



Value Chain Study of Tomato of Ranchi, Jharkhand

2017-18

Under MIDH Project



BY

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VALUE CHAIN STUDY OF TOMATO OF RANCHI, JHARKHAND

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We sincerely hope and believe that the findings and recommendations of this report will help to further the cause of Honorable Prime Minister's vision of doubling farmers' income by 2022 as well as provide relevant insights in dovetailing to the recently initiated 'Operation Greens' under the Union Budget 2018-19. We believe this report will serve as a valuable resource, providing the necessary framework to inform various stakeholders across the tomato value chain in Jharkhand as well as other states across India updating of livelihood at farmer.

(Dr,P.K. Gupta)
Director NHRDF

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ABBREVIATIONS/ ACRONYMS

APMC	Agricultural Produce Market Committee
ATMA	Agriculture technology Management Agency
APEDA	Agricultural and Processed Food Products Export Development Authority
CAGR	Compound Annual Growth Rate
e-NAM	Electronic- “National Agriculture Market”
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FPO	Farmer Producer Organization
FYM	Farmyard manure
GSDP	Gross State Domestic Product
GOVT.	Government
ICAR	Indian Council of Agricultural Research
IQF	individually quick-frozen
IFFCO	Indian Farmers Fertiliser Cooperative Limited
IPM	Integrated Pest Management
INM	Integrated Nutrient Management
KVK	Krishi Vigyan Kendras
SMS	Short Message Service
SAU	State Agriculture University
NHRDF	National Horticultural Research & Development Foundation
NPK	Nitrogen, Phosphorous, and Potash (Potassium)
MSP	Minimum Support Price
MIDH	Mission for Integrated Development of Horticulture
NHB	National Horticulture Board
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PPP	Public-private partnership
PFDCs	Precision Farming Development Centres
R&D	Research and Development
ToR	Terms of Reference
VEGGED	The Jharkhand State Adivasi Co-Operative Vegetable Marketing Federation Ltd.
VCs	Value Chains

Executive Summary

This study “Value Chain of Tomato” in Ranchi Jharkhand was conducted under the National Horticultural Research & Development Foundation (NHRDF) with a view (i) To understand the current state of tomato supply chain in key region, (ii) To work out the cost of production and margin distribution among stakeholders, (iii) To list agri-input source, brand and company, (iv) To estimate the losses/wastage from harvest to consumption, (v) To learn about the on farm, non-farm and logistic constraints, (vi) To understand the factors that influence price of tomato, (vii) To find out the constraints in market linkage and, (viii) To identify the key areas of intervention and policy recommendation. Data were collected through field visit and interaction with farmers, stockists/aggregators, mandi traders, APMC officials, exporters, input suppliers, wholesalers and retailers. In addition, the consultant also conducted discussion with the Government officials of ATMA, Agriculture Department, Horticulture Department, APMC Marketing Board, Seed Testing Laboratory, VEG-FED and Reliance Fresh in Ranchi. The total sample size of farmers had been taken from 5 villages of each block (Tamar, Burmu, Mandar, Nagri and Ratu) and 40 farmers of each block (8 farmers from each village) of Ranchi district for the study. Selection of five blocks (Tamar, Burmu, Mandar, Nagri and Ratu) and villages were done in a manner that representative data emerge from that particular area on the basis of area under tomato cultivation and prior discussion with officials.

By analyzing data it has been found that Jharkhand’s productivity of tomato is lesser than average India’s and world’s productivity of tomato. Numbers of intermediaries, middleman, and agents were existing, due to which a big share of profit of producer goes to these intermediaries. Farmers were exploited by agents and middle man and consumer were bought tomato at high cost either in Jharkhand or in other states. The condition of tomato processing in Jharkhand is very poor. None of the farmers reported about any type of processing unit. Also none of the farmers reported about availability of exporters, contract farming and about retail chain to buy their produces directly from their farms. Due to non-availability of these facilities, local traders and commission agents have full control on the markets. As a result, farmers face many problems like inadequate market information, misleading by traders, deducting higher charges, high commission rate, multiplicity of charges and offering of lower prices of their produce by traders. Processors were not interested to establish a processing unit due to unavailability of raw material (tomato of processing varieties) and high investment to establish a processing unit. For processing point of view, the lack of improved cultivars suited for processing is the main constraint in India. Tomato varieties in India have been bred mainly for the fresh market. Therefore, to address this issue, the introduction of high-yielding varieties including open pollinated varieties suitable for processing is required. During the previous

year, this type of initiative was taken by Safal (Mother Dairy). It distributed tomato seedlings of processable varieties to the farmers in the district (as reported by the farmers). Many traders in the weekly markets also reported about the need of primary processing unit like sorting, grading, packaging and storage facilities.

By analyzing this poor condition, farmers should approach towards contract farming, cluster formation, farmer's producer organization, e-mandi, and agriculture produce marketing committee to reduce the middleman in supply chain and gain maximum profit share. Farmers should also use sophisticated technologies like plastic culture, drip irrigation, integrated pest management practice, fertilizer scheduling, and use of high yielding varieties for fresh tomato produce. Whereas processed varieties should be used to make quality product and establishment of processing units in Jharkhand. Farmers should planning month wise for production, storage and time of marketing of tomato as fresh produce or use tomato for processing or export according to the return on the produce or the product. Jharkhand government should make friendly food processing policies so that polices should be attractive and competitive for establishment of tomato processing units in Jharkhand. Jharkhand government should approach towards resources mapping and ensure agriculture export zone for tomato in Jharkhand.

1 Introduction

Tomato (*Lycopersicon esculentum*) is one of the most important vegetables in India accounting for about 11.04 percent of the total vegetables production in the country. It is a popular winter vegetable and also one of the most important "protective foods" because of its special nutritive value. But, due to its high perishability it cannot be preserved in fresh form throughout the year. In India, vegetable production is increasing at the Compound Annual Growth Rate (CAGR) of 2% but tomato production is increasing at the CAGR of 0.78% only. Area under tomato has also decreased during last five years. It is due to low price of tomato offered to growers during peak season. Huge post-harvest losses of the harvested tomato also occur due to inadequate storage facilities, which brings substantial loss to the growers and hence to the national economy. Preservation of tomato in semi processed form not only takes care of the marketable surplus but also ensures the supply of raw materials for finished products like sauce, ketchup, drink etc. A simple technology of concentrating tomato pulp kept in locally available containers might be a solution to the problem of huge tomato loss during harvesting period.

Jharkhand with its diverse agro-climatic conditions is much suited for the development of horticulture based economy with ample scope of growth. The wide product base, high volume of round-the-year production, strategic geographical location, abundant sunlight and high domestic demand automatically project horticulture as the thrust area of development. The horticultural produce including off-season vegetables from Jharkhand state are being preferred in the neighbouring states for their quality and time of availability. Vegetables in Jharkhand are grown all over the state on an area of 293.53 thousand hectares with production of 3370 thousand MT during 2016-17. Jharkhand ranks 14th in vegetable production and 16th in tomato production. In India, 2.52 % of vegetables and 1.55 % of tomato are produced in Jharkhand. Major vegetables grown in the state are off-season cabbage, capsicum, off-season cauliflower, tomato, peas, French bean, *khari* potato, *khari* onion, leafy vegetables, vegetable jackfruit, cucurbits, carrot, beet root, baby corn & cowpea. The average productivity of vegetables in the state is 14.8 MT per ha and of tomato 11.72 per ha. North Eastern Plateau region has maximum production as well as highest productivity of vegetables. The region also has the advantage of being an important sourcing hub for consumption markets like Patna, Kolkata and other parts of West Bengal.

In the state, Ranchi is leading in overall vegetable production and second leading in tomato production after Chatra district. Western Plateau regions in the district have round the year cultivation of vegetables like cauliflower, French bean, brinjal and tomato. South eastern region, being relatively smaller and fraught with soils with high iron content, does not record a high

production. Most of the vegetables grown in the state have good acceptability in fresh retail markets. Tomato and potato are produced in abundance in the district or state which often causes glut situation leading to distress sale and high wastage as the surplus produce cannot be converted into value added products. Therefore, a proper supply chain management is required in vegetables to improve all the stages of the supply by adopting best global practices in storage, packaging, handling, transportation and value added services to meet the country's demand and better price of the produce to farmers. Due to drawbacks of the current supply chain like high level of wastage, quality degradation, poor infrastructural facilities and high cost, Government and private operators have to join hands to improve the physical infrastructure, information sharing and the service required for quality improvement of the supply chain. Therefore, the **National Horticultural Research and Development Foundation (NHRDF)** has taken the initiative to conduct a **“Value Chain Study on Tomato in Ranchi district (Jharkhand)”** and assigned this study to Indian Agribusiness Systems Limited or Agriwatch with the purpose to know the gaps between the production of tomato at the field level and its reaching the end consumer. Presently, NHRDF is enriching Indian horticulture by developing and disseminating advance technologies for making India as a global leader in horticulture sector”. This organization has a focus especially on the promotion of vegetable crops to enhance the production, productivity and minimizing post-harvest losses of onion, garlic and other export-oriented horticultural crops to meet the domestic needs and make India the global leader in export.

The National Horticultural Research and Development Foundation (NHRDF) was established by National Agricultural Co-operative Marketing Federation of India Ltd. (NAFED) and its Associate Shippers of onion on 3 November, 1977 under Societies Registration Act, 1860 at New Delhi with a vision of “enriching Indian horticulture by developing and disseminating advance technologies for making India as a global leader in horticulture sector by enhancing the production, productivity and minimizing post-harvest losses of onion, garlic and other export-oriented horticultural crops, which will facilitate to meet the domestic needs and make India the global leader in export. The NHRDF is a voluntary centre of All India Coordinated Research Project on Vegetable Crops and All India Network Research Project on Onion and Garlic of the Indian Council of Agricultural Research. NHRDF is also a national level agency under Mission for Integrated Development of Horticulture and National Vegetable Initiative for Urban Cluster, of Department of Agriculture and Cooperation, Ministry of Agriculture and Farmer Welfare, Government of India. The mandate of the NHRDF is to:

- ✚ Undertake / conduct research or provide facilities in research and scientific investigations for the growth and development of varieties of different export-oriented horticultural crops.

- ✚ Establish institutes, laboratories, research centres, model farms, and study teams for promoting better quality and higher yield of horticultural produce, better packaging, suitable transportation and shipping to improve the shelf-life of the produce as also to conduct experiments and provide funds for such research work and to educate farmers and disseminate technical know-how and results derived by conducting training programmes, seminars, farmers' meets etc.
- ✚ Investigate and conduct research experiments for assessing demands of the horticultural produce of the Indian origin in foreign countries by conducting extensive survey and undertake research and development of horticultural produce with export potential and to motivate farmers to grow such varieties of horticultural produce with the object of further developing horticultural exports from India.
- ✚ Prepare, edit, print, publish and circulate books, research papers and periodicals bearing upon the growth and development of horticultural produce or other scientific and research activities connected therewith, and to establish and maintain collections, libraries, statistics, scientific data and other information relating thereto.
- ✚ Conduct all aspects of scientific research and developmental activities in the field of horticulture or otherwise conducive to the objectives of the NHRDF provided that none of the activities of NHRDF will be undertaken for profit nor shall it involve any profit motive. However, the NHRDF may receive nominal service charges, wherever found necessary in the interest of maintaining financial stability of the NHRDF.
- ✚ The NHRDF shall provide extended services to the farmers in the form of research and developmental activities such as seed development, vermicomposting, bio-pesticide production and distribution and other laboratory services for which NHRDF may collect revenue from the farmers so as to establish a revolving fund or credit to corpus fund for further expansion of research and developmental activities.

1.1 Objectives of the study

The main objective of the assignment is to understand the gaps in value chain of tomato and measures required to improve the value chain to sustain the livelihood of farmers and other stakeholders of the area. The point wise objectives of the study were:

- To understand the current state of tomato supply chain in key region
- To workout the cost of production and margin distribution among stakeholders
- To list agri-input source, brand and company
- To estimate the losses/wastage from harvest to consumption

- To understand the factors that influence price of tomato
- To learn about the on farm constraints
- To learn about the non-farm constraints
- To understand logistic constraints
- To find out the constraints in market linkage
- To identify the key areas of intervention and policy recommendation

2 Approach and Methodology

The complexity of a commodity system depends on the level of development of the state, geographical location, crop, time of year, weather, road conditions, available technology, infrastructure, labour supply, distance to markets, market demand etc. Basic questions need to be answered for evaluating a value chain are **Who? What? How? When? Where? Why? and How much?** However, the interpretations of the answers to these questions tend to vary and thereby solutions vary greatly depending upon which explanation is considered the cause of the problem. In analyzing a particular value chain, it is very important to obtain a clear understanding of the diverse participants in the food system and their respective roles and motivation. In Jharkhand, area under vegetables has been increasing at a very fast rate evidently due to their better economics as compared to other crops. Therefore, certain vegetables like off-season cabbage, capsicum, off-season cauliflower, tomato, peas, French bean, *kharif* potato, *kharif* onion, leafy vegetables, jackfruit, cucurbits, carrot, beet root, baby corn and cowpea are becoming popular with the farmers but there has been greatest emphasis on production of tomato due to its round-the-year high demand and higher price in off-season. Thus, to understand the relationship of the value chains to the broader market it is important to understand the various actors and their direct/indirect influence on chain performance.

2.1 Mapping the value chain

The following generic layout provides the baseline framework of the value chain in vegetables.

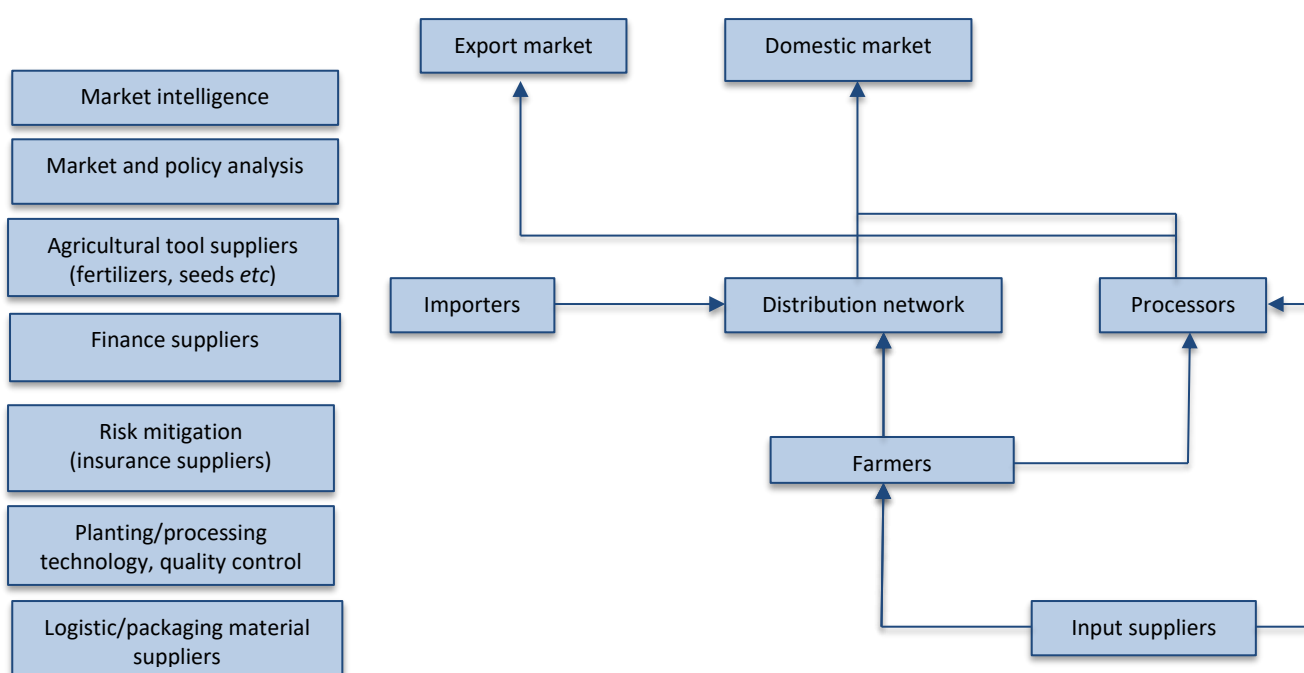


Figure 1: Generic layout of actors and linkages in the chain

The value chain includes a series of activities leading from production to eventual distribution into the market. Decision “diamonds” are used to identify steps in the chain that are further evaluated. Each of these diamonds are numbered breaking the value chain map into logical “process group” or “business units”. Each one of these numbers, therefore, classifies the activity according to a specific type of task and is structured as detailed in the table number 1 below.

Table 1: Decision Diamond

Diamond number	Value chain step
1	Input supply
2	Farm production
3	Post-harvest treatment
4	Logistics
5	Processing
6	Marketing

This study is based on channel mapping methodology which is a process of tracing a product flow through an entire channel from the point of product conception to the point of delivery/consumption. This process highlights the underlying patterns of inputs, constraints and competitive advantage that a producer has. It also traces the path of all value-adding and non-value adding activities associated with the production of a good involved at each stage. Whereas more traditional methods of product and market analysis isolate operational costs along various stages of production, the methodology employed here is a much more comprehensive tool, particularly as it takes into account an entire spectrum of activities and inputs associated with a product. Although the value chain analysis is usually employed at a product level, output from the analysis provides useful indicative data on production and operational costs associated with a specific market.

The current study required a holistic approach for proper assessment of the cultivation practices, disease- pest infestation, usage of pesticides, yield and reduction in storage losses, market information, marketing channels and farmers' perception and other parameters as per the ToR. Keeping in view the scope of work in the given ToR and with the understanding of the objectives, the approach and methodologies adopted for this programme are summarized in the following paragraphs.

2.2 Approach

The approach adopted for this study was to analyze secondary data as well as primary data both collected through interviewing of 200 farmers and 50 other stakeholders involved in tomato value chain to arrive at the conclusion as per the study objectives, particularly the usefulness to the farmers. For this study the following steps were primarily adopted:

- Collection and review of secondary data like district level database, reports, documents, Government policies, plans and programmes
- Development of questionnaires and checklists for primary data collection
- Mobilisation of the study team
- Expert interaction and interview with Government officials
- Continuous contact and consultations with the various concerned agencies and the Client Sharing of information throughout the study period with the client and flexibility to respond to desired changes and directions
- Field survey in the selected areas to arrive at a conclusive analysis of the emerging scenario
- Analysis of secondary and primary data using appropriate tools

2.3 Designing the study

To achieve the desired results the consultant has developed a five-step approach to arrive at the best solution. The components of the approach are discussed as under:



Step – I: Diagnosis – This phase involved initial discussions with the client, review of the historical data and learnings from similar exercises carried out earlier. The objective was to understand the client’s requirements, expectations and specific objectives for carrying out the study and to ensure that the client and the project team are on the same platform.

Step – II: Discussion and Designing – This phase involved initial workings on study design. Based on the outcomes of the step-I, the consultant prepared a study design which was further discussed with the client to get his feedback and incorporate suggestion. The consultant used a participative and consultative approach to develop the study design.

Step – III: Implementation – This phase involved the actual study. Once the final study design was developed, the study was carried out in the field by the team trained for collection of information and face-to-face interviews of the stakeholders to get accurate information /data as much as possible. Four members’, expert team interacted with farmers, traders & mandi agents and had face-to-face interviews.

Step – IV: Detailing – At this stage preliminary analysis has been carried out and the recommendations were presented to the client in the form of a draft report. After consultations and taking into account the suggestions of the client; changes and modifications have been made (wherever required) in the method of analysis and even the field study was carried once again.

Step – V: Deliver– Submission of the final study report and discussions on final recommendations.

2.4 Methodology

The methodology adopted for this study was focused on certain parameters and variety of indicators which have significant importance in collecting reliable and adequately detailed information about the pre & post-harvest practices and marketing methods being followed by the farmers. This will play the most important role in evaluating the gaps and potential of the interventions. The following methodological framework was followed for the present study:

Task 1: Developing the sampling plan and the associated fieldwork schedules.

Task 2: Desk research by the analysis of secondary data

Task 3: Face-to-face interviews and data collection from the different stakeholders like sampled growers, traders, mandi agents etc.

Task 4: Stakeholders interactions and *in-situ* review of practices at grower's level and market places.

For fulfilling the objectives of the study, both quantitative and qualitative analysis methods have been employed to provide strong evidence of achievements against the key review questions. In the last stage, report is structured in line with client requirements and gives concise summaries of findings pertaining to project indicators yielding expected outcome, clear conclusions and well thought out recommendations based on both internal & external factors.

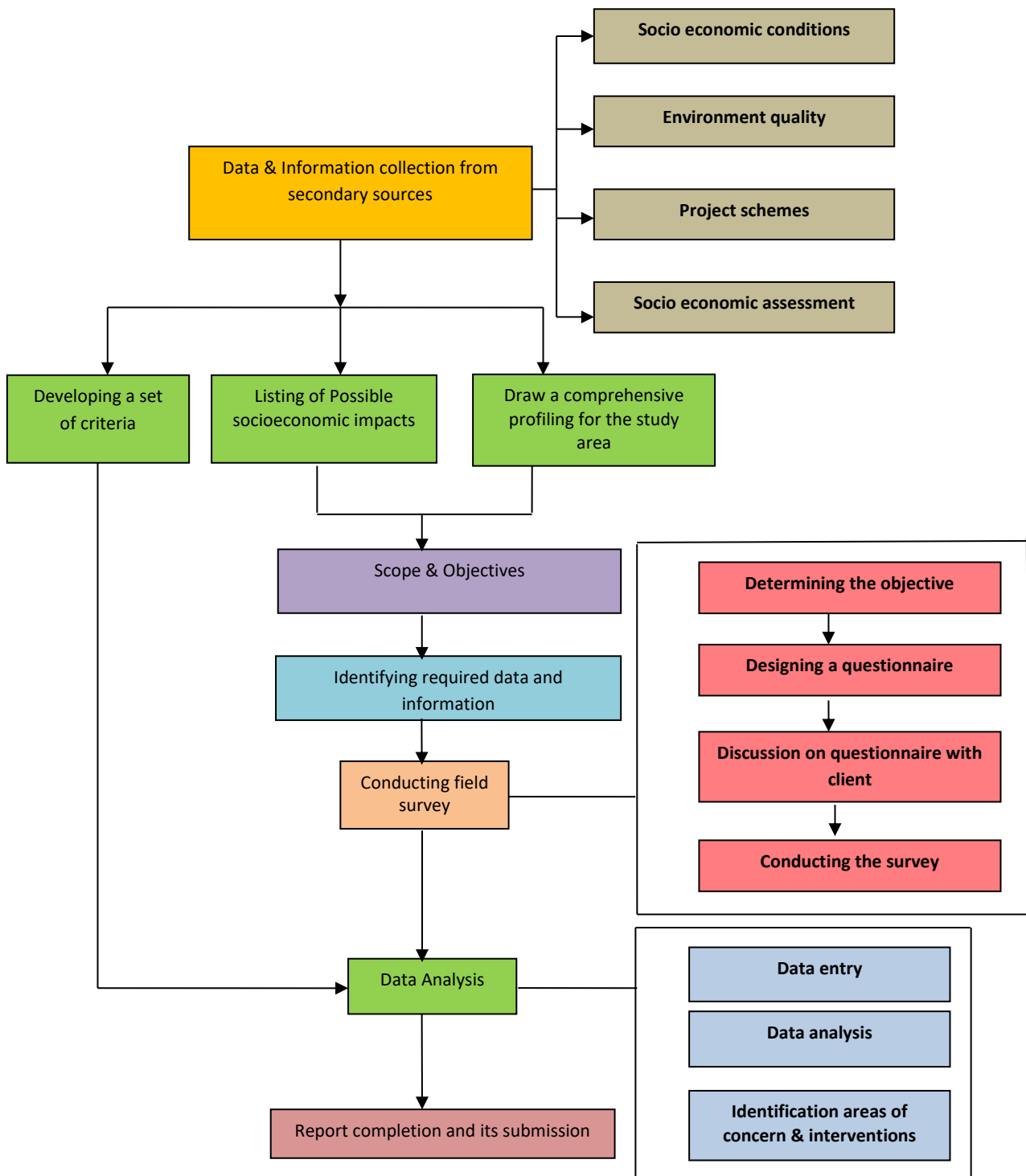


Figure 2: Methodology adopted during study

2.4.1 Sample design

Purposive – Random Sampling Method was adopted to conduct field survey. It had the statistically significant sample size of the farmers and other stakeholders as mentioned in the table number 2 below.

Table 2: Stakeholder-wise sample size

Stakeholders (Key interviewers)	Sample size
Farmers	200
Stockist/aggregators	8
Mandi traders	8
APMC officials	2
Exporters	8
Seed/input suppliers	8
Wholesaler	8
Retailers	8
Total	250

Final sample size of farmers had been taken from 5 villages of each block (Tamar, Burmu, Mandar, Nagri and Ratu) and 40 farmers of each block (8 farmers from each village) of Ranchi district for vegetable value chains. Selection of villages was done in a manner that representative data emerge from that particular area on the basis of area under tomato cultivation and prior discussion with officials. The selection of farmers was made purposive cum randomly and therefore, to have sufficient degree of freedom, a sample of 200 farmers was drawn. In Ranchi district, Tamar-I, Burmu, Mandar, Nagri, Bundu, Angara and Ratu blocks are leading in tomato production. Therefore, it was decided in the client meeting that these blocks will be suitable for the tomato survey because we can see clear picture of tomato value chain in these block and finally we conducted study of Tomato Value Chain in the blocks Tamar, Burmu, Mandar, Nagri and Ratu which are shown in the figure number 3 below.

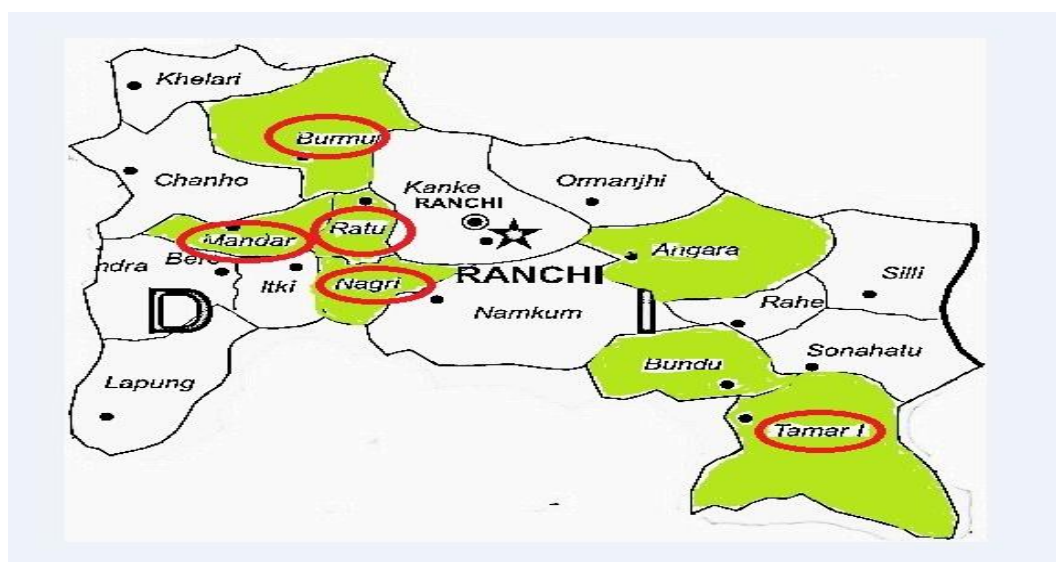


Figure 3: List of blocks (in red circle) for tomato field survey

In addition, the consultant also conducted discussion with the Government officials of ATMA, Agriculture Department, Horticulture Department, APMC Marketing Board, Seed Testing Laboratory, VEG-FED and Reliance Fresh in Ranchi.

2.4.2 Primary data analysis

The data collected from the primary survey were analyzed using pivot table in excel. Primary data analysis was done to generate the required information as per Terms of Reference of the study. Microsoft excel was used for both qualitative and quantitative data analysis in order to achieve the stated objectives. The responses from the interviewed respondents were coded, summarized and then the above mentioned software packages were used for analysis.

The data collected were analyzed for deriving the current picture of value chain for tomato. Further analysis to determine marketing cost, marketing margin, price spread, marketing efficiency and farmer's share in consumer rupee in various supply chains was undertaken. The study also aimed to identify the constraints perceived by various stakeholders and study the factors influencing the marketing cost, market margin and marketing efficiency.

The gap analysis led to identification of intervention points required for creating efficiency in value chain and the identified intervention helped in identification and quantification of investment opportunities for creating efficient value chain for the selected commodity.

2.4.3 Secondary data analysis

Extensive desk study and secondary data collection was undertaken to compile and present information reviewing existing government policies and programmes under different agriculture institutions/organizations encouraging commercial agriculture in the state. Secondary data mining also helped to identify potential, competitive and consuming markets (State, National & Global context) for respective commodity.

Information on the status, growth, future plans of private players in value chain structure and objectives & functions of the Agricultural institutions which deal with respective commodity were collected from the concerned institutions, websites and secondary sources.

2.4.4 Limitations

The study was fraught with some limitations as given below:

- It was not possible to study consignments of the tomato from field to market to assess the actual losses due to time constraint.

- The assessment of losses have been based on responses of farmers, collectors, traders and retailers; which were further validated by discussions with concerned officials, opinion makers among the stakeholders in targeted value chains, researchers and policy makers.

3 Tomato Overview

Tomato is one of the most important "protective foods" because of its special nutritive value. It is one of the most versatile vegetables with wide usage in Indian culinary tradition. Tomatoes are used for soup, salad, pickles, ketchup, puree, sauces and also in many other ways. It is also used as a salad vegetable. Tomato has very few competitors in the value addition chain of processing. In the world, India is the second largest tomato producing country after China. As per FAOSTAT, 2014, India produces 187.36 lakh tonnes of tomato which is 8.38% of total world production from 8.82 lakh hectares which is 14.64 % of total area under tomato in the world. In India, tomato is mainly grown in two seasons across the country –June to September (*kharif*) and October to February (*rabi*), whereas in few regions it is produced throughout the years except 1 or 2 months based on the climatic conditions.

3.1 Area, production and yield trend of tomato

3.1.1 International scenario

Tomato is the world's largest vegetable after potato and sweet potato, but tops the list of canned vegetables. The total global area under tomato is 60.26 lakh hectares and the global production is to the tune of 2234.74 lakh tonnes. The major tomato producing countries along with their area, production and productivity in the world are given in the table number 3 below.

Table 3: Country-wise area, production and yield of tomato (2014-15)

Countries	Area (ha)	Production (t)	Yield (t/ha)
China	1001711	52722967	52.63
China, mainland	996464	52586860	52.77
India	882030	18735910	21.24
United States of America	163380	14516060	88.85
Turkey	319109	11850000	37.13
Egypt	214016	8288043	38.73
Iran (Islamic Republic of)	159132	5973275	37.54
Italy	103171	5624245	54.51
Spain	54750	4888880	89.29
Brazil	64363	4302777	66.85
Mexico	95207	3536305	37.14
Russian Federation	118421	2819193	23.81
Uzbekistan	65052	2285801	35.14
Others	1788714	35343420	55.12

Total	6025520	223473736	49.34
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Source: FAOSTAT, 2014-15

China is by far the largest producer with an estimated production of 105.31 million tonnes. India is second on the list. Together, these two countries account for more than half the world's production. After China and India, others tomato producing countries are United States of America, Turkey, Egypt, Iran, Italy, Spain and Brazil. China and China Mainland alone produce about 48% of the total tomato in the world. India is the second largest producer and accounted about 8.38% of the total world production which is shown in the figure number 4 below.

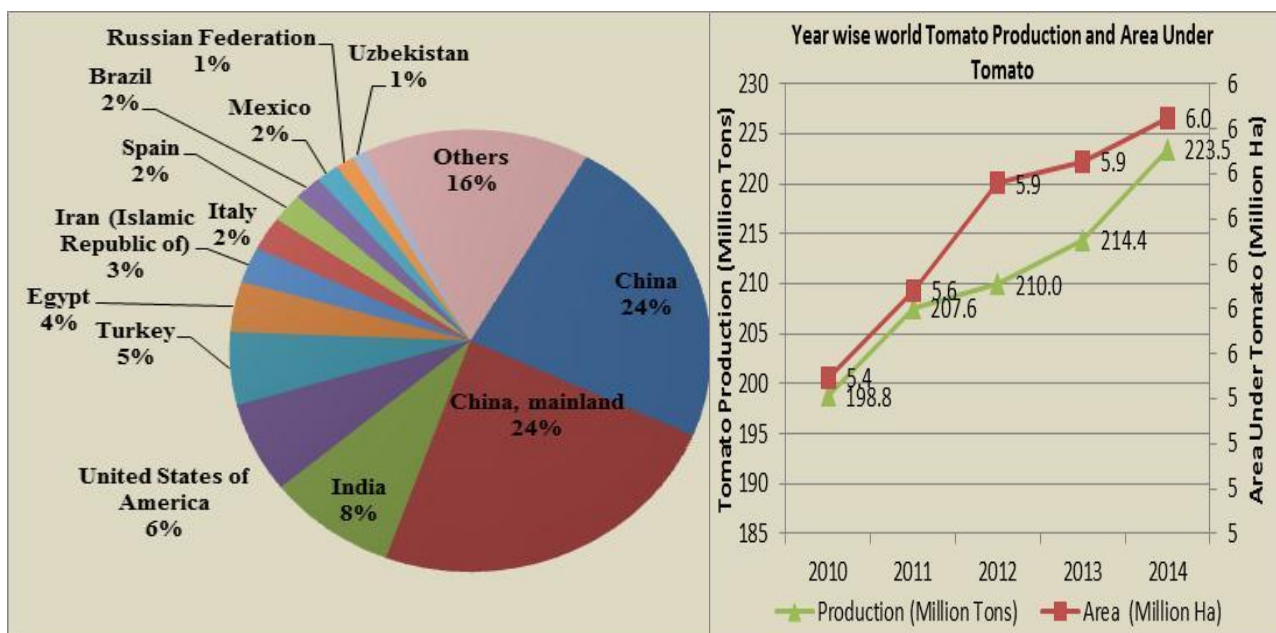


Figure 4: Country-wise share of tomato production (2014-15) and year-wise area and production

Source: FAOSTAT, 2014-15

Annual average availability of tomato in the world is 210.83 million tonnes and its production is continuously increasing at the CAGR of 2.37 % and area at the CAGR of 2.04%. As per FAO Statistics, total area under tomato in 2010 was 5.4 million ha in the world which became 6 million tonnes in 2014 and its total production in the world was 198.8 million tonnes in 2010 which became 223.5 million tonnes in 2014 this indicates that area under tomato and its production is increasing continuously in the world.

Although, China is leading in tomato production but from export point of view, top ten leading exporters of fresh tomato in the world are Mexico, Netherlands, Spain, Jordan, Turkey, Morocco, Belgium, France, India and USA. As per FAO Statistics, in 2013, India exported around 228.44 thousand MT of tomato to different countries like Nepal, Pakistan, United Arab Emirates and Bangladesh. USA dominated the world in import of fresh tomato, importing around 1.54 million

tonnes in the year 2013. The other major importers of fresh tomato are Russian Federation, Germany, United Kingdom, Pakistan, Canada, and United Arab Emirates.

As per APEDA (Agricultural and Processed Food Products Export Development Authority), beside fresh tomato, India also exports many value added products like tomato ketchup, tomato sauce, tomato juice and preserved/ prepared tomato on large scale as shown in the table number 4 below, which indicates that tomato has huge export potential in the international market.

Table 4: Year-wise exported quantities of fresh and value added products of tomato

Tomato Items	2014-15		2015-16		2016-17	
	Qty. (MT)	Rs. lakh	Qty. (MT)	Rs. lakh	Qty. (MT)	Rs. lakh
Fresh tomato	217999.33	44461.34	158504.59	37772.91	267198.49	54806.04
Tomato ketchup & other tomato sauces	2729.05	3320.62	2907.46	3339.86	3576.14	4168.92
Tomatoes, prepared/preserved	775.02	346.63	190.14	101.16	234.73	136.65
Tomato juice	199.32	95.05	321.21	129.3	255.82	100.46
Total	221702.72	48223.64	161923.4	41343.23	271265.18	59212.07

Source: APEDA, 2016-17

3.1.2 National scenario

There is a sizeable increase in acreage and production of tomato in India. There was an increase from 478.80 thousand ha in 2002-03 to 799 thousand ha in 2016-17, while in terms of production it has increased from 7616.70 thousand MT in 2002-03 to 19542.00 thousand MT in 2016-17, indicating that during last fifteen year farmers have taken more interest in tomato cultivation. From 2002 to 2015, area under tomato and its production has increased at the CAGR of 3.76% and 7.17%, respectively.

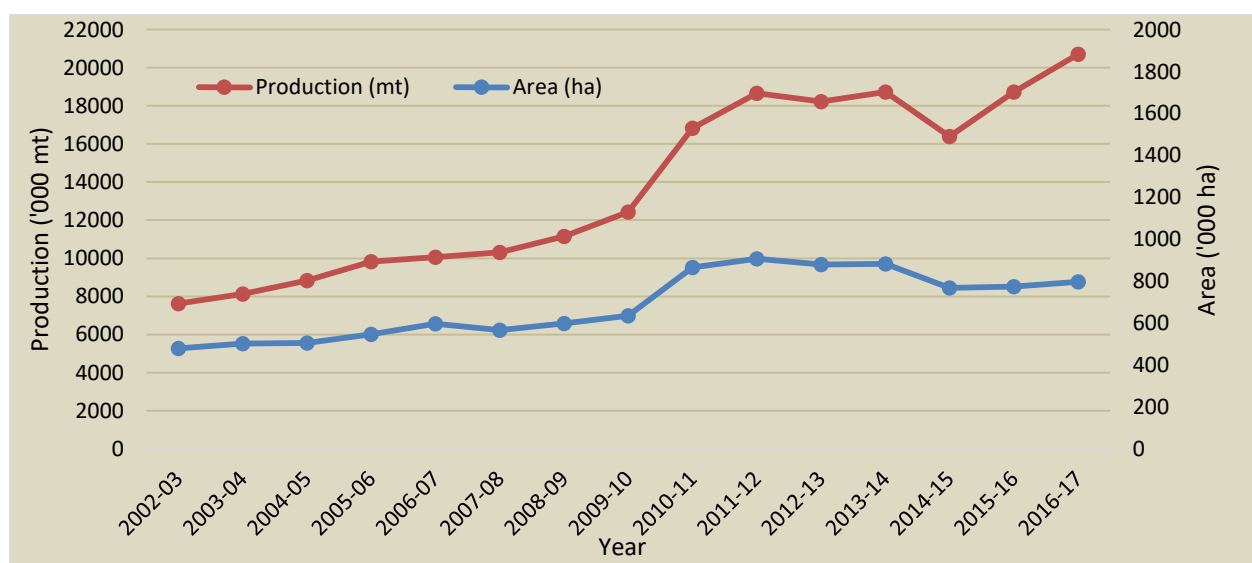


Figure 5: Year-wise area under tomato and tomato production

Source: NHB (Indian Horticulture Database, 2014 & Horticulture Crop Estimates for the year 2014-15, 2015-16 & 2016-17)

From the above figure number 5 and table number 5 given below, it is also clear that tomato production and area have continuously increased up to 2013 because of higher demand, increase in consumption and higher rate of return. But after 2013, area under tomato started decreasing and it is only due to low price of tomato in the market during peak production period which was observed during the survey. During the survey, farmers reported that due to low price in the market in peak production period and higher attack of insect pests and diseases they are losing their interest in tomato cultivation. In India percentage share of tomato production from the total vegetable production is on an average 11.04% and total area under tomato of the total vegetables is 8.76% which is shown in the table below.

Table 5: Year-wise area and production of vegetables and share of tomato in total vegetables

Vegetables	2012-13		2013-14		2014-15		2015-16		2016-17	
	Area ('000 Ha)	Production ('000 MT)	Area ('000 Ha)	Production ('000 MT)	Area ('000 Ha)	Production ('000 MT)	Area ('000 Ha)	Production ('000 MT)	Area ('000 Ha)	Production ('000 MT)
Total vegetable	9205.00	162187.00	9396.00	162897.00	9542.23	169478.23	10106.00	169064.00	10295.00	176177.00
Tomato	880.00	18226.60	882.00	18735.90	767.32	16384.98	777.46	18286.39	799.00	19542.00
% share of tomato	9.6%	11.2%	9.4%	11.5%	8.0%	9.7%	7.7%	10.8%	7.8%	11.1%

Source: NHB (Indian Horticulture Database, 2014 & Horticulture Crop Estimates for the year 2014-15, 2015-16 & 2016-17)

All India average production of tomato is 18-18.5 million MT every year. Tomato yield is highest in the states of Himachal Pradesh, U.P and A.P. with values of 43.98, 39.49 and 37.86 t/ha, respectively. In Jharkhand, the average yield of tomato is only 12.68 t/ha which is much lower than the national average this indicates that Government should introduce high yielding varieties of tomato in the state and should provide training on package of practices of tomato on a larger scale so that farmers can produce large amount of tomato on same available land.

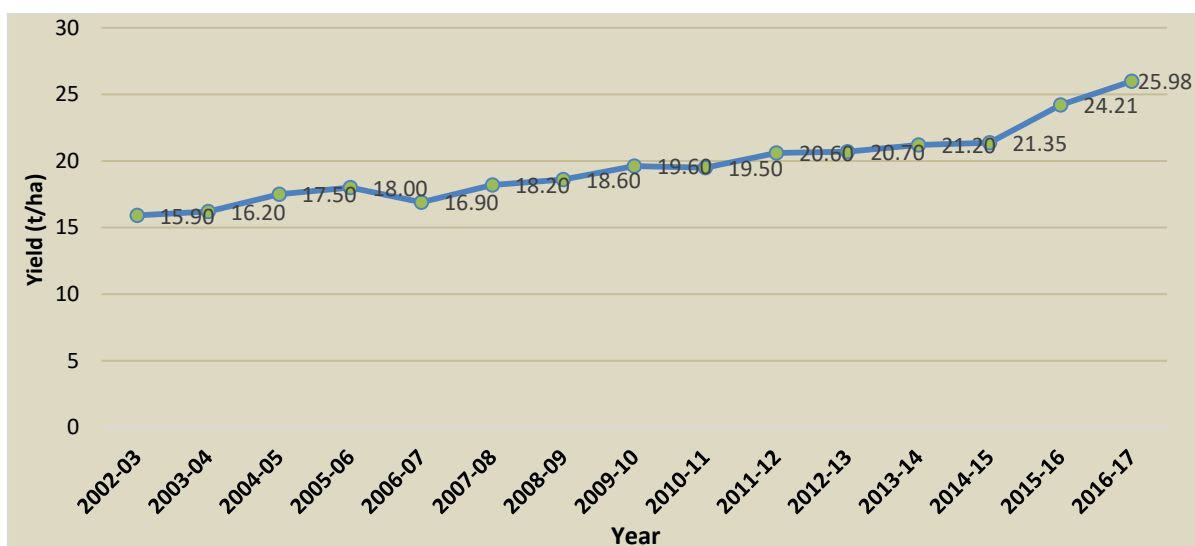


Figure 6: Tomato yield trend in India (2002 to 2016)

Source: NHB (Indian Horticulture Database, 2014 & Horticulture Crop Estimates for the year 2014-15, 2015-16 & 2016-17)

Figure 6 shows the yield trend over last one decade. The average yield of tomato in India has increased from 15.90 MT/ha in 2001 to 24 MT/ha in 2015-16 and this is because of the increase in availability of better inputs, seeds and use of better cultivation methods. In some states, yield is comparatively higher than all India average because of favourable weather conditions.

Table 6: State-wise area, production and yield of tomato in India (2016-17)

State	Area ('000 ha)	Production ('000 MT)	Yield (t/ha)
Andhra Pradesh	49.79	4481.01	37.86
Madhya Pradesh	95.40	2719.57	31.02
Karnataka	60.45	1916.86	33.55
Gujarat	48.76	1411.85	28.43
Odisha	90.99	1311.21	14.2
West Bengal	57.35	1233.03	21.07
Maharashtra	50.71	1124.89	22.07
Chhattisgarh	62.33	1082.34	16.55
Bihar	46.21	1009.60	21.85
Uttar Pradesh	20.99	831.51	39.49
Haryana	31.82	643.59	23.26
Tamil Nadu	26.34	629.16	21.67
Telangana	37.97	520.47	25.44
Himachal Pradesh	11.06	473.28	43.98
Assam	18.18	393.60	25.2
Jharkhand	19.75	231.46	12.68
Other	68.78	695.03	14.68
Total	796.87	20708.44	25.47

Source: Ministry of Agriculture and Farmer Welfare, 2016-17

From the area and production point of view, it is also clear from the above table that Madhya Pradesh has largest area under tomato followed by Odisha, Chhattisgarh, Karnataka and West Bengal. In terms of production, Andhra Pradesh, Madhya Pradesh, Karnataka and Gujarat are the

leading tomato producing states because of higher yield in these states. Tomato yield in Jharkhand is only 12.68 t/ha which is lower than India's average tomato yield. This indicates further scope for increase in production in the state with same acreage. In terms of acreage, Jharkhand had a share of 2.48% only in 2016-17. The following chart shows the percent share in acreage of states in India.

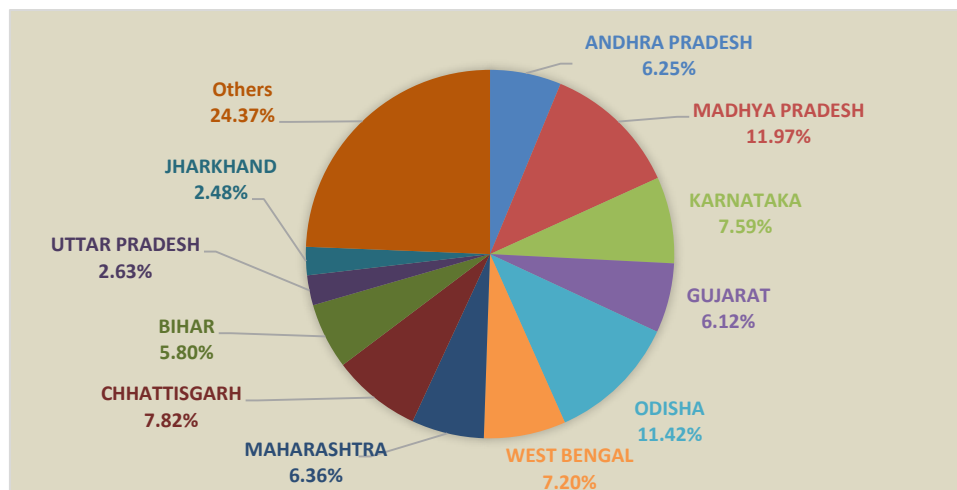


Figure 7: State-wise percentage share of tomato acreage in India (2016-17)

The southern and central states including the states of Andhra Pradesh, Madhya Pradesh, Karnataka, Gujarat, Maharashtra and Odisha contribute maximum to the total tomato production in India. Jharkhand is at 16th positions in tomato production and produce approximate 1.12% of total country production. Andhra Pradesh was leading in tomato production followed by Madhya Pradesh, Karnataka, Gujarat, Odisha, West Bengal and Maharashtra in 2016-17 which is shown in the figure below.

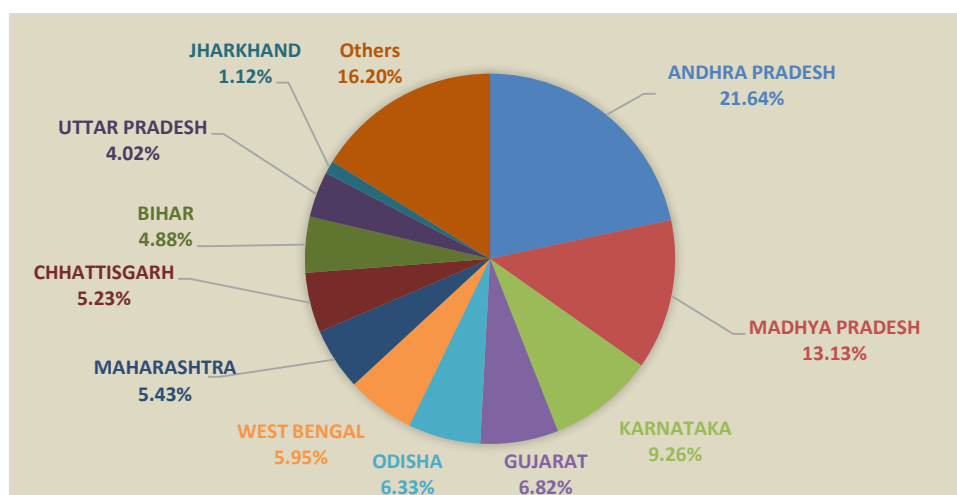


Figure 8: State-wise production of tomato in India (2016-17)

3.1.3 State scenario in crop production

Jharkhand is categorized as plateau region having red laterite soils. Total cultivable area of the state is 38 lakh ha, out of which net sown area is only 25.75 lakh hectares accounting 28.08 percent of the

total geographical area (79.71 lakh hectares). Current fallow, other fallow, barren land and cultivable waste land is 24.10 lakh ha, which indicates that there is an opportunity to bring more land under plough in the state. The state has varied climatic regions: upland, lowland and plain land. 1/3rd of the total geographical area is forest and mines of industrial importance, and the main agriculture crops are paddy, maize, pulses, sunflower, groundnut and fruits. Average annual rainfall in Jharkhand is 1400 mm and only 12.73% of the cultivable area is irrigated. Most of the rain water is lost as run off. Soil structure is poor with low fertility. Almost 90% of the soils are acidic and deficiencies of zinc, molybdenum and boron are prevalent.

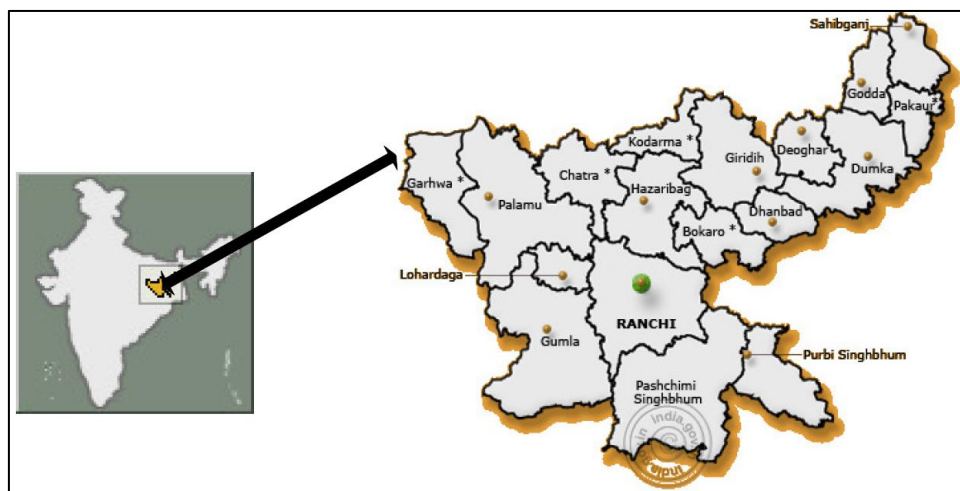


Figure 9: State map of Jharkhand

In the state, agriculture and allied sector has recorded an impressive average annual growth rate of above 5.23% between 2011-12 and 2015-16. This sector includes crop production, livestock, forestry & logging and fisheries. But the overall performance of this sector has mainly been depending on crop production. The crop production has grown at an average annual rate of 7.18% per annum between 2011-12 and 2015-16. As a result, despite not so good performance of livestock and forestry and logging sub-sectors, the overall performance of agriculture and allied sector has remained good.

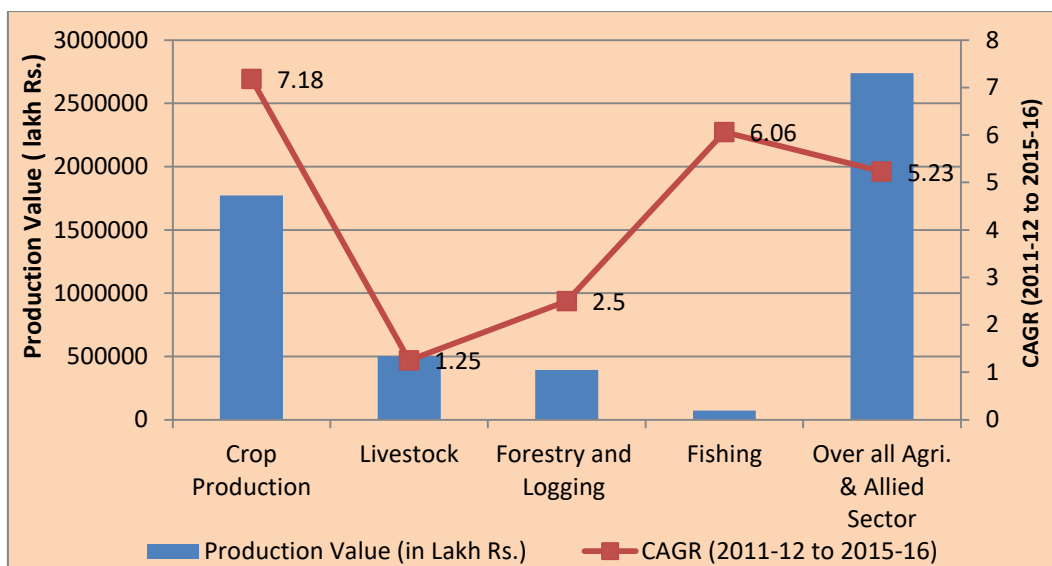


Figure 10: Production value and CAGR of agriculture & allied section in Jharkhand

Source: Jharkhand Economic Survey, 2016-17

Crop production in Jharkhand is mainly rain-fed. As a result, its production has fluctuated from year to year depending upon the weather conditions in the state. In comparison to the previous year, its production declined by 4.5% in the year 2013-14 and increased by 16% in the year 2015-16. But, on the whole it has shown an increasing trend. This has been because of both improvement in productivity and change in composition of crops in favour of high valued crops.

Jharkhand is the first state to establish “Single Window Facility” for farmers which provides information on various Government scheme, weather, pricing of agriculture products, soil health cards, seeds, fertilizers, crop insurance and loan. Approximately 100 Agriculture Single Window Systems have been established throughout the state. The overall growth rate of agriculture in the state is 9% which had a contribution of 14% to GSDP in 2015-16. About 516 seed villages have been established through 24 Krishi Vigyan Kendras (KVK) in the year 2016 and 9 KVKs have been planned during 2017. The state is now self-sufficient in paddy seed production. It produces about 2669.80 thousand tonnes of paddy, 287.30 thousand tonnes of wheat, 384.93 thousand tonnes of maize, 495.13 thousand tonnes of pulses and 183.43 thousand tonnes of oilseeds.

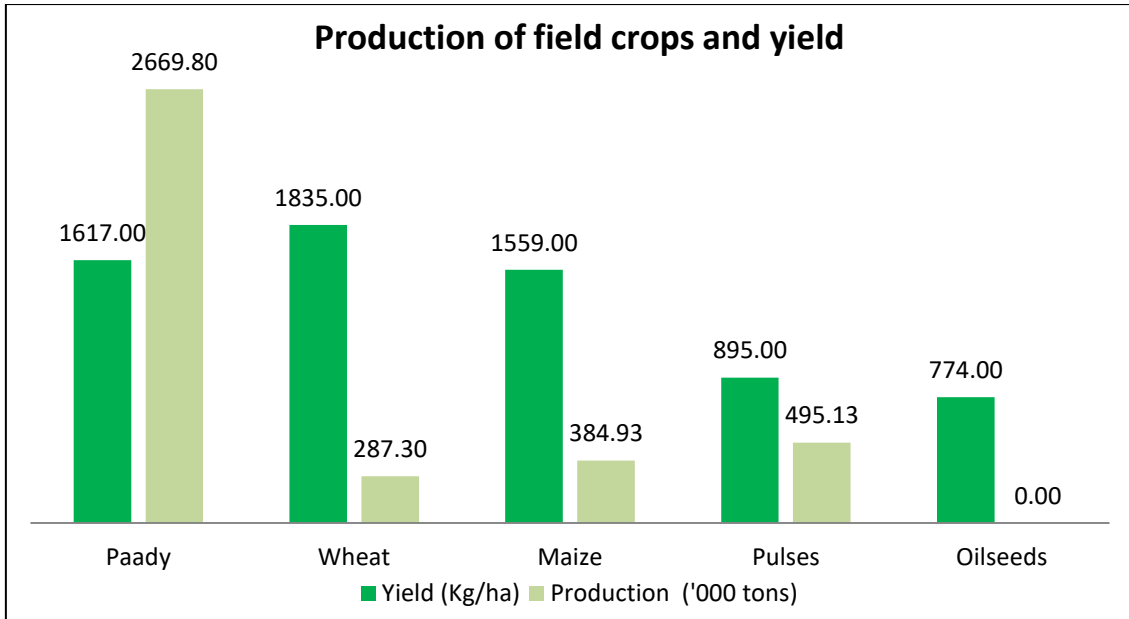


Figure 11: Production of field crops and yield (2015-16)

Source: Jharkhand Economic Survey-2016-17

Jharkhand is located in eastern India due to which it caters food products to a large population of the country. Farmers in the state cultivate many varieties of fruits and vegetables, both for domestic consumption and export. Many vegetables including cauliflower are cultivated round the year in the state. Some high value vegetables like French bean, capsicum, chilly and carrot are also produced in large quantity. In fruits, the state has the highest area under mango, followed by jackfruit, banana, guava and lemon. Production-wise consideration also shows that mango and jackfruit are the highest produced fruits followed by papaya, guava, lemon and litchi in the state. As per Ministry of Agriculture and Farmer Welfare (2016-17), the state produces approximate 1.13% of the total fruits production of the country. An interesting observation in the figure below is that beal occupies the least area of around 654.03 hectare and its production is one of the highest at around 35475.11 tons.

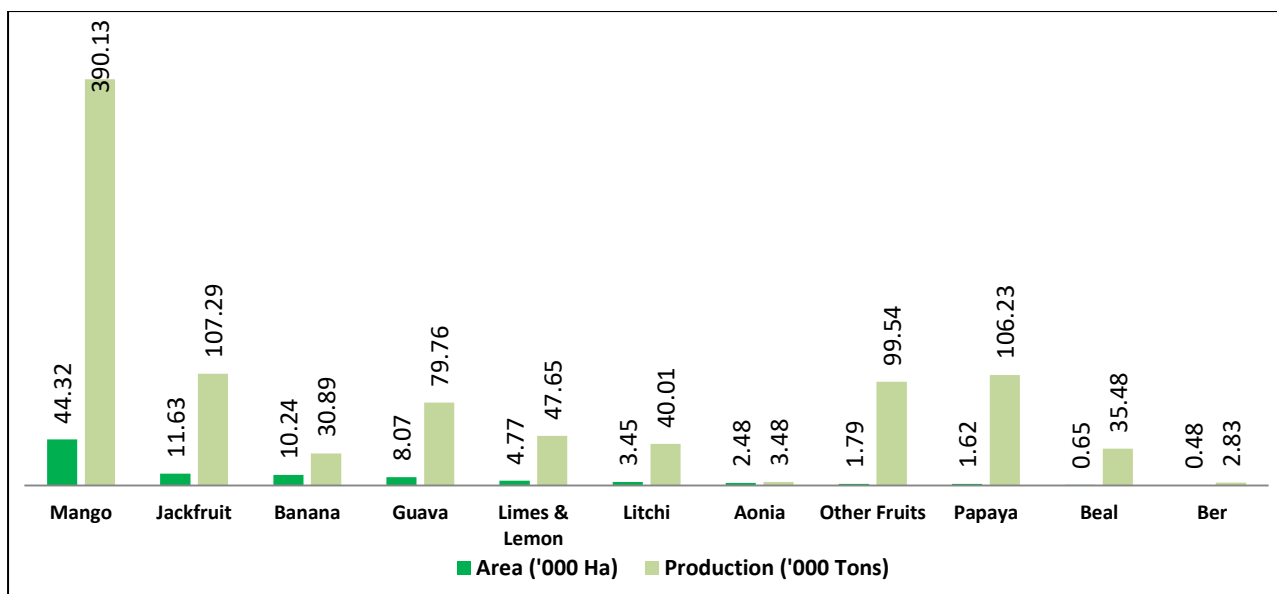


Figure 12: Area and production of fruits (2015-16) in Jharkhand

Source: Jharkhand Economic Survey, 2016-17

In vegetable production, Jharkhand has around 3.32% of total area under vegetables of the country and produces around 2.52% of the total vegetables and stand at 15th position in vegetable production. In the state, tomato has the highest area coverage among all the vegetables, followed by potato, cabbage, brinjal and cauliflower. Capsicum has the least area coverage followed by pumpkin, carrot, cucumber and radish. Over all the total area coverage in the state for vegetables is approximately around 347.68 thousand hectares and production is 2780.76 thousand tonnes. Production wise observation shows that potato is the highest produced vegetables followed by cabbage, onion, tomato and cauliflower. The least produced vegetables in the state are capsicum, bitter gourd and bottle gourd.

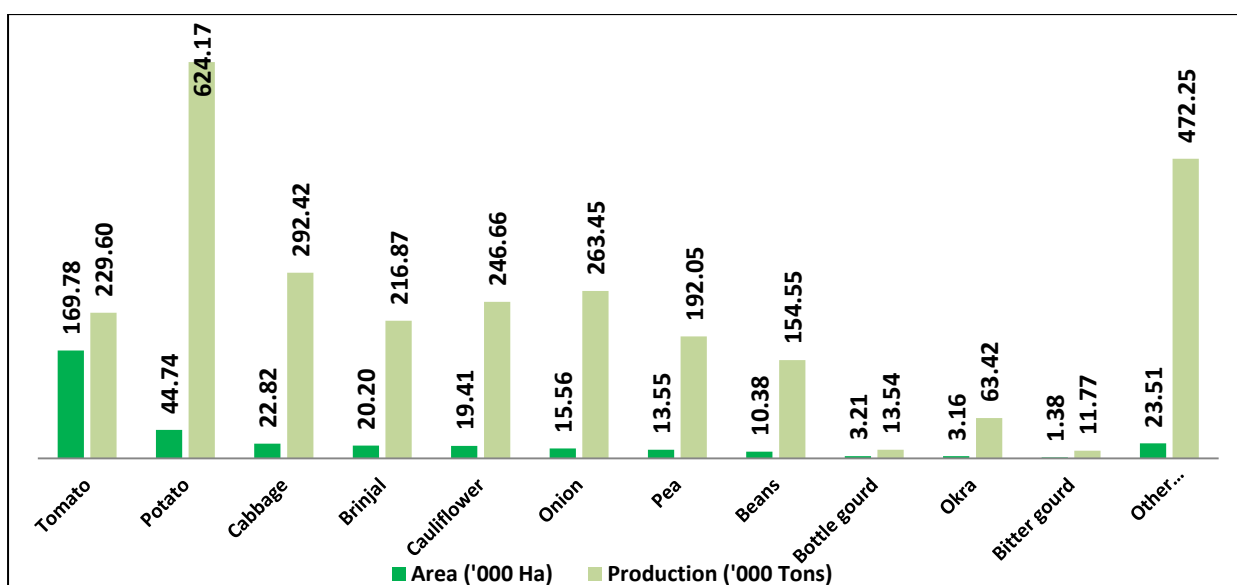


Figure 13: Area and production of vegetables in Jharkhand (2015-16)

Source: Jharkhand Economic Survey, 2016-17

From the above figure number 13, it is clear that Jharkhand state has highest area under tomato as compared to other vegetables like potato, cabbage, cauliflower and onion but tomato production is lower than these crops. It may be due to low yield of tomato besides being highly susceptible to insect pests and diseases attack as compared to other vegetables.

Table 7: District-wise area and production of vegetables and tomato (2016-17)

S.No.	District	Total Vegetables			Tomato		
		Area (ha)	Production (MT)	Production Share (%)	Area (ha)	Production (MT)	Production Share (%)
1	West Singhbhum	1002.40	15726.80	0.5%	183.60	3468.00	1.5%
2	Simdega	8990.00	129449.00	3.8%	750.00	7155.00	3.1%
3	Saraikela	424.00	2220.00	0.1%	30.00	372.00	0.2%
4	Sahebganj	9128.60	118827.60	3.5%	232.00	2196.20	0.9%
5	Ranchi	117995.30	895099.86	26.6%	3932.53	41207.43	17.8%
6	Ramgarh	6425.00	182156.00	5.4%	230.00	4655.00	2.0%
7	Palamu	4596.20	56083.51	1.7%	718.34	9432.99	4.1%
8	Pakur	6466.30	89807.00	2.7%	215.20	2451.60	1.1%
9	Latehar	8564.60	108780.65	3.2%	829.20	10681.77	4.6%
10	Lohardaga	11511.70	163164.13	4.8%	1243.50	11843.00	5.1%
11	Koderma	5241.75	178800.50	5.3%	685.50	6576.30	2.8%
12	Khunti	10997.58	183006.66	5.4%	698.81	7331.49	3.2%
13	Jamtara	7591.00	136600.00	4.1%	750.00	2200.00	1.0%
14	Hazaribagh	5584.00	125731.00	3.7%	310.00	6085.00	2.6%
15	Gumla	12665.00	193063.00	5.7%	439.00	5532.00	2.4%
16	Godda	3917.00	58158.50	1.7%	80.80	777.00	0.3%
17	Deoghar	5405.00	56323.00	1.7%	770.00	1860.00	0.8%
18	Dhanbad	5552.90	120566.50	3.6%	278.80	2656.00	1.1%
19	Dumka	19464.00	125155.45	3.7%	1930.00	27410.00	11.8%
20	E. Singhbhum	4332.00	70914.00	2.1%	902.00	18394.00	7.9%
21	Garhwa	6092.10	37776.62	1.1%	0.00	0.00	0.0%
22	Giridih	14712.00	42303.56	1.3%	1090.00	3580.00	1.5%
23	Chatra	11373.00	168997.00	5.0%	3025.00	48400.00	20.9%
24	Bokaro	5499.20	111289.50	3.3%	423.00	7191	3.1%
Total		293530.63	3369999.84	100%	19747.28	231455.78	100%

Source: State Horticulture Department, Jharkhand 2016-17

In the state, Ranchi district is leading in vegetables as well as tomato production. The state has a total vegetable production of 3369.99 thousand tonnes and Ranchi alone contributes 26.60% of it. Also, about 17.80% of total tomato is produced in Ranchi. Ranchi is second largest tomato producing district after Chatra in the state. The total area under vegetables in Ranchi is about 118 thousand hectares out of which 3.93 thousand hectares (3.33 % of total area under vegetables) is under tomato cultivation. Other districts viz Dumka, E. Singhbhum, Lohardaga, Latehar and Palamu are also ahead in tomato production in the state.

3.2 Seasonal availability of tomato

In India, tomato is mainly grown in two seasons across the country –June to September (*kharif*) and October to February (*rabi*) whereas in some regions it is produced almost throughout the years

except 1 or 2 months based on the climatic conditions. In Jharkhand too, it is grown in the same two seasons and its harvesting period is between October to December and February to April which is shown in the figure below.

Table 8: Peak and lean season of tomato in Jharkhand

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JHARKHAND												

Peak Season
 Lean Season

The monthly all-India average wholesale prices of tomato during the months June to September are always on higher side ranging from Rs. 35 to 45/kg because of the off-season and lower supply of tomato from producing regions. But in peak harvesting period, its wholesale price never goes beyond Rs. 15/kg as can be seen from the figure number 14 below. It always remains between Rs.10 to 15/kg and in the primary mandi its price is below Rs. 10/kg which leads to low returns at farmer’s level while the maximum profit goes to aggregators, wholesalers and retailers.

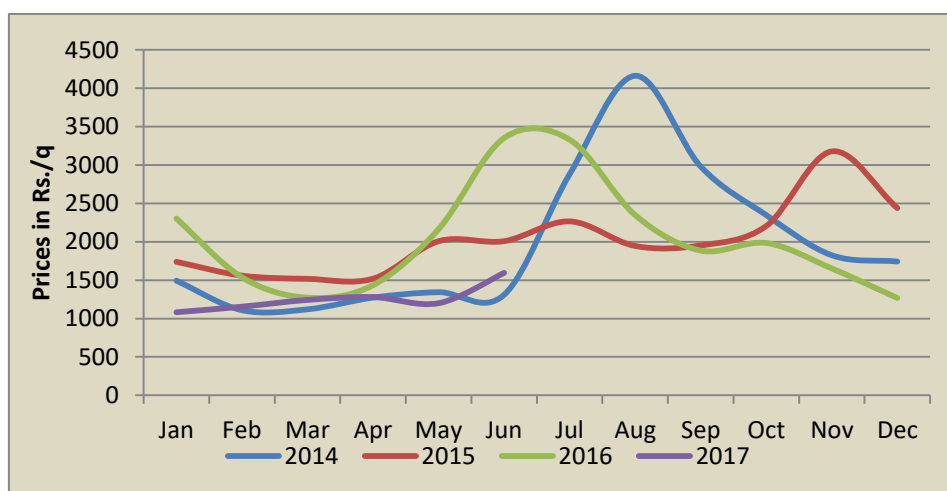


Figure 14: Tomato wholesale price seasonality

4 Constraints and Challenges in Tomato Production

The horticulture sector in Jharkhand is facing a number of challenges, which results in low productivity, poor quality and high wastages due to insect pest & disease attacks and post-harvest losses. The sector is constrained by low productivity, high cost of production, lack of post-harvest infrastructure resulting in huge post-harvest losses, inefficient & fragmented supply chain, lack of know-how and poor market access & intelligence. The major challenges are depicted in figure 15 below.



Figure 15: Major challenges faced by farmers

The following are the main issues in the horticulture sector of the state that need to be addressed in order to improve the production and market potential of the producers which in-turn will help the farming community to get better income.

4.1 Stage-wise constraints and challenges in tomato production

This chapter concentrates on the problems of tomato cultivation in Ranchi district. The problems of the sector can be classified into four stages viz. crop production stage, harvest & post-harvest management, logistic and marketing which are as follows;

A. Crop Production

During the course of discussion with farmers, it was found that the productivity is low and cost of production is high due to following reasons:

- Adoption of old production practices
- Non-availability of good quality seeds / planting material and lack of awareness

- Mostly rain-fed agriculture
- Lack of timely availability of inputs and technical advice
- High labour cost
- Low and irregular monsoon/ untimeliness and insufficiency of rains
- Non-availability of disease resistant hybrid variety seeds to the farmers
- Lack of extension services to guide about high tech farming
- Lack of awareness among farmers about crop insurance and soil testing
- Due to climate change, increase in pests and diseases attack and limited remedial measures
- Natural disaster: - The untimely rainfall, its irregularity, famine or drought etc. are the conditions prevailing in surveyed area.
- Continuously raising rates of fertilizers, manure, insecticides and pesticides.
- Fragmented land holding- the land is fragmented and divided into pieces. Hence permanent facilities like well, pipelines, leveling are not adopted.
- Lack of tour visit/farm visit of progressive farmer's farm and research station.

B. Harvest and Post-Harvest Management

- Pre and post-harvest losses: At farm level, while harvesting, some small size tomatoes also fall down and such fruits are included in culled fruits. Thorn injury and splitting / cracking are other important causes of loss in tomato at farm level. The post-harvest loss in tomato can be categorized into two main types, the first being the physical damage caused to the fruit and the second due to incidence of pests and diseases.
- Poor handling and lack of post-harvest & storage infrastructure
- Location of farm far from road side (poor connectivity)
- Lack of storage facilities: the available cold storage facility is insufficient in the study area. Moreover, most of them are under the control of privateers, who actually charge higher rent and the available space in these storages is inadequate.
- Wastage of huge quantity of tomato during glut situation due to lack of processing unit and their marketing.

Logistic:

- High transportation cost due to low volume of produce and distant location of farm from main market
- In the absence of co-operative effort by growers, difficulty in aggregating the produce making it unfeasible for transportation and thus reducing the negotiation power of producers *vis-à-vis* traders
- Lack of cold chain/ reefer-vehicles to maintain quality during transportation of fresh produce

- Non-availability of good logistic management system

Marketing:

- **Problem of Pricing:** - the most threatening problem before the tomato producer is the fact that rates are determined by the agents and traders. Moreover the price received is not in accordance with the production cost.
- **Problem of place for marketing:** - Through observations and interviews of respondents, it was found that the seat-spares where the farmers stay for sale are charged. The regular and large-scale traders and retailers reserve the places in market unofficially. Eventually, the small farmers have to face the problem of place almost regularly. Incidentally clashes, and even quarrels break out every now and then.
- **Lack of marketing organization:** - It is observed that there is no cooperative and private sangh in the district. Therefore, the producers rush personally to the market or through commission agents to sell the produce in weekly markets. Hence, they do not get reasonable rates.
- **Price risk:** – The prices of tomato products fluctuate not only from year to year, but also from month to month, day to day and even on the same day. The changes in prices may be upward or downward. Price variation cannot be ruled out, for factors affecting the demand for, and the supply of tomato products are continually changing.
- **Heavy sales in local market:** – A majority of tomato growers in the study area sell a large part of the produce in villages in the weekly market either to the consumers or to the commission agents. In these weekly village markets, they are forced to sell their produce on the road side without any shelter and it leads to large volume of loss, which results in low returns for their produce.
- **Lack of co-operative marketing system:** – To avoid the malpractices and exploitation by the agents, commission agents, private or traders' organizations in the market, it is necessary to establish a co-operative marketing system.
- **Lesser share of producer in consumer's rupee:** - Lesser share of producer in consumer rupee due to unfair trade practices by local traders/commission agents.
- **Lack of market information:** - Lack of market information and thereby limited access to the domestic & international market.
- **Lack of technical knowledge:** - Lack of technical knowledge about picking of fruits and their sorting, grading and packaging.

- **Lack of market intelligence facilities:** - Farmers only depend on local traders/ mandi agents to know the market price and as per the information they received, sell their produce to the traders/commission agents.
- **Absence of regulated marketing system:** - Absence of organized marketing system for tomato/vegetables is yet another major problem faced by the growers in the study area. Marketing of fresh tomato faces a number of problems due to their bulky nature, seasonality and high degree of perishability. It leads to the involvement of a number of intermediaries, middlemen or commission agents who dominate the trade and realize huge profits. It is generally believed that the growers do not get remunerative prices for their produce, while the consumers have to pay high prices for the same.
- **Strong association of traders and market functionaries:** - While farmers do not have organizations for safeguarding their interest during selling the produce, traders and other market functionaries had their strong associations or unions. As such the practices prevalent in the trade circles are usually biased against the farmers resulting in low price, high cost of marketing and inconveniences to the farmers at the time of sale.
- **Lacks of producers' organizations:** - Tomato growers are unorganized and market their produce individually. Because of their low bargaining power, they had to deal with traders having a strong organization. They could not, therefore, insist on a reserved price for their produce, producers watch the auction of the produce as silent spectators and are exploited by traders.
- **Chain of intermediaries:** - Tomato sale consists of three channels: 1) Private and co-operative sangh, 2) wholesalers, and 3) retailers. They exploit farmers financially in different ways such as loading and unloading, weigh wages, commission etc. It lessens the share in consumer rupee and the farmers have to accept low rates.
- **Lack of facility of processing:** - Tomato is processed for products such as juice, paste, ketchup, sauce, soup and powder. However, such agro-based industry does not exist here. In such circumstances, the farmers have no way out for them to sell the produce (tomato) quickly and thus invite further loss in rates.
- **No opportunity of export:** - Poor export performance over the years is a threat in the study area. There are no satisfactorily organized efforts to produce tomato exclusively for exports.
- **Absence of knowledge of grading and standardization of tomato produce:** - A large number of tomato farmers have little knowledge of the practice of the grading of the produce prior to its sale. They usually pick up superior and inferior quality products to make a single lot. As

a result, they get a lower price for their tomato produce. These practices have lowered the market prestige and consumers have lost confidence in the quality of the product.

- **Gluts of tomato in the market:** - Total respondents take tomato crop only once in a year. Their aggregate tomato produce is taken to the market at once. It results into the problem of excess supply which affects the returns on production cost badly.
- **Reluctant attitude of Government towards tomato producer:** - Lack of supportive policies for tomato growers by the Government have reduced the scope for increase in production and exports in the study area.
- **Existence of malpractices:** - Many malpractices such as deduction of unauthorized market charges, spurious deductions, unfair weighment of the produce, unhealthy sale method, taking away a part of the produce as sample, arbitrary deduction for religious and charitable purposes *etc.* were common in the marketing of tomato products. Malpractices become more frequent when the farmers have low economic status, little or no education and weak bargaining power. As a result, the producer's share in the consumer's rupee is very low.
- **Market Intelligence:** - Market intelligence is another problem that has emerged and is an important adjunct for orderly marketing. With the increased market surplus and opening up of trade, the importance of market intelligence has increased.

5 Nature and Structure of Industry

5.1 Interrelationship

The tomato value chain can be broken down into the following core segments with their corresponding actors or players: input sourcing (suppliers), financial & training support (Govt.), farm production (farmers), marketing (traders / wholesalers / retailers / agents / exporters), logistics supports (Transporters/private storage facility), APMC and consumption (consumers or end users). The following figure portrays the Value Chain Map for tomato showing the core segments, the relevant actors of the industry, the government institutions largely involved in the development of the chain as well as enabling laws and policies that promotes the competitiveness, productivity and sustainability of the industry.

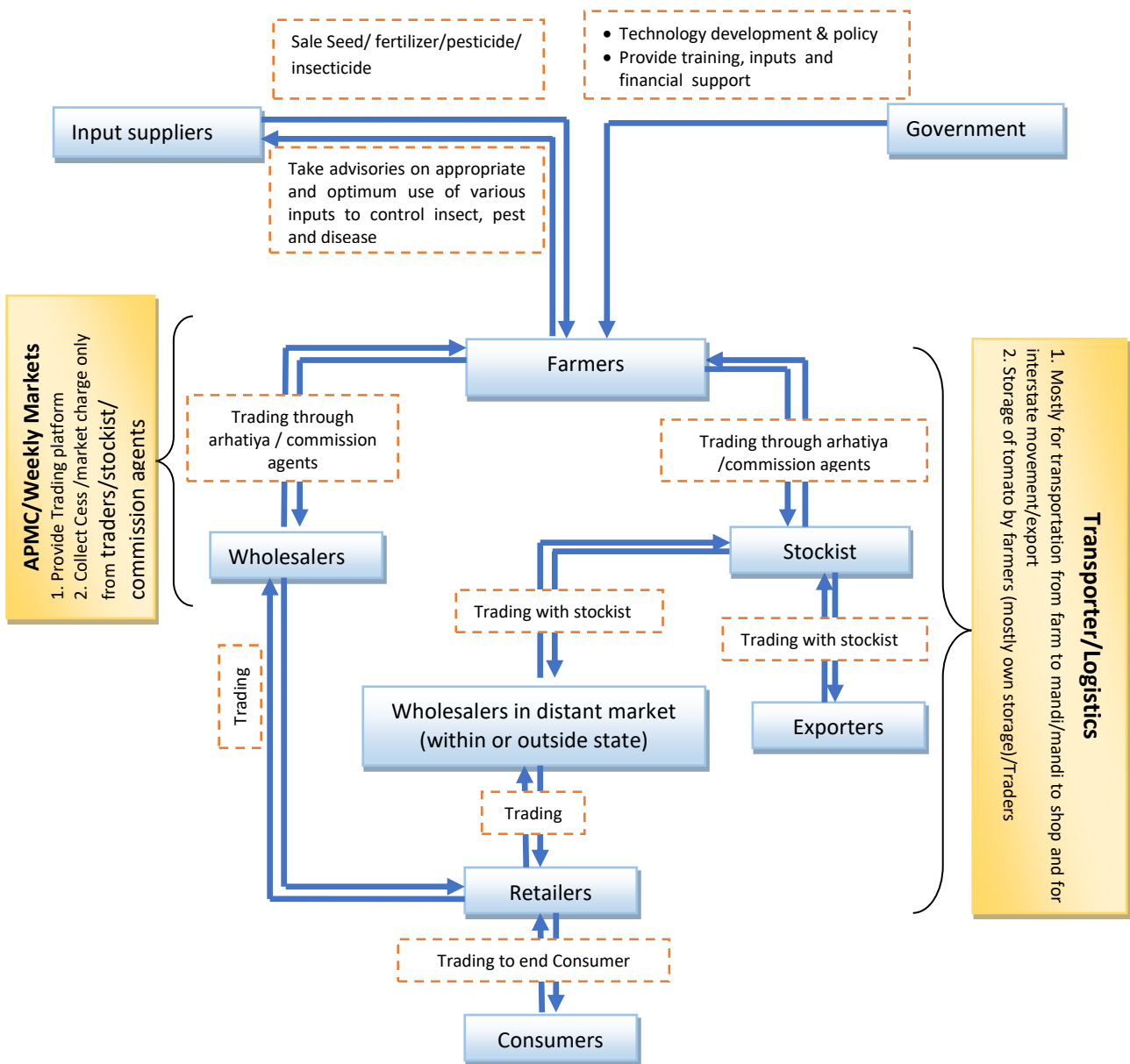


Figure 16 : Value chain mapping and interrelationship in tomato value chain

This is the relationship among different players operating at the vertical level in the tomato value chain. It is observed that farmers in Ranchi district procure their inputs from suppliers like private shops, dealers/private traders, NHRDF and also some times from Govt. agencies. Farmers purchase these inputs on the basis of their own experience or on the basis of advice given by input suppliers.

APMC provides space to all the farmers or traders for tomato trading. All tomato growers in the surveyed area reported that they sell their produce at weekly markets through commission agents/arhatiya. Stockist/traders or wholesalers purchase tomato through commission agents and sell to retailers in the same district or wholesalers in the other distant markets. Stockist/traders in the districts always sell their products to wholesaler of the other districts or other states and also sometimes export to the other countries. Commission charges and market cess in the APMC mandi are always paid by traders but due to removal of Section 31 (B) and (C) in Jharkhand state on 27th April, 2015, APMC officials do not have any control on traders and they also do not collect any type of cess from the traders. APMC officials only arrange space for weekly market and the market charges are collected by land owners. Farmers only bring their produce at the weekly market. Previously, farmers also used to pay commission to the arhatiya/commission agents but now Government removed this rule due to which commission agents/arhatiya now do not care about the price paid to the farmers by traders.

5.2 Supply chain

The value chain analysis was conducted by adopting a comprehensive approach in which apart from using secondary information from various sources such as departments of the State Government, Central Developmental Agencies and R&D institutions, primary information was also collected through face-to-face interviews with different actors / stakeholders in the VCs. Such data were used for gap analysis, identification of interventions and opportunities for strengthening VCs. Field survey was conducted for analyzing the tomato value chain to assess its competitiveness and potential across different parts of the country.

5.2.1 Farmers' profile and cropping pattern

Jharkhand is well known for the production of horticultural crops which mainly include fruits and vegetables. Horticulture is one of the critical sectors in the economy of the state. It provides much needed opportunity for diversification and increased employment in the state where the scope of high rate of growth in conventional agriculture is rather limited due to peculiar topography and majority of scattered and marginal holdings.

5.2.1.1 Socio economic profile of sampled farmers

The socio economic conditions of the target group indicate their basic characteristics which may be instrumental in the adoption of new technologies and interventions. The demographic profile of the farmers covered in the survey in terms of their education, farm size, land ownership etc. is presented in the following section.

A. Size of land holding and land ownership

As per the Agriculture Census, during 2000- 2011 there was a decline in the average size of operational landholdings in India, reflecting the immense population pressure on the limited land resource available for cultivation. The average size of operational landholdings dropped from 1.33 ha in 2000-01 to 1.15 ha in 2010-11. Consequently, during the same period, the number of landholdings in the marginal and small categories swelled by about 17 million and 2 million, respectively. Landholding size determines investment in agriculture, productivity, farm mechanization and the sustainability of farm incomes itself. Landholdings in the marginal category (less than 1 ha) constitute 67 per cent of the operational holdings in the country (2010-11). In terms of area operated, the share of marginal holdings has increased to 22 per cent (2010-11) from 19 per cent (2000-01). Similarly, the share of operated area under small farm holdings (1 ha to 2 ha) increased from 20.2 per cent to 22.1 per cent during the same period. Small and marginal holdings together constitute 85 per cent of the number of operational holdings and 44 per cent of the operated area in the country.¹

As per “Agriculture Census 2010”, the categorization of farmers under large, medium and small categories has been done as per the criteria for division of landholding which is given in the table 10 below:

Table 9: Percentage distribution of number of operational holdings

S. No.	Category of holding	Size group (ha)	Percent of operational holding	
			India	Jharkhand
1	Marginal	< 1.0	67.10	68.23
2	Small	1.0 - 2.0	17.91	15.83
3	Semi-medium	2.0 - 4.0	10.04	10.44
4	Medium	4.0 - 10.0	4.25	4.75
5	Large	> 10.00	0.7	0.75

Source: Agriculture Census-2010

As per the Agriculture Census 2010, In Jharkhand, about 68.23 percent of farmers are marginal having land less than 1 ha and 15.83 percent are small farmers having land holding 1 to 2 ha. In medium categories of farmers, about 10.44 % are semi-medium and 4.75 % are come under medium categories. In large categories of farmers only 0.75 percent of the farmers in the state have

¹ State of Indian Agriculture, 2015-16

landholding more than 10 ha. It shows that operational landholding of farmers in Jharkhand is very small and the farmers also have fragmented landholding.

Out of the total 200 surveyed farmers, 92% having land less than one hectare and come under the category of marginal farmers and 62% having land between one to two hectares and fall under category of small farmers. In medium category of farmers, about 17.50% are in semi-medium and just 4% in medium categories. Only 1.50 % (3 farmers) belong to the large category. This pattern of distribution of land clearly indicates that most of the farmers in Jharkhand are marginal and small.

Table 10: Landholding distribution of sampled farmers in Ranchi district

Landholding (ha)	Number of farmers	Percent of famers
Marginal (< 1 ha)	92	46.00
Small (1 - 2 ha)	62	31.00
Semi-medium (2 - 4 ha)	35	17.50
Medium (4 - 10 ha)	8	4.00
Large (> 10)	3	1.50
Grand total	200	100

Most of the surveyed farmers (79 percent) have their own land and they are not taking it on lease. About 19% of famers are doing farming on own as well as leased land and about 1.50 % of farmers doing farming only on the leased land. Only one farmer who reported that he does farming on his own land and also leased out his land. Those who take on lease give half of their produce to the land owner as lease rent.

Table 11: Type of land available for cultivation in Ranchi

Type of land	Number of farmers doing farming	Percentage of farmers doing farming
Only own land	158	79.00
Own and leased in land	38	19.00
Only leased in land	3	1.50
Own and leased out	1	0.50
Total	200	100.00

B. Education status and farmers' categories

According to the Census Statistics 2011, India's literacy rate is 74.04 % and that of Jharkhand is 66.11%. In Ranchi district of Jharkhand, total literacy rate is 76.06% which is also confirmed in our field survey.² Amongst the 200 surveyed farmers, about 76.50% were found to have a formal education, out of which, about 9 percent were found to have completed, 9 percent had completed Sr. Secondary education, 30.50 percent completed high school and 28 percent primary school. Only 14.50 percent of the surveyed farmers were found illiterate and about 9 percent were able to read

² Population Census 2011 (<http://www.census2011.co.in/district.php>)

and write. People are taking education very seriously now a days in rural area and despite of very limited resources, they motivate their children to pursue education for a better future.

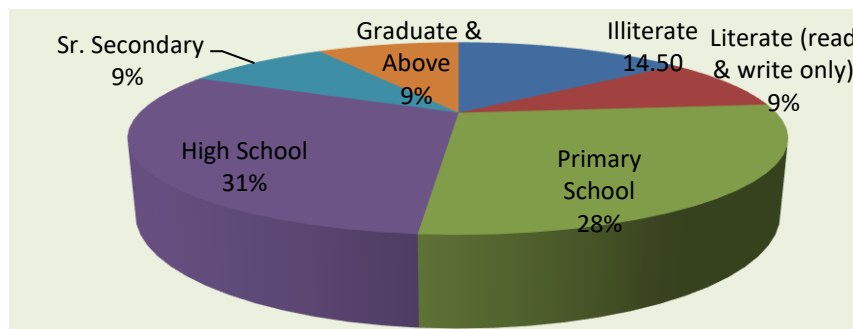


Figure 17: Education status of farmers in Ranchi district

During the survey it is also observed that most of the farmers belong to ST category which is about 53%. Only 18% of the farmers reported that they are in General category while 29% were in OBC category. None of the farmers was in SC category, as can be seen in the figure 18 below.

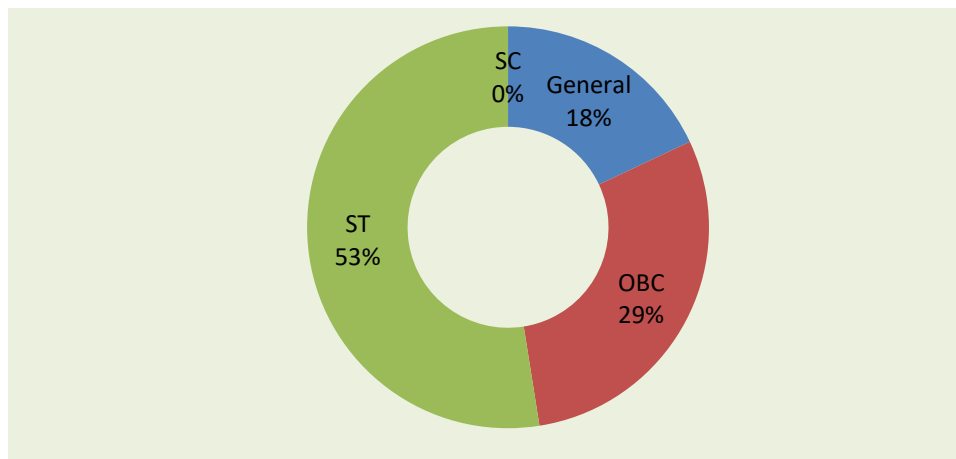


Figure 18: Percentage of farmers' category in surveyed area

C. Annual income

Out of the total surveyed farmers, only 23% reported their annual income to be more than one lakh and rest of the farmers (about 77%) had their annual income equal to or less than one lakh. About 45% of the farmers had the annual income in the range of Rs. 50000 to 100000, 27% in the range of Rs. 25000 to 50000 and 4.50% earned less than Rs. 25000. In the category of farmers having annual income of more than one lakh, about 16% earned Rs. 100000 to 150000 with only 7% reporting the income more than Rs. 150000.

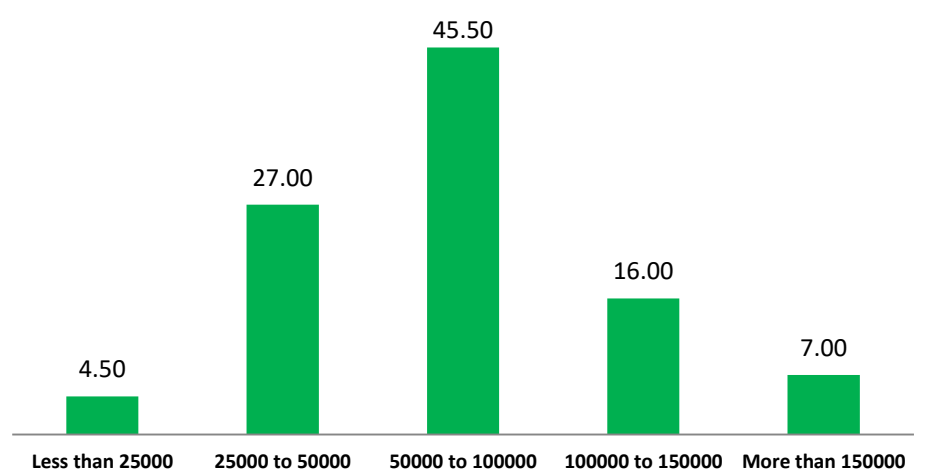


Figure 19: Percentage of farmers in different annual income slabs

The income range was found to be highest in the Burmu, Ratu and Nagri due to larger area under vegetables. These block fetch excellent price as the quality of the produce is good and very close to the city Ranchi.

Table 12: Block-wise surveyed farmer's income in Ranchi

Surveyed block	Farmers' annual income in Ranchi district										Total No. of Farmers
	Less than Rs. 25000		Rs. 25000 to 50000		Rs. 50000 to 100000		Rs. 100000 to 150000		More than Rs. 150000		
	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	
Burmu	1	2.5	4	10	23	57.5	8	20	4	10	40
Mandar	3	7.5	14	35	13	32.5	7	17.5	3	7.5	40
Nagri	0	0	11	27.5	24	60	3	7.5	2	5	40
Ratu	5	12.5	5	12.5	14	35	14	35	2	5	40
Tamar	0	0	20	50	17	42.5	0	0	3	7.5	40
Grand total	9	4.5	54	27	91	45.5	32	16	14	7	200

D. Experience in tomato farming and area under tomato cultivation

Many farmers in the state who have taken up vegetable farming in Ranchi owing to a surge in demand, especially from Odisha, West Bengal and Bihar, are now regularly supplying tomato, capsicum, cucumber, French beans and cauliflower to these states. Many traders in district Ranchi reported that quality of every vegetable grown here is quite good and has huge demand in other states where the vegetables can be supplied within 12 to 24 hrs. Due to round the year demand of vegetables particularly tomato and their good price in cash, farmers are shifting their lands from cereal crops to vegetable crops.

During the survey, it was observed that about 75% of the farmers started doing tomato farming during last 15 years. Previously they were only doing paddy cultivation as can be seen from the table below. Only about 25% of the farmers were doing tomato farming for more than 15 year, which indicates that slowly and gradually mindset of farmers are changing and they are taking more

interest in tomato or vegetable farming as compared to cereal crops. Due to change in this mindset, income level of many farmers has also changed many-fold.

Table 13: Experience of the surveyed farmers in tomato cultivation

Experience in tomato farming	Number of farmers	Percentage of farmers
Less than 5 Years	26	13.00
5 to10 Years	67	33.50
10 to15 Years	56	28.00
15 to 20 Years	33	16.50
More than 20 Years	18	9.00
Total	200	100.00

Farmers in the survey area reported that they are taking more interest in tomato farming because of high demand, low cost of production, resource suitability, better margin and availability of adequate water. As farmers reported, most prevalent reasons in tomato farming are low cost of production, better margin, high demand and resource suitability which can be seen from the table below. Due to rainfed, only 3% of the farmers reported that they are doing tomato farming because of availability of adequate water.

Table 14: List of reasons for doing tomato cultivation

Reason to engage in tomato production	Number of farmers	Percentage of farmers
High demand	5	2.50
Low cost of production	44	22.00
Resource suitability	8	4.00
Availability of adequate water	3	1.50
Better margin	26	13.00
High demand and low cost of production'	45	22.50
High demand and resource suitability	20	10.00
Resource suitability and low cost of production	18	9.00
Resource suitability and better margin	10	5.00
High demand, resources suitability and low cost of production	7	3.50
Others	14	7.00
Total	200	100.00

From the table 16 below, it is clear that about 30 % farmers cultivate tomato in an area of more than 50% of their land. Among all the five blocks, about 48% of farmers in Tamar reported that they cultivate tomato in more than 50% of their land followed by Mandar, Ratu, Burmu and Nagri where 35%, 25%, 22.5 and 20% of farmers, respectively reported to cultivate tomato in more than 50% of their land. The above data indicate that farmers of Tamar block are taking more interest in tomato farming. In Ranchi district, Tamar is also leading tomato producing block which supplies good quality

of tomato in the city of many states like Kolkata in West Bengal, Patna and Bihar Sharif in Bihar and also Odisha.

Table 15: Percentage of area used by farmers for tomato cultivation

Block	Percentage of area under tomato								Total	% of farm income from tomato farming
	Less than 25%		25 to 50%		50 to 75%		75 to 100%			
	Nos.	%	Nos.	%	Nos.	%	Nos.	%		
Burmu	12	30.0	19	47.5	6	15.0	3	7.5	40	36.00
Mandar	10	25.0	16	40.0	13	32.5	1	2.5	40	37.38
Nagri	19	47.5	13	32.5	8	20.0	0	0.0	40	35.63
Ratu	16	40.0	14	35.0	9	22.5	1	2.5	40	38.50
Tamar	10	25.0	11	27.5	15	37.5	4	10.0	40	37.13
Total	67	33.5	73	36.5	51	25.5	9	4.5	200	36.93

Farmers also reported that on an average about 37% of their total annual income from farming is from tomato alone, which acts as a motivational factor for farmers to adopt tomato cultivation.

5.2.1.2 Crop production

In Jharkhand, tomato is cultivated in two seasons, June to September (*kharif*) and October to February (*rabi*) and its harvesting period is from October to December and February to April. Area coverage under tomato farming is maximum in *rabi* season which is about 80% of the total area under tomato farming and 20% in *kharif* season. But in the surveyed blocks of district Ranchi, many farmers also reported that they are taking three crops in a year - *kharif*, *rabi* and summer crops and average yield of tomato is maximum in *rabi* season which is about 70.89 q/acre followed by summer season (60.36 q/acre) and *kharif* season (57.52 q/acre). Average yield of tomato was the highest in Tamar (62.31 q/acre) in *kharif* season and Mandar in *rabi* (80.63 q/acre) & summer season (63 q/acre) as can be seen in the table 17 below. In all the three seasons, farmers only use hybrid seeds of tomato. The yield reported by farmers is very less as compared to yield reported by National Horticulture Board (NHB). Therefore, Government should focus on the introduction of high yielding varieties in the state. Soil type in the surveyed area is mostly 'Red loam' followed 'clay'.

Table 16: Block-wise area under tomato and the yields achieved

Block	Kharif / rainy acreage		Rabi acreage		Summer acreage	
	Total area of tomato (acres)	Yield (q/ acre)	Total area of tomato (acres)	Yield (q/ acre)	Total area of tomato (acres)	Yield (q/acre)
Burmu	30.80	57.93	17.40	75.83	6.50	61.67
Mandar	23.60	58.80	18.35	80.63	3.70	63.00
Nagri	20.90	56.52	18.65	70.00	1.00	60.00
Ratu	21.50	55.00	15.00	61.82	0.50	50.00
Tamar	32.50	62.31	49.90	68.50	8.00	50.00
Grand Total	129.30	57.52	119.30	70.89	19.70	60.36

5.2.1.3 Major tomato varieties cultivated

It has been found that around 23 varieties of tomato are grown by farmers in Ranchi district. But, among all the reported varieties, Lakshmi NP 5005, Hybrid, U.S. 440 and Kapila are the most widely grown varieties. These varieties are grown only due to easy availability of seed as reported by 69% of surveyed farmers followed by high demand in market (46%), higher shelf-life (43%), higher productivity (9%) and higher price in the market (6%). Some varieties like 1322, NA 501, Arka Rakshak, and Arka Vardan as listed in the table below give higher yields but not used by the farmers due to their non-availability of seed on time.

Table 17: List of tomato varieties reported by the surveyed farmers

Variety	Nos. of farmers who reported	Crop duration (Month)	Yield (q/acre)
Swarn Lalima	3	3.67	108.00
Swarna Baibhav	2	3.83	50.00
Lakshmi NP 5005	70	3.53	93.00
NA 501	2	3.83	125.00
Arka Vardan	1	4.00	110.00
Arka Rakshak	2	3.67	112.50
Hybrid	69	3.27	74.27
Dhaniya	4	3.43	60.00
Kapila	29	3.38	90.33
U.S. 440	47	3.10	73.83
U.S.5005	1	3.00	80.00
777	2	3.33	50.00
1322	1	4.00	150.00
Alankar	4	3.96	87.50
Bioseed	1	4.00	60.00
Champion	1	5.00	80.00
Jk Hardev	2	3.33	90.00
Khyati	1	3.00	70.00
Namdhari	2	3.50	75.00
Pusha Rubi	1	3.33	80.00
Suraksha	1	3.67	60.00
Shakti	1	3.33	50.00
Swedesi-777	1	2.67	80.00

To get best quality of seeds of the varieties mentioned in the above table, about 90% of farmers reported that they purchase seed from private retail shops in the block and the rest 10% of farmers purchase it from the agri-input dealers, peer farmers and sometime produce at their own.

Table 18: Source of seeds/planting material

Sources of planting material	Farmers' response	
	Number	%
Produced by own	2	1.00
Agri-input dealer	12	6.00
Private retail shop in the block	179	89.50
Procure from Universities/KVK	0	0.00
Government supply/Agriculture office at subsidies rate	0	0.00
Peer farmer/local village	0	0.00
Agri-input dealer and private retail shop both	6	3.00
Private retail shop in the block and peer farmers both	1	0.50
Total no. of farmers	200	100.00

About 90% farmers who purchase seeds from private retail shop in the block reported that they do it because it is available easily in their vicinity and get the seed on credit too. Among all the farmers, about 83% also reported that seed obtained from these retail shops also give expected results. None of the farmers in the surveyed area reported about 'Seed Development Centre'.

5.2.1.4 Fertilizers and pesticides

A. Manure and fertilizers

The requirement of nutrients in tomato generally depends on soil type, region of growing, varieties and removal of major nutrients. Fertilizer doses also depend upon the fertility of soil and amount of organic manure applied to the crop. As per recommendation, 25 tonnes/ha of FYM should be applied to field one month before planting. NPK should be applied at the rate of 100:60:60 kg/ha. In case of transplanting method, the top dressing is taken up on 30th days after planting or during earthing up the plant. In hybrid varieties, NPK should be applied at the rate of 200:150:100 kg/ha along with borax @ 10kg and sulphate @ 50 kg/ha. The top dressing in hybrid varieties is taken up with N @ 50 kg/ha and K @ 150 kg/ha in 3 equal splits at 30, 45 and 60 days after planting.

As per the field survey, farmers apply mostly DAP, urea, potash and compost in tomato crop. About 79 % of farmers reported that they use DAP, urea and potash and 9 % reported that they use DAP and urea. Rest of the farmers (12%) use combination of all types of fertilizers. All the farmers reported that they purchase fertilizers from retail shop only. IFFCO, Paras and Sardar brands of fertilizers are most popular among the surveyed farmers and always prefer these brands. Few farmers also prefer, Saktiman, PPL and Sufala brands. As reported by 58% of farmers, fertilizers of these brands are easily available at lower price, while 39% of them told that these give good result.

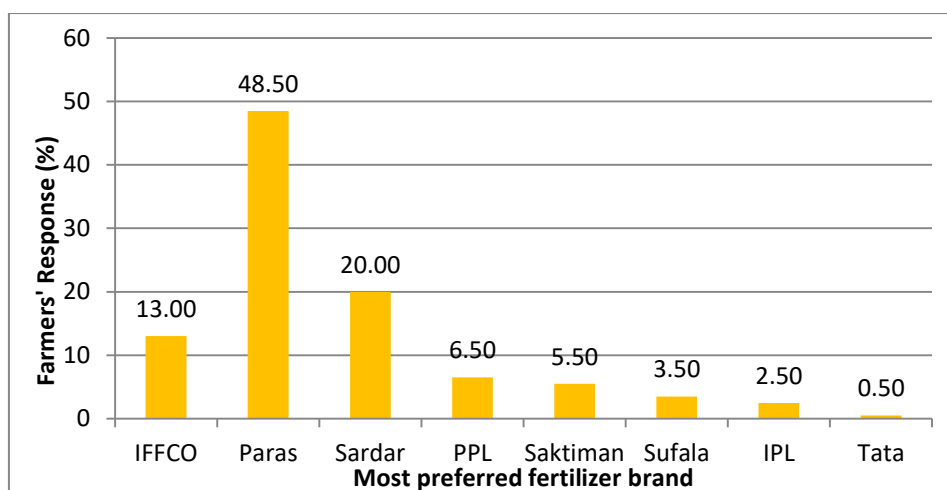


Figure 20: Most preferred brand of fertilizers

Majority of the farmers also reported about the use fullness of organic manure. As per most of them, the main benefits they received after use of organic manure are- better yield, good quality produce and improvement of soil health which is mentioned in the table below.

Table 19: Benefit of organic manure

Benefit of Organic Manure	Farmers response	
	Nos.	%
Higher yield	163	81.50
Good quality of produce	24	12.00
Soil health improvement	9	4.50
Higher yield and good quality of produce	4	2.00
Grand total	200	100.00

B. Pesticide & weedicide application

Tomato is a high-value crop. Both high yield and quality are important for economic considerations. Insects and diseases are the major problem in tomato production. Gram pod borer, serpentine leaf minor, tobacco caterpillar and root knot nematode have the potential to reduce or destroy the crop. Tomato is also attacked by the vast range of fungi, bacteria and viruses which can destroy wide range of crops if not managed properly on time. The most common diseases are anthracnose, bacterial spot, bacterial blight, bacterial canker, buck eye rot, damping off, early blight, fusarium wilt, late blight, leaf curl, mosaic, powdery mildew, rots, and septorial leaf blight. During the survey, about 51 % of farmers reported about disease Blast and 48 % about Jhulsa as the most prevalent diseases. Only few farmers reported about blight and fruit borer. As per farmers, their tomato crops are attacked by these insect, pests and diseases every year and cause considerable damage to both quantity and quality. About 96% of farmers reported that they are not getting permanent solution of these insect, pests and diseases. To protect the crops from insect pests and diseases, farmers apply different types of pesticides purchased on the basis of suggestions received from input dealers and

peer farmers. Only few farmers reported about State Agriculture department which indicates that role of Agricultural Scientists in solving farmers' problems regarding insect, pests and diseases is negligible and that is the reason behind these diseases occurrence year after year. All the farmers reported that whatever good information they get, they adopt it and due to that the production is increasing. But they do not get permanent solution to these problems. Some times on the basis of suggestions received, they use new varieties and also get the benefits of new schemes. In the surveyed area, out of all the 200 farmers, only four were aware about training available on vegetable cultivation and also on tomato farming. They also utilized benefit of that training programme. Therefore, Government should focus more to spread awareness of training programme available for vegetables or tomato cultivation so that farmers could get real benefits of the available schemes and increase their income and standard of living.

In the surveyed area, farmers reported 13 different types of pesticides but among them, Tarzan, M-45, Rogar, Dhanuvit, Eocks, Feridol and Rodomil are most popular and preferred by most of the farmers. These pesticides are easily available at private shops and nearly 100% of the farmers also reported that they purchase the above mentioned pesticides from private shops only. No one reported about other sources of inputs which indicate that farmers have good faith on private retail shops. Endofil, Tata, Bayer, Dhanuka, Namdhari and Syngenta brands of pesticides are most popular among the surveyed farmers and they always prefer these brands for tomato crop. Few farmers also use Kaif, Semnish and Indosil brands of Pesticides. About 48 % farmers reported that they prefer these brands because these are easily available and give good results. About 30% of farmers also reported that they preferred these brands because these are cheaper than other brands.

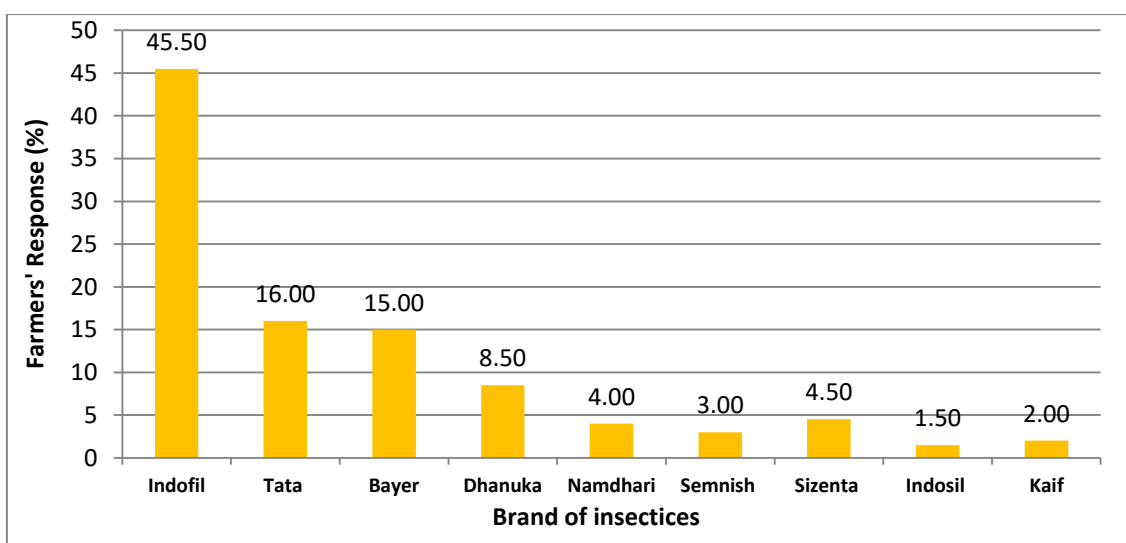


Figure 21: Most preferred pesticide brands

Weeds can be controlled chemically or mechanically. Chemical weed control can be used by applying recommended chemicals. Mechanical process should be shallow and not too close to the plant; this will prevent damage to the plants. Hand-hoeing is also practiced, especially with tomato production under protection. In the surveyed area, about 36 % of farmers reported that they use weedicide to control weeds in tomato field while rest of the farmers (about 64%) control weeds manually. The weedicides used by the surveyed farmers are Super-D, Tarka Super, Super Killer, MD-45 and Brackup. All the farmers also purchase these weedicides from private shops due to easy availability in their nearby market at low price as reported by 89% of farmers. Most preferred brands in weedicides are Dhanuka, Bayer, Syngenta and Tata. But the most preferred brand is Dhanuka as reported by 94% of the farmers. None of the farmers in the sample survey reported about Integrated Nutrient Management (INM) in tomato crop which denotes lack of awareness among farmers about importance of IPM and INM.

5.2.1.5 Irrigation

Irrigation is critical in tomato production. It is important to supply sufficient water at critical times, such as immediately after sowing or transplanting. Excess irrigation after a long dry spell without prior light irrigation results in fruit cracking. During the first four weeks, 21 mm of water should be applied per week, while during the following eight weeks 38 mm water per week is needed. Plants that are irrigated late in the season produce watery fruits of poor quality. Sometimes it is best not to use an overhead sprinkler irrigation system because wet leaves encourage early and late blight disease. In the surveyed area most of the farmers (99%) irrigate tomato crops by tradition method *i.e.* flood method with well. Only two farmers in the surveyed area use drip system to irrigate their crops which indicates that the area under micro-irrigation of tomato crops is negligible. Therefore, Government should make plan to educate farmers to adopt drip irrigation. During the discussion with one of the ATMA officials regarding adoption of micro-irrigation, he reported that Government is giving training to many farmers on the adoption of micro-irrigation now a days and on the benefits of the scheme “Prime Minister Krishi Sinchayee Yojana”. During the previous year, 28 batches of farmers received training under this scheme. Government of India is committed to accord high priority to water conservation and its management. To this effect Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) has been formulated with the vision of extending the coverage of irrigation ‘Har Khet Ko Pani’ and improving water use efficiency ‘More Crop Per Drop’ in a focused manner with end-to-end solution on source creation, distribution, management, field application and extension activities.

5.2.1.6 Cost of production

On the basis of farmers' response, the average cost of production was found to be Rs. 33838.50 /acre. The farmers spend highest amount on labour during land preparation (23.92 % of total cost of cultivation) followed by seed/planting material (9.84%). On manure & fertilizers, tractor, pesticides and irrigation the expenditure was 8.54, 8.24, 6.84 and 4.73%, respectively. The sampled farmers spend very small amount on the hiring of machineries (4.39%) because in most of the cases farmers have their own arrangement. Farmers also reported that they spend 23.66% of the total cost of production during harvesting and 9.84 % in transportation and marketing of tomato which is also mentioned in the table 21 below.

Table 20: Cost of production of tomato (Rs./acre)

S. No.	Particulars	Input cost (Rs./acre)	Percent of total expenses
1	Cost of seed/ planting material	3328.50	9.84%
2	Cost of human labour (Land Preparation)	8095.00	23.92%
3	Cost of bullock labour/tractor	2787.00	8.24%
4	Cost of manure & fertilizers	2891.00	8.54%
5	Cost of pesticides & weedicide	2315.50	6.84%
6	Cost of irrigation	1599.00	4.73%
7	Cost of hiring machineries including pumps, sprayer etc.	1486.50	4.39%
8	Harvesting cost	8007.50	23.66%
9	Cost of transportation to most prevalent market	2067.00	6.11%
10	Cost incurred during sales at the most prevalent market	1261.50	3.73%
	Total cost of production	33838.50	100.00%

In tomato cultivation, farmers face lots of problems like high incidence of insect pest and disease attacks, high cost of fertilizers and pesticides, lack of finance, lack of water, non-availability of desired seed, chemical fertilizers and insecticides & pesticides on time, and weather variations. But when we calculated weighted average of the problems on the basis of the farmers' responses then it became very clear that among all the cultivation related problems in tomato, weather variation, high incidence of insect pest and disease attack and lack of water are the main issues for the farmer as can be seen in the table 22 below.

Table 21: Problem faced by farmers in the cultivation practices

Problems in tomato cultivation	Weighted average		
	Rank-1	Rank-2	Rank-3
High incidence of insect and pest attack	2.30	0.29	0.04
High cost of fertilizers and pesticides	0.33	0.67	0.29
Lack of finance	0.08	0.54	0.07
Lack of water /water become salty	1.34	0.36	0.08
Non-availability of desired seed o time	0.23	0.54	0.14
Non-availability of chemical fertilizers on Time	0.03	0.26	0.20
Non-availability of desired insecticides & pesticides	0.02	0.28	0.06
Non-availability of desire insecticides & pesticides on time	0.08	0.26	0.06
Weather variation	2.36	0.20	0.06

5.2.1.7 Govt. scheme for crop management

A. Soil testing

Soil testing service for farmers is being provided by Jharkhand state government through its agriculture department. Soil testing helps to know the quantity of available nutrients for plants and other important characteristics of soil. Once a farmer gets report of soil test, he can make changes in soil fertility with the help of fertilizers for better yield. The charge for soil testing is vary from Rs. 15 to 20 /sample. In case of heavy metals like manganese, iron, zink and copper etc. the charges are Rs. 20/- per sample. At present, soil testing facilities are available in Ranchi district in three places, which are:

- Agriculture Office Ranchi
- KVK Lab
- Private Company in Hehal in PPP mode

Besides this, soil testing kits are available in each block total number being more than 70. As per the Department of Agriculture, Ranchi, total number of farmers who received soil Health Card is about 42000. During the survey, it was observed that out of the 200 surveyed farmers, about 51% were aware about soil testing facilities and among them only 5% have got their soil tested. Among these, 5%, only one farmers received soil health card and also received advice for the crops. Rest of the farmers reported that soil is tested but soil health card is not provided by Government officials yet. This indicates that only few farmers are aware of soil testing facility and its benefits. Therefore, the state Government should focus to increase awareness among the farmers about soil testing facilities available and the benefits obtained through it. The farmers who got their soil tested confirmed that now they know what the problem in their soil was.

B. Pradhan Mantri Fasal Bima Yojana (PMFBY)

Hon'ble Prime Minister Shri Narendra Modi unveiled the new scheme Pradhan Mantri Fasal Bima Yojana (PMFBY) on 13th January, 2016. This scheme will decrease the burden of premiums on farmers who take loans for their crops and also safeguard them against the inclement weather. The settlement process of the insurance claim under the scheme is very fast and simple so that the farmers do not face any problems regarding the crop insurance. This scheme has been implemented in every state of India, in association with the respective state Governments. There is uniform premium of only 2% to be paid by farmers for all *kharif* crops and 1.5% for all rabi crops. In case of annual commercial and horticultural crops, the premium to be paid will be only 5%.

But, during the survey it was found that awareness among farmers about PMFBY scheme is very little. Only 32% of the farmers reported that they are aware about PMFBY scheme and also none of

them has taken benefit of the scheme for tomato so far. Therefore, state Government should focus to increase awareness among the farmers about this scheme.

C. Weather information

During the survey it was also observed that farmers are getting information on weather condition but their accuracy is very low. About 31 % of the surveyed farmers reported that they are receiving weather information through TV (59% farmers), radio (1.75%), through SMS from IFFCO (6.56%) and Meteorological Department (6.56%). About 5% of the farmers also reported about Newspaper as a source of information. Besides this, few farmers also reported about block office as a source of weather information as shown in the table 23 below.

Table 22: Sources of weather information

Source of weather information	Farmers' response	
	Nos.	%
Radio	9	14.75%
TV	36	59.02%
SMS from Meteorological Department	4	6.56%
Block Office	1	1.64%
IFFCO Kisan	4	6.56%
Newspaper	3	4.92%
Radio & TV	2	3.28%
Radio and SMS from Meteorological Department	1	1.64%
SMS from Meteorological Department & IFFCO Kisan	1	1.64%
Total no. of farmers	61	100.00%

D. Loan Facility

In the surveyed area about 68% of the farmers are marginal and financially not well off. Therefore, in this case loan facilities provided by the Government can play important role in tomato farming. During the survey it was observed that among the 200 surveyed farmers, only 20% utilized the loan facilities from the bank only. None of the farmers reported about other sources of loan. Among the rest 80% farmers, 63% reported that they do not need loan while 17% reported that nobody gives the loan easily.

5.2.2 Post-harvest management

5.2.2.1 Sorting and grading

During the survey, all the farmers reported that they undertake all types of post-harvest practices like cleaning, sorting, grading, weighing & packaging in tomato. All of them also grade their produce before selling in the market. During grading, size and shape are the main factors considered by 94% of the surveyed farmers. Besides size and shape of the tomato, 43% of the farmers also consider colour of the fruits and 41% removed damaged and diseased fruits during grading of tomato. Few farmers also consider immature, deformed and blemished condition of the fruits during grading.

Cracking of the fruits is also one of the major issues for the farmers because due to cracking in fruits traders do not offer good price to the farmers as reported by most of the farmers.

Table 23: Factors considered by farmers during grading of tomato

S. No.	Factors for grading of tomato	Farmers' response	
		Nos.	%
1	Size & Shape	188	94.0
2	Ripened/Raw	17	8.5
3	Immature	8	4.0
4	Colour	86	43.0
5	Diseased and damaged	82	41.0
6	Deformed/ blemished	4	2.0
7	All of the above	5	2.5
	Total no. of farmers	200	

As per field observation, except packaging and storage all types of post-harvest practices are done by farmers and their expenses in these activities are mentioned in the table below:

Table 24: Charges incurred by farmers during PHM

Activities	Self/pre-harvest contractor / traders/local traders	Charges (Rs./q)
Cleaning	Self	14.87
Grading	Self	12.47
Packaging	No packaging	-
Weighing	Self	No charges
Transportation	Self	22.43
Storage	No storage	-

For the packaging of tomato, most of the farmers use bamboo baskets and old & small plastic bags. All the farmers sell their vegetables in weekly market nearer to their village. For transportation, they use auto-rickshaw or cycle. Also, none of the farmers reported about storage of tomato. There are two to three cold storages in Ranchi district but these are mostly used only for potato. In cleaning of fruits after harvesting, average price reported by farmers is Rs. 14.87 /q while Rs. 12.47/q is paid for grading of tomato fruits. In transportation from farm to market, average expenses farmers bear are Rs. 22.43/q as shown in the above table 25.

5.2.2.2 Constraints in postharvest management

A. Constraints in grading & packaging

The main aims of cleaning, sorting & grading and packaging is to keep the food in good condition until it is sold and consumed, and to encourage customers to purchase the product. These value addition activities provide the correct environmental conditions for food starting from the time food is packed through to its consumption. Among all the value addition activities, packaging is the most important one that increases the durability of products. But, due to shortage of skilled labour farmers are unable to grade and pack the produce properly. During the survey, 82 percent farmers

reported about higher wages of the skilled labour followed by shortage of skilled labour. About 7% of the farmers also reported no problems in sorting and grading tomato during marketing.

Table 25: Constraints faced by farmers during grading & packaging

Problems	Farmers' response	
	Nos.	%
Shortage of skilled labour	41	20.50%
Higher wages	163	81.50%
No problem	14	7.00%
Total no. of farmers	200	

B. Logistic constraints

While analyzing transport of agriculture produce, it was identified that transportation costs play critical role in recognizing the link between accessibility and agricultural development. Good transport system is critically important to competitive agricultural marketing.

There are many issues and constraints associated with transportation of agriculture produce. If, transport services are poor quality or expensive then farmers will be at a disadvantage when they try to sell their produce. An expensive service will naturally lead to lower farm gate prices (the net price the farmer receives from selling his produce). Seasonally blocked roads or slow and infrequent transport services, along with poor storage, can lead to great losses in the agriculture produce.

In the surveyed area of Ranchi, on an average, 56 % of the farmers reported high transportation cost as a major problems followed by non-availability of reefer transportation, vehicles not available in time and lack of vehicles as reported by 25, 15 and 9% of farmers, respectively. None of the farmers reported about lack of better connectivity to the mandi that might leads to crop damage during transportation. Few farmers also reported that they are not facing any problems during transportation of tomato from farm to market/mandi.

Table 26: Constraints faced by farmers during storage and transportation

Post-harvest practices	Problems	Farmers' response	
		Nos.	%
Transportation	Lack of vehicles	18	9.00
	Vehicles not available in time	30	15.00
	Non-availability of reefer transportation	49	24.50
	High transportation charges	112	56.00
	Lack of better connectivity to mandi	0	0.00
	No problem	26	13.00
Storage facility	No storage facility	128	64.00
	Inadequate storage facility in village	69	34.50
	No problem	3	1.50
Total no. of farmers		200	

None of the sampled farmers store their tomato to sell in the lean season. About 64 % farmers reported that there is no space for the storage of tomato and 35% of total about inadequate storage facility in village. Only few farmers reported that there is no problem for storage of tomato as shown in the above table 27.

5.2.2.3 Post-harvest losses

Losses are a measurable reduction in foodstuffs and may affect either quantity or quality or both. They arise from the fact that freshly harvested agricultural produce is a living thing that breathes and undergoes changes during post-harvest handling. Post-harvest losses are caused by both external and internal factors like mechanical injuries, damage due to insects & pests attacks and physiological deterioration. Fresh tomato is highly susceptible to mechanical injury owing to their tender texture and high moisture content. Poor handling, unsuitable packaging and improper packing during transportation are the main reasons for injury in tomato.

The study revealed that there are about 9.86% losses in tomato at the farmer's level. Maximum losses in tomato occur at the cleaning, grading, weighing & packaging stage (5.23%) followed by harvesting & aggregation (3.02%) while during transportation the losses are only 1.61% due to weekly market being very close to their village. There is no storage losses observed at farmer's level as they hardly stored tomato. Tomato is sold by the farmers same day or the next day after harvesting.

Table 27: Post-harvest losses in tomato

S.No.	Post-harvest losses	Average post-harvest losses (%)
1	Harvesting and aggregation	3.02
3	Cleaning, grading, weighing & Packaging	5.23
4	Transportation (farm to mandi)	1.61
	Total losses	9.86

At Commission agents/ stockist/local trader's level, average losses reported are 2% which is mainly due to inability to sell timely, cleaning, sorting & weighing and bad weather conditions. Stockist/traders throw out most of their damaged tomato. They only sell about 5 to 10% of total damaged tomato at lower price and rest of the tomato (about 90 to 95%) dumped as wastage.

At the wholesaler and retailer's level, the losses are on an average 9.38 and 11.25%, respectively and the main reasons of losses are time taken in selling of produce, sorting, grading and bad weather conditions. Retailers sell 50% of their damaged produce at lower price but wholesaler throw out all the damaged produce.

5.2.3 Market and market opportunities

Marketing of agricultural produce is the most important aspect on the part of growers to realize the commercial value of their produce. The study carried out detailed analysis of the way produce is being marketed and how the information is being followed by the growers in the decision making process. Successful commercial production of vegetables and fruits is a demanding task that requires a good combination of production and marketing decisions by the growers.

5.2.3.1 Marketing channel

Farmers are scattered in remote villages while the consumers are in semi-urban and urban areas, and in some cases in the distant international markets. There are different agencies and functionaries through which the produce passes and reaches the consumer. It is observed from the study that tomato passes through various intermediaries like commission agents, local traders/stockists, wholesalers, processors, retailers *etc.* before reaching the final consumers it consists of 4 to 6 levels as may be seen in the figure 22 below.

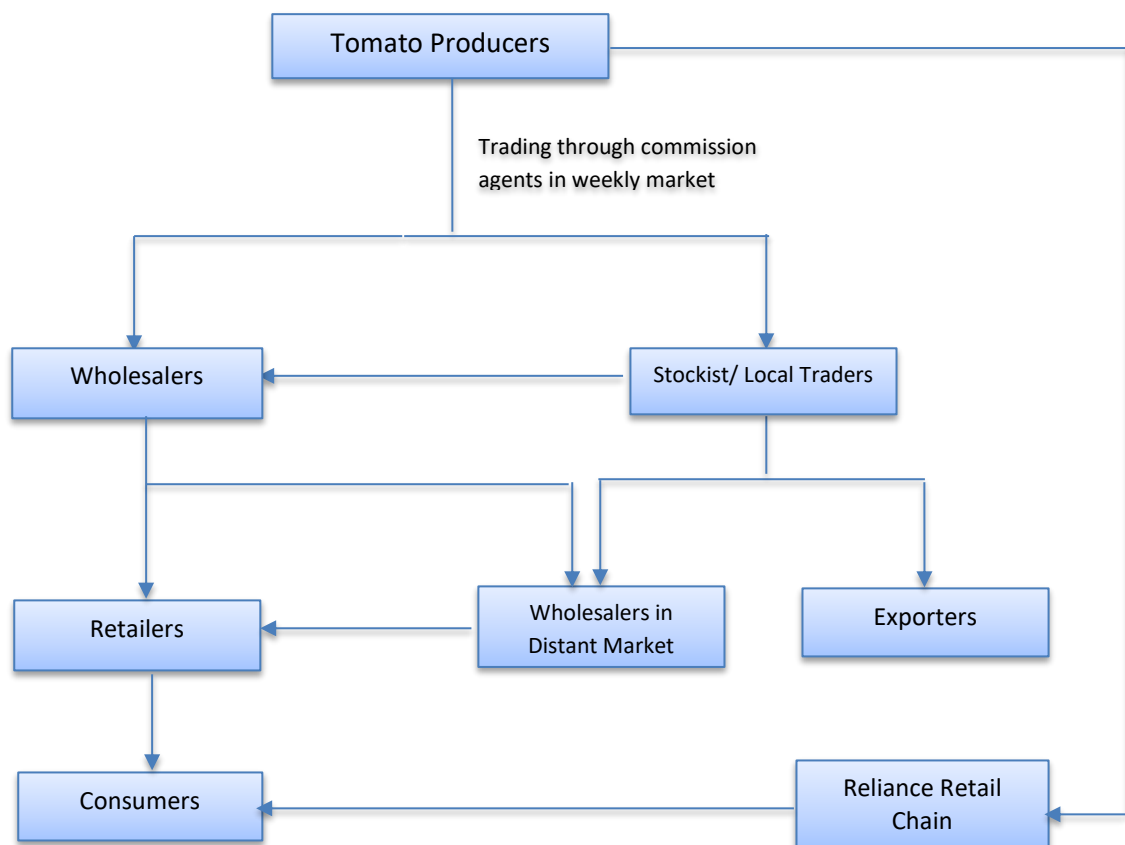


Figure 22: Marketing channel of tomato in Ranchi

Supply chain of vegetables is too long and fragmented where intermediaries collect a sizeable share from the price of the produce. Weekly mandi system has number of inefficiencies like non-transparent price setting where both seller and buyer are often cheated; huge losses occur due to non-scientific handling and storage. There exists inadequate infrastructural support in the

government regulated supply chain leading to losses as high as 20 to 30% in case of vegetables, especially tomato.

During the survey, it was observed that in Ranchi district, most of the farmers are not progressive and they do not have much knowledge about markets. They sell their best quality of produce directly to local traders/commission agents, wholesalers/stockists in the nearby local weekly markets. Sometimes many traders/commission agents reach the road side and bargain with farmers on the way to the market and offer them very low price. Being outside the mandi, farmers are not aware of prevailing prices of their produce and hence sell the produce to the traders at very low price. Such farmers get very depressed later, when they come to know about the actual value of their produce. Most of the farmers in the district are marginal and small and therefore have low volume of produce. Hence, to save the transportation cost and time, they sell their produce in weekly market or sometimes on the road side on the way to the mandi. Very few farmers of these areas sell their produce to the big traders in cities like Ranchi. Most of the surveyed farmers (98%) of the district reported that they sell their tomato to the local traders/commission agents in local weekly market at their own.

About 68% of the farmers reported that they sell their tomato to the local traders and 31% reported about commission agents, 21% about the wholesalers and 12 % about retailers. Very few farmers sell their produce to aggregators/stockists. About 20% of the farmers also reported that they sell the left over or poor quality tomato directly to the consumers, as shown in the figure 23 below.

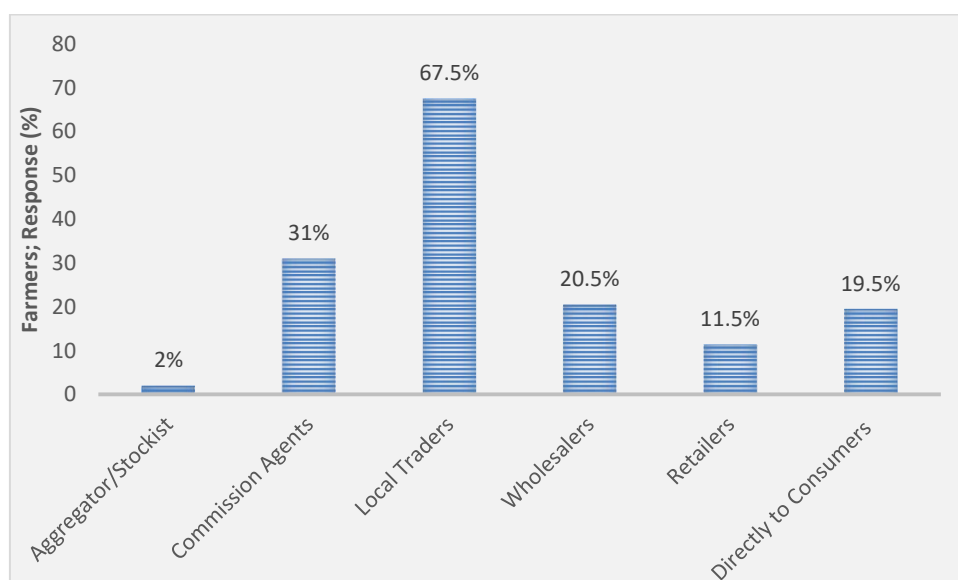


Figure 23: List of market intermediaries preferred by farmers

The farmers also reported that no traders come to their door step to collect/purchase tomato or to provide any type of facilities like transportation, packaging material etc. To bring the produce in the

mandi, most of the farmers use rented vehicles or trolley. To improve the quality of produce, only one out of 200 farmers reported that he uses preliminary treatment material like use calcium or boron at the stage of maturity or harvesting to enhance the quality of produce.

Also none of the farmers reported about the presence of any type of FPOs. Hence, there is a strong need for the formation of FPOs for the tomato farmers because in peak production season, farmers do not get good price. Sometimes they prefer to throw their tomato on the road side or leave in the field itself. Therefore, to get good price it is necessary to start aggregate marketing so that they can sell their produce directly to the big traders in the city or to the big traders of other states. This can also create fear among local traders and force them to offer better price to the farmers. So, by doing this, farmers can also control price offered by local traders/commission agents to some extent.

None of the farmers also reported about any type of processing unit, exporters, contract farming and about retail chain to buy their products directly from their farms. Few farmers (only 4%) reported about alternate marketing system like private market and do direct marketing to sell their produce. Therefore, to reduce the losses during glut situation, Government should focus on the development of processing units, export facilities, contract farming and formation of FPOs. Due to non-availability of these facilities, local traders and commission agents have full control on the market. As a result farmers face many problems like inadequate market information, misleading by traders, deducting higher charges, high commission rate, multiplicity of charges and offering lower prices to the farmers. During the survey, about 80% of farmers also reported that they do not get adequate market information and nearly 10% of them reported about misleading information. Regarding malpractices in the market, about 46% of the farmers reported that traders quote lower price than actual price of the produce. Few farmers also reported about multiplicity of charges and high commission rates as mentioned in the table 29 below.

Table 28: List of constraints and challenges faced by farmers

S. No.	Post-harvest practices	Problems	Farmers' response	
			Nos.	%
1	Market intelligence	Information available for limited markets only (inadequate information)	159	79.50
		Misleading information	19	9.50
		Inadequate information and misleading information	8	4.00
		No problem	14	7.00
2	Mandi infrastructure	In-adequate space available in mandi	21	10.50
		Non availability of auction platforms	25	12.50
		Non-availability of adequate staff for auction	88	44.00
		Non-availability of storage facility in mandi	80	40.00
		No problem	10	5.00
3	Malpractices in the markets	Deduct higher charges	14	7.00
		Higher commissions	32	16.00
		Multiplicity of charges	40	20.00
		Deduct under charges	37	18.50
		Quote lower price than actual prices	92	46.00
		No problem	11	5.50
Total no. of farmers			200	

Many farmers also reported about the challenges they face in daily marketing of their tomato like non-availability of Govt. Staff for auction, lack of storage facilities and insufficient space for marketing. During the survey, about 44% farmers told about lack of Govt. APMC staff during auction, 40% about lack of storage facilities, 13% about non-availability of auction platform and 11% about insufficient space for marketing of tomato as mentioned in the above table 29.

5.2.3.2 Main market and sources of information

About 98% of the farmers reported that they sell their produce to the traders of local weekly market because it is very close to their village and thus save time and transportation cost. Average distance of local weekly market reported by farmers is 8 km and its distance varies from 2 to 15 km. Main weekly markets as reported by the farmers are Brambe, Nagri, Bhuiyadih, Makhmandru, Bijupad, Mandar, Ratu, Umedanda and Santranji. Average price of tomato in these market varies from Rs. 766 to 1600 /q. Farmers get maximum price of their tomato in Makhmanru weekly market. Average price of tomato the farmers get in these markets is Rs. 10.19/kg as shown in the table 30 below.

Table 29: List of main weekly markets, average price and distance from the farm

Main weekly market	Farmers' response		Market information	
	Number	%	Average distance	Average market price (Rs./q)
Bhuiyadh	40	20	4.61	1372.75
Bijupad	14	7	9.07	985.71
Brambe	56	28	13.56	892.71
Makhmandru	30	15	4.95	916.67
Makhmanru	5	2.5	1.00	1600.00
Mandar	16	8	9.81	881.25
Nagri	40	20	8.24	955.00
Ratu	9	4.5	11.38	1025.00
Umedanda	3	1.5	1.67	766.67
Santranji	1	0.5	15.00	800.00
Grand total	200		7.93	1019.58

The reasons to select these markets are; high prices, less transportation cost and convenience to the farmers for selling their produce. About 37% of farmers reported that they prefer these markets as these are close to their place and thus they save transportation cost in addition to high price they receive in these markets. Very few farmers reported about convenience caused as listed in the figure 24 below.

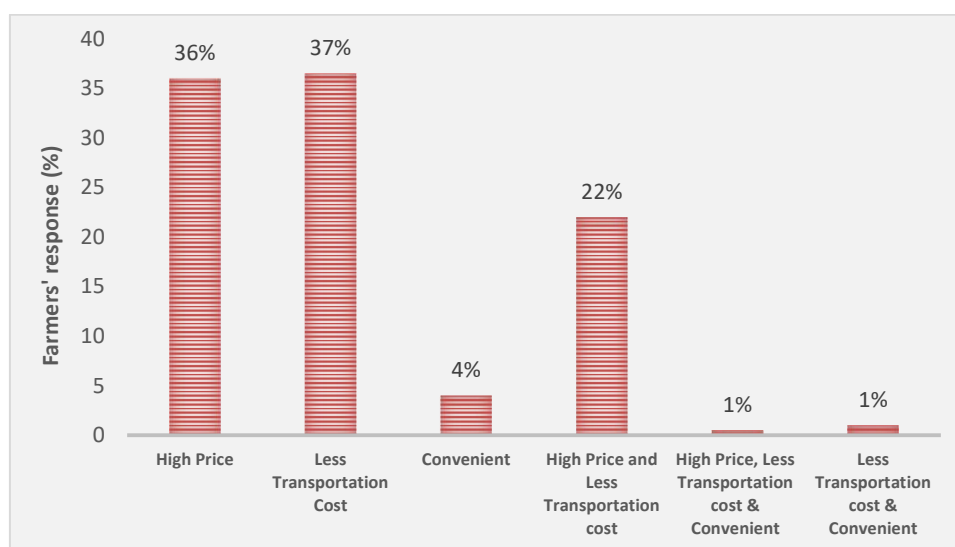


Figure 24: Factors considered by farmers in market selection

In Jharkhand state, there are 28 APMCs. In Ranchi, APMC mandi is located in Pandra and under that APMC there are a number of weekly markets where farmers sell their horticulture produce like tomato. In April 2015, supervision power of APMC officials was withdrawn by state Government. Now APMC officials do not have power to control the traders in these weekly markets, and these are being managed by traders as per their convenience. They often cheated farmers a lot. Even the market fee being charged earlier has been abolished which indicates that weekly markets are totally

trader oriented now in the district. APMC in Pandra has many facilities and lot of space for trading but no farmer brings his produce there because of longer distance from the village. E-NAM has also started in 19 APMCs of Jharkhand including APMC of Pandra where Government is providing the following facilities:

- Online trading facilities
- E-auction hall
- E-Kisan Bhawan
- Three desktops, one laptop, printer with internet connection for e- trading
- TV and cooler

However, only very few traders and farmers have traded through e- trading platform because most of the farmers do not want to come as they have fear of no sale of these. As per Agriculture Marketing Board officials, a total of 11333 quintals of produce bearing a value of one crore ninety lakh rupees has been traded through e- trading (e-NAM Platform) till date. In Jharkhand, a unified license is also needed through which any traders from any city can trade through e - trading platform.

Besides APMC, there is also an IQF unit of Safal in Nagri and Reliance Fresh collection centre but they purchase only good quality of vegetables. Reliance Fresh has one of its collection centres in Tamar to purchase good quality of tomato. Presently, Safal is in second phase of expansion and has plan to purchase tomato from farmers also. During the previous year, it distributed planting material of tomato to many farmers but did not purchase the produce from them, but in future they have plan to purchase tomato also from farmers. There is no processing unit of tomato in Ranchi district.

The potential markets for tomato growers in Jharkhand are daily markets in Ranchi, Bokaro, Dhanbad, Jamshedpur, some town of West Bengal, Odisha, UP and Chhattisgarh, and Patna, Bihar sharif & Hajipur in Bihar. All the traders in weekly markets purchase tomato and send it to different neighbouring states. They take order on phone from big traders of different markets and take order on phone and purchase the produce as per the requirement and send to them.

5.2.4 Price realization of tomato

5.2.4.1 Price build up

In market survey, it is observed that, approximate 68% of tomato in the mandi is purchased by local traders, 31% directly by commission agents/arhatiya, 21% by wholesalers and 12% by the retailers. Local traders/commission agents, after procurement of tomato from farmers sell it to the local wholesalers or stockists, wholesalers in distant markets and to local retailers at average margin of

Rs. 98 /q. Wholesaler/stockist sell the procured tomato to big wholesalers within or outside the state, retailers, bulk consumers and street vendors at an average margin of Rs. 156.25/q. Tomato reaches the end consumer through retailers, who sell tomato to the consumers after getting average margin of Rs.300/q. Among all the players in the supply chain, retailers get the highest net profit. Net profit at farmers' level is only Rs.1.27/kg as shown in the following table. It is because of bumper production of tomato in the peak season that causes lower price of tomato. Farmers do not have sufficient storage facility to hold the tomato for longer period. Due to non-availability of sufficient storage facility, farmers are compelled to sell during peak production period which leads to lower price realization. Traders procure the tomato in peak season and sell to the distant city markets and get better margin.

Table 30: Price buildup of tomato

Stakeholder	Components	Price realization at different levels	Wastage per kg (%)	Activity-wise cost (Rs./kg)
	Farmer net price (Rs./Kg)	1.27		
Farmer	Cost of cultivation			4.3
	Cost of transportation from farm/home to market (transportation and packaging)			0.29
	Cost incurred in cleaning and sorting			0.27
	Cost incurred during sales at the most prevalent market			0.18
	Total losses (during harvesting, transportation, cleaning & sorting grading, storage and marketing)		9.86%	0.69
	Selling price of farmer	7		
Local Traders/commission agents/arhatiya	Grading, sorting, weighing and packaging			0.23
	Packaging material cost			0.08
	Storage			0.00
	Loading & unloading cost			0.17
	Mandi fee			0.00
	Wastage during sorting, cleaning & transportation		2.00%	0.14
	Commission (8%)			0.56
	Margin			0.98
	Other cost			0.08
	Selling price	9.24		
Wholesalers	Laour charges (loading & unloading)			0.20
	Transportation cost			1.00
	Cleaning, sorting, grading & weighing			0.26
	Wastage during sorting, cleaning & transportation and weight loss		9.38%	0.87
	Margin			1.56
	Selling price at commission agent point	13.12		
Local traders/retailer	Transportation, loading & unloading cost			0.81
	Sorting grading			0.11
	Loss due to transportation & sorting		11.25%	1.48
	Margin			3
	Selling price to the consumer	18.53		

5.2.4.2 Low price realization and price determination of tomato

The surveyed farmers have no facilities to get information regarding real price of vegetables in markets due to which they are unable to negotiate with the traders. They only contact their friends or relatives to get market information as reported by 68% of the farmers. In the survey, about 96% of the farmers reported that they get market information but most of the times from their farmer friends.

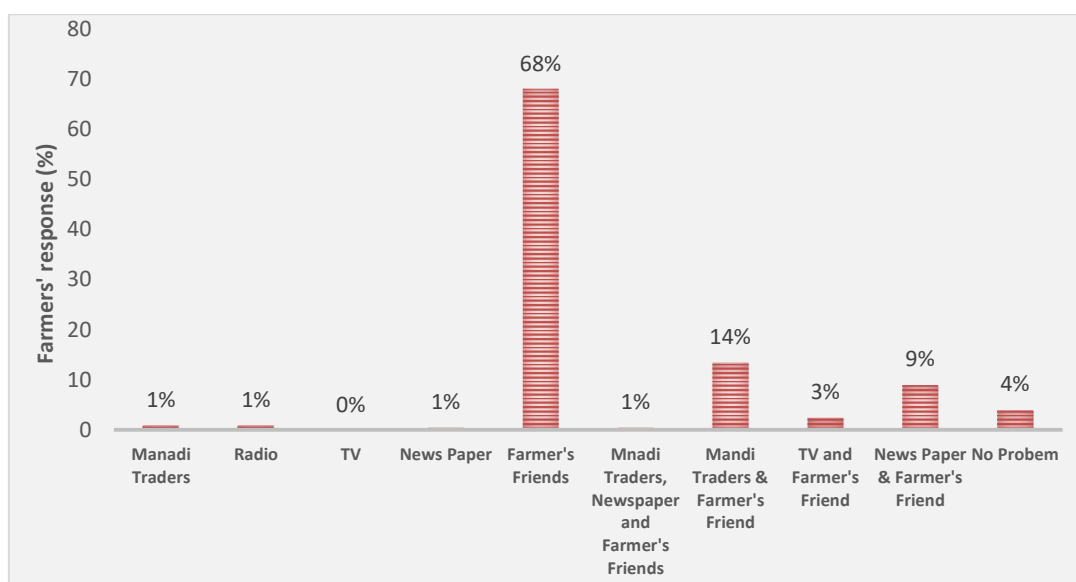


Figure 25: Sources of market information

During trading in the market, farmers face many challenges like forced sale due to lack of market information, very high commission, faulty weighing facilities & pricing, practices of bribing, inadequate grading & storage facilities and non-availability of credit facilities as shown in the table 26 below.

The responses given by tomato growers regarding their knowledge on various aspects of marketing revealed that absence of market information, faulty weighing /pricing facility and availability of inadequate grading facility in APMC/weekly mandi, and very high commission rate are the main problems faced by most of the farmers. Practice of bribing at the market, non-availability of credit facility and lack of storage facility are also highlighted by farmers as a major problem which is indicated in the following table. Due to these constraints, farmers get lower price of their produce.

Figure 26: Market constraints and challenges

Marketing constraints/problems	Weighted average			
	Rank-1	Rank-2	Rank-3	Rank-4
Forced to sell to the traders due to absence of market information	3.7	0.2	0.0	0.0
Non-availability of credit facility	0.7	2.1	0.3	0.0
Faulty weighing/pricing	0.7	1.4	0.6	0.0
Very high commission rates	1.5	1.1	0.5	0.0
Presence of exploitative middlemen	0.4	1.4	0.7	0.1

Practice of bribing at the market	0.2	1.6	0.7	0.1
Inadequate grading facility	0.4	0.9	0.9	0.1
No storage facility	0.9	0.1	0.1	0.8

6 Conclusion and Recommendations

Like any other agricultural commodity, tomato also suffers from unpredictable weather conditions like drought, unseasonal rainfall and hailstorms. Tomato growers give their best in tomato cultivation but due to many unfavorable conditions and, insect pests & diseases, they do not get good returns from their tomato crop. Tomato has round the year demand but sometimes, during peak harvesting season when supply of tomato in the market becomes very high, a glut situation is created in the market that leads to very low price of tomato. Due to this, tomato prices in the market fall suddenly and reach as low as Rs. 1 or 2 /kg, which is less than cost of cultivation (Rs.4.30 /kg) as reported by the surveyed farmers. In this situation, harvesting and transportation cost create extra burden on the farmers, and therefore, tomato growers are compelled to throw their tomato on road side or sometimes leave the produce in the field itself. Due to lack of other options like processing unit, export facilities and storage facilities in the surveyed area, farmers have limited options and depend only on local traders or local commission agents to sell their produce.

In the surveyed area about 68% of the farmers are marginal and 16% are small. Therefore, due to high transportation cost, they are also unable to sell their tomato in the other distant markets or in the city market to get better price. Also none of the farmers reported about the FPOs that could help them to sell their tomato in the aggregation to save harvesting and transportation cost.

In April 2015, supervision power of APMC officials in the APMC and weekly markets was withdrawn by the state Government. Hence, the APMC officials do not have power to control over traders any more. The weekly market is managed by traders as per their convenience. They often cheat the farmers a lot. Even the market fee being charged earlier has been abolished and this has created financial burden on APMC. The APMC in Pandra has many facilities and a lot of space for trading but no one brings the produce there because of longer distance from the villages. E-NAM (National Agriculture Market) also started in 19 APMCs of Jharkhand including APMC of Pandra. But only very few traders and farmers have traded through e- trading platform because most of the farmers are not sure whether their tomato will be definitely sold. Therefore, after the study we have come up with few recommendations that might help farmers and improve the value chain:

A. Replacement of low yielding varieties: Average yield of tomato in the country is 24 t/ha but in Jharkhand, it is only 12.68 t/ha. Hence, the Government should introduce high yielding varieties of tomato in the state and should also provide proper training on package of practices of tomato on a large scale so that farmers can produce large amount of tomato on same available land area.

B. Introduction of varieties suitable for processing: For processing point of view, the main constraint in India is the lack of improved cultivars suited for processing. Tomato varieties in India have been bred mainly for the fresh market. Therefore, to address this issue, the introduction of high-yielding varieties including open pollinated varieties suitable for processing is required. During the previous year, this type of initiative was also taken by Safal (Mother Dairy). It distributed tomato seedlings of processable varieties to the farmers in the district (as reported by the farmers). Therefore, Government should also encourage seed companies and facilitate them to develop locally adapted varieties that meet the quality requirements of the processing industry in India.

C. Productivity enhancement and reduction of production cost: During the course of discussion with farmers, it was found that the productivity is low and cost of production is high due to following reasons:

- Adoption of old cultivation practices
- Non-availability and lack of awareness about good quality seeds / planting material
- Agriculture being mostly rainfed
- Lack of timely availability of inputs and technical advice
- High labour cost
- Low and irregular monsoon
- Lack of extension services to guide about high tech farming
- Due to climate change, increase in pests and diseases and limited remedial measures
- Continuously raising rates of fertilizers, insecticides and pesticides

To resolve the above constraints, MIDH provide assistance in the following field:

- I. Adoption of old production practices can be resolved by promoting Precision Farming Development Centres (PFDCS) under MIDH. Twenty two PFDCs are anchored in SAUs, ICAR Institutes and IIT, Kharagpur. The ultimate goal of PFDC is to provide requisite information to farmers so that they are in a position to apply necessary inputs. For this purpose financial assistance would be provided to PFDCs from MIDH on project basis through the SHMs. PFDCs take up the activities such as trials, demonstrations for plasticulture and precision farming technologies for horticulture crops, survey to ascertain field adoption of the technology, training of farmers/ officials, display centre, publicity etc.
- II. To meet the requirement of planting material, assistance is provided by MIDH for setting up new hi-tech nurseries and small nurseries under the Public as well as Private sector.

- III. Agriculture in the state is mostly rainfed. Irregular & low rainfall/monsoon also adversely affects the production and productivity of crop, therefore, to resolve these issues, MIDH is providing assistance for the development of water resources.
- IV. High labour cost and non-availability of sufficient manpower are one of the most critical constraints faced by most of the farmers. Horticulture mechanization is one of the solutions to improve farm efficiency and reduce drudgery of farm work force and by promoting horticulture mechanization under MIDH.
- V. Due climate change, increase in pests and diseases attack and limited remedial measures can be resolved by promoting INM/IMP. MIDH provides assistance for Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) for horticultural crops.
- VI. Continuously rising rates of fertilizers, insecticides and pesticides can be resolved by using organic farming and INM/IPM under MIDH scheme.

Therefore, it is recommended that Government should spread awareness among the farmers about the availability and benefit of above scheme of MIDH, so that they can improve their tomato yield and reduce cost of production. It will also help farmers to get better margin of their produce.

- D. Infrastructural development:** Area and production of tomato in the state or in the country is increasing year after year which indicates that farmers are taking more interest in tomato production due to better returns. Many farmers also changed their cropping pattern and started doing vegetables/tomato cultivation instead of cereal crops. However, due to its high perishability of tomato and limited marketing option, farmers remain helpless and sell their produce only to the local traders in the weekly markets. None of the farmers in the surveyed area reported about availability of processing units, export facilities and storage facilities that could help farmers to hold their tomato during glut situation. Many traders in the weekly markets also reported about the need of primary processing unit like sorting, grading and packaging facilities. Therefore, it is recommended to establish primary & secondary processing units, export facilities and storage facilities to get better price in the peak season or in glut situation. It will also help to a great extent in the reduction of losses in tomato value chain.
- E. Increasing awareness regarding grading and standardization of tomato:** A large number of tomato farmers have little knowledge of the practice of the grading of the produce prior to its sale. They usually pick up superior and inferior quality products to make a single lot. As a result, they get a lower price for their tomato produce. These practices have lowered the market

prestige and consumers have lost confidence in the quality of the product. Therefore, it is recommended that Government should spread awareness among the farmers regarding post-harvest management of tomato after harvesting and also establish integrated pack house in the Rural haat/weekly market so that farmer could get better price of their produce.

- F. Promotion of farmers' groups:** In Jharkhand state, about 68% of the farmers are marginal and 16% are small. Since small and marginal farmers do not have enough amount of produce, they cannot sell it directly to the big wholesalers or organized retail chains as they buy good quality tomato in large quantities. In the market, traders and other market intermediaries have their strong associations or unions while farmers do not have such organizations for the safeguard of their interest. As such, the practices prevalent in the trade circles are usually biased against the farmers, resulting in low price offer, high charges of marketing and inconveniences to the farmers at the time of sale. Therefore, state Government should promote formation of farmer producers' groups who could do the business together. It would not only help in reduction of total cost but would also increase net price realization by individual farmers.
- G. Infrastructural support at farmers' group level:** During the last few years, promotion of FPOs is taking place and Govt. has been successful in making it. It is a question of its sustainability now and small interventions at each FPO level can bring a significant change in Indian farming techniques. In case of tomato growing areas, small pulping machines can be established at selected FPOs which would lead to reduced post-harvest losses and better price realization for the farmers. Farmers' will be encouraged to increase tomato yield and area under it.
- H. Control of Government in weekly markets:** In April 2015, the supervision power of APMC officials in the APMCs and weekly markets was withdrawn by the state Government. As a result, APMC officials lost their power to control traders in the weekly markets which lead to, weekly markets being managed by traders as per their convenience. They cheated farmers a lot. Even market fee is also removed from market that created financial burden on APMC. Therefore it is recommended that state Government should provide at least supervision power to APMC officials and instruct them to depute one of their staff in the weekly market to monitor fair trading.
- I. Ending the malpractices from weekly markets:** Many malpractices such as deduction of unauthorized market charges, spurious deductions, unfair weighing of the tomato, unhealthy sale method, taking away a part of the produce as sample *etc.* are common in the marketing of tomato and other vegetables in the weekly markets/rural haats. Malpractices become more

frequent when the farmers have low economic status, little or no education and weak bargaining power. As a result, the producer's share in the consumer's rupee is very low. Therefore, it is recommended that open auction of vegetables should be strongly promoted under the supervision of APMC/Marketing Board officials in the weekly markets/rural haats.

- J. Price Determination:** The prices of tomato products fluctuate not only from year to year, but also the year from month to month, day to day and even on the same day. The changes in prices may be upward or downward. These prices are generally determined by the agents and traders. Sometimes, the price received by farmers is not in accordance with the production cost. Therefore, it is recommended that Government should fix MSP for tomato so that farmers receive price at least equal to the cost of production.

- K. Proper Implementation of e-NAM:** The APMC in Pandra has many facilities and lot of space for trading but no farmer bring his produce there due to longer distance from the village. E-NAM was started in 19 APMCs of Jharkhand including the one at Pandra in Ranchi. But only very few traders and farmers had traded through the e- trading platform because farmers were not sure that their produce will be sold there. Therefore, Government should spread awareness among farmers and traders about the benefits of the online trading through e-NAM platform. Also the sale of their produce must be assured.

- L. Market Information:** In the surveyed area, most of the surveyed farmers reported that they know market information only through farmers' friends and relatives. There is no other source of information available in the market. Therefore, it is recommended that Government should start mobile based SMS facilities to spread real time market information for the tomato growers.

- M. Establishment of Alternate Marketing System:** It was observed that there is no cooperative and private sangh in the district. Therefore, majority of the tomato growers in the study area sell a large part of the produce in villages in the weekly markets either directly to the consumers or to the commission agents. Producers rush personally to the market or through commission agents to sell the produce in these markets. Hence, they do not get reasonable rates. In these weekly markets, few small and marginal farmers with low quantity of their produce, who wish to sell on their own, are forced to sell their produce on the road side without any shelter as most of the space is occupied by big traders. This eventually leads to a large volume of loss, resulting in lower return for their produce. Therefore, to avoid the malpractices and exploitation of farmers by the commission agents

and local traders, it is necessary to establish a co-operative marketing system/private market sangh that will increase competition among traders and help farmers to get good return of their produce.

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List of farmer with contact details

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3	SahdevMahtoh	Buda Khukhra	Mandar	Ranchi	9060807131
4	Vijay Thakur	Buda Khukhra	Mandar	Ranchi	7050905044
5	Jitu Ladka	Buda Khukhra	Mandar	Ranchi	7764017230
6	Sukhram	Buda Khukhra	Mandar	Ranchi	7250918518
7	Kalpan	Buda Khukhra	Mandar	Ranchi	9661697785
8	Mh. Islam	Buda Khukhra	Mandar	Ranchi	7764837619
9	Sharof Anshari	Banjhila (Pokhar Toli)	Mandar	Ranchi	7261821410
10	Asaraf Ansari	Banjhila (Pokhar Toli)	Mandar	Ranchi	9835241446
11	Aalam	Banjhila (Pokhar Toli)	Mandar	Ranchi	9955433192
12	Abdul Ansari	Banjhila (Pokhar Toli)	Mandar	Ranchi	9798225465
13	Shadat Awashari	Banjhila (Pokhar Toli)	Mandar	Ranchi	9934843505
14	Basuradeen	Banjhila (Pokhar Toli)	Mandar	Ranchi	7464095828
15	Lakhna Kuchhar	Banjhila (Pokhar Toli)	Mandar	Ranchi	9162365508
16	Charwawra	Banjhila (Pokhar Toli)	Mandar	Ranchi	
17	Jaleshwar Sah	Mahuwa Jadi	Mandar	Ranchi	8969950545
18	Isoul Ansari	Mahuwa Jadi	Mandar	Ranchi	
19	Kalindar Gop	Mahuwa Jadi	Mandar	Ranchi	7320936294
20	Jataru Uraon	Mahuwa Jadi	Mandar	Ranchi	8809503551
21	Rajkumar Singh	Mahuwa Jadi	Mandar	Ranchi	9771666363
22	Maton Shah	Mahuwa Jadi	Mandar	Ranchi	8002896103
23	Dara Singh	Mahuwa Jadi	Mandar	Ranchi	7250496142
24	Shiv Sharvan	Mahuwa Jadi	Mandar	Ranchi	9931055452
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26	Muktar Ansari	Sargaon Murjuli	Mandar	Ranchi	9162674958
27	Kalam Anshari	Sargaon Murjuli	Mandar	Ranchi	
28	Brajakishar	Sargaon Murjuli	Mandar	Ranchi	8102341444
29	Tarkeswar Singh	Sargaon Murjuli	Mandar	Ranchi	9835550544
30	Nawal Kishor Singh	Sargaon Murjuli	Mandar	Ranchi	9546649493
31	Babar Singh	Sargaon Murjuli	Mandar	Ranchi	8789628460
32	Akhilesh singh	Sargaon Murjuli	Mandar	Ranchi	9708331351
33	Mahesh Urwa	Gudgud Jadi	Mandar	Ranchi	8521655031
34	Bharata Urwa	Gudgud Jadi	Mandar	Ranchi	8404822634
35	Sobha Urwa	Gudgud Jadi	Mandar	Ranchi	8809790073
36	Ashwini Kumar Hajam	Gudgud Jadi	Mandar	Ranchi	9523242179
37	Gandura Ram	Gudgud Jadi	Mandar	Ranchi	9102271121
38	Telanga	Gudgud Jadi	Mandar	Ranchi	9973996731
39	Sujit Urwa	Gudgud Jadi	Mandar	Ranchi	9006873964
40	Magra Urwa	Gudgud Jadi	Mandar	Ranchi	7762914615
41	Charka Munda	Aara Chakme	Burmu	Ranchi	9955785045
42	Dhameshar Prasad	Aara Chakme	Burmu	Ranchi	9572650691
43	Munua Munda	Aara Chakme	Burmu	Ranchi	7761849432
44	Mahesh Prasad	Aara Chakme	Burmu	Ranchi	8521159992
45	Diwakar	Aara Chakme	Burmu	Ranchi	9921192726
46	Vicky Kumar	Aara Chakme	Burmu	Ranchi	9939897567
47	Maheshwari Prasad	Aara Chakme	Burmu	Ranchi	9955530149
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52	Madhusudhan Sahu	GinJo Thakurgaon	Burmu	Ranchi	9973372378
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55	Ashok Shahu	GinJo Thakurgaon	Burmu	Ranchi	8809025494
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57	Sadik Anar	Umedanda	Burmu	Ranchi	9801555874
58	Sahil Ansari	Umedanda	Burmu	Ranchi	8084018005
59	Ajad Aansari	Umedanda	Burmu	Ranchi	9661115473
60	Anwar Ansari	Umedanda	Burmu	Ranchi	7321943434
61	Mahadev Shah	Umedanda	Burmu	Ranchi	8969290147
62	Balram Shah	Umedanda	Burmu	Ranchi	9771255095
63	Sharjun Shah	Umedanda	Burmu	Ranchi	9006608934
64	Sadbrit Naik	Umedanda	Burmu	Ranchi	8809916204
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92	Manu Oraon	Halhu	Nagri	Ranchi	9631209552
93	Raju Mahil	Halhu	Nagri	Ranchi	7782813057
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99	Jamanvell	Kesharo	Nagri	Ranchi	
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102	Anup Sahan Kachhap	Kesharo	Nagri	Ranchi	9534105102
103	Pawan Tirki	Kesharo	Nagri	Ranchi	7480022718

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108	Daud	Bandhiya	Nagri	Ranchi	9973675481
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110	Punal	Bndheya	Nagri	Ranchi	9110101349
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114	Sanika Munda	Singpur	Nagri	Ranchi	
115	Manoj Munda	Singpur	Nagri	Ranchi	7260066400
116	Lodhu Munda	Singpur	Nagri	Ranchi	9931588597
117	Lal Singh Munda	Singpur	Nagri	Ranchi	
118	Bhadwa Tirki	Singpur	Nagri	Ranchi	7033957064
119	Vinay Singh	Singpur	Nagri	Ranchi	9631207929
120	Nagvar	Singpur	Nagri	Ranchi	7321031068
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131	Husna Uraon	Hurhuri	Ratu	Ranchi	8877146698
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149	Sabhau Ansari	Puriyo	Ratu	Ranchi	9162964974
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151	Charo Uraon	Puriyo	Ratu	Ranchi	9934747693
152	Adnin Minze	Puriyo	Ratu	Ranchi	8051114944
153	Sujit Khalkha	Makhamndaru	Ratu	Ranchi	
154	Mange Uraon	Makhamndaru	Ratu	Ranchi	9523007167
155	Jay Mangal Uraon	Makhamndaru	Ratu	Ranchi	
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157	Suresh Mahto	Makhamndaru	Ratu	Ranchi	

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160	Vimla Khalkho	Makhamndaru	Ratu	Ranchi	8292411014
161	Madan Mahto	Baburamdih	Tamar	Ranchi	8294910294
162	Narsingh Manghi	Baburamdih	Tamar	Ranchi	9798386460
163	Santosh Mahto	Baburamdih	Tamar	Ranchi	9570861600
164	Kartik Mahto	Baburamdih	Tamar	Ranchi	7280983947
165	Nakul Puran	Baburamdih	Tamar	Ranchi	9693802633
166	Man Mohan Mahto	Baburamdih	Tamar	Ranchi	9771120806
167	Ashok Kumar Mahto	Baburamdih	Tamar	Ranchi	9771120808
168	Sunil Kumar	Baburamdih	Tamar	Ranchi	7549360229
169	Meshnath Lohra	Kasidih	Tamar	Ranchi	8757531173
170	Dev Nath Lohra	Kasidih	Tamar	Ranchi	7479960595
171	Mahabir Mahto	Kasidih	Tamar	Ranchi	9973212220
172	Jagannath Lohra	Kasidih	Tamar	Ranchi	7632857077
173	Chand Singh Mahto	Kasidih	Tamar	Ranchi	7361905145
174	Shiv lal Mahto	Kasidih	Tamar	Ranchi	9931229718
175	Himat Mahto	Kasidih	Tamar	Ranchi	9570081129
176	Gorupado Mahto	Kasidih	Tamar	Ranchi	9110931982
177	Maheshwar Munda	Brundadri	Tamar	Ranchi	
178	Arjun Mahto	Brundadri	Tamar	Ranchi	9771775303
179	Fegua Munda	Brundadri	Tamar	Ranchi	
180	Manki Munda	Brundadri	Tamar	Ranchi	9801743161
181	Bhagrath Mahto	Brundadri	Tamar	Ranchi	8210460257
182	Dhavidhan Mahto	Brundadri	Tamar	Ranchi	9570310398
183	Karan Singh Munda	Brundadri	Tamar	Ranchi	7361030784
184	Guru Charan Mundo	Brundadri	Tamar	Ranchi	7250589084
185	Ravindra Singh Munda	Hadam Lohar	Tamar	Ranchi	9939967959
186	Naresh Singh Mundo	Hadam Lohar	Tamar	Ranchi	7258011122
187	Prakash Paramjit	Hadam Lohar	Tamar	Ranchi	7870373303
188	Jado Prasad Hajana	Hadam Lohar	Tamar	Ranchi	8084139110
189	Madan Kumar Hajam	Hadam Lohar	Tamar	Ranchi	9523246894
190	Sudhir Hajam	Hadam Lohar	Tamar	Ranchi	7070931139
191	Krishna Pramanik	Hadam Lohar	Tamar	Ranchi	9934778834
192	Aamin Singh Munda	Hadam Lohar	Tamar	Ranchi	8521420830
193	Ramlal Mahto	Birdih	Tamar	Ranchi	9162917337
194	Hare Krishna Mahto	Birdih	Tamar	Ranchi	9572352195
195	Depti Mahto	Birdih	Tamar	Ranchi	7292934620
196	Krishna Mahto	Birdih	Tamar	Ranchi	9162917337
197	Parwati	Birdih	Tamar	Ranchi	7256020830
198	Kailash Mahto	Birdih	Tamar	Ranchi	8002858962
199	Jagarnath	Birdih	Tamar	Ranchi	7091262918
200	Yogeshwar Mahato	Birdih	Tamar	Ranchi	7541994708