand. These demand may be for feed, industrial uses, food and export. Presently around 59 per cent of maize grain is used as animal feed, with poultry feed alone accounting for about 83 per cent. Maize is an ideal poultry feed and it would continue to be used heavily in this sector. Thus, growth in the poultry industry would have a direct impact on maize demand. The Indian poultry feed market is expected to grow at an annual rate of 7-8 per cent, with overall growing at CAGR of 8 per cent *(Anonymous, 2015).* With these growth rates, it is expected that by 2025, India would require about 32 MMT of maize grain for meeting its feed requirement. As regards the demand for industrial uses, the starch industry in India is at a nascent stage with the annual per capita consumption of starch in the country being merely 1.3 kg, as compared to 64.5 kg in the USA and over 10 kg in Asian countries like China and Indonesia. However, the same is likely to improve in the coming years as starch finds diverse applications in the food and beverage, paper, pharmaceutical, textile, bio-fuel and other industries. Thus, with the rising demand for starch products from various industries, the Indian starch industry is expected to grow by around 15 per cent per annum in the coming years (Anonymous, 2012). Maize is a major source of industrial starch and it is expected that demand of maize for industrial uses would increase to 15 MMT by 2015 from the present level of 4.25 MMT.

In 2011-12, human consumption of maize in the rural areas was 1.56kg/person/year, while in urban areas it was 0.168 kg/person/year *(NSSO, 2014).* Projecting from 2011 census data, consumption of maize as direct human food stands at 1.36 MMT in the year 2011-12. From the past consumption surveys by NSSO, it is evident that per capita consumption of maize in rural areas has reduced by more than 35 per cent from 3.7 kg/annum in 2004-05 to 2.4 kg/annum in 2009-10, and further down to 1.56 kg/annum in 2011-12. In 2011-12, consumption of maize as food was reported relatively higher (more than 5 kg/person/annum) in the states of Himachal Pradesh, Gujarat, Jammu & Kashmir, Madhya Pradesh ad Rajasthan. In urban areas, maize consumption continues to be low. However, keeping in view the recent interest of

urban consumers in specialty corn, like sweet corn, baby corn, popcorn, quality protein maize (QPM) etc; and rising popularity of multi-grain flour, it is expected that demand for maize as food may touch 2 MMT by 2015. In terms of maize demand for exports, the Asian nations together constitute about half of the total world maize import of about 100 MMT. India enjoys both price and freight advantage in such a huge global maize market *(Kumar et. al, 2013).* With strong trade interventions and competitive pricing, it is expected that by 2025, India would have the opportunity to export 10 MMT of maize, provided the domestic demand is met and there are exportable surplus.

Taking into account the demand scenario in individual sectors, the overall maize demand is expected to be very robust in the next decade. By 2025, India would require 50 MMT maize for domestic consumption, of which 32 MMT (64%) would be required in the feed sector, 15 MMT (30%) in the industrial sector, 2 MMT (4%) as food, and 1 MMT (2%) for seed and miscellaneous purposes. Over this, there would be about 10 MMT of export potential. India needs to produce overall 60 MMT of maize by 2025 to fulfill the domestic and export demands. Thus, doubling India's maize production by 2025 would be an opportunity *(Yadav et.al, 2016).*

But there are challenges to improve maize productivity. Drought is recognized as the most important constraint across the rain fed environments, which constitutes 75 per cent of maize area in India. This situation is likely to exacerbate in the coming decades due to changing climate, often leading to inadequate and/or uneven incidence of rainfall in the crop season alongside temperature changes *(Bernstein et. al, 2007).* India is also facing increased frequency and magnitude of extreme weather events, including flood, high temperature, high wind etc. *(Prasanna et. al, 2014).* Maize is particularly vulnerable to the reproductive stage heat stress. Climate projections also suggest that elevated temperatures, especially in the drought prone and rainfed areas, are likely to result in significant crop yield losses *(Cairns et. al, 2013).* Spring maize is an important option for intensifying and diversifying cropping systems in India, but is prone to severe heat stress during flouring/early grain filling stages, particularly in the upper and middle Indo-Gangetic plains

highlighting the importance of developing improved maize cultivars with built in tolerance to high temperature stress *(Cairns et. al, 2013; Yadav et. al, 2015).*

However, a strong demand pull will also result in some expansion of maize area, mainly through cropping intensification. The maize area is expected to touch 12 MHa by 2025. *Kumar et. al (2013)* have predicted that major expansion in maize area is expected in Karnataka, Maharashtra, Odisha, Andhra Pradesh and Tamil Nadu.

In fact, there is a huge shortage of proper post-harvest infrastructure facilities in India. It is estimated that about 2.45 per cent of maize is lost at the farmers' field level during harvesting, threshing, winnowing, transportation and storage *(Anonymous, 2002).* In Karnataka, the state with the highest maize cultivation in India, the post-harvest loss at the farm level was estimated to be 3.02 per cent. About 0.68 kg/quintal of maize was lost at the storage level. About 0.49/qtl was lost at the drayage level, whereas at transportation, threshing, packaging and clearing level losses were 0.44, 0.34, 0.15 and 0.10 kg/qtl, respectively *(Basappa et. al, 2017).*

Unlike rice and wheat, maize as a commodity has grown on its own strength in the market dynamics. Although, the MSP is announced every year, there is hardly any public procurement of maize. The complete production to end user value chain and supply chain needs to be strengthened. Price difference between the farmer's realization and the end user is about Rs. 585/tone of maize production, which can be eliminated by creating the business model of direct purchase by end user/industries without brokers. The development of efficient and integrated maize grain market is essential to drive simultaneously the maize seed sector *(Kumar et. al, 2013).* So, the supply and value chain strengthening from producer to end user will enhance maize production /consumption.

Maize processing industry in India is still in its infancy, unlike countries like US and China. There is huge potential to increase the use of maize in industrial applications. Maize starch is used as an adhesive in the textile industry, as a thickener in food industry, for increasing paper strength in paper industry, as filler in pharmaceutical industry, as feed stocks for manufacture of glucose, dextrose, ethanol and a number

of other products *(Eliasson, 2014)*. In India, about 40 per cent of the total companies engaged in starch production are new entrants. These entities require greater incentives for establishing a robust starch industry. Growth in starch industry would translate into greater demand of maize and remunerative prices for the farmers.

Above review suggests that there is need to develop mechanisms for strengthening the production, marketing and processing maize system across the maize growing states, so that the poor maize growers can also be benefitted.

1.3 Need of the Study

Past strategy for development of agricultural sector has focused primarily on raising agricultural output and improving food security. The strategy paid dividends as the country was able to address severe food shortage. It has made the country not only food self-sufficient at aggregate level, but also a net food exporting country. The strategy did not explicitly recognize the need to raise farmers' income and any direct measure to ensure remunerative prices of the crops, particularly when there is a dynamic market of produce. This is true in case of maize crop in Bihar. Marketing of maize outside the state and high transportation cost have largely affected the farmer's income out of its marketing. So, it is the felt need for undertaking a study relating to the supply chain of maize and possibility of processing of maize in the state itself. The study will have greater implications in regard to income and employment of farmers along the Maize Road (consisting of 13 districts of the state). The study will have also inter-ministerial significance (like Railways for ease of transportation; food processing for value addition; trade and commerce for trade of maize and its value added products; industries for ease of business doing environment including agriculture at its centre stage for production and marketing). Hence, the study is highly desired.

1.4 Objectives of the Study

The specific objectives of the study include:

i. *To study growth of acreage, production and productivity of maize in the state.*
ii. *To analyze the cost of production of maize in the study area.*
iii. *To identify the different supply chain of maize marketing in the study area.*
iv. *To explore the possibility of processing/value addition of maize in the state.*
v. *To identify the constraints in production, efficient marketing ad processing of maize and suggest policy measures.*

1.5 Limitations of the Study

The study suffered with following limitations:

i. The results of the study were based on two maize potential selected districts falling under two different agro-climatic sub-zones. These districts are from Bihar's Maize Road (11 districts out of 38 districts in the state), so it may not be generalized for whole of the state.
ii. The reference period of the study was 2016-17, which was a favourable year for production of maize crop in the state. But the subsequent year particularly Rabi-Maize 2017-18 was reported to be unfavourable due to climatic stress and adulterated maize seeds.
iii. Identification of possible marketing channels, calculation of price spread and estimation of marketing efficiency were based on unbiased observations, discussions and survey, but these may suffer with some human errors.

1.6 Data and Methodology

The study is based on primary and secondary data. The primary data were collected from two selected districts of Bihar with reference period of 2016-17. The selection of districts was based on two different maize potential agro-climatic sub-zones in terms of area and yield of maize crop in the respective sub-zones of the state. From each district, one block/tehsil was selected based on the same criterion. Within the selected block/tehsil, two clusters of village comprising 3-4 small villages per cluster were selected for conducting the survey. A total of 50 farm households from each cluster of villages were selected with total farm households adding up to 100 from

each district. Households were selected randomly for analyzing the supply chain of maize marketing. The households were duly classified in existing four farm size classes viz., marginal (<1 ha or 2.5 acres), small (1-2 ha or 2.5 to 5 acres), medium (2-4 ha or 5 to 10 acres) and large (>4 ha or > 10 acres). Further, adequate care was taken to ensure that the selected households represented proportionately the operational land holding sizes. Thus, a total of 200 farm households were interviewed using a pre-tested structured schedule. The data gathered from primary source have been analyzed using tabular analysis. CAGR of maize crop has been calculated based on secondary data. The details of the sample distribution of the farm households are depicted in table 1.3.

Besides, some case studies out of the identified different categories of stakeholders have also been undertaken such as, maize leading traders at railway rake points, formal agency like JEEViKA for maize trading, Gulab Bagh Mandi (Purnea)--- The Maize-hub of India and a few selected maize processors for its value addition.

Table 1.3: Distribution of the Sample Farm Households

Zone	District	Block	Village Cluster	Sample Hhs				
				Marg.	Small	Med.	Large	Tot.
Agro-Climatic Sub-Zone – I	Samastipur	Kalyanpur	Barehta	10	17	10	07	44
		Bibhutipur	Sakhmohan	13	23	14	06	56
Agro-Climatic Sub-Zone – II	Katihar	Korha	Basgarha	19	17	12	---	48
		Barari	Lakhmipur	---`	27	08	17	52
Total	**02**	**04**	**04**	**42**	**84**	**44**	**30**	**200**

1.7 Organization of the Report

The report has been divided into Six chapters. First chapter provides background of the study including its need, objectives, data and methodology and limitations of the study. The second chapter presents the growth trends of maize in Bihar. The third chapter focuses on the status of food processing industries in the state, while, the fourth chapter brings out socio-economic characteristics of sample area and the households. The supply chains of maize marketing are discussed in the fifth chapter followed by concluding remarks and policy recommendations as concluding chapter.

CHAPTER – II

GROWTH TRENDS OF MAIZE IN THE STATE

2.1 Background

Since the bifurcation of erstwhile Bihar in November, 2000 agricultural sector in Bihar has assumed even greater significance in the light of the fact that its rich mineral base has gone to Jharkhand. Thus, the development of agriculture and allied sectors assumes utmost importance for the overall development of the economy. This task is not very difficult. Given the wide variety of fertile soils and access to water resources, agricultural sector in Bihar has the potential to alter its productivity levels across its crops. The topographical advantage of Bihar is reflected in its diversified cropping pattern. Largely, the agrarian economy is tilted towards subsistence crops, as revealed by the acreage under food grains, which was 93.5 per cent in 2016-17. Cereals dominate the cropping scenario with an area share of 86.6 per cent during 2016-17. It is almost the stagnant for last several years. Alike the country, maize is also the third largest cereals in the state. It contributes nearly 21.3 per cent to total cereals' production, preceded by rice (45.6%) and wheat (33.1%). In fact, maize is cultivated in all the 38 districts of the state in varying areas but the state's 'Maize Road' covers 11 districts falling on north of the river Ganges and on both sides of Koshi, Gandak and Bagmati. These districts are Muzaffarpur, East Champaran, Vaishali, Katihar, Purnea, Samastipur, Begusarai, Bhagalpur, Araria and Madhepura. It occupied nearly 75.3 per cent (542.62 thousand hectare) of the state's total maize area (720.91 thousand hectare) and produced 79.5 per cent (3060.7 thousand tones) of the state's total maize production (3845.7 thousand tones) during the year 2016-17.

It is commendable to note that Bihar has been awarded with **Krishi Karman Award** for rice in 2013-14 and maize production in 2016-17. Moreover, the trend analysis is the most common practice in terms of collecting information and attempting to spot a pattern . This technique is often used in extracting an underlying behavioural

pattern based on a time series data, which remains partly or wholly hidden by noise. This method helps to understand that how and why things have changed or will change over time. A simple description of these techniques is called estimation which can be simply undertaken by compound and annual growth rates analysis. In this chapter, the area, production and yield growth trends of maize crop in the state have been also analyzed with CAGR and AAGR.

2.2 Growth in Area

In Bihar, the maize area gradually expanded from 620.5 thousand hectare in 2000-01 to 720.91 thousand hectare in 2016-17 accounting for 16.18 per cent increase during the last one and half decades. During the period, the average annual growth rate (AAGR) was 0.98 per cent whereas compound annual growth rate (CAGR) was 0.94 per cent (table 2.1). This is a clear indication that maize is gradually spreading to new areas and to some extent also replacing wheat, banana and some millet crops.

2.3 Growth in Production

During 2000-01, the state produced 1497.3 thousand metric tons of maize, which touched to 3845.70 thousand metric tons in 2016-17, registering significant increase of 156.84 per cent. This increase was recorded merely on 16.18 per cent expansion in area during the same period. So, enhancement of yield by about 121 per cent, had remained instrumental for such an increase in production. It could be relatively easier to enhance the production on the bank of a low base of productivity. During 2000-01 to 2016-17 the AAGR and CAGR were 7.47 per cent and 5.71 per cent respectively (table 2.1).

Table 2.1: Area, Production and Productivity of Maize Crop in Bihar

(Area in '000 hectare/Production in '000 tones/Productivity in kg/ha)

Year	Area	Production	Productivity
2000-01	620.5	1497.3	2413
2001-02	594.3	1488.3	2504
2002-03	603.4	1349.8	2236
2003-04	616.4	1473.6	2390
2004-05	629.9	1491.2	2367
2005-06	649.1	1397.2	2152
2006-07	641.9	1714.8	2671
2007-08	620.6	1735.6	2797
2008-09	629.2	1719.8	2733
2009-10	640.9	1478.6	2307
2010-11	653.7	2108.2	3225
2011-12	674.9	2486.1	3683
2012-13	693.3	2755.9	3975
2013-14	732.2	2904.2	3966
2014-15	706.5	2478.7	3508
2015-16	704.9	2517.1	3571
2016-17	720.9	3845.7	5335
CAGR (%)	**0.89**	**5.71**	**4.78**
AAGR (%)	**0.98**	**7.47**	**6.39**

Source: Different publications of Economic Survey (Bihar), GoB.

2.3.1 Season wise Growth in Production

Bihar's maize, which is primarily a rabi crop, has been a success sector mainly due to the quality of the produce, which has grown steadily in the last few years. During 2007-08, winter (rabi) maize was cultivated with a share in production of about 46 per cent of the total production in the state. It was about 55 per cent of the total maize production in the state during 2016-17. This gives unique position to the state in national maize market with most of the maize processing units in north-India dependent highly on maize from Bihar for a significant period of time. The season wise production level of maize in Bihar during the last one decade may be seen from table 2.2. The season-wise production AAGR also revealed that during rabi season it was higher at 18.02 per cent followed by kharif (9.57%), summer (7.44%) and the total annual by 10.34 per cent. Similarly the CAGR was also higher at 9.52 per cent in rabi followed by kharif (6.86%) and summer (4.87%).

Table 2.2: Season wise Production Level of Maize in Bihar ('000 tones)

Year	Kharif	Rabi	Summer	Total
2007-08	321.41 (17.31)	858.29 (46.22)	677.32 (36.47)	1857.01 (100.00)
2008-09	371.82 (21.69)	752.73 (43.92)	589.45 (34.39)	1714.00 (100.00)
2009-10	401.47 (26.00)	544.14 (35.23)	598.83 (38.77)	1544.44 (100.00)
2010-11	468.52 (22.22)	922.29 (43.75)	717.39 (34.03)	2108.20 (100.00)
2011-12	622.42 (24.34)	1098.17 (42.95)	836.47 (32.71)	2557.06 (100.00)
2012-13	926.32 (33.61)	791.00 (28.70)	1038.63 (37.69)	2755.95 (200.00)
2013-14	778.21 (26.80)	1199.39 (41.30)	926.64 (31.90)	2904.90 (100.00)
2014-15	825.15 (33.29)	913.78 (36.86)	739.82 (29.85)	2478.75 (100.00)
2015-16	692.70 (27.52)	1105.14 (43.91)	719.26 (28.57)	2517.10 (100.00)
2016-17	624.30 (16.23)	2131.51 (55.42)	1089.89 (28.35)	3845.70 (100.00)
AAGR (%)	**9.57**	**18.02**	**7.44**	**10.34**
CAGR (%)	**6.86**	**9.52**	**4.87**	**7.55**

Source: Compiled from various years of Economic Survey (Bihar), GoB.

In the early 1960s, a national program researches, with assistance from the **Rockefellor Foudation**, studied the suitability for Bihar of a range of maize hybrids and management practices, taking data on factors as; planning density, sowing dates, fertilizer requirements, maturity class, storability and pest control. The massive efforts include basic research to extension and seed production. As a part of this, the researchers tested maize in the rabi season. Yields were high and consistent, due among other things to the great number of sunny days and the long growing season, as well as the drier and cooler conditions, which were amenable to the crop but less so to pests. Farmers quickly began planting winter maize in Bihar, and the practice eventually spread to parts of north-India.

Moreover, with rich water resources and available irrigation in winter (rabi) and summer seasons, irrigated area under maize particularly in Maize Road-Districts of the state increased and so have the yields. During the last two seasons viz., 2015-16 rabi and 2016-17 rabi increased the participation of national players and a few multinationals have led to a structural change in the maize ecosystem in Bihar.

2.4 Growth in Yield

Productivity of maize in Bihar was 2413 kg/ha in 2000-01, which well above the all-India average productivity of 1822 kg/ha in the same year. It further touched to 5335 kg/ha in the year 2016-17, which was also much higher as compared to all India average (2700 kg/ha). In fact, Bihar's maize yield is touching the yield level of the world's leading maize growing countries viz; Brazil (5500 kg/ha) and China (6000 kg/ha). Agricultural innovations such as rabi (winter) maize have helped dispel the spectre of near-term starvation for many small holders in the state. In course of the field survey it was said that *'Makka ne bana diya pucca'* particularly in *'Simanchal region'* of the state. The yield AAGR and CAGR during 2000-01 to 2016-17 were 6.39 per cent and 4.78 per cent respectively (table 2.1).

2.4.1 Season wise Growth in Yield

Rabi maize's yield was 7482 kg/ha, which was higher compared to kharif (2586 kg/ha and summer 5601 kg/ha) during the year 2016-17 (table 2.3). Barring a few years, almost similar trend was recorded during the last one decade. It means the yield of rabi maize has touched a new height in the state followed by summer and kharif. During the last decade the growth trend also revealed the AAGR to be at 12.34 per cent for rabi followed by kharif (10.49%) and summer (8.91%). Similarly, the CAGR was 7.79 per cent for kharif followed by rabi (6.46%) and summer (4.06%).

Table 2.3: Season wise Productivity Level of Maize in Bihar (Kg/ha)

Year	Kharif	Rabi	Summer	Total
2007-08	1221	4001	3762	2823
2008-09	1518	3610	3153	2676
2009-10	1709	2601	3047	2411
2010-11	1998	3880	3952	3225
2011-12	2358	4584	4327	3670
2012-13	3549	3264	5468	3975
2013-14	2814	4552	4820	3966
2014-15	2974	3630	4171	3508
2015-16	2559	4421	3903	3571
2016-17	2586	7482	5601	5335
AAGR (%)	**10.49**	**12.34**	**6.42**	**8.91**
CAGR (%)	**7.79**	**6.46**	**4.06**	**6.57**

Source: Compiled from various years of Economic Survey (Bihar), GoB.

2.5 District wise Area, Production and Yield of Maize during 2016-17

The shares of area and production of maize for various districts of Bihar have been presented in table 2.4 for the year 2016-17. The productivity of maize for each district with its rank has also been presented in table 2.5. As per ranking, the top three districts in terms of maize area are Katihar (12.4%), Khagaria (8.8%) and Samastipur (8.6%), which altogether came to about 30 per cent of the total maize area in the state. Production level of these three top districts is found to be about 42.4 per cent while districts such as Katihar, Purnea and Darbhanga registered tops three high productivity levels (table 2.5).

Table 2.4: District wise Area, Production and Productivity of Maize in Bihar during 2016-17

(Area in '000 hectare/Production in '000 tones/Productivity in kg/ha)

Districts	Area	Production	Productivity
Patna	6.34 (0.9)	13.91 (0.4)	2194 (31)
Nalanda	8.05 (1.1)	36.56 (1)	4540 (14)
Bhojpur	2.64 (0.4)	5.16 (0.1)	1957 (34)
Buxar	1.28 (0.2)	3.01 (0.1)	2357 (30)
Rohtas	0.08 (0)	0.13 (0)	1663 (37)
Kaimur	0.35 (0)	0.73 (0)	2098 (32)
Gaya	4.39 (0.6)	13.71 (0.4)	3124 (24)
Jehanabad	0.44 (0.1)	2.08 (0.1)	4751 (21)
Arwal	0.52 (0.1)	2.93 (0.1)	5684 (7)
Nawada	1.51 (0.2)	4.38 (0.1)	2910 (25)
Aurangabad	1.18 (0.2)	2.84 (0.1)	2414 (29)
Saran	24.99 (3.5)	109.42 (2.8)	4378 (16)
Siwan	18.02 (2.5)	85.09 (2.2)	4724 (13)
Gopalganj	11.28 (1.6)	31.74 (0.8)	2815 (26)
Champaran (W)	5.37 (0.7)	18.39 (0.5)	3423 (21)
Champaran (E)	46.68 (6.5)	122.28 (3.2)	2619 (28)
Muzaffarpur	13.38 (4.4)	56.62 (1.5)	1804 (35)
Sitamarhi	5.38 (0.7)	21.83 (0.6)	4057 (17)
Sheohar	1.5 (0.2)	6.68 (0.2)	4439 (15)
Vaishali	32.39 (4.5)	123.48 (3.2)	3813 (19)
Darbhanga	14.36 (2)	101.96 (2.7)	7100 (3)
Madhubani	0.09 (0)	0.34 (0)	3953 (18)
Samastipur	61.88 (8.6)	300.39 (78)	4855 (11)
Begusarai	56.44 (7.8)	211.4 (5.5)	3745 (20)
Munger	2.19 (0.3)	4.3 (0.1)	1962 (33)
Sheikhpura	0.68 (0.1)	1.19 (0)	1758 (36)
Lakhisarai	4.44 (0.6)	1.86 (0)	420 (38)
Jamui	4.43 (0.6)	11.99 (0.3)	2704 (27)
Khagaria	63.53 (8.8)	404.63 (10.5)	6369 (6)
Bhagalpur	40.7 (5.6)	138.49 (3.6)	3403 (22)
Banka	10.37 (1.4)	33.89 (0.9)	3267 (23)
Saharsa	29.68 (4.1)	165.1 (4.3)	5564 (8)
Supaul	15.26 (2.1)	83.79 (2.2)	5491 (9)
Madhepura	40.89 (5.7)	214.46 (5.6)	5246 (10)
Purnea	36.93 (5.1)	285.54 (7.4)	7731 (2)
Kishanganj	3.51 (0.5)	23 (0.6)	6561 (4)
Araria	42.25 (5.9)	274.13 (7.1)	6489 (5)
Katihar	89.55 (12.4)	928.28 (24.1)	10366 (1)
Bihar	**720.91 (100)**	**3845.7 (100)**	**5335**

NB: Figure in parentheses denotes percentage and ranking for productivity
Source: Department of Agriculture, GoB.

Table 2.5: Classification of Districts based on Production/Productivity of Maize in Bihar

Prod./Productivity	Triennium 2014-17	
	Developed Districts	Undeveloped Districts
Production	Katihar, Khagaria, Samastipur	Sheikhpura, Kaimur, Rohtas
Productivity	Katihar, Purnea, Darbhanga	Muzaffarpur, Sheikhpura, Lakhisarai

Source: Economic Survey, Bihar : 2017-18, Govt. of Bihar

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CHAPTER – III

STATUS OF FOOD PROCESSING INDUSTRIES IN BIHAR

3.1 Background

In the literature of economic development, it is generally found that it is the primary sector, which holds the key to growth of the economy in the initial stages. Within the primary sector the most important is the agricultural sector. However, as economic development picks up, demand shifts from agricultural sector to secondary and tertiary sectors. Thus, further development in the economy is possible only through a big push in the secondary and tertiary sectors. This established pattern is also visible in Bihar. During the last five years (2011-12 to 2015-16), the overall economy has grown at 4.9 per cent, while the secondary sector has grown at 8.5 per cent and the tertiary sector has recorded a growth rate of 5.3 per cent at constant price (table 3.1). Although the pace is not very high, this implies a structural change of the Bihar's economy.

Table 3.1: Sectoral Growth Rate of GSDP

Sectors	2015-16		2016-17		2011-12 to 2015-16	
	Current Prices	Constant Prices	Current Prices	Constant Prices	Current Prices	Constant Prices
Primary	9.3	4.4	13.9	6.6	7.2	(-) 1.2
Secondary	5.7	1.6	4.5	(-) 0.2	13.9	8.5
Tertiary	13.9	10.1	18.7	14.5	12.1	5.3
Overall	11.2	7.5	14.8	10.3	11.2	4.9

Source: Economic Survey, Bihar : 2016-17

If one tries to identify the major contributors to growth of the state income in recent years in the form of medium-term behavior of sectoral growth rates, it is found that sectoral growth rates at constant prices for the period 2011-12 to 2015-16 meant for mining and quarrying are 67.5 per cent, manufacturing (25.9%), transport storage-communication (13.5%) and financial services (10.1%). These are probably drivers of growth of Bihar economy. All these sectors have registered a growth rate of more than 10 per cent which is much higher than overall growth rate of 4.9 per cent.

In spite of a decent growth of 8.5 per cent for the secondary sector, the level of industrialization in Bihar is still very low and its contribution to the state's GSVA stands at below 20 per cent, compared to the national average of above, 31 per cent (table 3.2). Indeed, this ratio is the lowest in Bihar compared to Gujarat (50%), Chhattisgarh (48.9), Odisha (41.4%), Jharkhand (39.3%) and Tamil Nadu (34.5%). Since the contribution of the industrial sector to GSVA in Bihar stands nearly unaltered at 19 per cent, it is obvious that whatever modest change that Bihar's secondary sector has shown during recent years is due to the higher growth rate of its tertiary sector.

Table 3.2: Sectoral Composition of GSVA at Constant Prices (2011-12) .

Sectors	2011-12	2012-13	2013-14	2014-15	2015-16 (P)	20160-17 (Q)
Bihar						
Primary	25.8	27.1	23.4	22.2	21.7	21.0
Secondary	18.8	15.6	19.3	20.9	19.8	18.0
Tertiary	55.5	57.2	57.3	56.9	58.5	61.0
India						
Primary	18.4	17.7	17.2	16.1	15.4	---
Secondary	33.1	32.3	31.7	31.4	31.3	---
Tertiary	48.5	50.0	51.1	52.5	53.4	---

Source: Economic Survey, Bihar : 2016-17 & Agril. Statistics at a Glance, 2016

The latest Annual Survey of Industries (ASI), which relates to 2014-15 data reveals that there were 3530 units in Bihar, compared to 1669 units in 2005-06, implying a CAGR of 11.1 per cent for the period of 2005-06 to 2014-15. For India as a whole, there were 2.30 lakh units in 2014-15, compared to 1.40 lakh units in 2005-06, showing a lower CAGR of 6.8 per cent for the same period. All these factories, however, were not in operation. In Bihar, out of 3530 factories (2014-15), 2942 factories (83.34%) were operational; while in India, out of 2.30 lakh factories, 1.89 lakh were operational (82.2%). Since the mineral resources have got separated from Bihar after the bifurcation (2000), one would have expected that presence of agro-based industries will be relatively more in Bihar, but this is not the reality. As apparent from table 3.3, the share of agro-based industries in Bihar in 2014-15 was 34.9 per cent the corresponding figure being higher at 41.6 per cent for country as a whole. This actually indicates the fact that the substantial potential that exists in Bihar in regard to agro-based industries because of its wide bio-diversity, is yet to be realized fully.

Table 3.3: Number of Factories and Factories in Operation in Bihar

Year	No. of Factories			No. of Factories in Operation		
	Agro-based	Non-Agro based	Total	Agro-based	Non-Agro based	Total
Bihar						
2005-06	470 (28.2)	1199 (71.8)	1669 (100)	440 (31)	978 (68.9)	1420 (100)
2006-07	278 (17.4)	1323 (82.6)	1601 (100)	228 (16.2)	1182 (83.8)	1410 (100)
2007-08	466 (26.8)	1319 (73.9)	1785 (100)	404 (25)	1209 (75)	1613 (100)
2008-09	437 (24.6)	1340 (75.4)	1777 (100)	377 (24.3)	1172 (75.7)	1549 (100)
2009-10	510 (26.6)	1409 (73.4)	1919 (100)	454 (26.3)	1271 (73.7)	1725 (100)
2010-11	918 (32.7)	1889 (67.3)	2807 (100)	822 (32.3)	1725 (67.7)	2547 (100)
2011-12	1126 (34.8)	2106 (65.2)	3232 (100)	1014 (35.3)	1858 (64.7)	2878 (100)
2012-13	1141 (34.1)	2206 (65.9)	3347 (100)	1005 (34.1)	1941 (65.9)	2946 (100)
2013-14	1148 (33.6)	2272 (66.4)	3420 (100)	1036 (33.1)	2096 (66.9)	3132 (100)
2014-15	1232 (34.9)	2298 (65.1)	3530 (100)	1129 (38.4)	1813 (61.6)	2942 (100)
CAGR	17.4	8.8	11.8	17.9	8.6	11.1
India						
2005-06	61936 (44.2)	78224 (55.8)	140160 (100)	57863 (43.5)	75028 (56.5)	132891 (100)
2006-07	54902 (37.9)	89809 (62.1)	144711 (100)	51681 (37.3)	86937 (62.7)	138618 (100)
2007-08	62189 (42.5)	84196 (57.5)	146385 (100)	59124 (42.1)	81443 (57.9)	140567 (100)
2008-09	67259 (43.3)	88063 (56.7)	155322 (100)	64005 (42.6)	86285 (57.4)	150290 (100)
2009-10	65409 (41.2)	93469 (58.8)	158878 (100)	62299 (40.8)	90336 (59.2)	152635 (100)
2010-11	87520 (42.8)	117011 (57.2)	204531 (100)	69249 (41.6)	97387 (58.4)	166336 (100)
2011-12	93251 (42.9)	124303 (57.1)	217554 (100)	72769 (41.4)	102939 (58.6)	175708 (100)
2012-13	87803 (39.5)	134317 (60.5)	222120 (100)	68698 (38.4)	110403 (61.6)	179101 (100)
2013-14	87775 (39.1)	136803 (60.9)	224578 (100)	70993 (38.2)	114697 (61.8)	185690 (100)
2014-15	95887 (41.6)	134546 (58.4)	230433 (1000)	77049 (40.7)	112417 (59.3)	189466 (100)
CAGR	6.4	7.2	6.8	3.7	4.8	4.3

Source: Bihar Economic Survey : 2017-18, Government of Bihar.

The industrial sector is small in terms of number of industries operating in Bihar. The share of Bihar in total number of industries in India was only 1.55 per cent in 2014-15, while its share in population of the country is 8.6 per cent. As regards the size of operational industries, it is again smaller than the national average by their capital base, employment and value of output. In 2014-15, the size of fixed capital of all industries in Bihar (Rs. 9.94 thousand crore) was only 0.4 per cent of the all-India figure (Rs. 2474.45 thousand crore). Such ratios of Bihar for other indicators are working capital (0.5%), persons engaged (1.1%), value of output (0.9%) and net value added (0.6%). The preponderance of smaller industrial units is however, not an unexpected phenomenon. The process of industrialization has only begun and is still at a nascent stage in Bihar. The only ray of hope in this otherwise bleak scenario is that the growth rate of factories in Bihar during the last decade had been 11 per cent, compared to the national growth rate of 4.3 per cent. If this trend is continued and further strengthened, Bihar's industrial economy should look up and with the buoyancy in other sectors of the country, the industries' sector should also strengthen the growth process (GoB, 2018).

3.2 Agro-based Industries

The state is spread across 93.6 lakh hectare and has three distinct agro-climatic zones (i) north-west zone, consisting of 13 districts receiving an annual rainfall of 1040-1450 mms, and the soil of which is sandy loam, (ii) north-east zone, covering 8 districts with an annual rainfall ranging between 1200-1700 mms consisting of loam or clay loam soil and (iii) south zone, which has 17 districts filled with soil of sandy loams, loam, clay or clay loam and receiving an annual rainfall of 990—1300 mms. The cultivators (71.96 lakh) and agricultural labourers (183.46 lakh) in Bihar produce a variety of crops, besides cereals (180.99 LMT) and pulses (4.62 LMT). These crops include oilseeds (1.26 LMT), fibres (15.71), fruits 40.97 LMT), vegetables (143.62 LMT), sugarcane (182.40 LMT) and tea (40.00 LMT) during 2016-17. Bihar is also endowed with a high population of milch animals, with a cow population of 122.32 lakh and buffalo population of 75.67 lakh and goat population of 121.54 lakh (GoB, 2018). Thus, Bihar offers enormous opportunities for agro-based industries.

3.3 Present Status of Food Processing Industries

Table 3.4 present the status of food processing industries in Bihar. The number of food processing industries in Bihar in 2015-16 was 399, of which 66.7 per cent (266 industries) were operational. By August 2016, there were a few additions, resulting in 407 units, of which 278 (68.3%) were operational. Although the range of products of the agro-based industries in Bihar is quite wide, it is the cereal based industries (rice, wheat and maize) which dominate the sector. Not less than two-thirds of the agro-based industries in Bihar are engaged in processing of cereals. Total employment under the food processing industry is 48.4 thousand.

Table 3.4: Details of Food Processing Industry in Bihar

Name of Industries	2015-16		As on August, 2016				
	No. of Units		No. of Units		Financial Progress (Rs. Crore)		Employment (Nos)
	Total	Operational	Total	Operational	Approved Project Cost	Grant Released	
Rice Mills	174	115	174	120	1607.45	184.10	6438
Wheat Milling	44	33	44	33	355.17	57.89	1806
Maize Processing	41	29	43	32	504.72	52.71	2120
Rural Agri Business Centre	52	37	53	37	466.23	74.32	1807
Cold Storage	3	0	3	0	15.10	1.35	122
F & V Processing	16	7	16	8	108.32	13.46	580
Milk Processing	9	6	9	6	242.42	16.44	586
Makhana Processing	4	2	4	2	5.55	0.67	70
Honey Processing	3	3	3	3	2.60	0.53	41
Biscuits Manufacturing	10	8	12	8	213.13	26.10	1946
Edible Oil Manufacturing	10	8	10	9	507.50	33.35	2001
Ice-Cream	6	4	7	4	34.73	3.53	203
Other Projects	25	14	27	16	316.39	29.40	2087
Food Park	2	0	2	0	309.80	3.00	28597
Total	399	266	407	278	4689.10	496.86	48404

Source: Department of Industry, Directorate of Food Processing, GoB.

3.3.1 Maize Processing

Around 3.85 million tons of maize were produced over an area of around 0.72 million hectare in the state during 2016-17. Winter (Rabi) maize is cultivated mainly in Bihar with a production of 2.13 million tons; about 55.4 per cent of the total production from out of 39.6 per cent of total maize area. This gives unique position to the state in national maize market with most of the maize processing units particular in north India depended highly on maize from the state for a significant period of time. With state productivity (5335 kg/ha) much higher than national productivity (2509 kg/ha) level and area under cultivation is expected to rise, the availability of good quality maize offers significant opportunities for entrepreneurs in the state.

However, the level of processing in the state is presently quite insignificant. There is, thus, a large opportunity for maize processing units, which can be set up for making a wide range of products like; starch, corn oil, corn flakes, corn flour, poultry feed etc. At present, there are 93 maize processing units distributed across the districts of the state. 23 units of them had been benefitted under the financial assistance programme of the state department of Food Processing. The units are

under Infrastructure Leasing & Financial Services Ltd. (IL & FS) cluster. Its district wise presence is stated in table 3.5.

Table 3.5: District wise Number of Maize Processing Units in Bihar benefitted under the State Department of Food Processing.

SN	Districts	Number
1.	Araria	02
2.	Begusarai	01
3.	Bhojpur	03
4.	Buxar	02
5.	Darbhanga	03
6.	East Champaran	01
7.	Gopalganj	01
8.	Patna	01
9.	Muzaffarpur	05
10.	Samastipur	01
11.	Vaishali	03
	Total	**23**

Source: Directorate of Food Processing, Dept. of Industries, govt. of Bihar

3.4 Government's Assistance

3.4.1 Support Institutions

The Department of Industries of the State Government of Bihar is trying utmost to promote industrialization in the state. The wings of the Department like Udyog Mitra, District Industries Centre (DIC) and Bihar Industrial Area Development Authority (BIADA) look after the promotion of industries in the state. The Department of Industries is taking serious interest in the industrial development of the state and this is reflected in the rise of its expenditure level. The expenditure on industries sector rose to Rs. 1116 crore in 2016-17, from a meagre Rs. 429 crore in 2011-12. The percentage share of industries to expenditure on economic services rose. It was Rs. 44943 crores in 2016-17 accounting for 2.5 per cent of expenditure on Economic Services.

a. Udyog Mitra

Udyog Mitra was created under the aegis of the Department of Industries to help prospective entrepreneurs in establishing industries. Udyog Mitra is also associated with the preparation of monitoring reports of schemes being implemented by the District Industries Centre. In 2016-17, Udyog Mitra was able to spend the entire allotted amount of Rs. 110.00 crop, implying an utilization ratio of 100 per cent. In 2016-17, 1098 entrepreneurs got benefitted as against 906 in 2015-16. This is very encouraging.

The Udyog Mitra has prepared the profile of all the districts in the state in terms of land mapping. It has also been nominated as the implementing agency for National Mission for Food Processing, a scheme launched by the Central Government. Under the Cluster Development Scheme of the Union Government, Udyog Mitra is working for the development of 13 clusters across the state. Under this, establishment of 'Suvidha Kendras,' marketing assistance, and redressal of specific problems faced by entrepreneurs are addressed by Udyog Mitra. A private firm has been co-opted by Udyog Mitra for cluster development programmes.

b. District Industries Centre

The District Industries Centre (DIC) was created by the Department of Industries as a nodal agency for helping entrepreneurs to set up industries in the state. The DICs place special emphasis on micro, small and medium enterprises. As mentioned before, DICs are also the principal implementation agency for Prime Minister's Employment Generation Programme (PMEGP). In 2016-17, 2389 units received margin money through DICs, against a target of 1506. This implies an achievement rate of 158 per cent. As regards financial performance, the total disbursement was Rs. 6530 lakh, against a target of Rs. 3008 lakh. This again implied an even higher achievement rate of 217 per cent.

c. Bihar Industrial Area Development Authority (BIADA)

Under the statutory provisions of the Bihar Industrial Area Development Act, 1974, BIADA was created to help promote industrialization in the state, encompassing the total gamut of development. It has the authority to acquire land to be allotted to the investors for establishment of industrial units. Further, BIADA also develops necessary infrastructure for industrial development such as roads, power and water connections, etc. BIADA has four regional offices at Patna, Darbhanga, Bhagalpur and Muzaffarpur. Till September, 2017 BIADA had acquired 5185 acres of land, out of which, 587.02 are reserved for infrastructure, administrative blocks etc. and 141.51 acres are still vacant. The remaining land has been allotted to 2497 industrial units.

d. Infrastructure Development Authority (IDA)

The Bihar State Infrastructure Development Enabling Act, 2006 is a comprehensive legislation for rapid development of physical and social infrastructure in the state and attracting private sector participation in designing, financing, construction, operation and maintenance of infrastructure projects in the state. The Act also tries to reduce administrative and procedural delays. Under this Act, the Infrastructure Development Authority (IDA) was constituted on April 27, 2006 with the Chief Secretary as Chairman and Development Commissioner as Vice-Chairman. In the light of Industrial Incentive Policy 2006, a land bank was established on August 28, 2006 for accelerating the process of land acquisition for different development schemes. The IDA is the nodal agency for PPP projects in the state. In the last decade, IDA had played a pivotal role in the development of industrial infrastructure of Bihar.

e. Office of Investment Commissioner

In order to encourage 'Make in Bihar' and facilitate private investments to move into Bihar, the State Government had set up the Office of Investment Commissioner and had it located in Mumbai, the commercial capital of India. This office interacts closely with the corporate and financial world. Till December 31, 2017 this office had secured important investment proposals for super speciality hospital, cement, and food processing. The office could also get substantial amount of proposals for investment in the sectors like energy.

3.4.2 Bihar Industrial Investment Act, Rules and Policy, 2006

During the last two years, the State Government has introduced the Bihar Industrial Investment Promotion Act, 2016, Bihar Industrial Investment Promotion Rules, 2016 Bihar Industrial Investment Promotion Policy, 2016 Bihar Start-up Policy, 2017 and Policy for High Priority Sector, 2017. Introduction of these Acts and policies has ushered in a new era of industrialization and ease of doing business in the state.

For setting up a new business in the state, there are now four stages of clearance through the online integrated system. The stage – I, clearance refers to examining

the feasibility of the project by the SIPB and providing necessary approval. Stage-I clearance allows the investor to apply for subsequent stages of approval including financial clearance under the BIIPP, 2016. Next, the stage-II, clearances refer to all kind of clearances required at the pre-establishment stage. This is followed by stage – III, clearances which refer to all kinds of clearances required at the pre-operation stage i.e., before commencement of commercial production. Finally, Financial Incentive Clearance refers to the clearance requested/accorded for availing financial incentives. The 10 priority sector for investment are: (i) food processing, (ii) tourism, (iii) small equipment manufacturing, (iv) IT, ITeS, electrical and electronic hardware manufacturing, (v) textile, (vi) plastic & rubber, (vii)renewable energy, (viii) healthcare, (ix) leather, and; (x) technical education. Till January, 2018, 292 proposed food processing units were granted stage-I clearance with a total proposed investment of Rs. 1467.21 crores.

3.4.3 Bihar Industrial Investment Promotion Act and Rules, 2016

The promotion of investment, industrial facilitation, regulatory and process reforms, mandating user interface with adequate feedback mechanism and other related matters that make the state an attractive investment destination are central to the provisions of the Bihar Industrial Investment Promotion Act and Rules, 2016. The Act and Rules have laid down a robust mechanism for getting the approvals for starting a business. The Act has mandated the formation of State Investment Promotion Board (SIPB) with appropriate representation from all concerned departments to clear the business proposals in a coordinated and time bound manner. The SIPB has been adequately empowered to serve as a one stop shop for granting all kinds of approvals required by an investor, query handling and grievance redressal. The Department of Industries has notified clear guidelines for approvals, query handling and grievances redressal and has placed them in the public domain. Provisions like installation and operationalization of Online Single Window Clearance System which integrates services of around 15 Departments for granting various approvals to an investment proposal, self-certification and deemed approval, punitive action against the officials who do not dispose their responsibilities in a time bound manner etc. has introduced a great deal of

transparency and efficiency in the approval process. This is especially important in the context of the micro and small units which have generally lesser bargaining powers. These provisions have created a level playing field for all the investors in the state and clearly fostered the idea of an inclusive industrialization. A dedicated Call Centre-Cum-Help Desk has been established to provide handholding support to the investors on a real time basis.

3.4.4 Bihar Industrial Investment Promotion Policy (BIIPP), 2016

This policy lays a corner stone to achieve the desired level of industrialization in the state. The focus of the policy is on the development of adequate infrastructure, prioritizing core sectors with comparative advantages, promotion of advanced technology and skill development, a comprehensive and competitively structured package of assistance/incentives, and promotion of balanced regional development. The policy has pronounced various measures for the creation of enabling infrastructure during the policy period of 5 years. Some of the key measures include--- establishment of new industrial areas and expansion of existing industrial areas, Air Cargo Complex and Container Freight Terminal; promotion of Amritsar Kolkata Industrial Corridor (AKIC), promotion of Integrated Manufacturing Clusters (IMCs), increase in the supply of quality/reliable energy, establishment of gas pipeline network, establishment of Common Facility Centres in the potential MSME clusters, promotion of private participation for increasing availability of industrial land, and promotion of Private Industrial Parks.

The choice of 10 priority sectors for investments in the state, which include both manufacturing and service sectors, aptly proclaim that the state government is according clear emphasis on promoting the inclusive and sustainable industrialization. These 10 priority sectors are the ones having (i) largest employment generation potential, (ii) scope for capacity building and skill up-gradation of the youth at the grass root levels, (iii) lowest carbon foot-prints, and; (iv) requirement of only minimal basic physical infrastructures. As a general principle, this policy discourages establishment of any industry, which impacts the environment adversely.

Most importantly, the idea of inclusive and sustainable industrialization has guided the State Government in designing its incentive structure. This is evident from the additional incentive for MSME units, renewable energy units, and additional incentives offered to the SC/ST and women entrepreneurs. To promote MSMEs in the state, which are the largest employment generators across the country, the State Government has also introduced a preferential purchase policy as a part of the overall policy for industrialization. Under the policy, out of 72 clearances granted under the BIIP Policy-2016,; 26 (36.11%) were food processing sector.

Through an amendment in the Bihar Industrial Investment Promotion Policy was made in the year 2017, the State Government has announced additional/increased benefits to following three sectors (a) IT, ITeS and Electronic System Design and Manufacturing (ESDM), (b) Food Processing, and; (c) Textile, Apparel and Leather.

These three sectors have been identified as High Priority sectors in the state based on their economic and employment generation potentials. These sectors are manpower intensive and are based on the huge production potential for the diverse agricultural commodities in the state. The eligibility conditions for an industrial unit to be categorized as High Priority Sector are--- investment in fixed assets and plant machinery (excluding land), which ought to be more than Rs. 5.00 crore and employment of at least 50 workers (excluding support staff such as drivers, guards, etc.). The employment criterion is not applicable for food processing sector.

3.4.5 Bihar Start-up Policy, 2017

To foster innovations and promote innovation-led entrepreneurship, the state government has launched the Bihar Startup Policy in March, 2017. The policy envisions Bihar to emerge as the most preferred destination for startups by leveraging the potential of local youth through a conducive startup ecosystem. The key features of this policy include funding and technical handhold support initiatives that are synchronized with various stages of start-up business cycle--- validation stage, commercialization stage, and scale-up stage. Under this policy, provisions have been made for additional support to prospective entrepreneurs who

are the SC/ST/Women/Differently-abled. To sustain the initiatives financially, the state government has formed a start-up venture capital fund of Rs. 500 crore.

Till date, 26 start-ups have been granted support by the state government , 23 in services sector and 3 in manufacturing sector. The total amount of assistance was Rs. 65.71 lakh.

3.4.6 Ease of Doing Business

Ease of doing business (EODB) is helpful in attracting investments and ensuring better business environment for investors in a region. In Bihar, implementation of reforms related to ease of doing business has always been a priority of the state government. The state government is very keen to improve the atmosphere of doing business in Bihar, so that contribution of secondary sector in SGDP is increased. The significant jump in EODB index in 2016 (from 16.41 per cent to 75.82 per cent) clearly underlines the state government's consistent efforts to improve the index and its endeavor to strengthen its position as a preferred place to do business. A series of measures have been taken to improve the ease of doing business in the state and emphasis has been laid on simplifying and rationalizing the existing procedures for an easy entry and operation of business units across the state. Some of the major initiatives are: Availability of Information, Labour related reforms, Tax related reforms and Environment related reforms.

The state government is committed to continue with this drive and implement the reforms on a mission mode for facilitation of business in the state. The state government is targeting to be among top ten states in the overall ease of doing business index in the coming days.

3.5 Challenges and Outlook

The Bihar Industrial Policy, 2016 has placed high importance on agro-based industries in the state. In the policy paper, food processing sector has been included as one of the ten priority sectors. The new policy is expected to promote substantially the food processing sector in the state. Under this policy, special attention is given to perishable commodities because if it would reduces the wastage

of these commodities, the farmers would be able to realize better prices and thereby increase their incomes. Since basic infrastructure has not been fully developed for the sector as a whole. By 2017, the Government was committed to increase the processing facilities by 50 per cent, and thereby substantially reduce the wastages of agricultural produce. The income of farmers may increase by 30 per cent due to this and this was also expected to create about 10-15 lakh new employment opportunities by 2017. It definitely requires the wisdom and commitment of the government in implementing the available programmes and policies in letter and spirit.

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CHAPTER – IV

SOCIO-ECONOMIC CHARACTERISTICS OF THE SAMPLE AREA AND HOUSEHOLDS

To understand the socio-economic characteristics of the sample area and households, the information collected from secondary and primary sources has been analyzed in this chapter. The information are relating to a brief profile of the study area, general characteristics of the sample households, occupational distribution, operational land holdings, sources of irrigation, cropping pattern, usage of inputs and profitability of maize across the seasons *(particularly Rabi & Summer),* variety of seeds used, agricultural credit availed etc. are discussed in details. These characteristics play an important role in analyzing the supply chain maize marketing and possibility of its value addition in the state.

4.1 A Brief Profile of the Study Area

This study has been undertaken in two sample districts viz., Samastipur and Katihar of Bihar (table 1.3). These two districts are covered under the state's *Agro-climatic Sub-zone – I & II respectively and of the country's under Middle Gangetic Plains Zone.*

The demographic profile of the study area can viewed from tale 4.1. According to 2011 census, the population of sample districts is 7 per cent of the state's total population (104.1 million). The literacy rate in Samastipur district (61.86%) is almost equal to the state's literacy rate (61.80 %), whereas that stand lower in case of Katihar district (52.24%). The sex ratio in the sample districts are also in the same line as of the state. However, the population density is much higher in Samastipur district compared to the state's figure whereas that of in case of Katihar stand lower. The rate of urbanization in the state is 11 per cent and the sample districts much lower to the state's figure. The decadal growth of population in the state (25.4%) and the sample districts (25.5% & 28.4%) are much higher than that of India (17.6%).

Table 4.1: Demographic Profile of the Study Area (2011 Census)

District	Population (In lakh)	Literacy (In %)	Sex Ratio	Density	Urbanization Rate	Decadal Growth
Samastipur	42.6 (4.1)	61.86	911	1465	3.5	25.5
Katihar	30.7 (2.9)	52.24	919	1004	8.9	28.4
Bihar	**1041 (100.00)**	**61.80**	**918**	**1106**	**11.0**	**25.4**

In brackets figure is percentage to state's total.

Table 4.2 presents actual rainfall received in the sample districts and the state as well. It is to be noted here that only 56.4 per cent of the cultivated area in the state is under irrigation, so the dependency of this sector on monsoon continues to persist on a large scale. The data showed that the state has received an average rainfall of 993.2 mm during the last three years (2015-17), which is nearly 10 per cent below the normal rainfall. Though it is fairly adequate. This rainfall is largely due to south-west monsoon, which account for nearly 87 per cent of the total rainfall in the state.

Table 4.2: Actual Rainfall (mm) in the Study Area

District	2015	2016	2017	Avg. (2015-17)
Samastipur	893.8	1058.6	1004.3	985.6
Katihar	933.1	973.5	1125.2	1010.6
Bihar	**795.9**	**1071.6**	**1112.0**	**993.2**

Source: DES, Government of Bihar.

Bihar is landlocked state and is situated on the riverine basin of the Ganga leading to a high proportion of its total land being available for cultivation, compared to other states. The data on land utilization pattern of the state and the sample districts for 2014-15 is presented in table 4.3. It is remained more or less unchanged over last five years. Among the districts, there is considerable variation in terms of land use pattern. The sample districts are of course, valuable agrarian tracts of Bihar, which recorded higher net sown area compared the state's net sown area (56.4%) in the year 2014-15. Though, these two districts are not in higher category of the districts having the net sown area of more than 70 per cent. These districts are nearly 60 per cent of the geographical area were the net sown area. The cropping intensity in Samastipur (181 %) was higher than the state's figure (145 %) whereas that of almost at par with the state in case of Katihar district (142 %).

Table 4.3: Land Utilization Pattern in the Study Area (2014-15)

(Area in '000 ha)

Particulars	Samatipur	Katihar	Bihar
Geographical Area	262.3 (100.00)	291.3 (100.00)	9359.3 (100.00)
Forests	0.0 (0.00)	1.8 (0.62)	621.6 (6.64)
Barren & Unculturable	3.8 (1.46)	22.1 (7.59)	431.7 (4.61)
Non-Culturable	63.7 (24.28)	58.5 (20.08)	1712.0 (18.29)
Culturable Waste	0.0 (0.00)	0.6 (0.20)	44.7 (0.48)
Permanent Pastures	0.06 (0.02)	0.12 (0.04)	15.33 (0.16)
Tree Crops	8.3 (3.16)	11.12 (3.82)	247.8 (2.65)
Fallow Land	0.89 (0.34)	5.89 (2.02)	119.4 (1.28)
Current Fallow	26.52 (10.11)	12.88 (4.42)	888.5 (9.49)
Net Sown Area	159.0 (60.63)	178.3 (61.21)	5278.3 (56.40)
Gross Cropped Area	287.2	252.4	7672.9
Cropping Intensity (%)	181	142	145

Source: DES, Government of Bihar

4.2 General Characteristic of the Sample Households

The general characteristics of the sample households are shown in table 4.4. It can be clearly seen from the data that there are little variations in the socio-economic characteristics of the farmers across the farm sizes with respect to different attributes. The data reveals that the average age of sample farmers is 45.79 years at overall farms with a majority of them being male. On an average, the family consist of 5-7 members, out of which about two are engaged in farming with an experience of 21.59 years. These characteristics are relatively similar with respect to different farm sizes. With regard to the literacy level, a majority of them have studied secondary level (40.50%), followed by graduation (22%), higher primary (19.50%), primary (14%) and post-graduate (0.50%); however about 3.5 per cent of them are also found to be illiterates. At overall level, a majority of the sample farmers belong to general category (55.5%) followed by other backward castes (31%) and scheduled castes (13.5%).

Table 4.4: General characteristics of sample households

Sl. No	Particulars	Marginal	Small	Medium	Large	Overall
1.	Average age of respondents (Years)	49.02	45.23	47.43	40.43	45.79
2.	Male respondents (% to the total)	95.24	100.00	100.00	100.00	99.00
3.	Average family members engaged fully in farming (No.)	2.07	2.10	2.18	2.16	2.12
4.	Average years of farming experience (Years)	24.09	21.30	22.04	18.17	21.59
5.	Average family size (No.)	6.35	6.63	6.72	6.57	6.58
6.	Literacy Level (% of Farmers)					
i.	Illiterates	11.91	1.19	2.27	-	3.50
ii.	Primary (1 to 4)	28.57	11.90	13.64	-	14.00
iii.	Higher primary (5 to 9)	23.81	28.57	6.82	6.67	19.50
iv.	Secondary (10)	28.57	33.34	61.36	46.67	40.50
v.	Graduation	7.14	25.00	15.91	43.33	22.00
vi.	Post-Graduation	-	-	-	3.33	0.50
7.	Social Category (% of Farmers)					
i.	General	28.57	65.48	54.55	66.67	55.50
ii.	OBC	45.24	28.57	34.09	13.33	31.00
iii.	SC	26.19	5.95	11.36	20.00	13.50
iv.	ST	-	-	-	-	-

Source: Primary Survey

4.3 Details of Occupational Distribution

The details of occupational distribution of the sample farmers indicate that about 97.5 per cent are mainly engaged in agriculture and allied vocations at overall level whereas only 2 per cent have opted agriculture and allied sector as subsidiary occupation (table 4.5). Among the subsidiary ventures, 23.5 per cent are agricultural labourers followed by self-employed in service sector (8%), self employed in small scale industries (4.5%) and 0.5 per cent as non-agricultural casual labour.

Table 4.5: Occupational distribution of the sample farmers (% of farmers)

Sl. No	Particulars	Main					Subsidiary				
		Marginal	Small	Medium	Large	Overall	Marginal	Small	Medium	Large	Overall
1	Agriculture & allied	100.00	96.43	97.73	96.67	97.50	-	3.57	3.33	-	2.00
2	Agricultural labour	-	-	-	-	-	45.23	33.33	-	-	23.50
3	Self employed in small scale industries	-	-	-	-	-	-	5.95	13.33	-	4.50
4	Self employed in services	-	-	-	-	-	9.53	11.91	6.67	-	8.00
5	Non-agricultural casual labour	-	-	-	-	-	2.38	-	-	-	0.50
6	Salaried work	-	2.38	2.27	-	1.50	-	-	-	-	-
7	Household	-	-	-	-	-	-	-	-	-	-
8	Pensioner	-	1.19	-	3.33	1.00	-	-	-	-	-
9	Other	-	-	-	-	-	-	-	-	-	-
Total		100.00	100.00	100.00	100.00	100.00	57.14	57.46	23.33	-	38.50

Source: Primary Survey

4.4 Details of Operational Land Holdings

The details of average operational land holdings of the sample farmers presented in table 4.6 indicate that the average net operational area at overall farms is 6.20 acres. It is 1.73 acres at marginal farms, 3.85 acres at small farms, 8.80 acres at medium farms and 15.20 acres at large farms. Interestingly the uncultivated/fallow, leased-in and leased-out proportion are 0.05 acre, 0.39 acre and 0.10 acre respectively at overall farms. It seems that less than 1 per cent of the net operational area is left fallow and only 1 to 6 per cent of the net operational area is either leased-in or out.

With regard to irrigation, about 94.88 per cent of the net operational area is irrigated at overall farms level. Across the farms, it is higher at medium farmers (96.13%) and lower at marginal farmers (81.12%). The average rental value of leased-in irrigated land amounts to maximum of Rs. 18333 per acre for medium farmers and minimum of Rs. 12800 per acre for marginal farmers, however it is Rs. 16280 per acre at overall basis. Similarly, the rental value of leased-out irrigated land is Rs. 20000 per acre at overall farmers, while the rental value of leased-in un-irrigated land amounts to be Rs. 7255 per acre at overall level.

Table 4.6: Average operational land holdings of the sample farmers (in acres)

Sl. No	Particulars	Marginal	Small	Medium	Large	Overall
1.	Owned land	1.59	3.54	8.26	15.44	5.96
2.	Uncultivated/Fallow	0.03	0.04	0.08	0.08	0.05
3.	Leased-in	0.17	0.35	062	0.50	0.39
4.	Leased-out	-	-	-	0.67	0.10
5.	Net Operational Area(1-2+3-4)	1.73	3.85	8.80	15.20	6.20
6.	% Irrigated	81.12	95.17	96.13	95.79	94.88
7.	% Un-Irrigated	18.88	4.83	3.87	4.21	5.12
	% Total (6+7)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
8.	Rental Value of leased-in Irrigated land (Rs/acre)	12800.00	16272.73	18333.34	18000.00	16280.00
9.	Rental Value of leased-out Irrigated land (Rs/acre)	-	-	-	20000.00	20000.00
10.	Rental Value of leased-in Un-Irrigated land (Rs/acre)	6330.00	6800.00	8360.00	7850.00	7255.00
11.	Rental Value of leased-out Un-Irrigated land (Rs/acre)	-	-	-	-	-

Source: Primary Survey

4.5 Sources of Irrigation

Irrigation is considered one of the foremost inputs in agriculture. Crop failures in many parts happen due to lack of sufficient irrigation water. In Bihar, the major source of irrigation is bore well. It can also seen from the table 4.7 that bore wells (98.50%) form a major source of irrigation for different crops in the study area, as revealed by the sample farmers at the overall level. In addition, a negligible (<2%) of farmers use their open/dug wells as a source of irrigation.

Table 4.7: Sources of irrigation of the sample farmers (% of farmers)

Sl. No	Particulars	Marginal	Small	Medium	Large	Overall
1	Open/ Dug well	7.14	-	-	-	1.50
2	Bore well	92.86	100.00	100.00	100.00	98.50
3	Canal	-	-	-	-	-
4	Tank	-	-	-	-	-
5	Others	-	-	-	-	-
	Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source: Primary Survey

4.6 Cropping Pattern

Usually the cropping pattern followed by farmers depends upon the availability of irrigation, soil condition and agricultural practices and so on. So it is worthwhile to study the cropping pattern adopted by farmers in general. Crops grown by the sample farmers are shown in table 4.8. The sample farmers grow paddy, soyabean,

maize (rabi & summer), wheat, pulses and vegetables. It is evident from the data that large farmers account for as high as 53 per cent of the cropped area under paddy cultivation, followed by marginal and small (40.6%) and medium (39.2%) farmers. The second most important crop across the farm sizes was maize wherein medium farmers have allocated 34.1 per cent of their cropped area followed by marginal & small farmers (30.1%) and large farmers (23%). Wheat was the 3rd important crop grown by the sample farmers. About 15.3 per cent of the total cropped area was devoted on wheat by medium farmers followed by large farmers (14.1%) and marginal & small farmers (10.9%). About 6-8 per cent on vegetables, less than 2 per cent on pulses and up to 8 per cent on soyabean of the total cropped area were allocated by the sample farmers across their farm sizes. Moreover, it is also evident from the table that in un-irrigated conditions, sample farmers mainly grow paddy in kharif season and pulses in rabi & summer seasons, whereas in irrigated condition, besides paddy and pulses, wheat, maize, soyabean and vegetables were largely grown by them. Further, it is revealed that the cropping intensity was as high as 175.6 per cent on marginal & small farmers followed by medium farmers (157.1%) and large farmers (139%) at total level. Though, the same were a bit higher in irrigated condition whereas much lower (just at 50 to 70 %) in unirrigated condition across the sample farmers.

Table 4.8: Cropping pattern of Sample Farmers during 2016-17

(Area in acres & % in parenthesis)

SN	Crops	Irrigated			Un-Irrigated			Total		
		Marginal & Small	Medium	Large	Marginal & Small	Medium	Large	Marginal & Small	Medium	Large
1	Paddy	271.91 (39.98)	232.80 (38.97)	336.00 (53.48)	10.42 (69.56)	6.26 (59.17)	3.55 (36.60)	282.33 (40.62)	239.06 (39.32)	339.55 (53.23)
2	Soyabean	58.12 (8.54)	14.10 (2.36)	4.20 (0.67)	-	-		58.12 (8.36)	14.10 (2.32)	4.20 (0.66)
3	Rabi Maize	178.30 (26.21)	196.40 (32.88)	129.50 (20.61)	-	-	-	178.30 (25.65)	196.40 (32.30)	129.50 (20.30)
4	Wheat	76.20 (11.21)	93.08 (15.58)	90.52 (14.41)	-	-	-	76.20 (10.96)	93.08 (15.31)	90.52 (14.13)
5	Pulses (Lentil, Moong & Peas)	8.89 (1.31)	4.50 (0.75)	2.50 (0.40)	4.56 (30.44)	4.32 (40.83)	6.15 (63.40)	13.45 (1.93)	8.82 (1.45)	8.65 (1.36)
6	Summer Maize	31.00 (4.56)	16.00 (2.68)	17.50 (2.79)	-	-	-	31.00 (4.46)	16.00 (2.63)	17.50 (2.74)
7	Vegetables (Potato etc.)	55.70 (8.19)	40.50 (6.78)	48.00 (7.64)	-	-	-	55.70 (8.02)	40.50 (6.67)	48.00 (7.52)
G.C.A		680.12 (100.00)	597.38 (100.00)	628.22 (100.00)	14.98 (100.00)	10.58 (100.00)	9.70 (100.00)	695.10 (100.00)	607.96 (100.00)	637.92 (100.00)
NSA		366.56	371.98	436.75	29.30	15.01	19.22	395.86	386.99	455.97
CI (%)		185.55	160.59	143.84	51.13	70.47	50.47	175.59	157.10	139.90

Source: Primary Survey

In parenthesis percentage figure is shown.

4.7 Season wise Usage of Inputs and Profitability of Maize

In this section, the details of input use, output and returns realized by maize farmers in rabi and summer seasons have been presented separately.

4.7.1 Input Use, Output and Returns realized by Maize Farmers in Rabi Season

As stated earlier in Chapter-I that the reference period of the study was 2016-17 and during the 2016-17, the production share of the total maize in the state was 55.4 per cent in rabi (winter) season alone (table 2.2). The details of input use, output and returns realized by maize farmers across different size of farms in rabi season are presented in table 4.9. A perusal of the table reveals that, overall, the total paid-out cost including the imputed value of family labour was at Rs. 20125 per acre, which was (-) Rs. 1018 per acre to (+) Rs. 1154 per acre across the farm sizes. Among the inputs, the highest cost was incurred on ploughing & sowing (23.17%) followed by

seeds (18.24%), fertilizers (14.07%), amount paid to hired labour (12.83%), irrigation (12.54%), plant protection chemicals (6.13%), hiring costs of labour for ploughing, sowing etc. (4.71%), harvesting and threshing (2.63%), maintenance costs on assets/farm implements (2.12%) and imputed value of family labour (1.76%) at overall farmers.

As regards the returns per acre realized by the overall maize farmers table 4.9 indicates that at overall level and average maize grower found to received gross returns of Rs. 48134.19, consisting of the total value of main product for Rs. 43833.75 (91.07%) and by-product for Rs. 4300.44 (8.93%). The net returns was calculated at Rs. 28009.09 per acre. The cost-benefit ratio (CBR) was 1:2.39 at overall farmers level.

Above analysis clearly reveals that the net returns on cultivation of maize in rabi season were more than double the total paid-out costs incurred by sample farmers across the farm sizes.

Table 4.9: Input use, output and returns per acre realized by Sample farmers for Maize during Rabi Season (In Rs.)

Sl. No	Particular	Marginal	Small	Medium	Large	Overall
	Input use and their costs					
1	Ploughing and sowing charges (only machinery)	4241.38	4655.05	4722.50	4725.87	4663.82 (23.17)
2	Seed cost/ purchase of seedlings	3486.20	4410.53	3152.06	3751.16	3671.22 (18.24)
3	Organic/FYM	402.30	647.63	245.42	224.71	361.17 (1.80)
4	Chemical fertilizers	2778.01	2775.67	2909.98	2785.42	2830.69 (14.07)
5	Plant protection chemicals	1217.35	1290.13	1154.25	1298.84	1233.16 (6.13)
6	Irrigation charges	2724.13	2753.34	2400.71	2406.56	2524.40 (12.54)
7	Harvesting & threshing charges	530.00	530.54	527.85	532.63	529.98 (2.63)
8	Hired labour charges (including ploughing charges till planting, cost or sowing/ transplanting)	919.54	950.67	950.35	949.81	947.64 (4.71)
9	Imputed value of family labour	609.19	422.85	165.47	486.49	355.02 (1.76)
10	Hired labor (amount paid)	1998.27	2041.72	2676.93	3196.91	2582.11 (12.83)
11	Maintenance costs on assets used for the reference crop	201.15	252.97	267.82	921.24	425.92 (2.12)
	Total paid-out costs including imputed value of own labor	**19107.52**	**20731.10**	**19173.37**	**21279.63**	**20125.13 (100.00)**
	Returns					
1	Output (Main product)	38873.56	40870.92	45864.94	45503.47	43833.75 (91.07)
2	By product	2061.38	3228.45	4748.29	5489.19	4300.44 (8.93)
3	Gross returns	**40934.94**	**44099.37**	**50613.23**	**50992.66**	**48134.19 (100.00)**
4	Net returns	**21827.42**	**23368.27**	**31439.86**	**297013.03**	**28009.09**
5	CB Ratio	**1:2.14**	**1:2.30**	**1:2.64**	**1:2.40**	**1:2.39**

Source: Primary Survey
In parenthesis figure is shown.

4.7.2 Input Use, Output and Returns realized by Maize Farmers in Summer Season

As is evident from table 2.2 that during summer season of 2016-17, the production share of the total maize in the state was 28.3 per cent; accounts for half of the total

rabi maize production, achieved during the same agriculture year. The details of input use, output and returns realized by maize farmers in summer season are depicted in table 4.10. The data reveals that at the overall farmers, the total paid-out costs including the imputed value of family labour was estimated at Rs. 18662.47 per acre. It was lesser by about 7.3 per cent than that of rabi season. Across the farms, the total paid-out cost varied from (-) Rs. 734.37 per acre to (+) Rs. 561.10 per acre. Among the inputs, the highest cost was incurred on seeds (21.95%) followed by ploughing and sowing charges (19.96%), amount paid to hired labour (15.52%), fertilizers (10.08%), irrigation charges (9.45%), imputed value of family labour (6.86%), ploughing and transplanting charges paid to labour (4.96%), plant protection chemicals (4.72%), maintenance on farm assets and implements (3.41%) and harvesting and threshing charges (3.09%) at overall farmers.

As regards the returns per acre realized by the overall maize farmers table 4.10 further indicates that the gross returns was Rs. 39741.09. The net returns was estimated at Rs. 21078.61 per acre and the cost benefit ratio (CBR) was 1:2.13. The CBR across the farm sizes was almost similar to the overall farmers level.

Despite the fact that the summer maize is cultivated nearly half of the total maize area and produced half of the total production of rabi season; the net returns were more than double the total paid-out costs incurred by the sample farmers across the farm sizes.

Table 4.10: Input use, output and returns per acre realized by Sample farmers for Maize during Summer Season (in Rs.)

Sl. No	Particular	Marginal	Small	Medium	Large	Overall
	Input use and their costs					
1	Ploughing and sowing charges (only machinery)	3710.53	3720.93	3750.00	3714.29	3724.81 (19.96)
2	Seed cost/ purchase of seedlings	4005.26	4146.51	4067.19	4110.00	4096.12 (21.95)
3	Organic/FYM	-	-	-	-	-
4	Chemical fertilizers	1872.84	1884.30	1871.06	1892.14	1881.46 (10.08)
5	Plant protection chemicals	771.05	772.09	775.00	771.43	880.23 (4.72)
6	Irrigation charges	1842.11	1784.88	1625.00	1821.43	1763.56 (9.45)
7	Harvesting & threshing charges	578.95	577.91	575.00	578.57	577.52 (3.09)
8	Hired labour charges (including ploughing charges till planting, cost or sowing/ transplanting)	826.31	834.88	828.13	1177.14	924.81 (4.96)
9	Imputed value of family labour	2000.00	2000.00	1200.00	651.43	1280.62 (6.86)
10	Hired labor (amount paid)	2321.05	2365.11	2334.38	3174.29	2896.12 (15.52)
11	Maintenance costs on assets used for the reference crop	-	-	1100.00	1342.86	637.21 (3.41)
	Total paid-out costs including imputed value of own labor	**17928.10**	**18086.63**	**18125.75**	**19223.57**	**18662.47 (100.00)**
	Returns					
1	Output (Main product)	38407.89	36981.40	41576.56	42177.14	39741.09 (100.00)
2	By product	-	-	-	-	-
3	Gross returns	**38407.89**	**36981.40**	**41576.56**	**42177.14**	**39741.09 (100.00)**
4	Net returns	**20479.79**	**18894.77**	**23450.81**	**22943.57**	**21078.61**
5	CB Ratio	**1:2.14**	**1:2.04**	**1:2.29**	**1:2.19**	**1:213**

Source: Primary Survey
In parenthesis figure is shown.

4.8 Season wise Variety of Seeds Used for Maize

Maize crop in India is generally grown in kharif *(June-October)* season, which coincides with rainy season. It is susceptible to both less and access water and results in lower production in the country. In order to enhance production of this crop, a collaborative project with *Dr. L M Humphrey (USA)* introduced double cross hybrids (1959) which were grown on experimental basis in Bihar during kharif

season. These hybrids could not yield up to expectation. The reason for failure in obtaining good yield was occurrence of heavy rainfall during the crop period, which was a usual phenomenon of kharif season in Bihar. In order to protect crop from heavy rainfall, maize inbred, single cross hybrids and double cross hybrids were grown in rabi season first time on farmers fields in Bihar in the year 1961. The results were quite encouraging as the crop was free from incidence of insects, pests and diseases in addition to higher yield above the expectation compared to kharif maize with the opening up of new vista of rabi maize in the country. This experience encouraged in taking up of large scale testing of hybrids through series of multi-location trails and also the beginning of finding out suitable agronomic practices for exploiting yield potential of these hybrids.

Keeping in view the opportunities in rabi season, multipronged strategies were adopted such as hybrid seed production along with farmer's field demonstrations resulted in heralding maize revolution in Bihar. The rabi maize in Bihar state is occupying nearly 65 per cent area out of a total of 0.721 million hectare during 2016-17. In fact use of hybrids picked-up in late 80s in Bihar and till early 90s, the application of local and composite varieties of seeds ended. As of now, there is almost no contrast between traditional and non-traditional maize growing districts in Bihar with respect to adoption of improved cultivars across the seasons. Among the hybrids, the popular varieties, which were found to be used by the sample farmers were Pioneer 3522, Advanta 9081, Monsanto 900M, Kaveri-50 etc. The seed rate of application of these hybrid varieties was 8-9 kg/acre and yield rate was reported in the range of 35-45 quintals/acre across the seasons (table 4.11).

Tables 4.11: Season wise variety of seeds used by Sample Farmers for Maize crop during 2016-17

Season	Varieties	Seed Rate of Application (In kg/Acre)	Yield Rate (Qtl./Acre)	
			Rabi	Summer
Kharif, 2016	-	-	-	-
	-	-	-	-
Rabi, 2016-17 & Summer, 2017	Pioneer 3522	8-9	45	42
	Advanta 9081	9-10	43	38
	Monsanto 900M	8-9	44	36
	Kaveri-50	9-10	42	35

Source: Primary Survey

4.9 Details of Agricultural Credit Availed

For agricultural operations, inputs like seed, water, fertilizer and agricultural implements are most important. But such modern agricultural inputs cannot be procured from market without adequate support. Thus, farm credit is very important for the farmers, as it provides them with much needed working capital. The flow of institutional credit to agricultural sector has tremendously increased since 2000-01 in the country. During 2000-01to 2015-16, it has increased to almost 16 times.

The achievement to the target of agricultural credit flow in the country amounts to more than cent per cent since 2012-13. Though it is in the range of 85 to 96 per cent in Bihar during last five years i.e., 2012-13 to 2016-17 *(Bihar Economic Survey, 2017-18).*

4.9.1 Borrowing details of Sample Farmers

Various institutional and non-institutional credit sources identified across the study area and sample farmers are given in table 4.12. Overall as discussed above, there was a good trend noticed in the study area in terms of institutional sources. It is observed from the table that institutional sources (94.80%) dominate over the non-institutional sources (5.20%) at the overall farmers. Though, it moderately varied across the farm sizes (71 % to 100%) in case of institutional sources. In terms of per household (Hh), the amount of borrowing was reported to Rs. 16060/- at overall

farmers. However, it was as high as Rs. 37500/Hh in case of large farmers and as low as Rs. 3167/Hh in case of marginal farmers.

Tables 4.12: Borrowing details of Sample Farmers during the reference period *(In Rs/Hh)*

Sources	Marginal	Small	Medium	Large	Overall
Institutional					
i. CBs	1190.47	2678.37	13636.36	26666.67	8285.00
ii. Co-operative Banks	-	-	-	-	-
iii. RRBs	1071.43	2380.95	18181.82	10833.33	6850.00
Total	**2261.90**	**5059.52**	**31818.18**	**37500.00**	**15225.00**
In %	**71.43**	**84.66**	**96.42**	**100.00**	**94.80**
Non-Institutional					
i. Money Lenders	476.19	678.57	840.91	-	570.00
ii. Friends & Relatives	428.57	-	-	-	90.00
iii. Traders/Commission Agents	-	-	340.91	-	75.00
iv. SHG	-	238.10	-	-	100.00
Total	**904.76**	**916.67**	**1181.82**	**-**	**835.00**
In %	**28.57**	**15.34**	**3.58**	**-**	**5.20**
Grand Total	**3166.66**	**5976.19**	**33000.00**	**37500.00**	**16060.00**
In %	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source: Primary Survey

4.9.2 Purpose behind Borrowings

The purpose behind borrowing loans by the sample households is shown in table 4.13. As is evident from the table that at overall farmers only 18.50 per cent sample households were availed and remaining (81.50%) were not availed the borrowings. Those who availed agricultural credit, the crop cultivation (8.50%) was their main purpose behind the borrowings. Besides the crop cultivation, other motives behind the borrowings were consumption expenditure (4%), family obligations (3%) purchase of farm implements (2.50%) and 0.50 per cent for non-farm activities. Across all the sample farmers except the medium farmers, seasonal crop cultivation appears to be the main reason for borrowing loans.

As regards the quantum of amount for different purposes of borrowings of loan availed across the sample farmers, it is revealed from the table 4.13 that the proportion of seasonal crop cultivation was as high as 66.15 per cent followed by purchase of farm implements (28.15%), family obligations (3.02%), consumption expenditure (1.93%) and non-farm activities (0.25%) at overall level. Across the

sample farmers, seasonal crop cultivation and purchase of farm implements were the prominent wherein from 71 to 96 per cent of the borrowed amount were expensed.

Table 4.13: Purpose of borrowings during the reference period *(%)*

Sl. No	Purpose	Marginal		Small		Medium		Large		Overall	
		farmers	amount	farmers	amount	farmers	amount	farmers	amount	farmers	amount
1	Crop cultivation	9.52	71.42	9.52	84.68	4.54	55.09	10.00	71.55	8.50	66.15
2	Purchase of farm implements	-	-	-	-	6.82	41.32	6.67	28.45	2.50	28.65
3	Purchase of livestock	-	-	-	-	-	-	-	-	-	-
4	Consumption expenditure	4.76	7.52	4.76	7.36	4.55	1.04	-	-	4.00	1.93
5	Family obligations	4.76	15.04	2.38	7.96	4.55	2.55	-	-	3.00	3.02
6	Non-farm activities	2.38	6.02	-	-	-	-	-	-	0.50	0.25
7	Not Availed	78.58	-	83.34	-	79.54	-	83.33	-	81.50	-
8	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Primary Survey

CHAPTER – V

SUPPLY CHAINS OF MAIZE MARKETING

This chapter deals with the supply chains of maize marketing in the state. It includes marketed surplus of maize of average size of holdings, disposal of maize and possible supply chains, price spread across the marketing channels, marketing efficiency based on *conventional, Shephered & Acharya's methods*, constraints perceived by the sample farmers, suggestions to overcome the constraints and stakeholders' case studies.

5.1 Marketed Surplus of Maize by Average Size of Holdings

The marketed surplus which is an ex-post concept referring to the actual amount marketed. To have a clear picture on the conceptual issues, two concept of marketed surplus are used in recent literature viz., gross and net. Gross marketed surplus refers to the actually marketed quantities irrespective of the requirements for family consumption, farm needs and other payments; whereas net marketed surplus is the gross marketed surplus minus family consumption, farm needs and other payments. In the table 5.1 data on both the counts are available. Data presented in the table showed the volume of net marketed surplus along with the average size of maize farms across the holdings, total production etc. It reveals that the average area under maize on overall farms was 2.84 acres (47.65% of average operational land holdings). It was 1.26 across on marginal farms (79.24 % of average operational land holdings), 1.86 acres on small farms (52.54 % of average operational land holdings), 4.83 acres on medium farms (58.43 % of average operational land holdings) and 4.90 acres on large farms (31.74 % of average operational land holdings). The production was estimated at 117.34 quintals on overall farms. Out of it, the total consumption was 9.78 per cent (11.49 qtls), consisting of 5.90 per cent in family consumption and 3.88 per cent in the kind of payments to the labourers. The net marketed surplus was estimated at 106.05 quintals on overall farms; accounting for 90.22 per cent of total production. Across the farms, the net marketed surplus were 85.2 per cent on marginal, 85.5 per cent on small, 91.5 per cent on medium and 94.8 per cent on large

farms. Thus, unlike other agricultural produce, the net marketed surplus of maize is quite high. It is mainly due to low family consumption and other needs of the maize produce at the farmers' level.

Tables 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)	1.26	1.86	4.83	4.90	2.84
2	Production (In Qtl.)	48.54 (100.00)	74.80 (100.00)	208.16 (100.00)	200.93 (100.00)	117.54 (100.00)
3	Family Consumption (In Qtl.)	5.24 (10.80)	8.16 (10.91)	9.29 (4.46)	2.37 (1.18)	6.93 (5.90)
4	Payment in kind of Labour (In Qtl.)	1.94 (4.00)	2.66 (3.55)	8.33 (4.00)	8.04 (4.00)	4.56 (3.88)
5	Miscellaneous (In Qtl.)	-	-	-	-	-
6	Total Consumption (In Qtl.) (3 to 5)	7.18 (14.80)	10.82 (14.46)	17.62 (8.46)	10.41 (5.18)	11.49 (9.78)
7	Marketed Surplus (In Qtl.) (2-6)	41.36 (85.20)	63.98 (85.54)	190.54 (91.54)	190.52 (94.82)	106.05 (90.22)

Source: Primary Survey
In parenthesis percentage figure is shown.

5.2 Disposed of Maize and Possible Supply Chains

The supply chains are routes through which the produce moves from the point of production to the point of consumption. These are alternative paths for producers to reach consumers, accordingly the chain of intermediaries also varies. Often numbers of middlemen in marketing channels are many and this reduces the share of producers in the price of produce paid by the consumers. In Bihar, marketing of maize is done in different forms. In most of the cases farmers directly sell their produce to the village traders and or commission agents. Besides, some of the large producers use to sell their produce at distant markets or mandies and through formal agency also. In course of present study, some common identified marketing channels of maize follows:

i. Farmer → Village Trader → Commission Agent → Wholesaler → Maize Processor
ii. Farmer → Village Trader → Commission Agent → Wholesaler → Maize Stocker
iii. Farmer → Commission Agent → Railway Point Maize Trading → Maize Processor

iv. Farmer → Mandies → Trader → Maize Processor

v. Farmer → Mandies → Trader → Maize Stocker

vi. Farmer → JEEViKA → AAPCLtd. → NeML accredited Warehouse → Institutional Buyers/Stock and Sell at Premium

The first two channels (I & II) are common ways of maize marketing. Channel – III is for marketing of maize at Railway Rack Point through Commission Agents/traders, who are license and sell the produce to the poultry feed and starch manufacturing industries on booking of orders. A few large and medium farmers use to sell their produce by bringing their produce to big agricultural commodity mandies through Channel - IV & V. Channel – VI is the formal marketing channel i.e., The Bihar rural Livelihoods Promotion Society (BRLPS); popularly known as JEEViKA, a registered society under the aegis of the State Rural Development Department. These different marketing channels and farmers' use of these channels are presented in table 5.2. Table indicates that overall maize sold through different channels during the reference year was highest in channel – II (44.04%), followed by channel – V (17.27%), channel – IV (13.78%), channel – VI (12.47%), channel – III (10.64%) and channel – I (1.80%). The marketing channels based on decreasing order of importance are II, V, IV, VI, III and I. The quantity of maize sold through these descending channels were about 9339.9 quintals, 3664 quintals, 2923.7 quintals, 2645 quintals, 2255.7 quintals and 382 quintals respectively.

Tables 5.2: Disposal of Maize through different Marketing Channels *(In Qtl.)*

Sl. No	Farm Sizes	No.	Channels						
			I	II	III	IV	V	VI	Total
1	Marginal	42	-	1736.96	-	-	-	-	1736.96 (8.19)
2	Small	84	382.00	2261.00	2255.75	-	-	475.00	5373.75 (25.33)
3	Medium	44	-	2903.00	-	2306.89	1004.00	2170.00	8383.89 (39.53)
4	Large	30	-	2439.00	-	616.78	2660.00	-	5715.78 (26.95)
5	Overall	**200**	**382.00 (1.80)**	**9339.96 (44.04)**	**2255.75 (10.64)**	**2923.67 (13.78)**	**3664.00 (17.27)**	**2645.00 (12.47)**	**21210.38 (100.00**

Source: Primary Survey
In parenthesis percentage figures are shown.

5.3 Price Spread

Market functionaries help in moving the commodities from producers to stockers/processors. In the marketing of agricultural commodities the difference between the price paid by the maize stocker/processor and price received by producer for an equivalent quantity of produce is often known as price spread. The difference between the price at the producer's level and processor's/stocker's price in a perfectly competitive market situation (to ensure that the profits of the middlemen are only nominal) consists of marketing costs and margins are an indicator of the efficiency of the marketing system. The higher the difference between marketing costs and margin, the lower the efficiency and vice-versa. The absolute value of marketing costs and margins varies across channels, markets and time. The same were presented in table 5.3 as they reveal many facets of marketing and price spread in each channel of distribution and efficiency of the system.

Table No. 5.3: Price spread of Maize through different Marketing Channels

(in Rs/ Qtl.)

Sl. No	Particulars	Channels					
		I	II	III	IV	V	VI
1	Net price received by producer	998.00 (64.39)	1088.60 (77.20)	1025.72 (64.38)	1030.82 (65.45)	1080.08 (71.29)	1213.40 (78.28)
2	Producer's sale price	998.00 (64.39)	1088.60 (77.20)	1094.17 (68.68)	1090.27 (69.22)	1144.41 (75.54)	1213.40 (78.28)
3	Cost incured by Traders/Middlemen	57.20 (3.69)	58.23 (4.13)	-	-	-	49.77 (3.21)
4	Net margin CA	58.00 (3.74)	56.25 (3.99)	90.00 (5.65)	45.00 (2.88)	70.00 (4.62)	-
5	Cost incurred by Wholesalers/Traders	383.80 (24.76)	150.62 (10.68)	367.00 (23.03)	398.73 (25.30)	267.59 (17.66)	251.83 (16.25)
6	Wholesaler's Net Margin	53.00 (3.42)	56.30 (4.00)	42.00 (2.64)	41.00 (2.60)	33.00 (2.18)	35.00 (2.26)
7	Wholesaler's sale price to Processors/Exporters /Stockers	1550.00 (100.00)	1410.00 (100.00)	1593.17 (100.00)	1575.00 (100.00)	1515.00 (100.00)	1550.00 (100.00)

Source: Primary Survey
In parenthesis percentage figure is shown.

It is apparent from table 5.3 that **in channel – I** *(Farmer-Village Trader --- Commission Agent --- Wholesalers --- Maize Processor),* the overall producer's share in processor's rupee was 64.39 per cent. The cost incurred by traders/middlemen was 3.69 per cent

of consumer's price while net margins retained by the by traders/middlemen in this channel was 3.74 per cent (Rs. 57.20) of consumer's rupee. The cost incurred by the wholesalers/traders was 24.76 per cent (Rs. 383.80) and a net margin retained by the wholesalers was 3.42 per cent (Rs. 53) of consumer's price. The wholesaler's sale price to processors/exporters/stockers was Rs. 1550/quintal. Figures in table suggests that producer gets about two-third share of the consumer's rupee and the remaining one–third is distributed in between the margins of traders and wholesalers and cost incurred by the wholesalers in transporting the produce to the processors/exporters/stockers at distant locations.

In channel – II *(Farmer --- Village Traders --- Commission Agent --- Wholesaler --- Maize Stocker),* the overall average producer's share in consumer's rupee was 77.20 per cent (Rs. 1088.6). In this channel the farmers sell their produce to the village traders, who incurred a cost by 4.13 per cent (Rs. 58.23). A net margin of 3.99 per cent (Rs. 54.23) of the stocker's price was retained by the village traders/middlemen. The cost incurred by the wholesalers was 10.68 per cent (Rs. 150.62) and the net margin of the wholesalers was 4 per cent (Rs. 56.30). The stocker's price was Rs. 1410. Hence, the producer's share was higher in this channel compared to other channels of maize marketing except to channel – VI.

In channel – III *(Farmer --- Commission Agent --- Railway Rack Point Trading --- Maize Processor),* the producer's share is equal to channel – I. In this channel, the producer's share in consumer's rupee was 64.38 per cent (Rs. 1025.72). Producers sell their produce to Commission Agent at the Railway Rack Point, who retained a margin of 5.65 per cent (Rs. 90) ad incurred a cost of Rs. 367/quintal (23.03%) in transporting the produce outside the state. The wholesaler's net margin was 2.64 per cent (Rs. 42) who sell the produce to the outside exporters/processors. The wholesaler's sale price to processors/exports was Rs. 1593.17. In this channel, the cost of transportation was higher at 23.03 per cent (Rs. 367) and the total margins of commission agents and wholesalers was 8.29 per cent (Rs. 132).

In Channel – IV *(Farmer --- Mandies --- Trader --- Maize Processors),* the producer's share was a bit higher compared to channel – I & II. In this channel, the producer's share in consumer's rupee was 65.45 per cent (Rs. 1030.82). Producers sell their produce to the wholesalers of the agricultural mandies through the commission agents, who retained a net margin of 2.88 per cent (Rs. 45). Cost incurred by the wholesalers was 25.30 per cent (398.73) and a net margin of 2.60 per cent (Rs. 41). The consumer's price was Rs. 1575. It is evident from this channel that the net margins of commission agents and wholesalers together was just 5.48 per cent (Rs. 86), which was much lower compared to the cost incurred by the wholesalers in selling the produce to the distant consumers/processor.

In channel – V *(Farmer --- Mandies --- Trader --- Maize Stocker),* the path of maize marketing is farmer to maize stockers (for industrial use) through mandies and traders. The farmer's share in maize stocker's price was 71.28 per cent (Rs. 1080.08). It is higher compared to three preceding channels i.e, I, III & IV. This channel is the second largest channel, accounts for 17.27 per cent of the total marketed surplus of sample produce. Stocking of maize are generally of good quality maize. In this channel, the farmers sell their produce in mandies to the wholesale buyers through commission agents wherein the net margin of commission agents was 4.62 per cent (Rs. 70). The wholesalers incurred a cost by 17.66 per cent (Rs. 267.59) and the net margins of wholesalers was 2.18 per cent (Rs. 33). The stocker's price was Rs. 1515/quintal.

Channel – VI is meant for marketing of maize through a formal agency i.e., JEEViKA. In this channel Aaranyak Agri-Produce Company Limited (AAPC Ltd.) with the support of JEEViKA (by bringing all the women farmers of Katihar, Purnea and other adjoining districts associated with JEEViKIA) collects the maize produce for staking the produce in NeML accredited warehouse at Purnea and thereby sell the produce to the institutional buyers of the maize at premium price, negotiated with the buyers while trading on line, is sold. Under this channel, only 382 quintals (1.80%) of the total marketed surplus of overall sample farmers (21210.38 qtls) was sold. In this channel the producer gets 78.28 per cent (Rs. 1213.40) of the institutional

buyers/processors' price (Rs. 1550). The cost incurred by the trader (AAPC Ltd) was 3.21 per cent (Rs. 49.77). The overall cost incurred by the AAPC Ltd in stocking and transporting the produce to the final buyers was 16.25 per cent (Rs. 251.83) and a net margin was retained by the company was 2.26 per cent (Rs. 35). This channel provides the highest share to the producer's price in institutional buyer's rupees compared to all the marketing channel of maize marketing.

5.4 Marketing Efficiency

Marketing efficiency in alternate channels were worked out by three different methods. Comparison of the same is provided in table 5.4. The conventional method (E) suggests that channel – II was more efficient than channel I, III, IV, V & VI. Interestingly, the price received by the producer in channel-II (Rs. 1088.6) is lower than channel – VI, therefore this method does not appear suitable. If marketing margins are not included as a part of marketing cost, the *Shepherd's Method* (ME) suggests that channel – II is more efficient than the channel – I, III, IV, V & VI. The limitation of this method, as mentioned earlier, is that it does not take into consideration the price received by the producer. The modified method suggested by Acharya takes care of limitations in both these methods. According to Acharya's Method (MME), channel-VI is more efficient than channel – I, II, III, IV & V.

Table No. 5.4: Marketing Efficiency of Maize through different Marketing Channels

(In Rs/Qtl)

SN	Particulars	Channels					
		I	II	III	IV	V	VI
1	Trader's sale price or Processor's purchase price (RP)	1550.00	1410.00	1593.17	1575.00	1515.00	1550.00
2	Total marketing cost (MC)	441.00	208.85	435.45	458.18	331.92	301.60
3	Total Net Margins of Intermediaries(MM)	111.00	112.55	132.00	86.00	103.00	35.00
4	Net price received by producers (FP)	998.00	1088.60	1025.72	1030.82	1080.08	1213.40
5	Value Added (1-4)	552.00	321.40	567.45	544.18	434.92	336.60
6	Index of Marketing Efficiency a. Conventional Method (5÷2) E	1.25	**1.53**	1.30	1.18	1.31	1.11
	b. Shepherd Method (1÷2) ME	3.51	**6.75**	3.65	3.43	3.44	5.13
	c. Acharya's Method (4÷{2+3}) MME	1.80	3.39	1.80	1.89	2.48	**3.60**

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

5.5 Constraints Perceived by Farmers

5.5.1 Constraints in Production of Maize

In course of the study, several constraints relating to production have been perceived by the sample households. Table 5.5 highlights the constraints. Among the constraints, costlier of maize seeds than any other crops' seeds was largely reported by 38.50 per cent of the sample households followed by pecking-up of the seeds by rats, termites and birds (37.50%), drying of maize particularly in rabi maize (36.50%), shortage of labour due to migration and subsidized grains at PDS (33.50%), lack of proper irrigation facilities (30.50%) and destruction of the crop by blue bulls and boars (27.50%%).

Table 5.5: Major constraints faced in Production of Maize Crop (% of farmers)

SN	Problems	Marginal	Small	Medium	Large	Overall
1	Seeds are much Costlier. It is costlier than any other crop's seeds	40.48	33.33	47.73	36.67	38.50
2	During peak demand, adulterated fertilizers are sold, particularly in local/village markets.	21.43	22.62	22.73	-	19.00
3	Drying of Rabi maize is generally done at the farms on net length under open sky. If pre- monsoon rain occurs, it largely destroyed the produce in two ways- increased moisture harms the drying process, and falling of rain drops on the crop destroys the produce due to germination of fungus.	38.09	35.71	34.09	40.00	36.50
4	Due to lack of proper irrigation facilities, the benefits of hybrid seeds and fertilizers are not adequately realized.	40.48	40.48	6.82	23.33	30.50
5	Before sprouting of seeds, It is pecked-up by birds like, pigeon, sparrow, rats and termites etc.	45.24	42.86	25.00	30.00	37.50
6	During vegetative growth to maturity of the crop, it is widely destroyed/grazed by blue bulls and boars.	16.67	30.95	36.36	20.00	27.50
7	Shortage of labour due to migration and subsidized grains at PDS.	21.43	19.05	61.36	50.00	33.50

Source: Primary Survey

5.5.2 Constraints in Marketing of Maize

Production technology can only sow the seeds and bring forth the produce but marketing alone can harvest and deliver the output to the point where it is required after payment of fair prices to the farmers. Table 5.6 show constraints perceived by the sample farmers in marketing of maize in sample districts. These constraints are severe in case of trade of huge volume of maize produced in the state. Among the constraints, lack of storage facilities at the village or nearby area (58%) was the prominent ones, followed by taking 5 kg of more produce at per quintal of grain due to expected weight loss arising from moisture content in the grain (53.50%), frequent road snatchings while coming back to home after selling the produce in big mandies/markets (43.50%), harassment by traffic police, while moving for selling the produce in big mandies/markets (40.50%), lack of confidence on outside traders (33.50%) and absence of formal marketing agencies (20%).

Table 5.6: Major constraints faced in Marketing of Maize crop (% of farmers)

SN	Problems	Marginal	Small	Medium	Large	Overall
1	Selling of produce in Mandi is unsafe due to incidences of frequent road snatching	59.52	39.29	43.18	33.33	43.50
2	Harassment by traffic police, while selling the produce in distant markets/mandies.	50.00	29.76	45.45	50.00	40.50
3	Village/Local traders took 5 kg. more per quintal of grain due to expected loss of weight arising from moisture.	52.38	46.43	65.91	56.67	53.50
4	Lack of storage facilities at the village or nearby areas.	35.71	57.14	77.27	63.33	58.00
5	Lack of confidence on outside traders as a result of their past fraudulence acts.	40.48	13.09	52.27	53.33	33.50
6	Absence of formal procurement agencies.	16.67	38.10	-	3.33	20.00

Source: Primary Survey

5.6 Suggestions to Overcome the Constraints

5.6.1 Production

The study has also sought the suggestions from the sample farmers to overcome the production constraints. Among suggestions, the most important was rationalization

of maize seeds' prices (49.50%) followed by providing Tarpauling (40' x 40') to maize growers for protecting the output against the pre-monsoonal rains (30.50%), facilities for irrigation (30%), construction of threshing floor (25%), regular inspection and strict vigilance on adulteration of fertilizers (19%), preventing the incidences of destroying the crop from blue bulls and boars (16%) and provision of subsidy on dryer machine (15%).

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

SN	Suggestions	Marginal	Small	Medium	Large	Overall
1	Price of seeds should rationalized/reduced MRPs of all fertilizers & seeds should be displayed at all the authorized shops.	52.38	53.57	36.36	53.33	49.50
2	To check the adulteration in fertilizers, regular inspection & strict vigil should be made.	23.81	11.90	15.91	36.67	19.00
3	Subsidy on Dryer Machine (MRP Rs. 3 lakh) may be given under Farm Mechanization Scheme.	21.43	16.67	13.64	3.33	15.00
4	Threshing floor of 10,000 sq. feet may be constructed at the village or panchayat levels preferably at farms sites.	19.05	21.43	22.73	46.67	25.00
5	To check the incidences of destroying the crops by blue bulls and boars, Dept of Forests & Environment should devise appropriate action plan.	26.19	7.14	13.64	20.00	16.00
6	Irrigation facilities may be extended at large scale.	19.05	33.33	36.36	26.67	30.00
7	Tarpauling (40' x 40') may be provided under maize kit for drying the produce and keeping it safe in produce and keeping it safe in case if rain occurs.	47.62	23.81	31.82	23.33	30.50

Source: Primary Survey

5.6.2 Marketing

The sample farmers were also suggested to overcome the marketing constraints. Among suggestions procurement of maize by formal agencies (35%) was one of the important, followed by check on harassment by traffic police for smooth

transportation of output to the distant markets/mandies (34.50%), extending storage facilities at village or panchayat level (21%) and to check the unfair means prevailing in the agricultural commodity market licensing of traders under the rules may be made (10%).

Table 5.8: Suggestions to overcome the Marketing constraints (% of farmers)

Sl.No	Suggestions	Marginal	Small	Medium	Large	Overall
1	Procurement by formal agencies may be promoted.	19.05	35.71	47.73	36.67	35.00
2	Storage fatilities at the Village/Panchayat levels in PPP mode may be promoted.	45.24	16.67	20.45	-	21.00
3	Harassment by traffic police may be checked for safe & smooth transportation of the produce to the distant markets/ mandies,	19.05	34.52	40.91	46.67	34.50
4	Gap between the MSP and the prevailing prices may be compensated.	35.71	19.05	13.63	40.00	24.50
5	Since all the traders are having license, except the traders of agricultural commodities, so they should also be covered under the License Act for avoiding unfair practices prevailing in regard to weight & measurement of the produce.	23.80	5.92	-	16.67	10.00

Source: Primary Source

5.7 Stakeholders Case Studies:

5.7.1 JEEViKA in Maize Trading

The Bihar Rural Livelihoods Promotion Society (BRLPS) popularly known as JEEViKA, a registered society under the aegis of Rural Development Department, marks a key chapter in rural development in Bihar. JEEViKA's journey of the last decade has coincided with the changing face in Bihar. The objective of JEEViKA is to empower rural poor households, both socially and economically, through developing institutions of the women, like SHGs and their federations. JEEViKA was initiated in 2006 in six high priority districts (Gaya, Nalanda, Muzaffarpur, Purnea, Khagaria and Madhubani). After successful completion of phase – I (2006-

16), JEEViKA Phase – II: Bihar Transformative Development Project (BTDP) commenced in 2016 to expand the BRLP model both vertically and horizontally. This project aims at scaling-up the JEEViKA model across the state by further improving value chain and human development interventions. Over the last 10 years, JEEViKA mobilized SHGs women to engage large scale financial intermediation, leverage higher resources from formal financial institutions, access productivity enhancement services in agriculture and livestock through a community based extension system, engage with markets on fair terms by building economics of scale and improve access to government schemes and entitlements by facilitating awareness and participation.

Out of six key interventions of JEEViKA, one is Livelihoods Promotion and Value Chain. JEEViKA has carried out value chain interventions for commodity specific clusters, were identified based on value chain analysis done either by technical agencies or by the district team. JEEViKA successfully implemented maize farm value chain interventions are as follows:

Table 5.9: Value chain interventions by JEEViKA

SN	District(s)	Value Chain Intervention (Farm)
1.	Purnea	Maize Commodity Trading
2.	Khagaria	Maize Commodity Trading, Seed Marketing (Wheat & Paddy)

Source: Bihar Economic Survey: 2017-18, Vol. – II, p A -16.

In the farm value chain interventions, the forward linkage is supported by post harvest and market access for realizing higher price for farm produce through producer group and Women Farmers Producer Company (WFPC). In one of the widely lauded initiatives, JEEViKA, in partnership with technical support agencies, has worked on the maize value chain intervention in Purnea district. The Aaranyak Farmer Producer Company was able to procure 1014 tons of maize in the 2015-16 rabi season and by the end of 2016-17, the WFPC procured 3026 tons maize and in 2017-18 procured 13944 tons maize till now. JEEViKA has formed two such WFPC in Bihar relating to maize procurement (table 5.10).

Table 5.10: Business Portfolio of WFPCs Formed by JEEViKA

SN	District(s)	WFPC	Commodity Trading	Business Turn over in 2016-17 (Rs. In Lakh)
1.	Purnea	Aranyak Agri. Producer Company Ltd. (AAPC Ltd.)	Maize	458.00
2.	Khagaria	JEEViKA Women Agri. Producer Company Ltd.	Maize, Seed Marketing (Wheat & Paddy)	110.00
	Total	---	---	568.00

Source: Bihar Economic Survey: 2017-18 (Vol.-II), p A-16.

Producer groups and higher federations have been highly effective in large scale aggregation and collective marketing of farmers' produce, earning them better price per unit. The intervention eliminates multiple layers of intermediaries and thus, ensures better price realization and also allows to benefit from off season price escalation. The producer company initiated sale of their produde on an electronic trading platform to minimize risk. In the year 2014-15, the revenue earned by the producer company of Purnea was in tune of Rs 1.28 crore, with a net profit of 7.3 per cent (Rs. 9.35 lakh), 70 per cent of which was distributed to the producer group members as a patronage bonus. As a result, the farmers realized an additional return of Rs. 109 per quintal (12 % incremental value compared to the traditional maize procurement model). The introduction of digital weighing machine and electronic moisture metre for maize procurement and grading set a new trend in marketing which, in turn, benefitted farmers at large.

5.7.2 Maize Procurement by Aaranyak Agri. Producer Company Limited (AAPC Ltd.) with JEEViKA in the Study Area (Katihar)

Aaranyak Agri. Producer Company Limited (AAPC Ltd) is a women farmer producer company (FPC) based at Purnea, Bihar. There are a total of 2601 members in the company during 2016-17. The company was incorporated in the year 2009 with the support of Bihar Rural Livelihoods Promotion Society (JEEViKA) with a view of bringing all women farmers of Purnea and adjoining districts associated with JEEViKA under one umbrella. The objective of FPC is to organize farmers into a collective to improve their bargaining strength in the market.

In the year 2015, AAPC Ltd. with the support of Techno Serve India (a USA based Company) and JEEViKA started maize market linkage through producer groups formed by JEEViKA. The business performed during last two years by the AAPC Ltd. are as follows (table 5.11):

Table 5.11: Business of AAPC Ltd. during 2015-16 to 2016-17

SN	Year	District	Block/ Taluka	No. of Producer Groups	Total No of Members	Qty Procurred	Bonus (Rs/Qtl)	No. of Shareholders
1	2015-16	Purnea	Dhamdaha	10	299	1014	50	1251
2.	2016-17	Purnea	Dhamdaha	27	818	3042	60	2601

Source: JEEViKA, Katihar

After two years of successful intervention in Dhamdaha, AAPC Ltd. planned to scale up its business operations with a procurement 11000 MTs from 04 blocks of Purnea and also decided to take one block from Katihar i.e., Korha (study area) as pilot. As Purnea district was in scaling-up phase, so the target in the district was set for 10,000 MTs. Simultaneously, the target for Katihar was set around 1000 MTs. The details of targets were as below (table 5.12):

Table 5.12: Target and Achievement of procurement by AAPC Ltd.

SN	District	Block	Target (MTs)	Achievement (MTs) Till June, 2017	Achievement %
1.	Purnea	Dhamdaha	4000	4282.9	107.07
		Barhara Kothi	3000	2924.2	97.47
		Bhawanipur	1500	2371.2	158.02
		Banmankhi	1500	1234.6	82.31
2.	Katihar	Korha	1000	1782.7*	178.27
		Total	**11000**	**12594.9**	**114.53**

Source: JEEViKA, Katihar
**A total number of 565 farmers benefitted.*

Based on the assessment of the VOs (Village Organizations), their crop profile and existing post-harvest challenges faced, it was recommended to adopt an *Aggregation and Market Linkage Business Model* wherein member farmers are provided transparent and accurate valuation for their produce with minimal number of intermediaries between them and the final buyer. A comparative chart between the existing traditional model and AAPC Ltd. model are presented in box 5.1:

Box 5.1: Market linkage model of AAPC Ltd.

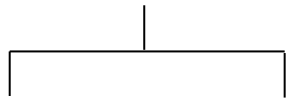
A. Existing Traditional Model

Farmer --- Local Aggregator --- Broker --- Trader (Mandi) --- Institutional Buyers

(NB:In this model, all the three intermediaries charged the commission and the institutional buyers purchase the output at market premium prices)

B. AAPC Ltd. Model

Farmer --- Village Organization --- Producer Company --- NeML Accredited Warehouse



International Buyers | Stock and Sell at Premium

(NB: In this model electronic weighing machines are used and also grading is used for greater transparency at VOs level. Producer company sell the produce to buyers at accredited warehouse. The quality is checked as per NeML standard and sold through NCD EX platform).

Advantages of AAPC Ltd. Model

i. The payment is deposited in the respective bank accounts within 3-4 days of the sale which, in turn, increase in farmer's income by about 10 per cent.
ii. Electronic weighing and grading.
iii. No commission.
iv. No deduction for any losses.
v. Trading through NCDEX platform & payment is made before delivery.
vi. Third party quality check facility.
vii. No warehouse charges.

However, the main problem before the AAPC Ltd. was *to win the confidence* of the farmers in the business area, as revealed in the discussion with the Associate of Techno Serve India.

(Based on discussions with Mr. Sachin Sharma, Associate, Techno Serve India and Sri Ajay Kumar Singh, District Project Manager, JEEViKA, Katihar on 24th November, 2017).

5.7.3 Gulab Bagh Mandi (Purnea, Bihar)--- The Maize Hub of India[1]

Gulab bagh mandi, Purnea (Bihar) is located at Purnea, the divisional and district headquarters as well. It is the major maize trading place in India. It is spread over in 68 acres. It accounts for around two million tons of maize supply to the eastern, northern and western part of India. The maize market in Bihar is highly unorganized which cause greater price fluctuation. Maize growing farmers of Bihar are not much aware about the maize price so they are not benefitting from these maize growing markets.

It is the only notified market in the state. It is India's largest maize market and trading centre. This is because Bihar does not impose any value added tax on maize. There is no Agricultural Produce Marketing Committee Act (APMC Act) and any marketing rule and regulation prevails in the mandi. The peak period of maize trading in this mandi is **April to August**. More than 100 registered traders and few unregistered traders are engaged in trading of maize. After rabi harvest the daily arrival is of 2000-2500 MT of maize. Maize price in this mandi fluctuate on daily basis and the main cause of its fluctuation is mismatch between demand generated by processing industry and supply of maize to the trading place. In general price of maize is high at the time of sowing (Oct-Nov.) and before harvesting (April). Maize price is also fluctuated by weather condition, minimum support price, price of substitutes, seasonal cycle, breakthrough in the technology etc. Maize is available at lowest price in this mandi in peak trading season. Most of the maize processing company stocks maize during this period. About 120-125 feed company of eastern India and 2 starch producing unit of Dalkhola and Malda (West Bengal) engaged in maize procurement from the mandi. Some of export oriented company like; *Louis Dreyfus (LD), Gnet, Cargil, NBSC, NCMSL, Sohan Lal Commodity etc.* is also engaged in maize procurement in mandi. These companies stock their procured volume of maize in inside and outside constructed godowns. Godowns are also constructed or hired by these companies. According to one estimate, out of 10 lakh MT warehouse

[1] *The analysis is made on the basis of discussions held on 13/03/2018 with several kachhaadatiyas namely M/s Durga Prasad Lohia, Pappu Kumar etc. and a PGDM (Agri business) course paper, prepared by Dewasish Ghoshal, NAARM, Hyderabad, India, 2010.*

capacity in Bihar 5 lakh MT is at Gulab bagh itself. These companies usually keep their procurement specialist at the mandi for the peak trading period of five months for assessing and ensuring exportable quality.

There are three commercial channels for maize: traders, government mandated markets (mandis), and trading through railway cart. On average 85 per cent of maize produce are processed through traders and mandis. The BAPMC Act (1960) legislated the creation of mandis to enable to more equitable distribution of the gains from agriculture among producers, consumers and traders. But BAPMC Act has repealed by the state government in 2006 and thus, there are no other market rule and regulation prevails at Gulab bagh mandi for trading. The mandi is central to the functioning of the marketing channel, and acts as delivery point where farmers bring produce for sale to traders. In the maize growing areas of Bihar, Gulab bagh mandi typically serves around 2500 to 4900 square kilometers.

Maize trading is conducted by commission agents called *adatiyas* (brokers who buy and sell produce) There are two types of adatiyas viz., kachha and pukka. *Kachhaadatiyas* are purchasing agents that buy only on behalf of others and *pukka adatiyas* who finance trade as representatives of distant buyers and sometimes procure on their own account. The lack of professional competition combined with the communal stranglehold on rural trading has made commission agents extremely wealthy. The operation of mandi conists of a number of different stages from the logistics of transporting grain to the market to quality inspection, auction, bagging and weighing and payment. Based upon local price information within the village, farmers decide in which of the nearby place to sell. They transport their produce to the mandis in tellers. Very often, to avoid peak-time crowds, farmers arrive at the mandi in the night or in early morning before they intend to sell. When the mandi opens in the morning, farmers bring their tellers to display within the mandi. The inspection by buyers is by sight. There is no formal method of grading the produce and the only instrument used is the moisture metre but rarely in use and the quality is assessed only through expertise of the brokers. In nutshell, the mandi operation process may be seen as below:

Inbound Logistics --- Display & Inspection --- Auction --- Bagging & Weighing --- Payment --- Outbound Logistic.

This way the mandi system does not serve the farmer well and is burdened by inefficiency. Because the farmer does not have the resources to analyze or exploit price trends, the timing of the sale may not result in the optimal price for the crop. Moreover, since the actual sale price is determined at the auction, by the time the farmer gets the price, it is too late to go to another place to make his sale. Other expenses and inefficiencies exist: the overnight stay near the mandi costs the farmer money; the crops are displayed in open air courtyards, and are therefore subject to being negatively affected by the weather; the process of inspection is unscientific and often arbitrary, tending to favour the buyer, and generally does not provide an incentive to farmers to invest in better seed or farming practices that lead to higher quality even though quality especially for processing, gain of moisture by the crops reduces the quality and the produce price. In addition, farmers find the auction process demeaning. Agents belong to a close-knit community that is socially and economically distinct from the farmers' community.

Apart from exploitation of the farmers, there are other inefficiencies in the system. Sometimes the multiple points of handling in the supply chain require the produce to be bagged, which takes four to five times longer to be unloaded at the processing plant than unbagged produce. The mandi system also does not serve trading companies; its inefficiencies make the mandi far from an optimal procurement channel. From the company's point of view, the key problem is the agents control of the market and the resulting distortions of price and quality. Thus, as a result of the commission agent structure in the traditional mandi system, processing companies have no direct interaction with the farmer. This gap creates a range of supply chain issues.

Concludingly, maize is evolved as a highly valuable and profitable crop for the farmers but due to unorganized market in Bihar, farmers are deprived of its benefits.

One side buyers are organized but on the other side farmers are unorganized, they are lacking the information regarding demand and price. It need to develop an organized platform where fair trading can takes place and farmers are not cheated, and to develop proper information based market where farmer and buyer both can get benefits of growing maize demand and production.

5.7.4 Trading of Maize at Railway Rake Points

This section has been prepared on the basis of discussions held with two leading licensee maize traders at two different and prominent railway rake points on 13/03/2018 & 19/06/2017. These two are Mr. Rajesh Kumar Choudhary (M/s Rajesh Kumar & Rakesh Kumar), 47 years, graduated with science stream, engaged in maize trading since 1983 and using **Indents** for railway rakes since 2008 and; Mr. Pawan Kumar Sarraf (pawan_sarraf@yahool.com), 60 years & graduate. Mr. Choudhary is trading at Shemapur (Katihar) railway rake point and Mr. Sarraf at Naugachia (Bhagalpur) railway rake point.

In Bihar, maize is traded in both the means of transportation viz., roadways and railways. Local transportation is generally made by truck/teller loads whereas the produce sent far distant destinations (outside the state) like; Tamil Nadu, Karnataka, Uttarakhand, Haryana, Punjab, Gujarat etc. by Railway rakes, available at 11railway rake points such as Purnea, Jalalgarh, Madhepura, Khagaria, Mansi, Begusarai, Bakhri, Kurshela, Shemapur (Katihar) Naugachia and Bhagalpur. These railway rake sidings/points are mostly in north-eastern region, popularly known as Seemanchal-Koshi region of the state. At each of the railway rake points, there are one or two large sized maize traders, who put their **Indents** to the respective zones of railways through local railway officials. About 40 to 50 rakes (each rakes are of 42 wagons) of maize is exported annually from each of the railway rake sidings. This way about 500 to 600 railway rakes are annually sent from the state. In one rake 45,000 bags (each bags contains 56 to 58 kg of produce) i.e., 2600 MT of maize are sent outside the state. This way about 1.3 to 1.5 million MT of maize is annually exported.

Farmers and local village traders (belonging to 30 kilometres of radius) brought their produce with teller loads of maize to the premises of big traders referred above who after assessment of moisture level (optimal level is <14%) and weighing the produce electronically, dump the produce at railway sidings for loading in the rakes. The payment to the farmers and village traders are transferred to their respective bank accounts in a day or two. As soon as the maize loads of rakes arrived to the destinations, the representatives of the final buyers/processors after verifying the quality of produce unload the volume for stocking at their godowns in and outside their industrial units and the payment, sometimes in advance and sometimes after deliveries, is made through digital transfers.

The railway charges a freight of Rs. 2500-3000 per MT and on an average the railway earns about Rs. 65 to 78 lakh per rail rake for transporting the produce outside the state. The traders at railway rake points incurred a transportation cost of Rs. 280 to 310 per quintal of produce and retained a net margin of around 2 per cent of total traded volume. The farmers' or village traders' selling price was reported to be about Rs. 1100 to 1200 per quintal, depending upon the inflow of the produce in the market. The traders sell their produce to the ultimate buyers in range of Rs. 1600 to 1700 per quintal. The annual turnover of Mr. Choudhary and Mr. Sarraf was reported to Rs. 200 to 250 crores and Rs. 100 to 125 crores respectively.

Constraints

The discussions with duo traders also revealed some constraints in pursuing the trade which ultimately reduce the producer' share in final buyer's rupee. Since the peak trading is made during May–July, so some seasonal and occasional bottlenecks are to be attended for the benefits of all the maize stakeholders and reducing marketing in efficiencies as well. These constraints are as below:

i. Free loading time is of only nine hours after which railway charges demurrage. The general rate of demurrage is @ Rs. 150/wagan/hour, which comes to Rs. 6300/rake/hour plus 5 per cent GST (i.e., Rs. 6615/rake/hour). But the rate of demurrage in Hazipur Railway Zone is

six times higher i.e., Rs. 40320/rake/hour compared to general demurrage rate.

ii. Transportation of maize and other agricultural commodities is treated at par with the industrial raw materials like coal, iron, stone chips etc. by railways.

iii. During the peak trading period, the temperature touches to around 45^0 C, which in turn, reduces the working potentialities of the labourers. It costs higher loading charges.

iv. There are no basic facilities like light, drinking water, pucca sheds, security and guard etc. at the railway sidings, resulting to fearness of theft of the produce and abduction of the traders.

v. Lack of piecemeal loadings in and around the potential maize markets. It was in practice before 2005-06.

vi. Rakes are not made timely available and there is no consideration of weather phenomenon.

Suggestions

i. Railway rake point at Bhagalpur may be shifted to Naugachia (north of the river Ganges and the potential maize area) particularly to avoid the frequent traffic jams and no-entry (15 hours) in the city of Bhagalpur.

ii. Loading and unloading charges of labourers at railway rake point may be fixed reasonably.

iii. Piecemeal loading at least 2 or 3 points adjacent to Purnea and Naugachia may be allowed so that small traders/village traders/big farmers could avail such facility. This will increase the marketing efficiency by reducing the transportation costs for carrying the produce for distantly locating railway sidings.

iv. Demurrage charges may be reduced to the normal demurrage rate i.e., Rs. 150/wagon/hour.

v. Free loading time may be increased from nine hours to twenty four hours.

vi. Railway sidings should be fairly developed with basic infrastructural facilities such as light, drinking water, pucca sheds, all weathered link roads and watch and guards.

vii. Rakes should be made available in time with prior information (24 hrs earlier) of expected arrival at the sidings.

5.7.5 Maize Processors

This section is based on insightful discussions (19/05/2018) held with two following leading maize processors, engaged in manufacturing, exporting and supplying of poultry feeds in Bihar: Dr. Rajesh Kumar (MBBS), General Manager, M/s Raj Agro Chem Product Private Ltd. (www.rajagrochem.com/e-mail:activafeeds@gmail.com), NH-57, Kanhara, Bochaha, Muzaffarpur, Bihar; established in April, 2012. Mr. Amit Saraogi, owner and co-founder of M/s Anmol Feeds Private Limited. (www.ammolgroups.com/e-mail:afpl@anmolgroups.com), Bela Industrial Area, Muzaffarpur, Bihar; started in 2000.

The installed capacity of the former unit is manufacturing of poultry feeds to the volume of 4500-5000 MT/month whereas that of 3000-6750/month in later case. The operational status was reported to 3500 MT/month and 4000 MT/month respectively. The peak and lean periods of manufacturing are Sept.—March (7months) and April – August (5 months) respectively. The share of maize, as raw materials in manufacturing of poultry feeds, is 60 per cent followed by soya (25%) and others like polished rice oil etc. by 15 per cent. The processors procure nearly 90-95 per cent of the required quantity of quality maize (having good pigmentation, large size of grain and low moisture content) from Purnea, Khagaria, Mansi, Begusarai etc. districts (popularly known as Semanchal-Koshi region of the state) through their procurement managers and stock the volume in their godowns inside the industrial premises.

There are 93 maize processing units, constituting micro, small and large sized, are operational in the state, with an objective of providing healthy nutritionally balanced and digestible poultry and cattle feed. These duo processors are of large sized

registered at the office of the Registrar of Companies, Patna, Bihar during 2009-10. Their business is spread over across India covering most parts of Bihar, Jharkhand, Uttar Pradesh, West Bengal, Orissa and eastern states also. Recently the later has added one more feather in its cap by entering in international market of Bangladesh, Nepal and Bhutan. The formal has launched its brand name as ACTIVA and the later ANMOL.

Till 2010, apart manufacturing, the distribution business was in the form of dealership but in post 2012-13, the duo adopted the ***Integration Business Model (IBM)*** wherein manufacturing and consumption both taken together. Under this model, they have established their own hatcheries on custom hiring basis in collaboration with the duly signed MoU among the farmers/rearers across the states. Earlier this model was in function in West Bengal since 2006-07. Besides own enterprises, the other stakeholders are farmer, trader and cutter. The business is progressive and self-sufficient in meeting the need of total poultry feeds of 1 to 1.5 lakh MT in the state. There is also no dearth of demand of poultry feeds outside the state due to high demand of chickens throughout the year barring a few months (2-3 months) in some of the states during festivals and holy months.

The duo need to procure the maize during 15 May to 15th July for their own use. However, 5 to 10 per cent of required quantity are to be purchased from Madhya Pradesh (Chindwara), Karnataka and Maharashtra during the month of April. The product is categorized as Pre-Starter (0-14 days), starter (15-26 days) and finisher (27 days and over). The prevailing prices of these products are @Rs. 2140/bag (50 kgs), Rs. 2005/bag (50 Kg) and Rs. 1996/bag (50 kg) respectively. the annual turnover was reported around Rs. 100-150 crores. Their enterprises are progressing but they were facing some constraints relating to unavailability of quality maize due to high moisture content at the time of harvesting and toxicated grains due to rains (summer) during the harvesting period.

Suggestions

- There will be great help to the poultry feed industry, if the maize policy is centered towards maize producers. This will include the strengthening of production chain (sowing to harvesting).
- There is need to establish a chain of community based dries to improve final grain quality. The installation of community dryers at producer level can address the issue of low quality maize due to aflatoxins and storage pest developed due to high moisture at harvesting.

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CHAPTER – VI

CONCLUDING REMARKS AND POLICY SUGGESTIONS

6.1 Background

Maize *(Zea mays L.)* is the third largest grain crop in India, after rice and wheat. It is cultivated in an area of about 9 million hectare, has an annual production of 23 million metric tons and an average national productivity of 2.57 metric tons per hectare. In recent years, the maize area, production and productivity have shown steady upward trends. It is grown across wide range of environments, extending from extreme semi-arid to sub-humid and humid regions. About 59 per cent of total production is used as feed, while the remaining is used as industrial raw material (17%), food (10%), exports (10%) and other purposes (4%). Because of its diverse usage in the feed industry and food sectors, it is considered as an internationally important commodity driving world agriculture.

Madhya Pradesh, Bihar Rajasthan and Uttar Pradesh are traditional maize growing areas whereas Karnataka and Andhra Pradesh non-traditional maize areas. It is predominantly a kharif season crop but in past few years, rabi maize has gained a significant place in total maize production in India. In recent years, significant changes have occurred in maize utilization besides the production, due to increasing commercial orientation and rising demand for diversified end users. Past strategy did not explicitly recognize the need to raise farmers' income, particularly when there is dynamic market of different produce. This is true in case of maize crop in Bihar. Marketing of maize outside the state and high transportation cost have largely affected the farmer's income out of its marketing, which have resulted to its further commercialization and doubling the production by 2025. Since the crop has backward and forward linkages with the poultry feeds, starch and other industries, thus, it has been undertaken with following objectives.

6.2 Objectives

i. To study growth of acreage, production and productivity of maize in the state.
ii. To analyze the cost of production of maize in the study area.
iii. To identify the different supply chain of maize marketing in the study area.
iv. To explore the possibility of processing/value addition of maize in the state.
v. To identify the constraints in production, efficient marketing and processing of maize and suggest suitable measures.

6.3 Methodology

The secondary and primary survey data are analyzed in the study. The area, production and yield of maize are analyzed using the secondary data. Two districts --- Samastipur and Katihar have been selected for primary study. Hundred farmers from each district have been selected. The pattern of marketing, trading, markets, processing, constraints and suggestions are assessed using the primary data and case studies.

6.4 Summary of Findings

6.4.1 Growth Trends of Maize in the State

Maize is also the third largest cereals in the state. It contributes nearly 21.3 per cent to total cereals' production, preceded by rice (45.6%) and wheat 33.1%). It is cultivated in all the 38 districts of the state in varying areas but the state's *'Maize Road'* covers 11 districts falling on north of the river Ganges and both the sides of Koshi, Gandak and Bagmati rivers. It occupied nearly 75.3 per cent of the state's total maize area and produced 79.5 per cent of the state's total maize production during the year 2016-17. It is to be noted that Bihar has been awarded with **Krishi Karman Award** for maize production in 2016-17. During 2000-01 to 2016-17 the maize area expanded from 620.5 thousand hectare to 720.9 thousand hectare, indicating 16.18 per cent increase. During the period, the AAGR was 0.98 per cent and CAGR 0.94 per cent. Similarly, the production touched to 3845.7 thousand MT from 1497.3 thousand MT, registering significant increase of 156.8 per cent during the same period. The AAGR and CAGR were 7.47 per cent and 5.71 per cent respectively. The yield rates increased from 2413 kg/ha to 5335 kg/ha indicating 121 per cent increase over the two periods. AAGR and CAGR of yield rates were 6.39 per cent and 4.78 per cent respectively. The season wise CAGR of maize

production was 6.86 per cent for kharif, 9.52 per cent for rabi, 4.87 per cent for summer and for annual 7.55 per cent during 2007-08 to 2016-17. Similarly, the season wise CAGR of maize yield rate was 7.79 per cent for kharif, 6.46 per cent for rabi, 4.06 per cent for summer and 6.57 per cent for annual during the same period. The analysis further reveals that maize area is gradually spreading to new areas and to some extend also replacing wheat, banana and a few millet crops. Substantial enhancement of yield rate had remained instrumental for significant increase in the level of production. Moreover, with rich water resources, the production and yield rate have touched a new height particularly in maize-road districts which, in turn increased the participation of national players and a few multinationals. This have led to a structural change in maize ecosystem in the state.

6.4.2 Status of Food Processing Industries in the State

Till August, 2016 there were 407 food processing units in the state and out of it 278 (68.3%) were operational. Although the range of products of the agro-based industries in Bihar is quite wide, it is the cereal based industries (rice, wheat and maize), which dominate the sector. These industries have created 48,404 employment in the sector. Maize give unique position to the state in national maize market with most of the maize processing units, particular in north India, depended highly on maize from the state for a significant period of time. With the state productivity (5335 kg/ha), much higher than national productivity (2509 kg/ha) level, and area under cultivation is expected to rise, the availability of good quality maize offers significant opportunities for entrepreneurs in the state. However, the level of processing in the state is presently quite insignificant. There is, thus, a large opportunities for maize processing units, which can be set up for making wide range of products like; starch, corn oil, corn flakes, corn flour, poultry feed etc. At present, there are 93 micro, medium and large maize processing units in the state. Out of it, 23 units have been benefited under the financial assistance program of the state department of food processing under IL & FS cluster. The Bihar Industrial Policy, 2016 has placed high importance on agro-based industries. Under the policy, food processing sector has been included as one of the ten priority sector.

6.4.3 Socio-Economic Characteristics of Sample Households

This study forms a sample of 200 farm household with an average age of 45.7 years and average family size of 6.5 members, of which 2.12 being engaged in farming. They have an experience of 21.6 years in the farming, but majority of them have studied up to secondary level (40.5%). More than half of the respondents are belong to general category (55.5%), followed by OBC (other backward classes) (31%) and scheduled castes (13.5%). The average net operational area in the study are is 6.20 acres. It is very important to note that that all most all the farmers undertake crop cultivation depending upon the irrigation source of bore wells (98.5%). The higher proportion of irrigated land are found among medium farmers, followed by large, small and marginal farmers, as they are not ready to take any risk in the process of crop cultivation. The leased-in irrigated lands and its rental values are highest in case of medium farmers (R. 18333/acre), followed by large (Rs. 18000/acre), small (Rs. 6272/acre) and marginal (Rs. 12800/acre) farmers. The common crops grown by the sample farmers include paddy, maize, wheat, pulses, soyabean and vegetables. The cropping intensity was higher at 175 per cent for marginal & small farmers followed by medium farmers (157%) and large farmers (140%). As regards the total paid out costs and net returns realized by the sample maize farmers during rabi season, it is estimated at Rs. 20125/acre and Rs. 28009/acre respectively at overall farmer level. The CB ratio is 1:2.39. similarly, in case of summer maize, the total paid out costs and net returns are Rs. 18662/acre and Rs. 21078/acre respectively. The CB ratio was 1:2.13. As regards the financing of agriculture, a majority are found to have availed of loans from institutional sources (94.8%). It appears to be a good symptom of development. Among the institutional sources, commercial banks followed by Regional Rural Banks forms the major sources of finance, whereas among non-institutional sources, moneylenders, traders/commission agents happened to be the major sources of credit to the sample farmers. At the aggregate level, seasonal crop cultivation (8.50%) is the main purpose behind borrowing of loans, which amounts to 66.15 per cent of the total borrowings amount.

6.4.4 Supply Chains of Maize Marketing

The volume of net marketed surplus of maize was 106.05 quintal (90.22%) against the production of 117.54 qtls on overall average farm size of 2.84 acres. Among the farms, the net marketed surplus on average large farms (4.90 acres) was highest at 190.52 qtls (94.82%) followed by medium (91.54%), small (85.54%) and marginal (85.20%) farms. It is revealed that unlike other agricultural produce the net marketed of maize is quite high mainly due to low family consumption and other needs of the produce at the farmers' level.

As regards the supply chains, which are routes through which the produce moves from the point of production to the point of consumption; the intermediaries also varies. Some common marketing channels for marketing of maize in the study area are as below:

i. Farmer → Village Trader → Commission Agent → Wholesaler → Maize Processor
ii. Farmer → Village Trader → Commission Agent → Wholesaler → Maize Stocker
iii. Farmer → Commission Agent → Railway Point Maize Trading → Maize Processor
iv. Farmer → Mandies → Trader → Maize Processor
v. Farmer → Mandies → Trader → Maize Stocker
vi. Farmer → JEEViKA → AAPCLtd. → NeML accredited Warehouse → Institutional Buyers/Stock and Sell at Premium

The overall maize sold through different channels during the reference period was highest in channel-II by 44.04 per cent (9339.9 qtls) followed by channel-V (17.27%) for 3664 qtls, channel-IV (13.78%) for 2923.7 quintals, channel – VI (12.47%) for 2645 quintals, channel – III (10.64%) for 2255.7 quintals and channel – I (1.8%) for 382 quintals.

The absolute value of marketing costs and margins varies across channels. It is apparent from the analysis that in channel – VI, the overall average producer's share in consumer's rupee was 78.28 per cent, followed by channel-II (77.20%), channel –V (71.29%), channel-IV (65.45%), channel - I (64.39%) and channel-III (64.38%). For

measuring the marketing efficiency in maize, three alternate methods were also worked out. The conventional method (E) suggests that second channel was more efficient than other channels but price received by the producer in this channel was the lowest. In *Shephered's method,* marketing margins were not included as a part of marketing cost and this also suggests that the second channel was more efficient than other channels. This however ignores price received by the producer. The limitations of both these methods are considered in the modified method suggested by Acharya. According to *Acharya's method* (MME), the channel - VI was the most efficient of all channels.

Among the production constraints, as perceived by the sample households were costlier of maize seeds than any other crops' seeds (38.5%) followed by pecking-up of the seeds by rats, termites and birds (37.5%), problem of drying of rabi maize (36.5%), shortage of labour due to migration as result of liquor ban in the state and subsidized grains at PDS (33.5%), lack of proper irrigation facilities (30.5%) and destruction of the crop by blue bulls and boars (27.5%).

The marketing constraints, as perceived by the sample households were lack of storage facilities at the village or nearby area (58%) followed by taking 5 kg. of more produce at per quintal of grain due to expected weight loss arising from high moisture content in the grain (53.5%), frequent road snatchings while coming back to home after selling the produce in big mandies/markets (43.5%), harassment by traffic police (40.5%), lack of confidence on outside traders (33.5%) and absence of formal marketing agencies (20.%).

Prominent suggestions to overcome the production constraints were rationalization of maize seeds' prices (49.5%) followed by providing tarpauling (40' X 40') to maize growing farmers for protecting the grains from pre-monsoon rains (30.5%), irrigation facilities (30%), construction of threshing floor (25%), strict vigilance over adulteration of fertilizer (19%), preventing the incidences of destroying the crop from blue bulls & boars (16%) and provision of subsidy on dryer machine (15%).

To overcome the marketing constraints, their suggestions were procurement of maize by formal agencies (35%) followed by check on harassment by traffic police (34.5%), extending storage facilities at village/panchayat level (21%) and check on unfair means adopted by the traders by licensing them (10%).

6.4.5 Stakeholders' Case Studies

While recognizing the immense scope of development in production, marketing and processing of Maize in Bihar, stakeholders views are captured as case studies. These are *JEEViKA in Maize Trading, Maize Procurement by Aaranyak Agri. Producer Company Limited (AAPC Ltd.) with JEEViKA in the study Area, Gulab Bagh Mandi --- The Maize Hub of India, Trding of Maize at Railway Rake Points and Maize Processors.* The insightful discussions with these stakeholders revealed many innovative solutions along with their operational pattern and constraints, which are briefed as follows:

a. JEEViKA

It has successfully implemented maize farm value chain interventions in the study area, particularly in Purnea and Katihar districts since 2015-16 through producer group and women farmers producer company (WFPC). The procurement figures for 2015-16 rabi was 1014 MT, 3026 MT for 2016-17 and 13944 MT for 2017-18. Producer groups and higher federations have been highly effective in large scale aggregation and collective marketing of farmers' produce. The intervention eliminated multiple layers of intermediaries and thus, ensured better price realization and also allowed to benefit from off-season price escalation.

b. AAPC Ltd.

A women farmer producer company, incorporated with the JEEViKA in 2009 aimed to organized farmers into a collective to improve their bargaining strength in the market. In 2015, the company with the support of Techno Serve India (US) and JEEViKA started maize market linkage through the producer groups formed by JEEViKA. After two years of successful intervention, it has scaled-up its achievement to 12595 MT of maize till June, 2017 against the target of 11000 MT. Besides there are many revealed advantages of AAPC Ltd, however, the major challenge is to win the confidence of the farmers.

c. Gulab Bagh Mandi (Purnea, Bihar)

It is India's freest grain market and largest maize trading centre, located at Purnea in north-east Bihar. After repealing of BAPMC Act, (1960) in 2006, there is no marketing rules and regulations in the mandi. More than 100 registered traders and a few unregistered traders are engaged in trading of maize in this mandi. About 125 feed companies of eastern India are engaged in maize procurement from the mandi. Out of 10 lakh MT warehouse capacity in Bihar, 5 lakh MT is at Purnea and Gulab bagh itself. Around two million MT of maize is annually traded in this mandi. It is conducted through Adatiyas (Commission Agents) in a manner through *inbound logistics ---- display & inspection ---- auction ---- bagging & weighing ---- payment ---- outbound logistic.* From the company's point of view, the key problem is the agent's control over the market, which in turn distorts the price and quality. This creates a range of supply chain issues.

d. Trading of Maize at Railway Rake Points

Two traders were discussed, who are using *indents* for railway rakes since 2008. About 500 to 600 railway rakes of maize across the 11 rail rake points are exported outside the state. The railway earns about Rs. 65 to 78 lakh per rail rake. About 1.3 to 1.5 million MT maize is annually exported. Major constraints are nine hours of free loading time, recognization of maize and other agricultural commodities by the railways are at par with industrial materials, lack of basic infrastructural facilities at the railway sidings etc. To overcome these problems suggestions include 24 hours of free loading time, shifting of railway rake point from Bhagalpur to Naugachia, fixation of loading & unloading charges, reduction in demurrage charge, provisioning of basic infrastructural facilities at railway sidings etc. These efforts will ultimately enhance the marketing efficiency of maize in the state.

e. Maize Processors

Two leading maize processors were discussed. About 93 maize processing units of different sizes are involved, and of them 23 have been facilitated by the State Department of Food Processing. Till 2010, apart manufacturing the distribution business was performed by these processors in the form of dealership but in post 2012-13, the *Integration Business Model (IBM)* was adopted by them, wherein

manufacturing and consumption both, are doing together. They were of the view that if the maize policy is centered towards the strengthening of production chain, then there will be a great help to the poultry feed industry. Assistance in community based driers to improve the maize quality is the need of the hour, revealed in the discussions.

6.5 Policy Recommendations

In Bihar and also in some other states, maize production is gradually shifting from rainy season to winter season (rabi). Besides, its demand and production are increasing more rapidly as compared to other major commodities. Simultaneously, it is estimated that by 2025, India would require 50 million metric tones of maize grain, of which 64 per cent would be required in the feed sector, 30 per cent in the industrial sector, 4 per cent as food and 2 per cent for seed and miscellaneous purposes. Thus, in next 7 to 8 years there is necessity and opportunity for increasing India's maize production by about 40 per cent from the current level of production of approximately 38 MMT (2016-17). To meet such target, some strong policy interventions will be required in the area of production, marketing and processing of maize in general and particularly in Bihar. These interventions may be as follows:

6.5.1 Production

i. Strengthening of production chain (sowing to harvesting) by way of availability of quality seeds at reasonable price, balanced use of nutrients, transplanting maize under late sown conditions etc. are to be taken care of.

ii. To address the issue of low quality maize, there is need to establish a chain of community based dryers at producer level, construction of threshing floors (10,000 sq. feet) at village level, providing tarpaulin (40′ x 40′) to maize farmers for preventing grains from pre-monsoonal rains etc.

iii. Aflatoxins and storage pests developed due to high moisture at harvesting, the installation of affordable community/metal silos at producer level may be made to save maize grains from pest infestation. This will simultaneously prevent the distress sale of crop at cheaper prices.

iv. Picking-up of grains before sprouting of seeds by pigeon, sparrow, rats, termites, etc may be checked in consultation with the plant protection scientists.

v. Destruction of the crop by blue bulls and boars may be checked with a co-operation of the Forest, Environment and Wildlife Management Department.

6.5.2 Marketing

i. To address the supply chain issues, market linkage model may be promoted or strengthened through farmers' producer company/group/organization. It will minimize the number of market functionaries or intermediaries and enhance the producer's share in consumer's rupee.

ii. The complete production-to-end user value chain needs to be strengthened. Since the price difference between the farmer's realization and the end user is about Rs. 1000 to Rs. 2000 tons of maize production, which can be eliminated by creating the business model of direct purchase by end user/industries without brokers/commission agents.

iii. The logistic for bulk handling system of maize from farm to industrial gate needs to be strengthened through development of hassle free roads (quality of roads and elimination of harassment by traffic personnel) and carriage by railways (24 hours of free loading time, reduction in demurrage charge, fairly developed basic infrastructure at railways sidings, provisioning of piecemeal loadings etc.)

iv. Improvement in market intelligence system and transparency in prices are the need of time.

6.5.3 Processing

i. The level of processing of maize in the state is presently quite insignificant. There is, thus, a large opportunity for maize processing units, which can be set up for making a range of products like; starch, corn oil, corn flakes,

corn flour, poultry & animal feed, zeinprotien etc. So, there is need to incentivize to maize based processing industries in the state.

ii. Having potential of strong viability for maize processing units in the State Government should geared-up the process of establishment of at least one mega food park in each of the agro-climatic zones or potentially identified geographical areas. As of now, one mega food park project is being executed at Khagaria (Zone – II) by Pristine Mega food Park Pvt. Ltd. under an agreement with MoFP&I, GoI.

iii. The state may be the *'Maize Processing Hub,'* if the maize policy is centered towards the strengthening of Maize Production Chains, as also suggested by selected maize processors.

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Addendum – 'A'

According to first two advance estimates, about 26 lakh MT of maize produced in 7.20 lakh ha area during 2017-18, which is around 12 lakh MT less as compared to previous year's (2016-17) production level of 38.45 lakh MT and about 18 lakh MT lower than the targeted production of 45 lakh MT. As per the report of district level enquiry committee comprising District Agriculture Officer and KVK Scientists/Scientists of State Agricultural Universities, constituted by the State Department of Agriculture and also based on field observations and discussions with different stakeholders of maize; the reason for low production is no ear (Cob) in rabi maize in 14 districts of Bihar, which affected 79576 maize farmers and 58088.68 ha maize area. The Enquiry Committee report revealed the reason as severe cold. The same seed, which was sown in normal season brought desired the ear (Cob) in the crop. The committee found that where the temperature was down by 10^0C than the normal one for continuously 10 days, cobs did not come out in the crop. The state department of agriculture submitted its report to state department of Disaster Management, which immediately recommended the distribution of compensation amount to the affected maize farmers @ Rs. 13500/ha for irrigated fields, Rs. 6800/ha for un-irrigated fields and the minimum compensation of @ Rs. 1000/ha against the estimated cost of production of @ Rs. 50000/ ha. The district wise number of affected farmers and area during rabi 2017-18 are depicted as below:

SN	Agro-Climatic Sub-Zone	Districts	Affected Area (In ha)	Targeted Coverage (In ha)	% of AA to TC	No. of Affected Farmers (%)
1.	I	Muzaffarpur	5031.81	21000	23.96	15058 (18.92)
2.	I	Sitamarhi	344.48	8500	4.05	867 (1.09)
3.	I	Darbhanga	4372.00	13500	32.38	11238 (14.12)
4.	I	Gopalganj	1642.84	13500	12.17	12566 (15.79)
5.	I	Seohar	830.17	1000	83.02	NA
6.	I	Madhubani	18.77	1000	01.88	NA
7.	I	Vaishali	1027.48	35500	6.63	NA
8.	I	West Chamaparan	814.24	8000	10.18	NA
		Sub-total	**14081.79**	**82000**	**17.17**	**39726 (49.92)**
9.	II	Supaul	2125.62	6000	35.43	8116 (10.20)
10.	II	Araria	4167.40	7500	55.56	9893 (12.43)
11.	II	Saharsa	1126.00	11500	9.79	2467 (3.10)
12.	II	Khagaria	26996.00	51000	52.93	NA
		Sub-total	**34415.02**	**76000**	**45.28**	**20476 (25.73)**
13.	III-A	Munger	2041.46	3000	68.05	5433 (6.83)
14.	III-A	Bhagalpur	7550.41	17500	43.14	13938 (17.52)
		Sub-total	**9591.87**	**20500**	**46.79**	**19371 (24.38)**
		Total	**58088.68**	**178500**	**32.54**	**79576*(100.00)**

Source: Compiled by the author on the basis of published data.
*NB: *The tentative number of affected farmers are more than one lakh.*

Besides, heavy rainfalls during 29-30 March, 2018 and 6-7 April, 2018 have also largely affected the maize crop in 18 districts and in 80,000 ha affecting more than 1.5 lakh farmers, which incurred an estimated loss of Rs. 107 cores. Further, two or three suicidal cases have been reported through newspapers, however, it will be pre-mature to contend in this regard.

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Annexure – I

Comments on the Report

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

Submitted by

Agro-Economic Research Centre for Bihar & Jharkhand, Bhagalpur, Bihar

1. Title of the draft report examined :
   An Analysis of Supply Chain of Maize Marketing and Possibility of its Value Addition in Bihar.

2. Date of receipt of the Draft report : 21st June, 2018
3. Date of dispatch of the Comments : 11th July, 2018

4. Comments on the Objectives of the Study :
   All the objectives of the study have been addressed.

5. Comments on the Methodology :
   Up to the mark, however number of sample farmers in each size groups is missing, which is required to be incorporated.

6. Comments on analysis, organization, presentation etc.
   a. The analysis, organization, and presentation of data is up to the mark, however, some suggestions are given in the manuscript for the betterment of the report.

   b. It is suggested to *edit the report* before finalizing.

7. Overall view on acceptability of report :

Authors are requested to incorporate all the comments and submit the final report.

Sd/-
(Hari Om Sharma)
Director
AER Centre
J N Krishi Vishwavidyalaya
Jabalpur – 482 004 (MP)

Annexure – II

Action Taken Report (ATR)

1.	Title of the Study	:	**An Analysis of Supply Chain of Maize Marketing and Possibility of its Value Addition in Bihar.**
2.	Date of Dispatch of the Draft Report	:	21st June, 2018
3.	Date of Receipt of the Comments	:	27th July, 2018
4.	Date of Dispatch of the Final Report	:	6th August, 2018
5.	Comments on the Objectives of the Study	:	No action is required.
6.	Comments on Methodology	:	Number of Sample Farmers in each Size Groups has been Incorporated.
7.	Comments on Analysis, Organization Presentation etc.	:	a. Done as per the comments in the manuscript. b. Done before finalizing.
8.	Overall view on Acceptability of Report	:	Incorporated all the comments

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