RAJASTHAN AGRICULTURAL COMPETITIVENESS PROJECT

Value Chain Analysis

Wheat

Prepared by:

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AGRI BUSINESS PROMOTION FACILITY
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Executive Summary: Wheat

Wheat is globally the leading source of carbohydrate in human food, with a content of about 71%. Apart from this, wheat is also a good source of protein (13%), fibre and magnesium. Different products of wheat commonly being used are atta (whole meal), maida (white flour), suji (coarse semolina), rawa (fine semolina), vermicelli and noodles. Wheat is the third largest cereal produced after maize and paddy and its output stood at 700 million tons in 2013-14.

The major wheat producing countries in the world are China, India, USA and Russia. Although India has the largest area under wheat cultivation but it is the second largest producer to China due to lower yields than China. In terms of exports, U.S. has always been the top exporter of wheat contributing nearly 1/5th of the total world’s exports. The exports from Australia have also been rising steadily from the late 2000s. Algeria was the largest importing country in the world followed by Italy, Indonesia and Japan in the year 2015-16. Algeria was the largest importing country in the world followed by Italy, Indonesia and Japan in the year 2015-16.

India’s share in the world for the area under wheat cultivation is about 12.4%, whereas it occupies 11.77% share in the total world wheat production. In India, nearly 85% of the total wheat production comes from 5 states in 2013-14 which are Uttar Pradesh, Punjab, Haryana, Madhya Pradesh and Rajasthan. Depletion in the irrigated water resources in some of the states like Rajasthan is encouraging farmers to explore less water intensive crops like pulses, oilseeds, maize/corn and fruits and vegetables or barley. India’s wheat production has increased in last 10 years at CAGR of 2.46%. The area under wheat cultivation has also increased in last 10 years at CAGR of 0.77 percent.¹ There is hardly any scope for expansion of area under Wheat. The main emphasis would be on increasing the productivity of Wheat by adopting the improved cultivation practices.

India exports significant quantity of wheat to Bangladesh, Nepal and U.A.E. Presently, Rajasthan accounts for 7.49% of the total wheat production and 7.24% of the wheat area in India. Ganganagar, Hanumangarh, Bharatpur, Kota, Alwar, Jaipur, Tonk, Sawai Madhopur, Udaipur, Chittorgarh and Pali are important wheat producing districts of the state. Wheat is included as a value chain crop in Palayatha, Jakham, Gudha and Orai-bassi clusters under RACP.

The commercial varieties grown in the state includes LOK-1, Raj-3037, Raj-3765, GW-496 and GW-322. A range of value added products are processed from different varieties which are Indian hard wheat (IHW) for wheat, Indian medium hard wheat (IHHW) for chapatti, Indian soft wheat (ISW) for biscuits and Indian durum wheat (IDUW) for pasta and traditional products. Sowing of wheat takes place in late October till early December in various parts of the state. Harvesting of wheat is carried out in the month of March-April.

¹ http://agricoop.nic.in/sites/default/files/Wheat.pdf
Since wheat is an important food item, its transactions take place in most of the markets of the country. Important wheat markets of Rajasthan are Kota, Alwar, Jaipur, Sriganganagar, Dausa, Hanumangarh, Sikar, Baran, Bundi, Bharatpur and Pali. Prices of wheat have shown a steady increase due to increase in price of MSP.

Some important support institutions for wheat in Rajasthan are Department of Agriculture, Govt. of Rajasthan who provides extensive support through their team of State/District/ Tehsil and Panchayat level officials on; recommended package and practices for the crop, mini kits for crop demonstration and subsidy support on certified seed distribution to farmers. Other support structures of the Department of Agriculture are the Rajasthan State Seed and Organic Production Certification Agency, The Rajasthan State Seeds Corporation Ltd, the State Institute of Agriculture Management, Rajasthan State Warehousing Corporation, Department of Agriculture Marketing and Rajasthan State Agriculture Marketing Board who contribute to the productivity, storage and market linkage of the crop. Apart from this, there are various Krishi Vigyan Kendras around Jaipur, Alwar and Kota attached through State Agriculture Universities/ ICAR also contribute in terms of seed production, technology demonstration and post-harvest management of the crop. RARI, Durgapura has also played a significant role in production of improved varieties of wheat contributing to both production and productivity in the State. Other support institutions in Rajasthan include the ATCs of the State Government who help in technology demonstration and scientific trial of various varieties for recommending PoP for the various agro-climatic regions for the crop. Wheat is notified commodity and most of the sales by farmers are conducted in various regulated markets through the MSP procurement system. Both the central and state government agencies like NAFED and RAJFED However, under Market Intervention Scheme (MIS), Food Corporation of India and other organizations procure wheat directly from producers at their collection centres.

The gross yield per acre is 50 quintals per ha. The market rate of the sale is about Rs. 1600 per quintal or Rs. 80000 per ha. The cost of cultivation is about Rs. 43150 per ha. Net realization per is about Rs. 36850 per ha. The additional earning from straw can be between Rs 12500 to 15000 depending upon the method of harvesting. Wheat is a water consuming crop and hence the focus of various Government agencies is shifting towards low water requiring crops making a balance in food security and water use efficiency.

A SWOT analysis of the Wheat value chain highlights that India is the second largest producer of wheat in the world after China and accounts for 8.7 per cent of the world’s total wheat production. Rajasthan accounts for 7.49 per cent of total production and 7.24 per cent of area under wheat in India. Over 20 districts are producing wheat and 11 are major producers’ viz. Ganganagar, Hanumangarh, Bharatpur, Kota, Alwar, Jaipur, Chittorgarh, Tonk, Sawai Madhopur, Udaipur and Pali. There is large scope of value addition in wheat such as flour, maida, suji and others. Demand for wheat flour, breads, cookies, cakes, frozen doughs, and frozen baked foods are ever growing.

But when it comes to its disposition in the target clusters of RACP, one finds that there is lack of knowledge of wheat production technologies among the local farmers. They also face the non-availability of improved & good quality seed. There is lack of grading and storage facilities. There is inadequate infrastructure/ facilities with producers, traders, millers and at market level resulting in marketing inefficiencies. The large number of intermediaries in the chain leads to low income to producer which eats into the margins of farmers. Obsolete techniques are being used in processing, which reduces output. There is lack of sufficient irrigation at critical stages of growth adversely impacts yield. Wheat requires 5-6 irrigation. Fluctuations in supply (based on production), coupled
with export-import dynamics, make prices of Wheat unstable which obviously affects producers and consumers both. Inadequate sorting, grading facility near production site fetches lesser price to farmers. There are sizeable post-harvest losses due to in-efficient storage practices. The procurement is mostly controlled by large players apart from State governments. There is also non-availability of private storage facilities/silos near production centres for storing round the year.

These weakness can be removed with the intervention opportunities such as setting up a FPC in the cluster which would then have a scope for tie up of FPCs through FCSC with firms like Aashirvad, Patanjali, Kellog’s, MSME firms, housing societies in urban areas and retail outlets. There is also scope for facilitation of start-ups from amongst FPCs or individual entrepreneurs, in secondary processing of value added products of Wheat like flour, bakery products, etc. There is also scope for establishment of quality sorting and grading facilities as part of FCSC, along with facilities for packaging and vehicle to facilitate transportation. The FPC can then promote good agricultural practices with regard to planting, harvesting, use of inputs, disease management, pest control, etc. through FCSC. FPCs can also undertake joint input sourcing activities for seeds, fertilizers, pesticides, etc. under the umbrella of CFC or FCSC as well as facilitate custom hiring services and hence lead farm mechanization through CFC.

Though there would always be threat of vast stretches of sandy desert, scarcity of rainfall and paucity of irrigation facilities which have been restricting wheat cultivation in the State of Rajasthan Farmers are getting attracted towards less water intensive crops like pulses and Barley and/or cash crops.

The price spread and values accrued to stakeholders across the chain reflects the profit margins accrued to different stakeholders. Much of the value accruals are accrued to processors and retailers. Producers’ incomes are apparently dependent on yield as well as their dependency on the type of end product. (eg. Flour, Maida, Sooji, Bakery products etc.) Due to limited infrastructure facilities at the dispersal of various stakeholders, marketing efficiency is adversely affected.

Generally, in case of wheat flour, farmers get 53.7 % share in consumer rupee with a 83% return on investment after deducting cost of cultivation. The margin of other stake holders is; APMC trader – 2.15% (Rs 64), Primary processor 7.55% (Rs 225), Secondary processor 15.47% (Rs 461, Wholesaler 6.71% (Rs 200) and Retailor 14.43% (Rs 430) per quintal. However, after taking holding/operations/marketing cost into account, the profit margin of processors reduces up to 2-5% and that of retailers and wholesalers reduce by around 2-5%.

The pre and post intervention value chain for the commodity may be viewed as follows:

- **Pre intervention Value Chain: Wheat**

  Wheat is notified commodity and most of the sales by farmers are conducted in various regulated markets. However, under Market Intervention Scheme (MIS), Food Corporation of India and other organizations procure wheat directly from producers at their collection centres. Since wheat is an important food item, its transactions take place in most of the markets of the country. Producers bring the produce to assembling markets. Further distribution of wheat is handled by aartiyas in the mandi then stockists, cleaning/grading units and then processing units before reaching the consumers through distribution channels of wholesalers and retailers. The marketed surplus of wheat, which has been estimated to about 40 to 50 per cent of production, was sold by the producers through different channels.
The present pre-intervention or the value chain for Wheat may be viewed as one with three critical production-distribution or activity-marketing channels. The product is largely marketed by farmers through the APMC, local vendors and private processors. Channel 1 and channel 2 may be viewed in terms of one for wheat grains while the other one for processed products of wheat like wheat flour, catering to the institutional buyers such as hotels, canteens, etc. and urban and rural households respectively. The third channel deals with the consumers from foreign countries like Algeria, Indonesia who can take both wheat grains as well as processed and packaged wheat products. The producers market their produce in both value chains through local traders and APMC Commission agents largely. There are total post-harvest losses of 5-9% in the storage, handling, transportation of wheat at every stakeholder’ point.

- **Post intervention value chain: Wheat**

The post-harvest value chain may be viewed in terms of one additional channel being developed into value added products through start-ups in fortified atta, wheat flakes etc. where there are also large players like ITC (Aashirwad atta) and Kellogs. Also, FPC of farmers could be evolved to undertake primary processing, grading, sorting, and storage activities and also promote alternate markets.

The post intervention value chain map for Wheat may be visualised as one with the three production-distribution or activity-marketing channels: cleaned and graded wheat grain and value added products like wheat flour. It is also envisaged that PCs of producers with FCSCs is evolved. Such FCSCs undertake storage, drying, cleaning, grading and sorting and packaging of produce activity. These FCSCs may offer other related services in terms of input facilitation, custom hiring and facilitating B2B connectivity.

As it is clear in the below given proposed value chain map of maize, the FPC intervention would take away the direct share of 3% in the channel 1 while there would be direct benefit of additional 2% to the farmers. The remaining stakeholders would remain unaffected as such from the FPC intervention. The FPC intervention would benefit the farmers by providing them with the appropriate storage facility as well as drying systems (solar preferably). This would positively impact the post-harvest losses which would reduce to 2-3% as compared to previously. It would also improve the holding period at the cluster level any FPCs would have an added benefit of storage system. Also, the restructured value chain will have PC/s and their FCSC/s replacing Mandis and undertaking aggregation plus grinding and sorting and packaging services. The PCs need input facilitation, custom hiring and marketing of produce.

**Intervention Plan**

The intervention plan may be considered in terms of three critical stages that are production, post-harvest and processing. Weather conditions play a critical role in the crop production. At the post-harvest stage, the prices tend to decline as harvesting progress and produce starts flowing into the market. At the post-harvest stage information on the storage parameters, quality needs to be disseminated. The processing related constraints may be viewed in terms of limited awareness on the special licence option to source directly from farmers/FPCs. Also, at the post-harvest and processing stage there is scope to evolve FPCs to farmers with FCSCs which undertake primary processing and storage activity. The intervention table for Wheat is as under:

By way of conclusion, this report on the value chain of wheat clearly brings out that unlike any other enterprise, agriculture is highly dependent on external factors like nature and particularly climate for its success. This perpetual environment of high risk and vulnerability has significantly lowered farmers’ confidence and suppressed their entrepreneurial instincts as was reflected in the discussions held at the cluster level meetings. In the Wheat value chain, despite increasing input costs, all active players such as suppliers, transporters, processors, traders and corporates but for producer farmers have benefitted. Thus RACP along with the market driven interventions of ABPF, aims to aggregate farmers and help join hands for a collective cause, help and even push them move up the agriculture
value chains as to actively participate in market functions. This would spur vertical business integration and diversify their market channel mix to reduce their vulnerabilities.

In this regard, an important role of ABPF- GT would be to carry out capacity building initiatives of the potential leaders (BoDs) of the FPC, NGO staff and PMU staff line, conduct value chain studies of crops (market led), plan interventions required to improve returns to farmers in the 17 project clusters, help develop the business plans for the registered producer companies of clusters, support and assist agri start-ups in the region and thus, develop alternate and direct market linkages. The formation of FPC, supported by RACP ABPF, local NGOs and facilitation centres like KVKs, provides the much needed opportunity to farmers to positively re-orient their destiny.
Chapter 1- Introduction

Wheat is a cereal grain that belongs to the grass family of the genus ‘Triticum’. It is cultivated mainly in the temperate and sub temperate regions of the world. A dry, one seeded fruit named kernel is obtained from this spiky grass like grain, which is ground to make flour and is consumed throughout the world as one of the most important staple food.2

Although a number of species of wheat are recognized in the world, only three species of wheat namely; Triticum aestivum (Bread wheat), T. durum (Macaroni wheat) and T. dicoccum (Emmer wheat) are commercially cultivated in India.3 Wheat is globally the leading source of carbohydrate in human food, with content of about 71%, apart from this, it also contains 13% proteins which is very high as considered to cereals and hence is also a major source of proteins around the world.

Origin and Importance

The first cultivation of wheat occurred about 10 000 years ago, as part of the ‘Neolithic Revolution’, which saw a transition from hunting and gathering of food to settled agriculture. These earliest cultivated forms were diploid (genome AA) (einkorn) and tetraploid (genome AABB) (emmer) wheats and their genetic relationships indicate that they originated from the south-eastern part of Turkey (Heun et al., 1997; Nesbitt, 1998; Dubcovsky and Dvorak, 2007)4

The health benefits of wheat greatly depend upon the form in which it is consumed. While whole wheat is extremely nutritious, the benefits of wheat are reduced if it is eaten as white flour which is obtained by processing after only 90% extraction from the grain in Indian condition. In case of other countries like Europe/USA highly refined wheat is used and hence around 80% wheat is harvested after processing for consumption in the western pattern. Some of the health benefits of the whole wheat are as follows:

- High source of Carbohydrates
- Good source of protein
- Good source of fibre
- Good source of manganese and magnesium in its unrefined state.5

The different products of wheat commonly used are Atta (whole meal), which is rich in Vitamin-A and Vitamin-B, Maida (white flour) contains lesser Vitamin-B and protein contents, Suji (coarse semolina) and Rawa (fine semolina). Some of the other products are vermicelli and noodles are also commonly used.

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2 http://univisionin.blogspot.in/2012/06/world-scenario-of-wheat.html
4 https://oup.silverchair-cdn.com
5 http://www.agrifarming.in/wheat-farming-information/
Table 1: Nutritional value of Wheat

<table>
<thead>
<tr>
<th>Nutritional value per 100 g (3.5 oz)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>1,368 kJ (327 kcal)</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>71.18 g</td>
</tr>
<tr>
<td>Sugars</td>
<td>0.41 g</td>
</tr>
<tr>
<td>Dietary fibre</td>
<td>12.2 g</td>
</tr>
<tr>
<td>Fat</td>
<td>1.54 g</td>
</tr>
<tr>
<td>Protein</td>
<td>12.61 g</td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>29 mg</td>
</tr>
<tr>
<td>Iron</td>
<td>3.19 mg</td>
</tr>
<tr>
<td>Magnesium</td>
<td>126 mg</td>
</tr>
<tr>
<td>Manganese</td>
<td>3.985 mg</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>288 mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>363 mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>2 mg</td>
</tr>
<tr>
<td>Zinc</td>
<td>2.65 mg</td>
</tr>
<tr>
<td>Other constituents</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>13.1 g</td>
</tr>
<tr>
<td>Selenium</td>
<td>70.7 mg</td>
</tr>
</tbody>
</table>

Source: USDA

1.1. Global Scenario
Wheat is the third largest cereal produced in the world and its output has increased from about 600 million tonnes in early 2000s to about 700 million tonnes in 2013-14. The major wheat producing countries in the world are China, India, USA and Russia which account for about 45% of the total world wheat output. Although India has the largest area under wheat cultivation but it is the second largest producer to China due to lower yields in the world.

Global wheat Production in 2016-17 was 735.59 million tons. This year's 748.24 estimated million tons could represent an increase of 12.65 million tons or a 1.72% increase in wheat production around the globe.6

Figure 1: Major Wheat Producing Countries

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6 https://www.worldwheatproduction.com/
European Union, a group of Euro countries, is the top producer, second largest consumer and exporter. However, in terms of individual countries, China is the largest consumer followed by India, Russia and U.S. In terms of exports, U.S. has always been the top exporter of wheat contributing nearly 1/5th of the total world’s exports. The exports from Australia have also been rising steadily from the late 2000s.

The below presented list makes it clear that the largest producers of wheat in the world are also the largest consumers of the world, which means, most of the wheat production is consumed at the place of production. The export market of wheat is getting competitive with the new entrants like India.7

Table 2: Top 5 producers, consumers and traders of wheat in the world 2013-14

<table>
<thead>
<tr>
<th>Cultivators</th>
<th>%</th>
<th>Producer</th>
<th>%</th>
<th>Consumers</th>
<th>%</th>
<th>Exporters</th>
<th>%</th>
<th>Importers</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>13</td>
<td>EU</td>
<td>20</td>
<td>China</td>
<td>18</td>
<td>US</td>
<td>19</td>
<td>Egypt</td>
<td>7</td>
</tr>
<tr>
<td>EU</td>
<td>12</td>
<td>China</td>
<td>17</td>
<td>EU</td>
<td>17</td>
<td>EU</td>
<td>16</td>
<td>China</td>
<td>6</td>
</tr>
<tr>
<td>China</td>
<td>11</td>
<td>India</td>
<td>13</td>
<td>India</td>
<td>13</td>
<td>Canada</td>
<td>15</td>
<td>Brazil</td>
<td>5</td>
</tr>
<tr>
<td>Russia</td>
<td>11</td>
<td>US</td>
<td>8</td>
<td>Russia</td>
<td>5</td>
<td>Australia</td>
<td>12</td>
<td>Indonesia</td>
<td>5</td>
</tr>
<tr>
<td>US</td>
<td>8</td>
<td>Russia</td>
<td>7</td>
<td>US</td>
<td>5</td>
<td>Russia</td>
<td>10</td>
<td>Algeria</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: USDA

Major Exporters and Importers of Wheat

Figure 2: Major exporting countries of Wheat

- Canada was the leading wheat exporting country in the world followed by US and Russia in 2015-16 as presented in the figure 2 above.
- India’s share in global exports was around 0.40 percent in the year 2015-16.

7 http://univisionin.blogspot.in/2012/06/world-scenario-of-wheat.html (retrieved on April 17,2017)
Figure 3: Major Importing Countries

As presented in figure 3, Algeria was the largest importing country in the world followed by Italy, Indonesia and Japan in the year 2015-16.

FAO's first forecast of global wheat production in 2017 stands at 744.5 million tonnes, indicating a 1.8 percent decline from the 2016 record level but still above the last five-year average. The year-on-year decline would mostly reflect the projected decrease in plantings in North America, and a return to normal production levels in Australia following an exceptionally high output this season.

The consumption of wheat in the world is increasing significantly but is successfully kept satisfied with an equally high production figures.

Table 3: Trends in world wheat demand and supply (million tons)

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Imports</th>
<th>Exports</th>
<th>Consumption</th>
<th>Stocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-11</td>
<td>651</td>
<td>132</td>
<td>133</td>
<td>653</td>
<td>198</td>
</tr>
<tr>
<td>2011-12</td>
<td>696</td>
<td>149</td>
<td>158</td>
<td>688</td>
<td>197</td>
</tr>
<tr>
<td>2012-13</td>
<td>658</td>
<td>144</td>
<td>137</td>
<td>686</td>
<td>176</td>
</tr>
<tr>
<td>2013-14</td>
<td>714</td>
<td>157</td>
<td>166</td>
<td>694</td>
<td>186</td>
</tr>
<tr>
<td>2014-15P</td>
<td>720</td>
<td>153</td>
<td>155</td>
<td>708</td>
<td>196</td>
</tr>
</tbody>
</table>

Source: USDA

1.2. Indian scenario
India stands first in area and second in production next to China in the world. India’s share in world wheat area is about 12.40%, whereas it occupies 11.77 % share in the total world wheat production.

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India’s wheat production has increased in last 10 years at CAGR of 2.46%. The area under wheat cultivation has also increased in last 10 years at CAGR of 0.77 percent. There is hardly any scope for expansion of area under Wheat. The main emphasis would be on increasing the productivity of Wheat by adopting the improved cultivation practices. Nearly 85% of total wheat production comes from five states in 2013-14. Uttar Pradesh is the largest producer of wheat contributing for about 32%, Punjab accounting for about 18% followed by Haryana for about 13%, Madhya Pradesh for about 12% and Rajasthan for about 10% of the total wheat output in the country.

The main varieties of wheat grown in India are as follows VL-832, VL-804, HS-365, HS-240, HD2687, WH-147, WH-542, PBW-343, WH-896(d), PDW-233(d), UP-2338, PBW-502, Shresth (HD 2687), Aditya (HD 2781), HW-2044, HW-1085, NP-200(d), HW-741.

Figure 4: State wise Share in Production

Source: Ministry of Agriculture, GoI

India’s wheat production in the last two years has declined below the rising trend line due to adverse weather conditions – untimely rains and hailstorms during the harvest in the year 2015/16 whereas due to early moisture and temperature stress in the year 2016/17. The wheat area peaked in most wheat growing states by the year 2014/15, and the crop is likely to further lose the ground to other high value crops (horticultural and plantation crops) and non-agricultural use in future. Irrigated agricultural lands under rice-wheat cropping system are the prime target for high-value agriculture and to satisfy expanding urbanization and industrialization needs. The wheat growing areas in the northwest India are also facing the problem of declining water table and soil salinity due to over-exploitation of ground water and unscientific irrigation practices (flood irrigation). Depletion of irrigation water resources is likely to put pressure the on area under wheat cultivation in north India.

http://agricoop.nic.in/sites/default/files/Wheat.pdf
www.commoditiescontrol.com/eagritrader/data/pages/index.php?id=72
http://apeda.gov.in/apedawebsite/SubHead_Products/Wheat.htm
in the next few years, forcing farmers to explore less water intensive crops like fruits, vegetables, corn, pulses and oilseeds.

Table 4: Production of wheat in India from 2010-2014

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2010-11</td>
<td>86.9</td>
</tr>
<tr>
<td>2.</td>
<td>2011-12</td>
<td>94</td>
</tr>
<tr>
<td>3.</td>
<td>2012-13</td>
<td>93.5</td>
</tr>
<tr>
<td>4.</td>
<td>2013-14</td>
<td>95.9</td>
</tr>
</tbody>
</table>

Source: Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

In the last decade, Indian wheat yields have ranged from 2.7 MT/hectare in the year 2007/08 to 3.2 MT/hectare. The yields across major growing states during a given season show large variation depending on irrigation capacity and technology adoption levels. The yields in large irrigated growing areas of the north (Punjab, Haryana and Western U.P.) are above 4.5 tons per hectare, while yields in the central and western states (Gujarat, Madhya Pradesh, Rajasthan, Bihar and most of Uttar Pradesh) are relatively low (1.5-2.8 tons per hectare) due to lack of assured irrigation facilities and low input use.13

Exports
The demand of India's wheat in the world shows a rising trend as per the figure presented above. The country has exported 618020.01 MT of wheat to the world valuing Rs.978.59 crores during the year of 2015-16. India’s wheat export in 2015-16 has however declined by 79% over the corresponding year in view of surplus global stocks and higher domestic prices as presented in the table below. India exports the most to Bangladesh, followed by Nepal and UAE.

Major Export Destinations (2015-16): Bangladesh, Nepal, United Arab Emirates, Taiwan and Philippines.

Table 5: Indian export of wheat (Top 5 destinations)14
**Product: Wheat/Value in Rs. Lacs**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>19,85,441.28</td>
<td>3,17,124.54</td>
<td>11,23,304.18</td>
<td>1,88,839.46</td>
<td>3,40,552.20</td>
<td>53,447.48</td>
</tr>
<tr>
<td>Nepal</td>
<td>76,348.06</td>
<td>12,356.82</td>
<td>1,11,256.32</td>
<td>17,046.86</td>
<td>1,19,045.60</td>
<td>18,381.16</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>6,64,860.25</td>
<td>1,14,900.33</td>
<td>3,91,018.78</td>
<td>67,736.20</td>
<td>99,722.30</td>
<td>16,040.69</td>
</tr>
<tr>
<td>Taiwan</td>
<td>38,017.69</td>
<td>6,599.13</td>
<td>25,366.00</td>
<td>4,372.95</td>
<td>14,591.00</td>
<td>2,269.68</td>
</tr>
<tr>
<td>Philippines</td>
<td>1,03,894.30</td>
<td>17,081.16</td>
<td>79,693.98</td>
<td>13,681.10</td>
<td>7,099.00</td>
<td>1,239.36</td>
</tr>
</tbody>
</table>

Source: DGCIS Annual Export

There is a significant increase in the Imports of wheat up to approximately 300%.

India imported around 5.02 lakh tonne wheat during last year. This year import volume may increase to 2 MMT if prices in domestic market continue to get firmer. In the month of November-2016 India imported around 5.41 lakh tonne wheat from France, Ukraine and Australia. Forward contract from Australia has been done for December shipment at $210 C&F per tonne. Yearly average CIF comes to $272.73 per tonne for 2015-16. This year CIF quote may move down to $205.00 per tonne as global market is expected to reel under pressure. FoB quote in Black Sea region has increased to $183 and may touch $190 per tonne by December end. As import duty is revised from 25% to 10% which will lead to increase of import volume.

Also, the exports have declined by approximately 96% as compared to that in 2012-13.

**Table 6: India's Wheat Trade during 2011-12 to 2015-16**

<table>
<thead>
<tr>
<th>Year</th>
<th>Export</th>
<th>Import</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-13</td>
<td>6.51</td>
<td>0.0</td>
</tr>
<tr>
<td>2013-14</td>
<td>5.56</td>
<td>0.01</td>
</tr>
<tr>
<td>2014-15</td>
<td>2.92</td>
<td>0.03</td>
</tr>
<tr>
<td>2015-16</td>
<td>0.61</td>
<td>0.51</td>
</tr>
<tr>
<td>2016-17(April-Jan)</td>
<td>0.23</td>
<td>3.03</td>
</tr>
</tbody>
</table>

**1.3. State scenario: Production**

Vast stretches of sandy desert, scarcity of rainfall and paucity of irrigation facilities have been restricting wheat cultivation in Rajasthan since long. But some of the irrigation projects initiated after Independence, especially the Indira Gandhi Canal, have brought about considerable improvement in the cropping pattern of the state.

Currently, the state accounts for 7.49 per cent of the total wheat production and 7.24 per cent of total area under wheat in India. Over 20 districts are producing wheat and 11 are major producers. Ganganagar, Hanumangarh, Bharatpur, Kota, Alwar, Jaipur, Chittorgarh, Tonk, Sawai Madhopur, Udaipur and Pali are important wheat producing districts of Rajasthan. Table 7 gives the total area, production and productivity of wheat in Rajasthan in 2014-15.

---

Table 7: Area, Production and yield of Wheat in Rajasthan during 2014-2015 (Area in - Hectares, Production in Tonnes and Yield in - KG/HA )

<table>
<thead>
<tr>
<th>Crop (2014-15)</th>
<th>Area (ha)</th>
<th>Production (MT)</th>
<th>Yield (kg/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>3,318,000</td>
<td>9,824,872</td>
<td>2.961</td>
</tr>
</tbody>
</table>

1.4. **District and cluster scenario: Production**

The graph presented below shows the major wheat producing districts in Rajasthan in the 2015-16. Ganganagar is major producing district in the state for production of wheat.

The top five districts producing wheat in Rajasthan are Ganganagar, Hanumangarh, Alwar, Baran and Bundi. Ganganagar (1037621MT) ranks first in the state followed by Hanumangarh which ranked second in the production of wheat with the production of (243714MT).

Table 8: Major districts producing wheat in Rajasthan

<table>
<thead>
<tr>
<th>Sr.no</th>
<th>District</th>
<th>Area (in Ha)</th>
<th>Production (in Tonnes/ Bales)</th>
<th>Productivity (in Kg/ hectar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ganganagar</td>
<td>274584</td>
<td>1037621</td>
<td>265</td>
</tr>
<tr>
<td>2</td>
<td>Hanumangarh</td>
<td>243714</td>
<td>973765</td>
<td>250</td>
</tr>
<tr>
<td>3</td>
<td>Alwar</td>
<td>213011</td>
<td>776427</td>
<td>274</td>
</tr>
<tr>
<td>4</td>
<td>Baran</td>
<td>159434</td>
<td>670807</td>
<td>238</td>
</tr>
<tr>
<td>5</td>
<td>Bundi</td>
<td>154914</td>
<td>646200</td>
<td>240</td>
</tr>
</tbody>
</table>

Major wheat producers in the RACP clusters are: Orai Bassi (Chittorgarh Jakham (Pratapgarh), Kushalgarh (Banswara), Phoolasar (Bikaner), Z distributary (Sriganganagar), Kheruwala (Jaisalmer), Sangod (Kota), Palayatha (Baran), Pisangan (Ajmer)
Table – 8.1: Area, Production and marketable surplus in RACP Clusters

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Area (Ha)</th>
<th>Production (MT)</th>
<th>Marketable surplus (MT) @ 80%</th>
<th>Value Rs in lacs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gudha</td>
<td>10,805</td>
<td>45,069</td>
<td>36055</td>
<td>5769</td>
</tr>
<tr>
<td>Jhakam</td>
<td>9,201</td>
<td>24,207</td>
<td>19366</td>
<td>3098</td>
</tr>
<tr>
<td>Orai Bassi</td>
<td>5,017</td>
<td>25,074</td>
<td>20059</td>
<td>3209</td>
</tr>
<tr>
<td>Sangod</td>
<td>10,880</td>
<td>38,080</td>
<td>30469</td>
<td>4874</td>
</tr>
<tr>
<td>Palaitha</td>
<td>4368</td>
<td>19,656</td>
<td>15725</td>
<td>2516</td>
</tr>
<tr>
<td>Total</td>
<td>40,271</td>
<td>152,086</td>
<td>121669</td>
<td>19467</td>
</tr>
</tbody>
</table>

The total area under wheat in RACP Value Chain Clusters is 40,271 Ha in 2016-17 with an estimated total production of 152,086 MT. The marketable surplus would be around 80% with a value of Rs 19,467 lacs.

Resource mapping of wheat in RACP VC clusters

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Major mandi/s around cluster</th>
<th>Distance from major cities nearby</th>
<th>Warehouses/ Cold store with Capacity</th>
<th>No of FPCs targeted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gudha</td>
<td>Bundi, Kota</td>
<td>83 km from Bundi, 88 km from Kota</td>
<td>Bundi – CWC-MT, SWC-MT, Kota – CWC MT, SWC MT</td>
<td>2</td>
</tr>
<tr>
<td>Jakham</td>
<td>Pratapgarh</td>
<td>20 kms from Pratapgarh</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Orai Bassi</td>
<td>Chittor, Neemuch, Begu, Nimbahera, Badisadri</td>
<td>30 kms from Chittorgarh, 60 kms from Neemuch, 20 kms from Begu, 55 kms from Nimbahera, 60 kms from Badisadri</td>
<td>Chittor – SWC – 30,750 MT</td>
<td>2</td>
</tr>
<tr>
<td>Sangod</td>
<td>Kota, Baran, Khanpur</td>
<td>62 kms from Kota, 50 kms from Baran, 30 kms from Khanpur</td>
<td>Kota – CWC – 1,20,000 MT, Cold store – 23,844 MT</td>
<td>2</td>
</tr>
<tr>
<td>Palaitha</td>
<td>Atru, Baran, Kawai Salpura, Kota</td>
<td>60 kms from Atru, 30 kms from Baran, 80 kms from Kawai Salpura, 60 kms from Kota</td>
<td>Baran – CWC – 5000 MT, SWC – 60,420 MT</td>
<td>2</td>
</tr>
</tbody>
</table>

1.5. Approach to Value Chain Analysis

In order to evaluate the value chain of Wheat, consultations were held with major stakeholders in the chain including farmers, Consumers, Processors, traders, supporting public and private service providers and institutions etc. in various parts of the state. Major Wheat producing clusters were considered for survey within Rajasthan.

Table 9: Surveyed Major markets for Value chain Analysis of Wheat (Detail data in Annexure-1)

<table>
<thead>
<tr>
<th>Surveyed Markets for the Value Chain Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within and Outside Rajasthan</td>
</tr>
<tr>
<td>1. Farmers in Bansur cluster (5)</td>
</tr>
<tr>
<td>2. Farmers in Deoli Cluster (5)</td>
</tr>
</tbody>
</table>
### Surveyed Markets for the Value Chain Analysis

<table>
<thead>
<tr>
<th></th>
<th>Market Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Farmer in Bari cluster (5)</td>
</tr>
<tr>
<td>4</td>
<td>Farmers in Banswara cluster (5)</td>
</tr>
<tr>
<td>5</td>
<td>Farmers in Baran cluster (5)</td>
</tr>
<tr>
<td>6</td>
<td>Farmers in Z Distributary cluster (5)</td>
</tr>
<tr>
<td>7</td>
<td>Farmers in Bundi cluster (5)</td>
</tr>
<tr>
<td>8</td>
<td>Farmers in Orai- Bassi cluster (5)</td>
</tr>
<tr>
<td>9</td>
<td>Farmers in Jakhmam cluster (5)</td>
</tr>
<tr>
<td>10</td>
<td>Farmers in Sangod cluster (5)</td>
</tr>
<tr>
<td>11</td>
<td>Farmer in Bonli cluster (5)</td>
</tr>
<tr>
<td>12</td>
<td>Farmers in Pisangan cluster (5)</td>
</tr>
<tr>
<td>13</td>
<td>Farmers in Mokhampura cluster (5)</td>
</tr>
<tr>
<td>14</td>
<td>Parle Biscuits, Bhiwadi (Processor)</td>
</tr>
<tr>
<td>15</td>
<td>ITC, Jaipur (Processor)</td>
</tr>
<tr>
<td>16</td>
<td>Alwar Roller Flour Mills, Alwar (Processor)</td>
</tr>
<tr>
<td>17</td>
<td>Nav Durga Roller Flour Mill, Bikaner (Processor)</td>
</tr>
<tr>
<td>18</td>
<td>Jindal Prime food pvt. Ltd, Bikaner (Processor)</td>
</tr>
<tr>
<td>19</td>
<td>Satguru food products, Ajmer (Processor)</td>
</tr>
<tr>
<td>20</td>
<td>Laxmi roller flour mills pvt ltd, Ajmer (Processor)</td>
</tr>
<tr>
<td>21</td>
<td>M/S Hazarimal Suganchand, SriGanganagar (Trader)</td>
</tr>
<tr>
<td>22</td>
<td>M/S Ramchandra Dinesh Kumar, Shriganganagar (Trader)</td>
</tr>
<tr>
<td>23</td>
<td>Mahindra Karan, Kota (Trader)</td>
</tr>
<tr>
<td>24</td>
<td>Lakki Traders, Bundi (Trader)</td>
</tr>
<tr>
<td>25</td>
<td>Jain Traders, Bundi (Trader)</td>
</tr>
<tr>
<td>26</td>
<td>Laxmi traders, Bundi (Trader)</td>
</tr>
<tr>
<td>27</td>
<td>Coordinator, RACP, SriGanganagar</td>
</tr>
<tr>
<td>28</td>
<td>Asst. Director, Agriculture Ext., SriGanganagar</td>
</tr>
<tr>
<td>29</td>
<td>DIC, SriGanganagar</td>
</tr>
<tr>
<td>30</td>
<td>DCA, Dep. of Agriculture, Sangod</td>
</tr>
<tr>
<td>31</td>
<td>DC, Water resources, Palathya</td>
</tr>
<tr>
<td>32</td>
<td>PC, APMC, Kota</td>
</tr>
<tr>
<td>33</td>
<td>Secretary, APMC, Ajmer.</td>
</tr>
<tr>
<td>34</td>
<td>Joint Director, Agri. Marketing, SriGanganagar</td>
</tr>
<tr>
<td>35</td>
<td>PD, ATMA, Kota</td>
</tr>
<tr>
<td>36</td>
<td>T.L, NGO, Sangod</td>
</tr>
<tr>
<td>37</td>
<td>SMS, NGO, Sangod</td>
</tr>
<tr>
<td>38</td>
<td>Director Agriculture University, Kota</td>
</tr>
<tr>
<td>39</td>
<td>PC, KVK, Baran</td>
</tr>
<tr>
<td>40</td>
<td>IWC, Kota</td>
</tr>
<tr>
<td>41</td>
<td>T.L, NGO, Palathya</td>
</tr>
</tbody>
</table>
Chapter 2 Pre Harvest Management

2.1 Major Commercial Varieties Grown in Rajasthan

- Growing HYVs like LOK1, Raj-3037, Raj-3765, GW-496, GW-322
- Indian Hard Wheat (IHW) for bread,
- Indian Medium Hard Wheat (IMHW) for chapatti and other products.
- Indian Soft Wheat (ISW) for biscuit.
- Indian Durum Wheat (IDUW) for pasta and traditional products.

The triple dwarf variety ‘Lal Bahadur’ developed at Durgapura centre became the trendsetter towards the development of high yielding, non-lodging nutrient responsive varieties. The variety Raj 1482 is very much in demand for its quality characteristics, Raj 3077 in addition to high yield, is well adopted for timely sown, late sown and light to moderate saline/alkaline conditions, Raj 3765 & Raj 3777 have tolerance to high temperature and rusts and are suitable for normal to very late sowing conditions, Raj 4037, Raj 4083 and Raj 4079 are highly heat tolerant varieties for warmer areas, Raj Molya Rodhak-1 is a significant development to overcome the problem of Cereal Cyst Nematode (CCN). Development of Raj 4120 is an outstanding contribution of the station having resistance to Ug 99 (Stem rust), which is an emerging threat for wheat cultivation in India. Recently August, 2012, Raj 4229 (IR-TS) and Raj 4238 (IR-LS) were identified having good yield potential and rust resistant.

The development of product specific varieties and cultivation on product specific locations are important, while planning in present market oriented agriculture. The varieties with weak gluten and protein contents below 10 per cent are suitable for cakes and cookies, whereas for chapattis, noodles and varieties wheat with medium protein (9 to 12 per cent) and gluten are used. However, for Macaroni and white bread, high protein content (above 12 per cent) and strong gluten strength are required.

2.2 New Initiatives and Practices

System of Wheat Intensification (SWI) which is based on the principles of System of Rice Intensification (SRI) is a new wheat cultivation technique which demands to maintain plant to plant distance at 8 cm and 20 cm between lines. This kind of sowing with proper plant density allows for sufficient aeration, moisture, sunlight and nutrient availability leading to proper root system development from the early stage of crop growth. After sowing, it is necessary to maintain plant population by gap filling and thinning of crowded seedlings. Besides this, 2-3 times weeding and irrigation is required for best results. These practices are carried in the early stage of wheat growth as associated with the principle of intensive care. System of Wheat Intensification (SWI) is one of the

16 http://www.zpdzone6.res.in/Rajasthan.htm
17 http://www.sknau.ac.in/en/constituents/institute/rajasthan-agricultural-research-institute-jaipur
promising technologies to increase productivity which ultimately contributes to the household level food security of marginal farmers. SWI has been successfully promoted by many agencies like PRADAN (2007), an NGO in Bihar with World Bank funded project and Agriculture Technology Management Agency (ATMA) of Government of India, People's Science Institute (PSI) another NGO in Uttarakhand (2008) in India and USAID in Mali (2009). SWI has been tested as innovative approach to increase productivity and being practiced in India, China, Ethiopia, Poland and USA. SRI has already been tested and evaluated by several NGOs, Nepal Agricultural Research Council (NARC) and the Department of Agriculture.

2.3 Seasonal Availability Pattern
The wheat is a Rabi crop and growing period is variable from one agro climatic zone to other. This effects the vegetative and reproductive period leading to differences in the potential yield. The harvesting is done in Karnataka, Andhra Pradesh, M.P. and in West Bengal in Jan.- Feb.; March-April in Punjab, Haryana, U.P. and Rajasthan and in April-May in Himachal Pradesh and J&K as presented in the table below.

<table>
<thead>
<tr>
<th>Table 10: Season availability of Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>Harvesting</td>
</tr>
<tr>
<td>Sowing</td>
</tr>
</tbody>
</table>

2.4 Land Preparation
The land preparation for wheat cultivation depends upon type of cultivation method. However, wheat crop requires well-pulverized soil for uniform seed germination. For increasing the soil fertility, well-decomposed farm yard manure should be applied during land preparation. It is recommended to supplement 15 tonnes/acre of FYM or any garden/field compost on the unploughed field.

Using local tractor or country plough, the field should be cross-ploughed after harvesting the rainfed crop (previous crop). For irrigated conditions, 3 to 4 harrowing should be carried out for crushing the clods. Remove any weeds from the previously cultivated crop to make the field weed free and clean. For proper seed setting and proper germination, one pre-soaking irrigation should be given to the seed bed or field just 3 to 4 days before sowing the seed. Required harrowing & planking should be given to prepare final seed bed for sowing the seed. Prepare proper irrigation channels between rows after forming the beds.

2.5 Sowing/Planting/Cultivation

Seed rate and treatment
The propagation of wheat crop is done by seeds. Seed rate depends on variety (cultivar), cultivation method (rain-fed or irrigated) and sowing method. On an average, seed rate of wheat varies from 50 to 130 kg/ha. However, late sowing may require more seed rate for avoiding any reduction in crop yield.

Seed rate in wheat farming is as presented below:
- 100 kg/ha – For normal condition.
- 125 kg /ha – For late sowing
- 40 kg/ ha – For wheat under system of intensification
To prevent the seed from seed/soil borne diseases, treat with Carbendazim or Thiram at 2 gm or 5 gm trycorderma spore /kg of seeds, 1 day (24 hours) before sowing in the field. To reduce loss caused by late sowing, One Should soak seeds in water overnight before sowing, closer spacing, using higher seed rate, shallow sowing (2 cm to 3 cm) and spreading thin covering of Farm Yard Manure soon after sowing.18

The ideal row spacing of 15 to 22.5 cm is followed depending on the situation. In case of late irrigated wheat crop, a row spacing of 15 to 18 cm is followed. When it comes to depth of sowing, Dwarf cultivars (varieties) should be planted at a depth of 5 cm -6 cm. The tall varieties of wheat crop (conventional) requires a sowing depth of 8 cm – 9 cm. Avoid deep sowing in the moist soils and deep sowing will be fine in-case of dry and rough soils. Under SWI, the seed to seed and line to line gap should be maintained uniformly at 20.32 cm.

2.6 Climatic and Soil Requirement
Wheat is primarily a crop of mid-latitude grasslands and requires a cool climate with moderate rainfall.

Temperature:
The ideal wheat climate has winter temperature 10° to 15°C and summer temperature varying from 21°C to 26°C. The temperature should be low at the time of sowing but as the harvesting time approaches, the higher temperatures are required for proper ripening of the crop. But sudden rise in temperature at the time of maturity is harmful.

Rainfall:
Wheat thrives well in areas receiving an annual rainfall of about 750 mm. The annual rainfall of 1000 mm is the highest limit of wheat cultivation. The isohyet of 1000 mm marks the boundary between wheat growing areas on one hand and rice growing areas on the other.

Soil type:
Wheat can be grown in many soil types, a well-drained, fertile clay loamy soils having moderate water holding capacity are ideal for irrigated wheat cultivation. Black soil is also very well suited for wheat cultivation. The commercial scale farmers should go for soil test for finding nutrient requirement and suitability of soil before going ahead with cultivation.

2.7 Nutrients Management

Table 1: Manures and Fertilizers in Wheat Cultivation19

<table>
<thead>
<tr>
<th>With assured fertilizer supply</th>
<th>Under fertilizer constraints</th>
<th>For the late sown irrigated wheat crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N) @ 80 – 120 kg/ha</td>
<td>Nitrogen (N) @ 60-80 kg/ha</td>
<td>Nitrogen (N) @ 60-80 kg/ha</td>
</tr>
<tr>
<td>Phosphorus (P2O5) @ 40- 60 kg/ha</td>
<td>Phosphorus (P2O5 @ 30-40 kg/ha</td>
<td>Phosphorus (P2O5) @ 30-40 kg/ha</td>
</tr>
<tr>
<td>Potash (K2O) @ 40 kg/ha.</td>
<td>Potash (K2O) @ 20-25 kg/ha.</td>
<td>Potash (K2O) @ 20-25 kg/ha.</td>
</tr>
</tbody>
</table>

Total Phosphorus (P2O5) and potash (K2O) and half of the nitrogen (N) should be applied at the time of sowing. Remaining quantity of Nitrogen (N) should be applied at the time of C.R.I (crown root initiation).

18 http://www.agrifarming.in/wheat-farming-information/
19 http://www.asiafarming.com/wheat-cultivation/
2.8 Water Management
About 5 to 7 watering are required in irrigated areas depending upon the amount of rainfall.
- 1st irrigation at 3 to 4 weeks after sowing.
- 2nd irrigation at 40 to 45 day after sowing.
- 3rd irrigation at 60 to 65 day after sowing.
- 4th irrigation at 80 to 85 day after sowing.
- 5th irrigation at 100 to 105 day after sowing.
- 6th irrigation at 15 to 120 day after sowing.

Prolonged drought, especially in rainfed areas, at the time of maturity is harmful, light drizzles and cloudiness at the time of ripening help in increasing the yield. Frost at flowering time and hail storm at the time of ripening can cause heavy damage to the wheat crop.

2.9 Weed Management
In wheat cultivation, weeds should be controlled by 2 to 3 hand-weeddings / hoeing. First one should be carried out 1 month after sowing and the subsequent operation should be carried out 40 to 45 days after sowing. Herbicides can be used to control weeds in wheat cultivation.

Only Grassy Weeds:
Fenoxaprop-ethyl @ 80 to120 grams a.i./ha in 250 to 300 liters of water / ha.
Clodinafop @ 400 grams/ha (60 grams a.i./ha) in 250 to 300 lit of water / ha.

Only Broadleaf Weeds:
Metsulfuron methyl @ 4 grams a.i. / ha. 250 to 300 lit of water / ha.
2,4-0 @ 500 grams a.i./ha in 250 to 300 lit of water /ha.

Both Broad Leaved and Grassy Weeds:
Metribuzin @ 175 grams a.i./ha in at least 500 lit of water /ha.
Sulfosulfuran @ 25.0grams a.i./ha in 250-300 lit of water /ha.
Combination of isoproturon & 2,4-0 may also be used for the control of mixed weed population in resistance free area.
A mixture of Sulfsulfuran at 25 grams/ha and metsulfuron methyl at 4 grams/ha in 250 to 300 lit of water /ha.

2.10 Pest & Disease management
Insect Pests: Wheat crop is attacked by a number of insect pests and rodents both in the field and in the storage. Some important common ones are presented under:

Cereal Cyst Nematode (Heterodera avenae)

http://www.asiafarming.com/wheat-cultivation/
http://www.asiafarming.com/wheat-cultivation/
http://www.agrifarming.in/wheat-farming-information/
The nematode found in most of the cereal growing regions of the country, especially, the dry and warmer areas of Rajasthan, Haryana and Punjab, but incidence is less in cooler climates. Larvae enter the roots near the growing point especially, at the seedling stage. Roots of infected plants become predisposed to various soil borne disease like root rots. In infected fields, the losses can be considerably enough. Most of the wheat cultivars are susceptible but some resist cyst formation. Chemical pesticides, some natural plant products and botanicals, coupled with improved cultural practices help in management of the CCN. For Rajasthan, one CCN resistant variety, CCNRV - 1 is available for the disease prone areas.

**Aphids**

Sitobion avenae, Rhopalosiphum padi and various other species

The aphids exist in different stages, viz., winged (alates), wingless (apterous) sexual and asexual forms. The rapid spread takes place through asexual reproduction where females give rise directly to nymphs rather than eggs. Infestation usually occurs during second fortnight of January till crop maturity.

When feeding in sufficient numbers, they can cause considerable damage, but under normal conditions, losses are not much. Chemical pesticides are recommended for this pest in wheat if the level of aphids per tiller crosses 10 during vegetative phase and 5 during reproductive phase. However, there is need to keep watch on this pest. The spray of imidacloprid @ 20 g a.i. per ha initially on border rows and if infestation is severe then in entire field will give good protection against this pest. Generally, natural enemies present in the field help in controlling the population of this pest.

**Brown Wheat Mite** (Petrobia lateens)

In most of the wheat growing areas, under rainfed conditions, especially in the states of Rajasthan, Haryana and M.P. Sometimes, it is a pest in humid and warm conditions of irrigated areas also.

They Brown wheat cause damage through mite infestation sucking mouth parts. When present in large numbers, mites cause a silvery flecking on leaves. Individual mites are too small to be visible with naked eye without effort. These can be seen by shaking the infested leaves on a white paper.

Most of the times, mites do not cause any production constraint in wheat so no management practices are required. However, there is a need to keep vigil on this pest so that it may not become important in changing cropping sequence of the future.

**Army Worm** (Mythimna separate)
The larvae are found in the cracks of soil and hide during the day but feed during night or early morning. In wet and humid weather, they may feed during day time also. They survive during summer on the subsequent crops like rice and also continue to exist in rice stubbles before wheat crop comes in the field. Recently, this pest is catching attention in the northern India under Rice-Wheat rotation and where rice stubbles / straw remain in the fields.

**Legume Pod-borer** Helicoverpa armigera (= Heliothis armigera)

This is a polyphagous insect that attacks various legumes as a pod border. It is seen damaging wheat ear heads at grain development stage when major hosts are not available. However, the damage is below economic threshold level. It is found mostly in northern and central parts of India. Wheat can serve as a bridge host for carryover of this polyphagous pest.

**Termites** (Odontotermis obesus, Microtermis obesi)

Mainly in the northern and central India, but also in some pockets of peninsular India.

Termites attack the crop at various growth stages, from seedlings to maturity. The severely damaged plants can be easily uprooted and look wilted and dried. In case roots are partially damaged, the plants show yellowing.

For effective management, chemicals like endosulfan, chlorpyriphos and carbosulfan can be used both for seed treatment and for broadcast of treated soil in standing crop.24

**Stripe Rust /Yellow Rust** (*Puccinia striiformis tritici*)

Hills, foothills and plains of north western India and southern hills zone (Nilgiri hills of Tamilnadu). Spreads through air-borne urediospores, when temperature is 10-20°C but the spread is checked above 25°C. Pathogen survives in the cool temperatures of hills (Himalayas and Nilgiris) and the primary infection takes places by middle of January in the foot hills and sub mountainous parts of north western India. Also, infection comes from across the western border; hence the probability of evolution of new races increases in this area. Yellow rust from Nilgiri hills cannot come out of the zone due to high temperatures in the Peninsular and Central India. Most of the presently recommended varieties are resistant. Major emphasis is on host resistance and cultivation of resistant varieties is the main strategy of management.25

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24 [http://agropedia.iitk.ac.in/content/insect-pests-wheat-crop](http://agropedia.iitk.ac.in/content/insect-pests-wheat-crop)
Karnal Bunt Tilletia indica (=Neovossi indica)
Parts of Northern Plains, especially Punjab, parts of northern Haryana, foot hills of J&K and HP, tarai area of Uttanchal, in lesser severity in Rajasthan, Bihar and UP. The states of Gujarat, Maharashtra, Karnataka and several parts of M.P. are free of KB. Seed and soil-borne; infection occurs at flowering by means of soil-borne inoculum. The degree of disease development depends upon the weather conditions prevailing during spike emergence to grain filling stage of crop. If the rains occur during the month of February in north Indian plains (disease-prone areas), the disease is likely to come with higher resistance power. Among the present day varieties, PBW 502 is resistant while the others show various levels of susceptibility. For management of this disease, one spray of Propiconazole (Tilt 25EC@ 0.1 %) should be given at the time of anthesis. Integration of one spray of propiconazole with one spray of bioagent fungus, Trichoderma viride (0.4% suspension) gives almost cent per cent disease control. The bioagent spray should be done before earhead emergence (Crop growth stage 31-39 on Zadoks scale), followed by the spray of chemical at start of earhead emergence (crop growth stage 41-49 on Zadoks scale). Two sprays of T. viride, at these two critical growth stages also give non chemical control of the disease which is almost similar to one spray of propiconazole. Chemical control should be adopted mostly in seed production plots.

Black Point (Alternaria alternate)
The disease causes blackening of embryonic region of the seed (black point), discoloration of area beyond the embryonic region (black discoloration (Caused by Aalternata, Curvularia lunate, Epicoccum sp., Bipolaris sorokiniana, etc.) and eye-spot symptom (B. sorokiniana). The warm and humid weather at grain filling or near maturity favours the disease. This disease is of minor importance. Only when the disease percentage is high, it causes concern to the trader and the consumer. The discoloured seeds are mostly shrivelled and they are separated out during processing.

Loose Smut - Ustilago segatum (U. tritici)
It is a seed borne disease; infection occurs during Loose Smut flowering through wind-borne spores. The infection remains dormant inside the otherwise healthy looking seed but the plants grown from such seeds bear infected inflorescence. Infection is favoured by cool, humid conditions during flowering period of the host plant.

Disease can be easily controlled through seed treatment with systemic fungicides hence resistance breeding has not attracted much attention. Treat the seed with fungicides like carboxin (Vitavax 75WP @ 2.5g / kg seed), carbendazim (Bavistin 50WP @ 2.5g / kg seed), tebuconazole (Raxil 2DS @ 1.25g / kg seed) if the disease level in the seed lot is high. If it is low to moderate, treat the seed with a combination of Trichoderma viride (@4 g/ kg seed) and half the recommended dose of carboxin (Vitavax 75WP @ 1.25g / kg seed).26

26 http://farmer.gov.in/pestanddiseaswheat.html
2.11 **Recommended Good Agriculture Practices (GAP)**

Agriculture is the mainstay of Indian economy. India’s basic strength lies in agriculture. But its vast potential has not been fully exploited. While World Trade Organization (WTO) poses some challenges, it also offers tremendous worldwide market opportunities for Indian agriculture produce. This market potential can be realized by reforming agriculture and making its produce internationally competitive in quality and food safety.

To enable produce to be internationally competitive innovative farming practices incorporating the concept of globally accepted Good Agricultural Practices (GAP) within the framework of commercial agricultural production for long term improvement and sustainability is essential. The GAP in addition to improving the yield and quality of the products, also has environmental and social dimensions. Implementation of GAP would promote optimum utilization of water resources such as pesticides, fertilizers, water and eco-friendly agriculture. Its social dimension would be to protect the agricultural workers’ health from improper use of chemicals and pesticides.27

The suitable package of practices for wheat cultivation from intensive agronomic research has been forwarded from time to time. It may be emphasized that there is prime need to adopt latest agronomic recommendations to utilize full potential of newly developed varieties.

**Practices suggested:**

- Select the recommended varieties for your area specific to each climatic condition.
- Use certified seed or with good physical purity and germination.
- Do not delay sowing beyond recommended period.
- Apply recommended quantity of fertilizers and use correct methods of application.
- Take proper care of weeds under control at right time with chemicals/manual weed control measure.
- Irrigate at proper time/stage of crop and avoid over irrigation.
- Adopt proper crop protection measures.
- Harvest the crop at proper stage and keep at safe moisture level.
- For optimizing any input is the most important and any negligence in this respect cannot be rectified by making by any modification in the method and quantity.28

The problem of non-availability of agricultural labour in time of wheat, non-availability of power supply and connection in time, non-availability of fertilizer in time, high price of input, Lack of irrigation facility, Lack of technical knowledge, Non Availability of hired farm machinery or implements, Non availability of sufficient bank/ co-operatives, are the major constraints faced by farmers in production of wheat. The major constraints related to marketing were Price fluctuation in wheat, high cost of transportation, lack of transport facility at local level, not getting price according to quality and No availability of power/power connection on time.29


28 [http://agropedia.iitk.ac.in/content/good-agricultural-practices-wheat](http://agropedia.iitk.ac.in/content/good-agricultural-practices-wheat)

29 [http://krishikosh.egranth.ac.in/handle/1/65854](http://krishikosh.egranth.ac.in/handle/1/65854)
2.13 Pre Harvest Constraints
Wheat cultivation does not suit warm and damp climatic areas. During the heading and flowering stages, excessively low or high temperatures and drought are harmful to wheat. In all situations, grain must be harvested in a timely manner, before shattering, pre-harvest sprouting, bird damage or weathering, to minimize pre-harvest losses, yet must be dry enough for storage. During threshing, cracking and breaking the grain should be avoided since damaged grain invites greater damage from storage moulds and insects, and reduces marketability.

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30 http://www.agrifarming.in/wheat-farming-information/
31 http://www.fao.org/docrep/006/Y4011E/y4011e0u.htm
Chapter 3: Post-Harvest Management

The farmer’s risk does not end when the crop matures, grain may be lost during harvest because of shattering and spillage or birds, rodents and insects may consume/damage it in the field or in storage. Early harvesting results in the grains with higher moisture content, which in turn may attract mould infestation resulting into development of aflatoxin. The postharvest losses can be reduced to half with the use of available technology viz., timely harvest, use of proper harvesting and threshing equipment’s, safe storage, prophylactic and curative measures to check infestation. However, farmers are not fully aware of the post-harvest losses during harvesting and storing etc.

3.1. Post-Harvest Losses, Harvesting Care and Post-Harvest Equipment

Table 12: Stage wise Post Harvest loss factors

<table>
<thead>
<tr>
<th>Critical stages of food supply chain</th>
<th>Moisture</th>
<th>Weather</th>
<th>Pests/disease</th>
<th>Infrastructure</th>
<th>Size of operation</th>
<th>Level of mechanization</th>
<th>Quality of Management</th>
<th>Operator Characteristics</th>
<th>Access to Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Food storage</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Processing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Packaging</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sales</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is a sizeable quantitative and qualitative loss of wheat during different post-harvest operations like threshing, winnowing, transportation, processing and storage. 75% of the total PHLs occur at farm level and 25 % at market level. Storage (33-35%) was the biggest contributor of these losses along the entire supply chain. Hence, it is imperative to give due emphasis to reduce qualitative as well as quantitative losses of wheat during post-harvest operations.

Harvesting Care:

The time of harvesting plays a vital role. The following harvesting care should be taken.

- Wheat crop should be harvested, when the grains become hard.
- Harvesting before maturity means low recovery of grain, higher proportion of immature seeds, broken and poor quality and disease prone during storage.
- Delay in harvesting means shattering and spillage of grains. Its exposure to birds, rodents and insect and pest attack.
• Harvesting should be done under dry sun condition to avoid getting moist.
• Harvested wheat should be kept separately to avoid mixing of varieties.
• Direct sun drying and excessive drying should be avoided.
• Threshing and winnowing should be done in the fields. The grains should be packed in sound clean gunny bags to minimize the losses during transportation.

<table>
<thead>
<tr>
<th>Threshing / Shelling Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pantnagar Axial Flow multi-crop Thresher TH – 25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MISCELLANEOUS EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. APAU Seed Treating Drum MC – 1</td>
</tr>
</tbody>
</table>

3.2. Grade Specification & Grading at Producer level
There is no need to emphasize that bold size grains free from chaff, broken, immature, shrivelled and weevil damaged free from admixture of other varieties, foreign matter, fetch higher prices. In the modern urban market, ready to cook items are in demand with increased purchasing capacity. Since wheat is produced in varying agro-climatic conditions, heterogeneous quality is unavoidable. Hence, it is necessary to have one national language for defining the quality characteristics to facilitate marketing without physical inspection. Grading provides following marketing benefits.

• Low expenditure in transport and storage
• Knowledge of prevailing price, and right markets.
• Easy financial assistance and future trading.
• Widens the market for farm products.
• Consumers get wide choice of quality at a reasonable price.
• Promotes competitive marketing.

Grade Specifications:
Grading is undertaken by different agencies following various criteria depending upon its end use. The bulk of the commodity may be simply classified on the basis of kernel texture as: (i) hard (ii) semi hard (iii) soft; On colour namely (i) white (ii) amber and (iii) red. The various factors which constitute quality are (i) impurities, which together with damaged grain may seriously affect milling quality, (ii) bushel and kernel weight, (iii) nature and structure of the kernel, and (iv) moisture content. The merchants in India consider mainly physical characters like impurity or refraction and general appearance of the grain. Refraction comprises of any one or a combination of the following:

Dirt or the foreign matter including oilseeds and non-food grains,
• Add mixture of other foodgrains,
• Damaged and ‘touched’ grains,
• Shriveled or immature grains,
• Weevilled grains,

**Grading Equipment:**

- Sampler – Tube or Scoop, Sample Divider Wheat Sample-50 gm.
- Cleaning and Grading System Machine
- Dust Collection Plant
- Screen Air Separation
- Clean- o-Graders
- De-stoners
- Gravity Separators
- Air Classifiers
- Pre-cleaning and Silo Storage System
- Aflatoxin Detection Kit – CFTRI.

**Grading at Producers Level:**

The grading of wheat at producer’s level is carried out in accordance with National Grade Standards since 1965. The produce brought by farmers is inspected and sampled by qualified and trained graders of APMCs.

1. **Directorate of Marketing and Inspection (DMI):**

The DMI under Ministry of Agriculture, Government of India has laid down grade specifications of wheat, which are known as the National Grade Standards. These are generally adopted in warehouses and regulated markets for grading. The Agmark grade specifications have been under Agricultural Produce (Grading & Marking) Act. 1937.

**Agmark Grade Designation and Definition of Quality of Wheat:**

**A. General Characteristics:**

- wheat shall be the dried grains of Triticum vulgare and Triticum durum Desf;
- have uniform size, shape and colour;
- be sweet, hard, clean, whole-some and free from moulds, weevils obnoxious smell, discoloration, admixture of deleterious substances and all other impurities except to the extent indicated in the Schedule
- be in sound merchantable condition
- not have moisture exceeding 12 per cent.

<table>
<thead>
<tr>
<th>Grade designation</th>
<th>Special characteristics</th>
<th>Maximum limits of tolerance 1% by weight</th>
</tr>
</thead>
</table>

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32 http://agmarknet.nic.in/profile_wheat.pdf
B. Definition:

Foreign matter: It includes, dust, stones, lumps of earth, chaff, stem of straw and any other impurity including non-edible seeds.

Other Food Grains: Edible food grains other than wheat.

Other Wheat: For this purpose wheat would be divided into two classes – (1) Durum or Macroni wheat and (2) Vulgare or common wheat; Durum again would be sub-divided into two groups (i) amber and (ii) red; and Vulgare would be sub-divided into three groups – (i) white (ii) amber and (iii) red.

Damaged Grains: Grains that are internally damaged or discoloured, damage and discoloration materially affecting the quality.

Slightly Damaged Grains: Grains that are superficially damaged or discoloured, damage and discoloration not materially affecting the quality.

Immature, shrivelled: Immature and shrivelled grains are those that are not properly developed. Broken grains are pieces of whole grains.

Weevilled Grains: Grains that are partially or wholly bored or eaten by weevil or other grain insects. N.B. – Grades I and II should be free from living insect infestation.

2. Grade Specifications of Central Warehousing Corporation (CWC):

The Central Warehousing Corporation has adopted PFA standards on the basis of gravimetric (percentage by weight) as indicated below:

<table>
<thead>
<tr>
<th>Foreign matter</th>
<th>Other edible Grains</th>
<th>Damaged Grains</th>
<th>Weevilled Grains</th>
<th>Moisture</th>
<th>Total (1+2+3) shall not exceed</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>6</td>
<td>6</td>
<td>10 by count</td>
<td>14</td>
<td>12</td>
</tr>
</tbody>
</table>

Foreign matter: Not more than 3 per cent, of this inorganic matter and poisonous seeds not more than 1.0 per cent and 0.5 per cent respectively. Of the total 0.5 per cent of poisonous seeds, Dhatura and Akra shall not exceed 0.025 per cent and 0.2 per cent respectively.

Damaged Grains: Not more than 6 per cent including Karnal bunt and ergot affected grains. Karnal bunt shall not exceed 3.0 per cent and ergot affected shall not exceed 0.05 per cent.

Uric Acid – not more than 100 mg. per kg

Mycotoxin – not more than 30 micrograms per kg.

Further categorization has been done on weevilled grains as well as the touched/germ eaten grains.

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33 http://agmarknet.nic.in/profile_wheat.pdf
Table 15: Wheat/Milo/Jowar - on the basis of weevil ing percentage

<table>
<thead>
<tr>
<th>Category</th>
<th>% of weevilled grains by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Up to 1%</td>
</tr>
<tr>
<td>B</td>
<td>Above 1% to 4%</td>
</tr>
<tr>
<td>C</td>
<td>Above 4% to 7%</td>
</tr>
<tr>
<td>D</td>
<td>Above 7% to 15</td>
</tr>
</tbody>
</table>

3.3. Major Storage Disease and Pest and their Control Measure

In India, post-harvest losses caused by unscientific storage, insects, rodents, microorganisms etc., account for about 10 per cent of total food grains. The major economic loss caused by grain infesting insects is not always the actual material they consume, but also the amount contaminated by them and their excreta which make food unfit for human consumption. About 500 species of insects have been associated with stored grain products. Nearly 100 species of insect pests of stored products cause economic losses. Storage insect pests are categorized into two types viz. Primary storage pests: Internal and External feeders and Secondary storage pests

Primary storage pests: Insects that damage sound grains are primary storage pests

- **Rice weevil**: Sitophilus oryzae (Curculionidae: Coleoptera)
  Both the adults and the grubs cause damage. The developing larva lives and feeds inside the grain causing irregular holes of 1.5 mm diameter on grains of rice, sorghum, wheat, barley, maize before harvest and in storage. The weevils destroy more than what they eat.

- **Lesser grain borer**: Rhyzopertha dominica (Bostrychidae: Coleoptera)
  Both the adults and the grubs cause damage. The adults and grubs bore into the grains feed and reduce them to mere shells with many irregular holes. The adults are powerful fliers and migrate from one godown to another, causing fresh infestation. Adults produce a considerable amount of frass, spoiling more than what they eat.

- **Angoumois grain moth**: Sitotroga cerealella (Gelechiidae: Lepidoptera)
  The damage is at its maximum during the monsoon. Only the larvae cause damage by feeding on the grain kernels before harvest and also in store. The larva bores into grain and feeds on its contents. Exit holes of 1 mm diameter with or without a trap door, are seen on the affected cereal grains. As it grows, it extends the hole which partly gets filled with pellets of excreta. It imparts unhealthy appearance and smell. In a heap of grain, the upper layers are most severely affected.

**Integrated Management of Stored Produce Pests**

The control methods of stored produce pests can be categorized into preventive and curative measures

**Preventive measures**

- Brush the cracks, crevices and corners to remove all debris in the godown.
- Clean and maintain the threshing floor/yard free from insect infection and away from the vicinity of villages.
- Clean the machines like harvester and thresher before their use.
- Made the trucks, trolleys or bullock carts free from infestation

34 http://agmarknet.nic.in/profile_wheat.pdf
- Clean the godowns/ storage structures before storing the newly harvested crop to eliminate various bio stages of pest hiding
- Provide a metal sheet up to a height of 25 cm at the bottom of the wood in doors to arrest the entry of rats
- Fix up wire meshes to windows, ventilators, gutters, drains etc., to prevent entry of rats, birds and squirrels
- Remove and destroy dirt, rubbish, sweepings and webbings etc. from the stores
- Close all the rat burrows found in the godown with a mixture of broken glass pieces and mud plastered with mud/ cement.
- Plaster the cracks, crevices, holes found on walls, and floors with mud or cement and white wash the stores before storing of grains.
- Provide dunnage leaving gangway or alleyway of 0.75 to 1 m all around to maintain good storage condition.
- Store the food grains in rat and moisture proof storage structures.
- Disinfest the storage structures receptacles by spraying malathion 50 EC @ 3 lit 100 m before their use.

**Curative measures**

1) **Ecological methods**
   a. Manipulate the ecological factors like temperature, moisture content and oxygen through design and construction of storage structures/ godown and storage to create ecological conditions unfavourable for attack by insects
   b. Temperature above 42°C and below 15°C retards reproduction and development of insect while prolonged temperature above 45°C and below 100 degrees may kill the insects.
   c. Dry the produce to have moisture content below 10% to prevent the buildup of pests.
   d. Kill the pest bio stages harbored in the storage bags, bins etc., by drying in the sun light.
   e. Store the grains at around 10 % moisture content to escape from the insect attack.
   f. Manipulate and reduce oxygen level by 1% to increase the CO2 level automatically, which will be lethal to all the stages of insects.

2) **Physical methods**
   a. Provide a super heating system by infrared heaters on the floor mills and food processing plants to obtain effective control of pests since mostly the stored produce insects die at 55 –600 C in 10 – 20 minutes.
   b. Modify the storage atmosphere to generate low oxygen (2.4%) and to develop high carbon di oxide (9.0 – 9.5) by adding CO2 to control the insects.
   c. Seed purpose: Mix 1 kg of activated kaolin (or) lindane 1.3 D (or) malathion 5 D for every 100 kg of seed and store/pack in gunny or polythene lined bags.
   d. Grain purpose: Mix 1 kg activated kaolin for every 100 kg of grain and store. To protect the pulse grains, mix activated kaolin at the above dosage or any one of the edible oils at 1 kg for every 100 kg of grain or mix 1 kg of neem seed kernel for every 100 kg of cereal / pulse and store.
   e. Do not mix synthetic insecticides with grains meant for consumption.

3) **Cultural methods**
   a. Split and store pulses to escape from the attack by pulse beetle since it prefers to attack whole pulses and not split ones.
b. Store the food grains in air tight sealed structures to prevent the infestation by insects

iv) Mechanical methods

a. Sieve and remove all broken grains to eliminate the condition which favour storage pests.
b. Stitch all torn out bags before filling the grains.

v) Chemical methods

a. Treat the walls, dunnage materials and ceilings of empty godown with malathion 50 EC 10 ml/L (or) DDVP 76 WSC 7 ml/L at 3 LLI spray solution/10 sq.mts.
b. Treat the alleyways and gangways with malathion 50 EC 10 ml/L or DDVP 76 WSC 7 ml/L (1 L of spray fluid/270 m3).
c. Spray malathion 50 EC 10 ml/L with @ 3 L of spray fluid / 100 m2 over the bags.
d. Do not spray the insecticides directly on food grains. Use knock down chemicals like lindane smoke generator or fumigant strips pyrethrum spray to kill the flying insects and insects on surfaces, cracks and crevices
e. Use seed protectants like pyrethrum dust, carbaryl dust to mix with grains meant for seed purposes only.
f. Decide the need for shed fumigation based on the intensity of infestation.
g. Check the black polythene sheets or rubberized aluminium covers for holes and get them ready for fumigation.
h. Use EDB ampoules (available in different sizes 3 ml, 6 ml, 10 ml, 15 ml and 30 ml) at 3 ml/quintal for wheat and pulses and 5 ml/quintal for rice and paddy (Do not recommend EDB for fumigation of flour oil seeds and moist grains)
i. Use EDCT (available in tin containers of 500 ml, 1 liter and 5 litres) at 30 – 40 litres/ 100 cubic meter in large scale storage and 55 ml/quintal in small scale storage.

Fumigation

Use fumigants like ethylene dibromide (EDB), ethylene dichloride carbon tetra chloride (EDCT), aluminium phosphide (ALP) to control stored produce pests effectively. Apply aluminium phosphide (available in 0.6 g and 3 gram tablets) @ 3 tablets (3 gram each) per tonne of food grains lot with help of an applicator. Choose the fumigant and work out the requirement based on the following guidelines.

- 3 tablets of aluminum phosphide 3 g each per ton of grain.
- 21 tablets of aluminum phosphide 3 g each for 28 cubic meters
- Period of fumigation is 5 days

Mix clay or red earth with water and make it into a paste form and keep it ready for plastering all-round the fumigation cover or keep ready sand snakes. Place the required number of aluminium phosphide tablets in between the bags in different layer. Cover the bags immediately with fumigation cover. Plaster the edges of cover all round with wet red earth or clay plaster or weigh down with sand snakes to make leaf proof. Keep the bags for a period of 5-7 days under fumigation based on fumigant chosen. Remove the mud plaster after specified fumigation periods and lift cover in the corner to allow the residual gas to escape. Lift the cover after few hours to allow aeration.
Chapter 4- Cost of production and Net value accruals to producers

A typical farmer in the region with about 3.2 ha land holding has 2 ha is deployed to Wheat production. The gross yield per acre is 40 quintals per ha. The market rate of the sale is about Rs. 1600 per quintal or Rs. 16 kg or Rs. 80000 per ha. The cost of cultivation is about Rs. 43150 per ha. Net realization is about Rs. 36850 per ha. Out of this about Rs. 10000 is cost of land preparation, seed cost is about Rs. 4800 per ha, fertilizer and pesticide cost is about Rs. 7600 per ha, weeding related (labour cost) is about Rs. 4000 and harvesting cost is about Rs. 3000, Thrashing cost Rs 2500, watering cost Rs 10000 and Transportation cost to mandi is about Rs. 1250 per ha; all totaling is around Rs. 43150 per acre. Seeds are sourced mostly from Raj seeds or from inhouse storage. Fertilizer and pesticides are procured from local input supplier. The farmer is selling produce in Mandi @ price range of Rs 1,600 per quintal. Apart from the grain, the yield of straw is around 50 quintals per ha with a value of around Rs 12500. The yield of straw may increase with manual harvesting. Varieties available in Wheat are Raj 3765, Raj 3077. Farmers in the region are not satisfied with the market price. Sometimes the production also gets reduced due to sudden change in climatic conditions.

<table>
<thead>
<tr>
<th>#</th>
<th>Particular</th>
<th>Amount (in Rs. Per ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Income (50 qtls/ha @ Rs 1600/ qtl)</td>
<td>80000</td>
</tr>
<tr>
<td>B</td>
<td>Cost of Production</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Land Preparation Cost</td>
<td>10000</td>
</tr>
<tr>
<td>2</td>
<td>Seed Cost</td>
<td>4800</td>
</tr>
<tr>
<td>3</td>
<td>Input Cost</td>
<td>7600</td>
</tr>
<tr>
<td>4</td>
<td>Weeding Cost</td>
<td>4000</td>
</tr>
<tr>
<td>5</td>
<td>Harvesting cost</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>Thrashing cost</td>
<td>2500</td>
</tr>
<tr>
<td>7</td>
<td>Watering cost</td>
<td>10000</td>
</tr>
<tr>
<td>8</td>
<td>Transportation Cost</td>
<td>1250</td>
</tr>
<tr>
<td>9</td>
<td>Total Cost of Production</td>
<td>43150</td>
</tr>
<tr>
<td>10</td>
<td>Net Profit per ha</td>
<td>36850</td>
</tr>
<tr>
<td></td>
<td>Opportunity cost of fodder production (Around same yield of fodder @ Rs 250/qtl. (The fodder yield is reduced if using a harvester)</td>
<td>12500</td>
</tr>
</tbody>
</table>
Chapter 5: Supply Chain of Commodity

5.1. Seasonal Availability and Price Pattern

5.1.1 Seasonal Availability

The crop is available in the market from March to April in most part of the country. Fresh stock is available from stockists till Jul-Sept following which, the crop is available from mandi godown and cold storages.

5.1.2 Market Arrivals & Prices in Major Markets of Rajasthan

<table>
<thead>
<tr>
<th>Year</th>
<th>2014-15</th>
<th>2015-16</th>
<th>2016-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>4713</td>
<td>1500</td>
<td>4446</td>
</tr>
<tr>
<td>February</td>
<td>2029</td>
<td>1500</td>
<td>3046</td>
</tr>
<tr>
<td>January</td>
<td>4547</td>
<td>1585</td>
<td>3458</td>
</tr>
<tr>
<td>November</td>
<td>6111</td>
<td>1470</td>
<td>9208</td>
</tr>
<tr>
<td>December</td>
<td>6436</td>
<td>1530</td>
<td>4580</td>
</tr>
<tr>
<td>October</td>
<td>8715</td>
<td>1450</td>
<td>7147</td>
</tr>
<tr>
<td>September</td>
<td>15016</td>
<td>1450</td>
<td>13572</td>
</tr>
<tr>
<td>August</td>
<td>13495</td>
<td>1450</td>
<td>8415</td>
</tr>
<tr>
<td>July</td>
<td>11588</td>
<td>1450</td>
<td>8733</td>
</tr>
<tr>
<td>June</td>
<td>105491</td>
<td>1400</td>
<td>14796</td>
</tr>
<tr>
<td>May</td>
<td>217289</td>
<td>1400</td>
<td>23951</td>
</tr>
<tr>
<td>April</td>
<td>131600</td>
<td>1400</td>
<td>76928</td>
</tr>
<tr>
<td>Harvesting</td>
<td></td>
<td>Peak Period</td>
<td>Lean Period</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month</th>
<th>Arrival</th>
<th>Price (Avg.)</th>
<th>Arrival</th>
<th>Price (Avg.)</th>
<th>Arrival</th>
<th>Price (Avg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>131600</td>
<td>1400</td>
<td>88967</td>
<td>1585</td>
<td>76928</td>
<td>1520</td>
</tr>
<tr>
<td>May</td>
<td>217289</td>
<td>1400</td>
<td>151872</td>
<td>1500</td>
<td>23951</td>
<td>1560</td>
</tr>
<tr>
<td>June</td>
<td>105491</td>
<td>1400</td>
<td>35173</td>
<td>1500</td>
<td>14796</td>
<td>1660</td>
</tr>
<tr>
<td>July</td>
<td>11588</td>
<td>1450</td>
<td>15356</td>
<td>1390</td>
<td>8733</td>
<td>1650</td>
</tr>
<tr>
<td>August</td>
<td>13495</td>
<td>1450</td>
<td>12488</td>
<td>1420</td>
<td>8415</td>
<td>1650</td>
</tr>
<tr>
<td>September</td>
<td>15016</td>
<td>1450</td>
<td>11979</td>
<td>1470</td>
<td>13572</td>
<td>1650</td>
</tr>
<tr>
<td>October</td>
<td>8715</td>
<td>1450</td>
<td>10582</td>
<td>1510</td>
<td>7147</td>
<td>1750</td>
</tr>
<tr>
<td>November</td>
<td>6111</td>
<td>1470</td>
<td>5188</td>
<td>1540</td>
<td>9208</td>
<td>1970</td>
</tr>
<tr>
<td>December</td>
<td>6436</td>
<td>1530</td>
<td>5994</td>
<td>1580</td>
<td>4580</td>
<td>1970</td>
</tr>
<tr>
<td>January</td>
<td>4547</td>
<td>1585</td>
<td>4509</td>
<td>1620</td>
<td>3458</td>
<td>1900</td>
</tr>
<tr>
<td>February</td>
<td>2029</td>
<td>1500</td>
<td>3580</td>
<td>1620</td>
<td>3046</td>
<td>1850</td>
</tr>
<tr>
<td>March</td>
<td>4713</td>
<td>1500</td>
<td>4278</td>
<td>1600</td>
<td>4446</td>
<td>1700</td>
</tr>
</tbody>
</table>
The last three year mandi arrivals shows there is a decrease in arrival. This is because, crop was damaged during harvesting period in 2014-15 and was not of procurement quality and hence was not procured by CWC/FCI. Later years showed good crop quality and hence there was increased procurement through Govt. channels. Hence mandi arrivals for open market was less. Prices have shown a steady increase mainly due to increase in MSP.

5.2. **Existing Marketing Channels**
Wheat is notified commodity and most of the sales by farmers are conducted in various regulated markets. However, under Market Intervention Scheme (MIS), Food Corporation of India and other organizations procure wheat directly from producers at their collection centres. Since wheat is an important food item, its transactions take place in most of the markets of the country. Important wheat markets of Rajasthan are presented in the table below.

<table>
<thead>
<tr>
<th>Rajasthan</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kota, Alwar, Jaipur, Sriganganagar, Dausa, Hanumangarh, Sikar, Baran, Bundi, Bharatpur and Pali</td>
<td></td>
</tr>
</tbody>
</table>

Producers bring the produce to assembling markets. Further distribution of wheat is handled by aartiyas in the mandi then stockists, cleaning/grading units and then processing units before reaching the consumers through distribution channels of wholesalers and retailers. The marketed surplus of wheat, which has been estimated to about 40 to 50 per cent of production, was sold by the producers through different channels as indicated under.

**Stake Holders in Various Marketing Channels**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Itinerant Traders</td>
<td>5. Flour Millers</td>
<td>8. Retailer</td>
</tr>
</tbody>
</table>

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35 http://agmarknet.nic.in/profile_wheat.pdf
Presently, producers enjoy output of about 50 quintals per ha. The market rate of sale is about Rs 80000/ha. The cost of cultivation is about Rs 43150/ha and therefore net realization is about Rs 36850/ha.

The present pre-intervention or the value chain for Wheat may be viewed as one with three critical production-distribution or activity-marketing channels. The product is largely marketed by farmers through the APMC, local vendors and private processors. Channel 1 and channel 2 may be viewed in terms of one for wheat grains while the other one for processed products of wheat like wheat flour, catering to the institutional buyers such as hotels, canteens, etc. and urban and rural households respectively. The third channel deals with the consumers from foreign countries like Algeria, Indonesia who can take both wheat grains as well as processed and packaged wheat products.

The producers market their produce in both value chains through local traders and APMC Commission agents largely. There are total post-harvest losses of 5-9% in the storage, handling, transportation of wheat at every stakeholder’ point.

The figure presented below represents all the production – distribution channels possible for wheat. These channels were identified based on the consultation with various stakeholders.
Figure 6: Pre-intervention value chain of wheat

Value Chain Analysis - Wheat
Marketing Cost

Marketing costs are the actual expenses incurred in bringing goods and services from the producer to the consumers. The marketing costs normally include:

- Handling charges at local points
- Assembling charges
- Transport and storage charges
- Handling charges by wholesaler and retailer

Market fees, commission charges and taxes on wheat in Rajasthan are described in the table below.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Particulars</th>
<th>Charges (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mandi tax</td>
<td>1.6%</td>
</tr>
<tr>
<td>2</td>
<td>Commission charge</td>
<td>2%</td>
</tr>
<tr>
<td>3</td>
<td>Tax</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>Miscellaneous charges (Handling, weighing,</td>
<td>It varies from market</td>
</tr>
<tr>
<td></td>
<td>loading, unloading, cleaning etc)</td>
<td>to market.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In bagru mandi Rs 6-7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>is the loading and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unloading charges per</td>
</tr>
<tr>
<td></td>
<td></td>
<td>quintal</td>
</tr>
<tr>
<td>5</td>
<td>Overall addition to purchase price from farmer</td>
<td>5%</td>
</tr>
</tbody>
</table>

Marketing margin

Total marketing margin is the cost involved in moving the Bajra from producer to consumer and profit of various market functionaries. Absolute value of the total marketing margin varies from market to market, channel to channel and time to time. Generally, traders from mandi undertake onward supply adding 2% margin to bulk handlers and animal feed units.

5.3. Alternative Systems of Marketing

Marketing information is a key to regulate the competitive marketing processes and to restrict the monopoly or profiteering stakeholders in the market. It is needed by producers in planning production and marketing of their produce, and is equally required by other market participants. Farmers need to be fully familiarized in different areas of agricultural marketing in order to improve their price realization. Marketing information is important at all the stages of marketing right from farm level to ultimate consumption level and simultaneously for all participants in these stages i.e. producer, trader (millers), consumer etc.

The Government of India has started Agricultural marketing information network scheme through Directorate of Marketing and Inspection to improve the present market information scenario by linking all agricultural produce markets in the States and Union Territories. This has been established to an extent in Rajasthan.

5.3.1. Direct Marketing

Direct buying of wheat grain, storing, and own recourse to processing are common in north and west regions of the country. The trend is towards direct purchase of processed wheat products, and within this from loose to packaged branded wheat products. The estimated average total marketing
cost of wheat is found to be of the order of Rs. 266 per quintal and in this transport has the largest share of 40 percent, commission and taxes make up 25 percent and wastage another 15 percent. When compared to the consumer farmer price spread, the marketing costs account for 74 percent of the spread, leaving 26 percent for margins, this is fairly efficient but there is significant scope for improvement. On an average, the farmers receive 66 percent of what the consumer pays. The government channel marketing cost is reported to be Rs. 309 per quintal, but this does not cover the whole chain and is not strictly comparable.

5.3.2. Contract Farming

Contract farming is defined as a system for the production and supply of agricultural/horticultural produce under forward contracts between producers/suppliers and buyers. The essence of such an arrangement is the commitment of the producer/seller to provide an agricultural commodity of a certain type, at a time and a price, and in the quantity required by a known and committed buyer.

Contract farming in wheat is being practised in Madhya Pradesh by Hindustan Lever Ltd (HLL), Rallis and ICICI. Under the system, Rallis supplies agri-inputs and know-how, and ICICI finances (farm credit) the farmers. HLL, the processing company, which requires the farm produce as raw material for its food processing industry, provides the buyback arrangement for the farm output. In this arrangement, farmers benefit through the assured market for their produce in addition to timely, adequate and quality input supply including free technical know-how; HLL benefits through supply-chain efficiency; while Rallis and ICICI benefit through assured clientele for their products and services. The consortium is also planning to rope in other specialist partners including insurance, equipment and storage companies. Cargill India Ltd. has also been engaged in contract farming of wheat where the procurement is from Madhya Pradesh.36

5.3.3. Private market yard

NCDEX offers wheat supply contract for the benefit of Indian farmers. Farmers can sell their wheat through NCDEX portal. However two major companies from Rajasthan like Star Agri Warehousing Ltd. and CGR Collateral Management Ltd. have taken licenses to operate their warehouses as Private market Yard. CGR is also a signatory of MoU with State Government of Rajasthan during GRAM, Kota and is keen to work with project farmers for offering their warehouses as Private market yard near to production centers from where farmers can store and sell their produce without going to Mandi. They are also offering 75% loan against warehouse receipt of wheat to farmers.

36 http://www.manage.gov.in/pgdmABM/spice/March2k3.pdf
Chapter 6- Processing Infrastructure
availability and Utilization

6.1. Processing

1. Flour Variety: Today there are two basic varieties of wheat produced in India to make Atta: Durum (Triticum durum Desf.) and Aestivum (Triticum Aestivum L). Aestivum is semi hard wheat compared to hard Durum. In India, about 90% of Atta is made from Gehun. Durum is also called Semolina. Durum is harder than any variety of Gehun.

Process: Milling process (cracking) results in high starch damage suitable for water absorption to make dough. The milling process also minimizes loss of Ash.

Figure 7: Various milling process of whole wheat
2. Bread
Type of Wheat: T. Astivum
Area of Cultivation: Punjab, U.P., Bihar & Rajasthan
Varieties: Dara, Kalyan, Mexican, sharbati, 147 – Avg, lok-1
Process: A blend of high-gluten hard wheat varieties optimized for using yeast Un-bleached. White flour made from hard wheat, slightly coarser than all-purpose flour.22

- **Mixing of Ingredients**
  • Has 2 functions: to evenly distribute the various ingredients and allow the development of a protein network (gluten) network to give the best bread possible

- **Rising/Fermentation**
  • Once the raw materials are mixed it is then left to rise

- **Kneading**
  • Any large gas holes that have been formed during rising are released during kneading

- **Moulding into Loaf Shapes**
  • Moulding the dough into desired loaf shapes

- **Rising**
  • During the final rising the loaf fills with more bubbles of gas, once this has proceeded far enough they are transferred to the oven for baking

- **Baking**
  • The loaf is then placed in a pre-heated oven to bake, such high temperature will kill the yeast and stop the further growth.

- **Cooling**
  • The whole loaf is cooled and at about 35°C before slicing and wrapping can be done without damaging the loaf

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3. **Maida**

Wholemeal flour made from soft wheat similar in texture to cake flour. In reality, it resembles more to the Pastry flour being Wholemeal flour (higher protein).

### 6.2. Stakeholder's Share in Consumer Rupee

The price spread along with margin at every stage of value chain starting from the farmer till retailer is presented in the table below.

**Table 17: Price spread table of Wheat**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Value per Quintal (Rs.)</th>
<th>Existing Stakeholder’s share in Consumer’s Rupee (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retailing: Sale by retailer to consumer</td>
<td>About Rs. 2980 per quintal which makes a margin of 15% (includes local logistics and storage)</td>
<td>Retailers 14.4%</td>
</tr>
<tr>
<td>Wholesaling: Sale by wholesalers to retailers</td>
<td>Rs. 2550 per quintal (Includes a margin of 5% and local logistics and handling)</td>
<td>Wholesalers 6.7%</td>
</tr>
<tr>
<td>Secondary processing: Sale after grinding and packaging</td>
<td>Rs 2350 per quintal (Gross value on sale after grinding, packaging and 10% margin)</td>
<td>Secondary Processors 15.5%</td>
</tr>
<tr>
<td>Primary Processing: Sale after sorting/grading to processors</td>
<td>Rs. 1889 per quintal (Gross value on sale with gross profit margin of 5% after sorting grading )</td>
<td>Primary Processors 7.6%</td>
</tr>
<tr>
<td>APMC: Sale upon trading at the mandi through auction</td>
<td>Rs. 1,664 per quintal (1.6% mandi tax, 2% aadat, loading, unloading)</td>
<td>Traders 2.1%</td>
</tr>
<tr>
<td>Production: Cost of production is Rs. 43150 per ha or Rs 863 per quintal (without fodder)</td>
<td>Rs. 1,600 per quintal (Gross value on procurement at Rs. 1600; net value accrual to producers after cultivation costs is Rs. 737/quintal)</td>
<td>Farmers 53.7%</td>
</tr>
</tbody>
</table>

The existence of a long chain of middle men including the APMC and related commission agents, producers share in consumers’ rupee is adversely affected. This mirrors the need for promotion of contract farming options eliminating/minimising the role of the APMC.

### 6.3. Price build up & Marketing Efficiency Analysis

The price spread and values accrued to stakeholders across the chain reflects the profit margins accrued to different stakeholders. Much of the value accruals are accrued to processors and retailers. Producers’ incomes are apparently dependent on yield as well as their dependency on the type of end product. (eg. Flour, Maida, Sooji, Bakery products etc.) Due to limited infrastructure facilities at the dispersal of various stakeholders, marketing efficiency is adversely affected.

Generally, in case of wheat flour, farmers get 53.7 % share in consumer rupee with a 83% return on investment after deducting cost of cultivation. The margin of other stake holders is; APMC trader – 2.15% (Rs 64), Primary processor 7.55% (Rs 225), Secondary processor 15.47% (Rs 461, Wholesaler 6.71% (Rs 200) and Retailor 14.43% (Rs 430) per quintal. However, after taking holding/operations/marketing cost into account, the profit margin of processors reduces upto 2-5% and that of retailers and wholesalers reduce by around 2-5%.
6.4. Consumer preference Analysis

Wheat has a wide range of preference by the consumers. Many consumers in urban areas living within a radius of 200-300 km from their home town in North India prefer not to buy packaged wheat flour from the market. They prefer to buy sorted graded wheat, wash it with water, and get it sun dried again. The grain is then taken to a nearby atta mill for grinding at a cost of around Rs. 2/kg.

Most of the working class prefer to buy branded wheat flour from the market. Aashirwad, Patanjali, Pillsbury etc. are some of the major players in wheat flour/atta. Western consumers prefer fine ground flour whereas Indian prefers coarse flour. Recently, the trend in wheat flour consumption has increased significantly towards multigrain atta where wheat flour is mixed with several other coarse grain atta to enrich its nutrient value and fiber percentage.

Apart from atta/wheat flour, the other most commonly used by products of atta are dalia, suzi and maida which are used across both households and food processing industry. Brand equity does not matter much and most of the retailing happens in loose or un-branded form.

The other usage of wheat flour is in confectionary industry. Generally, hard wheat (from Kota, Chittor, Sri Ganganagar etc. in Rajasthan) are preferred by biscuit industry whereas grains from Jodhpur, Shekhawati and Alwar belt are preferred for bread/cake industry.

Sharbai variety from MP is the most preferred wheat for general consumers. ITC has large procurement centers in wheat belt in MP for procuring and storing in large silos in MP for round the year supply of its Ashirwad brand of wheat flour.
Chapter 7 - Existing Institutional support and Infrastructure facility

7.1. Support at cultivation stage

A range of support institutions support value chain activities as described below.

7.1.1. Department of Agriculture, Govt. of Rajasthan:

The department has various verticals through which it supports production, productivity and market linkage in the state. It has a well established structure and network of State/District and panchayat level officials to provide extension services to farmers. The department issues licenses to various agri-input marketing companies including seeds, fertilizers and insecticides and ensures quality assurance to farmers through regular reporting from suppliers and random quality checks of agri inputs. The licenses are issued first at the State level by registering input/service providers. The registered companies can only supply inputs to district and regional level distributors who in turn make availability of the products at the retailers. All handlers of agri inputs and produce have to take license from competent authority either at district or state level. Similarly, the department also issues mandi licenses for traders at different APMCs for trading in specific commodities. The same are described below.

A. Extension vertical:

- **Extension support**: The extension wing recommends good agricultural practices for various crops as per various agro-economic zones, Promotes seed replacement through distribution of Minikits containing improved variety of seeds. It also provides grant support of upto 50 percent of the price of notified varieties of barley of less than 10 years or Rs 1000 per qin whichever is less. For hybrid varieties subsidy is - 50% of the price of seeds notified for less than 10 years or Rs 5000 per qin whichever is less. The department also provides upto 50% subsidy on micro-nutrient (50% of total cost or upto Rs 500/ha) and bio-fertilizer application (50% of total cost or Rs 300/ha) under various schemes viz. National Agriculture Development Scheme/ National Composite Safety Mission/ National Food Security Mission. The application can be submitted to the office of Agriculture Supervisor-Asst. Agriculture Officer/ Asst. Director (Extn.)/ Dy. Director (Extension) by eligible farmers at Panchayat/Sub-district and District level respectively. Under the head “Subsidy on Crop Demonstrations”, subsidy upto Rs 5000/ha is available for wheat cultivation through flagship programs like State Plan/NFSM.

- **District level farmer help desk**: Under this head, farmer help line are established at district level with nomititated district level officials from the office of Dy. Director, Agriculture
Extension to support farmers on various farming related problems. Apart from this, a state level help desk is also maintained whose telephone no is 0141-5102578

- **Agriculture information dissemination:** At the state level, technical dissemination is being done through the daily newspapers, agricultural papers, monthly publication of "Kheti Ri Bataan" bulletin is also being done. Apart from this, information about advanced agricultural methods of major crops during crop season, publishing posters, agricultural guides on various topics, and Rabi / Kharif package of practice books at the block level and farmers, people's representatives and farmers by producing farmer friendly literature. Is being distributed to the institutions related to. From day-to-day basis to all the radio stations of the state, from 7.45 to 8.15, share the information related to farming and phone in these programs is being broadcast on Tuesday, Thursday and Saturday. The program is being sponsored by the Department of Agriculture on Monday, Tuesday and Wednesday for three days a week. "Farming" program on Doordarshan- produced by the Agriculture Department, is broadcast from Doordarshan Kendra, Jaipur on every Thursday from 7.30 am to 8.00 pm. In this program, information about departmental schemes / programs being executed by the Agriculture Department, discussions with experts, problem-solving, confusion-solving, fortnightly work, message, success stories, innovation, short films, eclipse etc. The tax program is made simple, interesting and farm-making. The technical information on agriculture and related subjects to the farmers has been done by the Indian government to provide "Kisan Call Center" in the state through telephone. Farmers can get any kind of information related to farming by making free calls to phone number 1800 180 1551/1551, from basic / mobile telephone to 6.00 pm to 10.00 pm.

- **Water use efficiency promotion:** Under the Farm Pond Program, rain water harvesting is promoted with the provisioning of 50% subsidy or maximum amount of Rs 52,000/- on raw farm pond and Rs 75,000/- on farm pond with plastic lining whichever is less. This scheme is available under the Rashtriya Krishi Vikas Yojana.

  For Dighi construction (under National Agriculture Development Scheme/RKVVY), 50% of the unit cost or 350 / - per cubic meter filling capacity and 50% of the cost of the unit cost, on the construction of plastic lining (raw) diggings, by constructing a minimum of 4.00 lakh liters of Filler capacity and more than 50% of the unit cost. The amount of rupees 100 / - per cubic meter will be filled up or maximum Rs 2.00 lakh, whichever is less the grant will be payable.

  For Water Houze construction under the national Agriculture Development Scheme, support is provided for areas where deep water is used for irrigation. For constructing a minimum of one lakh liters of Fill Capacity water shed Houz for all categories of farmers, 50 percent of the unit cost or Rs. 350 / - per cubic meter fill capacity or maximum Rs. 75000 / - whichever is less is the subsidy element.

  Under the irrigation pipeline head (of National Agricultural Development Plan, National Food Security Mission, NMOP) water use efficiency is promoted for irrigation water. Under this scheme, PVC / HDPE of prescribed size for carrying water from source to farm on irrigation pipeline is supported. On the purchase of pipes, the farmers of all categories are given 50 percent of the cost or maximum amount Rs. 50 / - per meter on HDPE pipes or Rs. 35 / - per meter on PVC pipe or Rs. The maximum amount of Rs.15000 / - on the 20 / - per meter HDPE laminated le-flat tub pipe will be payable, whichever is less proportionate.
Under the Fountain Irrigation program through National Food Security Mission; Pulses and Wheat - Under the Fountain Irrigation Program, subsidy is 50% or the amount is Rs. 10000 / - per ha, whichever is less.

Under the Mobile Raingun support program, for irrigation of grains and pulses crops, subsidy of 50 percent of the cost under the Mobile Raingunization program or Rs.15000 / - per unit whichever is less, grant is payable. This subsidy is available under the NFSM scheme

- **Agricultural equipment grant distribution program**: Grants upto 40 to 50 per cent are given as per the category of farmers on the purchase of approved agricultural machinery viz. Seed cum Fertilizer Drill, Plow, Threser etc.

- **Gypsum distribution program**: 50% Subsidy is given to farmers on districtwise rate of Gypsum for maximum area of 2 hectare. This support is for soil reclamation of alkali soils.

- **Plant protection inputs**: Segment, viz. Plant Protection Chemicals / Bio Agents / Bio Pesticides / Pheromone Trap / Liyos Distribution, including weeds in crops; 50% of the price or Rs. 500 any less per hectare is payable as subsidy.

- **Plan Protection equipments segment**: Human transport * (napsek, foot sprayer, duster etc.) are given 40-50 percent of the cost or maximum 600-800 / - Per device as subsidy. Under Power Drivesegment * (Nepasek Power Sprayer) are given 50-60 percent of the price or maximum 3000-3800 / - Per device. For tractor mounted sprayers, 50% of the price or Rs 10,000 per device is subsidized. These schemes are as per targets allotted for respective districts.

- **Assistance for area specific integrated farming systems** like livestock based, horticulture based and tree based farming systems: Assistance is provided for farmers of selected village/cluster having land from 0.25 to 2 ha area per farmer. It is implemented on cluster basis with 100 ha of land. Subsidy applicable is: 50% of cost or 52500/-for farm pond, 50% of cost or 468/-per SQM for green house, 50% of cost or 30/- per SQM for low tunnel, 40% of cost or 800/-per colony for bee keeping, 50% of cost or 15000/-for diesel pump, 50% of cost or 50000/-for vermicompost unit Pucca @ 125/- per cubic ft, 50% of cost or 8000/-for HDPE vermi bed

- **Organic production**: Organic Barley also has a great potential. For support under the head, Promotion of Organic Farming, subsidies are available for heads like Conversion of land Cropping systems and organic seeds, traditional organic input production unit, botanical extracts production unit, use of phosphate rich organic manure, construction of vermicompost pit, use of liquid bio fertilizer and support for packing labelling and branding material support are subsidized for consecutive two years at a rate specified in the manual.

- **Subsidy on crop Demonstrations**: Crop Demonstrations is taken under State plan, National Mission on Oilseed and Oil palm and National Food Security Mission. Subsidy pattern of crop wheat demonstrations is Rs 7500 upto one ha

- **Prime-minister Crop insurance scheme**: Farmer have to pay 2% of insured amount in Kharif, 1.5% of insured amount in Rabi and 5% of insured amount in horticulture & commercial crops, subject to maximum of 7 hectare per farmer. Rest of the premium amount will be borne by central and state government in equal ratio. Beyond 7 hectare, farmer has to pay whole premium amount, i.e. without any subsidy.
• **Soil health card**: Under this component, district level soil and water testing labs support farmers on soil testing and providing soil health card for integrated nutrient management.

**B. Rajasthan State Seed Production and Certification agency** helps in ensuring production of certified seeds for farmers. The department is mandated to: Recognize varieties eligible for Seed Certification and annually publish lists indicating the names of such varieties, Maintain a list of sources of Breeder & Foundation seeds approved by the Central Seed Certification Board, Outline the procedure for submission of application for growing, harvesting, processing, labelling and tagging of seeds intended for certification, Undertake inspection of seed fields, seed processing plants and lots in accordance with the procedures outlined by the Central Seed Certification Board in accordance with Indian minimum seed certification standard (IMSCS), Regulate the processing of seeds at seed processing units and Ensure that the seeds certified by it conforms to the standards prescribed by the Central Seed Certification Board. Thus the department ensures availability of quality seeds for growers.

**C. Rajasthan State Seeds Corporation** helps availability of quality seeds at affordable prices through the cooperative network and private distributorship channel under the trade name “Raj Seeds”. During Rabi and Kharif seasons Rajseeds are made available at the door steps of the farmers through Beej raths operating at almost every panchayat samitee of the state. The department sold around 236456 quintals of wheat seeds in 2016-17.

**D. Rajasthan Kisan aayog (Rajasthan State farmer Commission):** It is mandated to Investigate and review of agriculture and allied sectors, keeping in mind the economic ecology and environment for sustainable development of agriculture and To inform the State Government for taking necessary measures to solve timely problems of agriculture, animal husbandry and fisheries, so that farmers can be protected against difficult situations, Talk to different farming organizations / associations to make the government aware of their demands and suggestions and To bring the difference in demand and supply to the attention of the State Government, so that its adverse effects are not on the peasantry.

**E. State Agricultural Management institute (SIAM), Durgapura Jaipur:** The institute is mandated to organize training programmes on functional areas of Agriculture and its allied sector namely; Induction courses on fresh recruitees, Refresher courses for in service officials , Crop production technologies, Management of Technology and Input, Irrigation Management, Dry land Farming, Crop Economics, Extension technique, Communication skills, National Workshop / Seminars etc.

**F. Agricultural Conservation Testing Centers (ATCs):** The department of Agriculture has ten ATCs who are mandated to find out the usefulness of the research recommendations received from the agricultural research centers under the agricultural universities of the state in various agricultural and regional conditions and local conditions and to amend the tests in the research recommendations according to local conditions. On the basis of the tests, preparations of agricultural climatic package of practice and amendment of the advanced agricultural methods are amended. Apart from this, the agri-certified testing centres also solve the technical problems in the day-to-day work of the extension workers.

**7.1.2. ICAR and allied institutions:**

The Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. The Council is the apex body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences
in the entire country. With 101 ICAR institutes and 71 agricultural universities spread across the country this is one of the largest national agricultural systems in the world. The ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development that has enabled the country to increase the production of food grains by 5 times, horticultural crops by 9.5 times, fish by 12.5 times, milk 7.8 times and eggs 39 times since 1951 to 2014, thus making a visible impact on the national food and nutritional security. It has played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology development and its scientists are internationally acknowledged in their fields.

**State Agriculture Universities (SAUs):**

The state four major Agriculture Universities namely; 1. Swami Keshwanand Rajasthan Agricultural University, Bikaner, 2. Maharana Pratap University of Agriculture and Technology, Udaipur, 3. Sri Karan Narendra Agriculture University, Jobner, 4. Agriculture University, Kota and affiliated colleges who contribute to research, education, training and knowledge dissemination on agriculture technology. The Agriculture Universities also provide research and extension support through attached Krishi Vigyan Kendras and Agriculture Research Stations.

Following are the varieties of Barley developed by various Agriculture Universities in Rajasthan.

<table>
<thead>
<tr>
<th>Name of university</th>
<th>Variety of seeds developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKNAU, Jobnear (Through ARS, Durgapura Jaipur)</td>
<td>The triple dwarf variety ‘Lal Bahadur’ developed at Durgapura center became the trendsetter towards the development of high yielding non-lodging nutrient responsive varieties. The variety Raj 1482 is very much in demand for its quality characteristics, Raj 3077 in addition to high yield, is well adopted for timely sown, late sown and light to moderate saline/alkaline conditions, Raj 3765 &amp; Raj 3777 have tolerance to high temperature and rusts and are suitable for normal to very late sowing conditions, Raj 4037, Raj 4083 and Raj 4079 are highly heat tolerant varieties for warmer areas, Raj Molya Rodhak-1 is a significant development to overcome the problem of Cereal Cyst Nematode (CCN). Development of Raj 4120 is an outstanding contribution of this station having resistance to Ug 99 (Stem rust), which is an emerging threat for wheat cultivation in India. Recently August, 2012, Raj 4229 (IR-TS) and Raj 4238 (IR-LS) were identified having good yield potential and rust resistant</td>
</tr>
<tr>
<td>SKRAU Bikaner</td>
<td>Breeder seeds 2263 qtls, TL seeds 501 qtls. Total 2764 qtls in 2013-14</td>
</tr>
<tr>
<td></td>
<td>Varieties: Raj. 3765, Raj 3077, Raj. 3777, Raj. 4037, Raj. 6560, Raj. 4083, Raj. 4120, Raj. 4079, CCNRV 1</td>
</tr>
</tbody>
</table>

**Krishi Vigyan Kendras;**

The State has 42 Krishi Vigyan Kendras affiliated through ICAR. The mandate of the KVKs is to: 1. Organize Frontline Demonstrations (FLDs) to establish production potential of various crops and enterprises on farmers field (Facilitete technology dissemination from Lab to field) 2. To conduct on farm testing to identify the location specificity of agricultural techniques under various farming systems, 3. Organize need based training to farmers on agri and allied activities, 4. Production and supply of good quality seeds and planting materials and various farming products to the farming community and 5. Work as resource center of agricultural technology for supporting initiatives of private, public and voluntary sector for improving agricultural economy of the district. The KVKs also offer soil testing facilities to farmers.
Agriculture Research Stations: Apart from the above, there are several agriculture research stations and sub-stations attached to the universities to undertake research/trial and demonstration of agriculture technologies. The list of KVKs is given in Annexure-5.

Indian Institute of wheat and barley research, Karnal:

The institute has thirty one funded centres, located in different SAUs, support multidisciplinary research on wheat and barley 1 2 Indian Council of Agricultural Research under the coordinated project. Besides the funded centres, more than hundred voluntary centres in SAUs are actively engaged in evaluation of genotypes. In addition, some testing sites are also provided by State Agriculture Departments and a few NGOs. These locations have been identified in such a way that distinct agro-climatic zones of the country (six mega zones under wheat cultivation are represented.

7.1.3. Credit facilities: Agricultural credit facilities in the state has both formal and informal sources. Under the formal sources, various banks are extending credit facility at subsidized interest rates under KCC schemes for farmers having land title. The Gram Seva Sahakari Samitis run by Cooperative Department also extends crop loans to farmers. However, as many farmers live in hindu-undivided families, i.e. land title is still with father and sons undertake farming in their share of land as mutually agreed in the village panchayat. In such cases, getting a formal source of crop loan is difficult. Hence many farmers resort to informal sources of loans from village level money lenders at exorbitant rates and exploit them later by forcing to supply the produce also through the money lenders.

7.1.5. Agri input availability: A number of input service providers (in seeds, fertilisers and pesticides) operate in the important barley producing clusters of Pisangan, Bansur, Deoli and Sangod. They are registered through the office of Dy. Director, Agriculture Extn. Of respective districts.

7.2. Support at post-harvest stage

Following are the major support institutions for post harvest handelling of agriculture produce in the state.

A. Department of Agriculture marketing (DAM): The department offers upto 50% subsidy on various sorting/grading machines as specified in the circular dated 19/07/2017.

B. Post harvest storage: Department of Agriculture provides subsidy for metal storage bins to farmers. Apart from this, following storage infrastructure is available in the state.

- **Rural Godowns:** There are 139 rural godowns in Rajasthan which stores mustard, gram, wheat, bajra, gaur, soybean, groundnut etc. The list of godowns in Rajasthan that store barley is attached in Annexure-5

- **Central Warehousing Corporation38:** The Central Warehousing Corporation (CWC) is the largest public sector warehouse operator with their godowns established in almost all the states of the country. At present, CWC have already established and operating more than 450 warehouses with a capacity of 93.25 lakh tonnes (as on 29/02/2004). These are scientifically constructed warehouses which facilitate the farmers to store their produce safely and to derive the benefit of pledge finance during the period of glut situation in the markets. (Annexure - 2 List out CWCs in Rajasthan)

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38Farmers’ portal, CWC Link (http://farmer.gov.in/CWC_Link.aspx) (retrieved on April 9, 2017)
State Warehousing Corporation
State Warehousing Corporations (SWCs) were established in different states under the purview of concerned state governments and constructed godowns at distant places. The total share capital of SWCs is contributed equally by CWC and concerned state governments and SWCs under dual control. The SWCs also provide storage facilities for green gram. (Annexure – 3 Lists of SWCs in Rajasthan)

C. Market information through Agmarknet:
The Directorate of Marketing and Inspection (DMI), an attached office of the Department of Agriculture, Cooperation and Farmers Welfare under Ministry of Agriculture & Farmers Welfare, was set up in the year 1935 to implement the agricultural marketing policies and programmes for the integrated development of marketing of agricultural and other allied produce in the country with a view to safeguard the interests of farmers as well as the consumers. It maintains a close liaison between the Central and the State Governments.

The Directorate is headed by Agriculture Marketing Adviser to Government of India and has its Head Office at Faridabad (Haryana), Branch Head Office at Nagpur (Maharashtra) and 11 Regional Offices at Delhi, Mumbai, Chennai, Kolkata, Hyderabad, Chandigarh, Jaipur, Lucknow, Bhopal, Kochi and Guwahati and the Central Agmark Laboratory at Nagpur.

D. Support on agri produce marketing through APMCs:
The state has 136 Krishi upaz mandi samitis (KUMS) and 310 market sub yards for trade of agriculture commodities. Among them, grain mandis in Jaipur, Ganganagar, Kota, Bikaner, Hanumangarh, Alwar and Sikar are major grain mandis in the state as far as wheat is concerned.

These APMCs are intended to be responsible for:

- Ensuring transparency in pricing system and transactions taking place in market area;
- Providing market-led extension services to farmers;
- Ensuring payment for agricultural produce sold by farmers on the same day;
- Promoting agricultural processing including activities for value addition in agricultural produce;
- Publicizing data on arrivals and rates of agricultural produce brought into the market area for sale; and setup and promote public private partnership in the management of agricultural markets

The APMCs also facilitate MSP procurement system for the State Government and Govt. of India. However, as most of these procurements are for the PDS system, the scope of such procurement is kept out of the value chain.

E. Support on post-harvest value addition: The Farm Gate Agro processing and Agri-marketing scheme of Govt. of Rajasthan has provisioning for subsidy upto Rs 20 lakh for a sorting/grading/ value addition project of Rs 50 lakh. Ministry of Food Processing, Govt. of India also has a scheme in the name of Kisan Sampada (Backward & forward linkage scheme) through which there is a provisioning of 35% subsidy for Farmers/Farmer Groups for establishing value addition facility for agri produce.

39 Agmarknet (http://agmarknet.gov.in/) (retrieved on April 9, 2017)
Chapter 8- Gap & Constraint Analysis

8.1. As Perceived by Producers and Other Stakeholders

Producer case illustration
Wheat

Gurdeep Singh is a typical farmer in Sri Ganganagar with about 8-acre land holding. About 5 acres are deployed to Wheat production. The gross yield is 16 quintal per acre. The market rate on the sale is about Rs. 1600 per quintal or Rs. 16 kg or Rs. 25,600 per acre. The cost of cultivation is about Rs. 16,000 per acre. The gross yield is 16 quintal per acre. The market rate on the sale is about Rs. 1600 per quintal or Rs. 16 kg or Rs. 25,600 per acre. The cost of cultivation is about Rs. 16,000 per acre. Net realization per acre is about Rs. 9,600 per acre. Out of this about Rs. 3,200 is the cost of land preparation, seed cost is about Rs. 1,920, fertilizer and pesticide cost is about Rs. 3,040 per acre, weeding related (labour cost) is about Rs. 1,600 and harvesting cost is about Rs. 3,520. Packing cost is Rs. 40 per 50 kg or about Rs. 1,280 per acre. Transportation cost to mandi is about Rs. 960 per acre. Fertilizer and pesticides are procured from local input supplier. Gurdeep Singh is selling produce at Sri Ganganagar Mandi @ price range of Rs 1,600 per quintal. Varieties available in Wheat are Raj 3765, Raj 3077. Farmers in the region are not satisfied with the market price. Sometimes the production also gets reduced due to sudden change in climate.

Discussion with Farmers at Sri Ganganagar
**Value Chain Analysis - Wheat**

**Expert Opinion:** Mr. Ankit Bansal, owner of “Nikhil Food Products”, is of the opinion that Wheat Flour has significant potential. Apparently, Rajasthan produces about 633,344 tonnes of Wheat. The important mandis for wheat are Bundi, Sri Ganganagar, Hanumangarh, Kota, Alwar, Baran and Bharatpur. Processing units are clustered across Kota, Sri Ganganagar, Bundi. Annual production of “Nikhil Food Products” is 6000 MT. They procure wheat from commission agents from APMC mandis. It procures wheat currently at price Rs. 1780 per quintal which includes commission and transportation charges.

**Cost of Production and Value Accruals:** A sample unit “Nikhil Food Products” has a turnover of about Rs 13 crores. The unit has installed capacity of 17 MT/day. The particular unit has an investment of about Rs 160 lakhs in buildings and Rs 275 lakhs in Plant and Machinery. The unit procures Rs 18.90/kg from APMC commission agent (which includes 1.5 % commission, transportation cost). Cost of processing is Rs 230 per quintal or 2.3 per kg. The particular unit is packaging wheat is three packets of 50 kg, 10 kg and 5 kg which costs Rs 23, Rs 13 and Rs 7.5 respectively. Yield during milling is barely 95% and Husk which is by-product is 5%. Unit is selling wheat flour at Rs 2350 per quintal to distributors who further sell it at an MRP of Rs 2980/quintal. Unit is selling husk at Rs 12 per kg which is used as cattle feed. Unit is selling its product in and around Jaipur market. Net margin is around 5% - 7% on sale price. Out of the turnover of Rs 12 crores, raw material costs are expected to be effectively almost Rs 10 crores. Out of manpower (20 full time persons) about Rs 30 lakh per annum, power about Rs 30-35 lakhs per annum. Profits are dependent on rapidly fluctuating input and output prices.

**Critical Constraints**

**Processor:**
- Processors are dependent on “Arthiya’s” traders in APMC for supply of inputs. However, wheat arrivals in the market from Rajasthan is in Mar-April.
- Processing margins are barely 5-7 percent.
- Price fluctuation is a major concern for processor; many a times they incur losses due to the price fluctuation.

Discussion with Mr. Ankit Bansal at VKIA, Jaipur
8.2. SWOT Analysis of the Value Chain of Wheat

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Wheat is the primary food staple food in North India</td>
<td>• Requires 5-6 irrigations</td>
</tr>
<tr>
<td>• India is the second largest producer of wheat in the world after China and accounts for 8.7 per cent of the world’s total wheat production</td>
<td>• Rising cost of cultivation due to increased use of fertilizers</td>
</tr>
<tr>
<td>• Many farmers in Rajasthan take up wheat crop</td>
<td>• Lack of sufficient irrigation at critical stages of growth adversely impacts yield</td>
</tr>
<tr>
<td>• Rajasthan accounts for 7.49 per cent of total production and 7.24 per cent of area under wheat in India. Over 20 districts are producing wheat and 11 are major producers viz. Ganganagar, Hanumangarh, Bharatpur, Kota, Alwar, Jaipur, Chittaurgarh, Tonk, Sawai Madhopur, Udaipur and Pali</td>
<td>• Inadequate sorting, grading facility near production site fetches lesser price to farmers</td>
</tr>
<tr>
<td>• Large scope of value addition – Flour, maida, suji and others.</td>
<td>• Sizeable post-harvest loss due to in-efficient storage practices</td>
</tr>
<tr>
<td>• Demand for wheat flour, breads, cookies, cakes, frozen doughs, and frozen baked foods is ever growing</td>
<td>• Mostly controlled by large players apart from State governments</td>
</tr>
<tr>
<td>• FPCs to undertake joint input sourcing activities for seeds, fertilizers, pesticides, etc. under the umbrella of FCSCs/ common facilities</td>
<td>• Non-availability of private storage facilities/ silos near production centers for storing round the year</td>
</tr>
<tr>
<td>• Scope of establishing sorting, grading, storage facility through FCSCs will help increase farmers share in the total re value of the crop</td>
<td>• Vast stretches of sandy desert, scarcity of rainfall and paucity of irrigation facilities have been restricting wheat cultivation in the State of Rajasthan</td>
</tr>
<tr>
<td>• Scope for tie up of PCs for sorted/graded wheat through FCSCs with firms like Aashirvad, Patanjali, Kellog’s, etc</td>
<td>• Farmers are getting attracted towards less water intensive crops like pulses and Barley and/or cash crops</td>
</tr>
<tr>
<td>• Scope for tie up of PCs through FCSC with housing societies in urban areas and retail outlets</td>
<td>• Scope for facilitation of start-ups in Wheat like flour, baked products etc.</td>
</tr>
<tr>
<td>• Scope for facilitation of start-ups in Wheat like flour, baked products etc.</td>
<td>• Establish storage facilities by PC as a part of FCSCs.</td>
</tr>
<tr>
<td>• PCs to also undertake custom hiring services and hence lead the farm mechanization through FCSCs</td>
<td>• PCs to undertake joint input sourcing activities for seeds, fertilizers, pesticides, etc. under the umbrella of FCSCs/ common facilities</td>
</tr>
</tbody>
</table>

Opportunity

<table>
<thead>
<tr>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vast stretches of sandy desert, scarcity of rainfall and paucity of irrigation facilities have been restricting wheat cultivation in the State of Rajasthan</td>
</tr>
<tr>
<td>• Farmers are getting attracted towards less water intensive crops like pulses and Barley and/or cash crops</td>
</tr>
</tbody>
</table>

Key constraints in Wheat crop:

The constraints observed under Wheat are divided under from different categories, viz Production related constraints, Post-Harvest related constraints and Processing and market infrastructure related constraints.
8.3.1. **Production related constraints:** Wheat is a high water consuming crop. The cost of watering is almost one third of the total cost of production and hence it is finding competition from less water consuming cash crops like mustard, pulses and barley. Use of fertilizers have also risen in recent years. Area under cultivation has reached its maximum potential and there is very little scope of growth.

8.3.2. **Post-Harvest related constraints:**
Non availability cleaning facility near production centers, wastage during storage and transportation and infestation are some of the major post harvest constraints.

8.3.3. **Processing and market infrastructure related constraints:**
Processing of Wheat involves high volumes, requires various licenses for production and marketing and hence is out of reach of farmers/farmer institutions. However, with the direct involvement of companies like ITC, Farmers can sell their produce directly to ITC with a higher margin after primary sorting grading. Currently there is lack of primary sorting and grading infrastructure at community level forcing farmers to sell semi-graded produce to traders who later on sell it at a higher margin after doing sorting, grading and cleaning.

**Lack of market intelligence services:** Farmers do not receive information on market prices. Some farmers sell crops through village level traders or to MSP system, because due to which they are not realising fair price.

**Lack of primary processing infrastructure:**

i. There is a non-availability of facilities for primary processing: cleaning, grading & sorting at the farm level.

ii. There is no practice and provision of producer level storage.

iii. There is acute lack of awareness among farmers regarding FAQ (Fair Average Quality) standards.

iv. Farmers do not practice the usage of basic equipment like moisture meter and weighing machine.

**Distant markets:** Due to the distance of APMC from farmers field, they resort to sell the produce to traders at non-competitive prices.

**Seasonal price variations:** Generally during harvesting period, prices are on lower side and reach highest after 5-6 months of harvesting. However, farmers do not have any option but sell immediately at lower prices as they need cash to meet out their expenses. They could realize higher price if they can hold the stock for 2-3 months.

**Malpractices in markets:** Many malpractices prevail in the markets of Wheat i.e. excess weighment, delay in payment, high commission charges, delay in weighing and auction, different kinds of arbitrary deductions for religious and charitable purposes etc.

**Infrastructure facilities:** Due to inadequate infrastructural facilities available with the producers, traders, millers and at market level, the marketing efficiency is affected adversely.

**Agribusiness policy related constraints:**
**Contract farming:** Rajasthan has adopted a model APMC Act, 2007. In Rajasthan Contract farming of desired variety and quantity as per buyer's/processor's need, has been allowed. Buyer/processors may supply inputs and technical know-how and farmers may produce the crop for sale to buyers at an agreed price. However, this price shall not be lower than minimum support price and title of land shall remain with farmer. Produce will be purchased at buyer/processor's business/factory place. But processors found less interested in registering under contract farming. Team ABPF discussed contract farming issues with some of the processors and related challenges are given below:

i. **Rule 5** – Each agreement shall be written on stamp paper of the value of Rs.100. This increases cost of procurement and procurement time.

ii. **Rule 9** – Separate registration form shall be filled for each agreement. Large amount of paper work can be reduced by group registrations or procurement directly from FPCs.

iii. **Rule 17**-In case the contract farming buyer fails or refuses to purchase the agreed quantity of the agriculture produce from the contract farming producer, he is to pay the amount of the difference between the agreed price and the actual sale price of the contracted produce in the market committee concerned to the producer. Mutual termination of contract should be allowed.

iv. **Rule 19** – The contract farming buyer need furnish an undertaking equal to 20% of the value of the contracted amount. This amount can be reduced and this will motivate big players to participate in contract farming.
8.4. PIESTEC Framework

Wheat can be summarily considered within the adapted PIESTEC framework as follows:

**Political**
- Legislation required for FPC formation

**Institutional**
- FPC model to be developed for strengthening farmers' cause
- KVKs to facilitate supply of inputs viz. HYV seeds, pesticides, etc. to farmers
- Limitations need to be corrected to encourage and up-scale contract farming practices

**Economics**
- Requires a high level of working capital and human labour
- Sound economics of wheats i.e. net profit of up to Rs 36,850 per ha with a productivity of 50 q per ha
- Wheat straw is also a major incentive for farmers as it fetches around Rs 250-300 per quintal.

**Social**
- Cultivated by mostly small and marginal farmers with little post harvest facility
- Production led farming mindset prevalent which should transform into market led production programme
- Fluctuations in market prices has discouraged intensification of cultivation of Wheat

**Technology**
- Require farm mechanisation- Wheat sowing and harvesting machine
- Promote fertigation
- Obsolete processing technologies being used in the cluster
- GAP practices should be adopted
- System of Wheat intensification (SWI) can increase productivity by around 25-40% in case of wheat with around 20% less inputs.

**Environment**
- Wheat requires 5-6 watering and is currently a challenge for the farmers.
- Farmer depends upon ground water, depletion of water bodies is a great threat.

**Competition**
- Crop shift probability to barley in the clusters
- Export require incorporating traceability in production, grading, packing and shipment
- Area under wheat is stagnant and other crops like pulses or mustard and to some extent barley is increasing in acreage.
8.5. Impact of GST over Wheat value chain:

The Goods and Services Tax is one indirect tax for the whole nation. GST is a single tax on the supply of goods and services, right from the manufacturer to the consumer. It will be levied at every stage of the product distribution chain by giving the benefit of Input Tax Credit (ITC) of the tax remitted in the previous stages. Therefore, the final consumer will bear only the GST charged by the last dealer in the supply chain, with set-off benefits at all previous stages. GST will replace all Central level taxes such as excise, service tax, custom duty as well as state level taxes like VAT, CST, entertainment tax among others.

Table 18: Tax Structure

<table>
<thead>
<tr>
<th>Transaction</th>
<th>New Regime</th>
<th>Old Regime</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale within the state</td>
<td>CGST+SGST</td>
<td>VAT+ Central Excise/Service tax</td>
<td>Revenue will be shared equally between the Centre and the State</td>
</tr>
<tr>
<td>Sale to another state</td>
<td>IGST</td>
<td>Central Sales Tax + Excise/Service Tax</td>
<td>There will only be one type of tax (central) in case of inter-state sales. The Center will then share the IGST revenue based on the destination of goods.</td>
</tr>
</tbody>
</table>

The impact on the Food Processing Businesses:

- With the latest information suggesting that the minimum GST rates will be 18% on all products.
- Implementation of the GST is said to increase the prices of agricultural goods. However, the products will be able to reach the consumer faster due to state-level taxes such as Octroi and entry taxes which will significantly reduce the time and hassle of transporting goods across state borders.
- GST will also favour the National Agricultural Market on merging all the different taxation on agricultural goods will improve the marketing and virtual market growth.
- Because GST is a consumption tax, it will be levied only when food products are sold by the manufacturer and not when they are manufactured.
- The Confederation of Indian Industries (CII) has also in its representation called for a zero rate tax on products which have a rate of up to Rs. 10/- and Rs. 20/-. It also demanded that all packaged material used as inputs by the food processing industry should have a zero-percent rate.

Impact on Restaurants and Food Joints:

Service tax liability with the credit of input VAT on goods consumed will get submerged into GST and irrespective of goods and services, the credit of input will be available for adjustment against the output liability. This will further optimize the working capital of these restaurants and consumers can expect the superior quality of goods and services.

Please refer to Annexure 4 for product wise GST rates of Food Products.
Chapter 9- Proposed Interventions & Investments

9.1. **Intervention areas for Value chain strengthening**

The problem of non-availability of agricultural labour in time of wheat, non-availability of power supply and connection in time, non-availability of fertilizer in time, high price of input, Lack of irrigation facility, Lack of technical knowledge, Non Availability of hired farm machinery or implements, Non availability of sufficient bank/ co-operatives are the major constraints faced by farmers in production of wheat. The major constraints related to marketing are price fluctuation in wheat, high cost of transportation, lack of transport facility at local level, not getting price according to the quality and No availability of power/power connection on time.

Table 19: Intervention Plan of Wheat along with stakeholders' matrix

<table>
<thead>
<tr>
<th>S.no</th>
<th>Stakeholder</th>
<th>Roles &amp; Responsibilities</th>
<th>Pre-intervention Constraints</th>
<th>Post Intervention Action</th>
<th>Action By</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Land Preparation, Cultivation of crops, Harvesting of crops, Sell the raw</td>
<td>Limited awareness of farmers, Availability of improved &amp; good quality varieties of Wheat among producers</td>
<td>To promote both table purpose varieties and processing purpose varieties as well as Farm Information Dissemination through District level exhibition, Kisan Melas, Printed materials, electronic media.</td>
<td>Agriculture University, Agriculture Research Institute &amp; Station, Seed Companies, Department of Agriculture, Extension team of RACP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.no</td>
<td>Stakeholder</td>
<td>Roles &amp; Responsibilities</td>
<td>Pre-intervention Constraints</td>
<td>Post Intervention Action</td>
<td>Action By</td>
<td>Timeline</td>
</tr>
<tr>
<td>------</td>
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<td>--------------------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>Farmers</td>
<td>produce</td>
<td>• Farmers are trained with production-led extension approach till date</td>
<td>Market led extension approach is necessary to increase farmers income.</td>
<td>Extension team of RACP and Processors (through ABPF)</td>
<td>Y1Q1-Y1Q2 (6 months after registration of FPC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Traditional package of practices followed by farmers</td>
<td>Increasing Research- Extension –Farmers linkages by organizing farmers–scientists interaction, Field Days and Kisan Goshties, Farmers’ Field Schools.</td>
<td>Extension team of RACP, Scientists from Agriculture universities and ABPF agribusiness experts</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• During harvesting time, prices collapse and hence warehousing option could help reduce distress sale.</td>
<td>Storage facility for farmers as part of FCSC</td>
<td>RACP, KVK and ABPF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Due to inadequate facilities of transportation at the village level, producers are forced to sell local merchants or traders directly at low prices</td>
<td>• Provision of Pick-up van as part of FPC services to the farmers.</td>
<td>ABPF, RACP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Lack of scientific sorting system and cleaning/grading facilities and farmers are unaware about</td>
<td>• To make farmer aware about quality parameters of Wheat for processing like value added products; washing/Cleaning &amp; Grading facilities as</td>
<td>RACP, SPs with inputs from ABPF</td>
<td></td>
</tr>
<tr>
<td>S.no</td>
<td>Stakeholder</td>
<td>Roles &amp; Responsibilities</td>
<td>Pre-intervention Constraints</td>
<td>Post Intervention Action</td>
<td>Action By</td>
<td>Timeline</td>
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</tr>
<tr>
<td>2</td>
<td>Processors</td>
<td>• Process the raw produce&lt;br&gt;• Value addition&lt;br&gt;• Packaging of value added product</td>
<td>• Limited adoption of direct procurement and contract farming&lt;br&gt;• Limited processed product available in the market which limits the marketing potential of the commodity</td>
<td>• Setting up alternate channel to sell directly from PC to processor or large retail shops.&lt;br&gt;• Facilitate the entrepreneur development to set up small scale processed product like Wheat flour</td>
<td>Large Processor/ Buyer and ABPF, RACP</td>
<td>Y1Q3-Y2Q2 (6 months after registration of FPC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ABPF, RACP</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>NGO</td>
<td>• Extension services to farmers&lt;br&gt;• Disseminate</td>
<td>• Lack of skilled personnel&lt;br&gt;• Poor field-farm level coordination</td>
<td>• Training of NGO field staff on market led extension services&lt;br&gt;• Business planning</td>
<td>• RACP&lt;br&gt;• ABPF&lt;br&gt;• KVKs</td>
<td>Y1Q1-Y2Q4</td>
</tr>
<tr>
<td>S.no</td>
<td>Stakeholder</td>
<td>Roles &amp; Responsibilities</td>
<td>Pre-intervention Constraints</td>
<td>Post Intervention Action</td>
<td>Action By</td>
<td>Timeline</td>
</tr>
<tr>
<td>------</td>
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<td>--------------------------</td>
<td>----------------------------</td>
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<td>---------</td>
</tr>
</tbody>
</table>
| 4.   | RACP        | Schemes to the farm level  
Distribution of seeds and farm kits as per various schemes  
Hand holding support to the farmers regarding RACP schemes  
Outdated extension activities  
Lower level of interaction and adoption of RACP/govt. schemes | training  
Monthly/Fortnightly review meetings with RACP  
Feedback of farmers from service area  
Exposure visits of NGO staff to successful FPCs | Create basic understanding among the RACP PMU staff about concepts of FPC  
Clear understanding on fundamental differences between FPC & Cooperative  
Create market linkages by bringing more big players and processors to the cluster  
Conduct training of the potential farmer leaders about FPC and its functioning  
Capacity building training of the NGO staff regarding the extension services to be provided to the farmers | ABPF  
RACP PMU Line staff  
NGO | Y1Q1-Y2Q4 |
In terms of intervention on the production front, facilitating water resources can be promoted through RACP and DoA interventions. Promoting improved agriculture practices like SWI/ use of organic fertilizers can be supported by RACP/DoALine departments under RACP and NGO service-provider may support the initiatives in terms of dissemination of benefit of using SWI technique. Traditional package of practices results in lower yield as against potential. There is therefore need to train farmers on the best package of practices.
There have been limited efforts in capacity building of farmer leaders (entrepreneurs) and BODs at the field-level. In this regard, it may be appropriate for ABPF to enable formation of FPOs to meet minimum scale requirements for upgrading as well as developing alternate market channels. Also, bank linkages under KCC scheme etc. may be explored. The RACP and line departments need also work in coordination with the NGO/service providers and the KVK etc. on high content of foreign materials in harvested gram, harvesting of immature grains and inadequate post-harvest infrastructure facilities for storage. The storage facility may be established as an FCSC with assistance under the project.

There is also need for awareness seminars and b2b meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively aggregated into FPOs/FPCs). Scope for re-orientation of Agri-marketing policy with reduced mandi taxes on direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF.

9.2. Envisaged Post-intervention value chain map of Wheat

9.2.1. Post intervention value chain of wheat

The post-harvest value chain may be viewed in terms of one additional channel being developed into value added products through start-ups in fortified atta, wheat flakes etc. where there are also large players like ITC (Aashirwad atta) and Kelloggs. Also, FPC of farmers could be evolved to undertake primary processing, grading, sorting, and storage activities and also promote alternate markets. The post intervention value chain map for Wheat may be visualised as one with the three production-distribution or activity-marketing channels: cleaned and graded wheat grain and value added products like wheat flour. It is also envisaged that PCs of producers with FCSCs is evolved. Such FCSCs undertake storage, drying, cleaning, grading and sorting and packaging of produce activity. These FCSCs may offer other related services in terms of input facilitation, custom hiring and facilitating B2B connectivity.

As it is clear in the below given proposed value chain map of maize, the FPC intervention would take away the direct share of 3% in the channel 1 while there would be direct benefit of additional 2% to the farmers. The remaining stakeholders would remain unaffected as such from the FPC intervention. The FPC intervention would benefit the farmers by providing them with the appropriate storage facility as well as drying systems (solar preferably). This would positively impact the post-harvest losses which would reduce to 2-3% as compared to previously. It would also improve the holding period at the cluster level any FPCs would have an added benefit of storage system. Also, the restructured value chain will have PC/s and their FCSC/s replacing Mandis and undertaking aggregation plus grinding and sorting and packaging services. The PCs need input facilitation, custom hiring and marketing of produce.

The Farmer’s income from Wheat cultivation may be enhanced. Presently, the market rate of the sale is about Rs. 45000 per Tons or Rs. 45 per kg or Rs. 267,188 per hectare. The cost of cultivation is about Rs. 225,856 per ha. Net realization per acre is about Rs. 41, 331 per ha. Other than good harvest practices, input facilitation (high seed prices during cropping season) needs to be provided/disseminated amongst farmers.
Figure 8: Post Intervention value chain map of Wheat

- **Channel 1**: Households, Hotel, Canteen
- **Channel 2**: Livestock Reapers
- **Channel 3**: Consumers in foreign countries like US, Ukraine

**Proposed Post-intervention value chain map: Wheat**

- **FPC (5%)**
  - Part processing: Cleaning, grading, powder making
  - Handling time: 3-4%

- **Farmers (57%)**

- **Retailers (14.4%)**

- **Distributors (6.7%)**

- **Processors: Flour mill (10.0%)**

- **Storage, Distribution**
  - Packaged products ready to use in required volumes
  - Soybean Processing: Soy flakes, Tofu, Oil, Soy Paneer

- **Cleaning, Grading, Storage, Packaging, Transportation**

- **Aggregation, Transportation, Packaging**

- **Post harvest cleaning, grading**

- **Harvested crop ready to sell in market**

**Stakeholders and % share in consumer rupee**

- **PH Loss (4.5-7%)**

**Value adding activities**

**Value added products**

**Support institutions**

**Legends**
- Information Flow
  - Product Flow
  - Money Flow
The FPC would therefore earn higher margins (that going to the pockets of commission agents and primary processors). The FPCs could undertake a host of activities ranging from input facilitation (seeds, pesticides, fertilisers), custom hiring in addition to providing common facility storage and primary processing facilities. These could help in increasing net value accruals to farmers by 15-30%. Well-designed FCSCs could help address these vices at the farm/producer level. At the processing stage, gaps are most apparent, in terms of awareness amongst processors in the inadequate producer processor links etc. These may be reduced through information dissemination and B2B initiatives matched with policy incentives (like mandi tax exemption) to facilitate the same.

9.2.2. Interventions through FPC in the barley value chain crop:

**Introduction to FPC Model**

Aggregation is the proposed solution of the constraints farmers are facing at present. It is proposed to form Farmers Producers’ Company by bringing farmers together in the form of voluntary groups of about 15 to 20 active farmers and federating 20 to 25 such groups into a Producer Company. These Producer Companies will be functioning on behalf of member farmers and will strive to undertake a range of activities which will result in added value accruals to farmers and value to farmers produce. To form a producer company, producer groups will be mobilized (in some cases, this initiative may have already been completed by NGO’s).

It is envisaged that an elected committee of members of Producers Groups will form a management committee and oversee the performance of an incentivized manager/CEO. The manager will be trained in technical issues of post-harvest management, marketing and in operating a transparent accounting system. The ABPF will support the operation of the Producer Company, and accelerate the cross learning of best practices.

**FPC Development Approach**

The FPC development approach may be viewed as depicted below:
Following are the steps to be followed for formation of the FPC:

- **PRI of the MTG:** The MTGs will be made aware on the FPC model through PRI and individual farmers will be motivated to join the FPC as shareholder through respective MTGs.
- **Initial discussions with MTG leaders:** After PRI is done, initial discussion will be done with the MTG leaders for further orientation on FPC concept.
- **Identification of MTG leaders:** MTG leaders who show inclination to the concept will be selected in the executive committee for FPC formation.
- **Resource mobilization and FPC planning:** The executive committee will meet 2-3 times to plan further activities of FPC viz. crops, strategy for business etc.
- **Election of BoD and share collection:** 10-12 BoD will be identified along with 2-3 expert directors one each from Agri, Horti, AH and WS dept. The BoD will decide on share value and initiate collection of share through MTG leaders.
- **FPC registration:** Following identification of FPC BoD, registration will be done. This may take 1-2 months as DIN no of BoD has to be generated first. Care should be take that all elected BoD should have PAN no so that there is no delay in paper formalities for registrations.
- **FPC business:** Following registration of FPC, ABPF will prepare business plan for the FPC and facilitate market linkage for input and output.
- **Setup of processing/financing – ABPF:** ABPF will further facilitate establishment of processing unit setup along with feasibility studies and planning business linkage with market players.
**Policy and Management**

A FPC will function within the overall policy and regulatory framework as per the Producer Company Act. The management of a FPC will vest with the elected Board from amongst the members. The provision about constitution of managing committee will be made in the byelaws. The management of FPCs will be by an elected Board of Directors. Therefore, the representatives of farmers will actually oversee and manage the affairs of a FPC.

**The selection criteria for membership of FPC may be viewed as follows:**

1. A member will express his willingness to become a member of MTG.
2. A member will actively participate in all functions and activities of MTG.
3. A member will contribute his equity to the FPC.
4. A member will bring all or part of his produce to the FPC for sale.
5. A member will purchase all or part of his farm inputs through the FPC.
6. A member will produce and prepare his produce for marketing as per directions of FPC.
7. A member will contribute his share to the Producer Association as upfront payment for the business development plan of a FPC as needed.
8. A member will contribute his share to the Producer Company towards the reserves of FPC as needed.

**Illustrative list of components of a common facility of a Producer Company (Food Grain)**

- Godown for storage, drying platforms
- 2-3 MT per hour grain cleaning, grading, and packing machinery with shed
- Additional need based Agricultural Equipment
- Computer with internet connectivity for market information
- Display Board with Accessories
- Auction Hall
- Input Suppliers Shops
- Toilets
- Drinking water & Electricity

**Note:** Though the illustrative infrastructure proposed is shown in the above tables, the actual infrastructure to be developed will be need based and on participative consultation process.

Typically, start-up may be involved in secondary and tertiary processing activities while FPO's may be involved in post-harvest and primary processing activity. In many cases, start-up may emerge firm within FPO members.

**The evaluation of success should be evaluated on the parameters as under:**

I. PCs operating without financial support by the end of 36 months.
II. The PC operates with a reserve fund to cover short term cash flow deficit and with potential for reinvestment in various activities.
III. The PC has an effective governing structure.
IV. The PC has a transparent accounting system.
V. The PC can function as a working example for other farmer organizations to observe and learn from.
VI. Contribution towards increasing farmers'/members incomes.

**FPC Revenue model**

The revenue model for typical FPCs may be viewed in terms of revenue from:
1. Input facilitation services (this could imply revenue by virtue of service such as dealership/distributorship for seeds, pesticides or fertilizers). About 50% of the dealer's discount may be perhaps is retained by FPC and 50 % be passed on to FPC farmer member as to reduce their input costs.

2. Processing and storage services through FCSCs to be offered to FPC members and other providers in the region and user/service charge collected (typically) at perhaps the rate of 1 to 3 percent of value of commodity.

3. Marketing service may be offered in terms of facilitating charges typically @ between 1-2 percent of sales value.

4. MSP facilitation service in terms of facilitating procurement and supply to NAFED/SFAC etc. after, a 1 percent service charges is levied for such activity by FPCs.

5. NCDEX related farmers trading may be facilitated by FPCs as a risk hedging option and user charges collected at a negotiated rate with members.

6. Custom hiring services may be provided either through tying up with service providers or including equipment as part of FCSC.

7. Working capital service in terms of FPC providing and marketing of produce from member farmers. Here, the FPC may retain the price spread as service charge.

9.2. Conclusion

This value chain analysis of wheat clearly brings out that unlike any other enterprise, agriculture is critically dependent on external factors like the bounties of nature for its success; be it unseasonal rain, hailstorm, delayed monsoon, less rain, no rain, or excess rain, all of which makes agriculture a high risk and vulnerable proposition. This perpetual environment of high risk and vulnerability has significantly lowered farmers’ confidence and suppressed their entrepreneurial instincts as was amply reflected in the discussions held over cluster level meetings.

Till date, farmers have benefitted mainly from government’s input driven schemes while market access interventions such as mandis have created more barriers (middlemen) than benefits and resulted into market inefficiencies that eventually exploited farmers. Despite being at the receiving end of market barriers and inefficiencies for generations, individually, small farmers may perhaps never muster enough strength to overcome market challenges. In such a scenario, the intervention of establishing Farmer Producer Companies in the clusters has potential to unleash their suppressed energies and to promote rural entrepreneurship. It would encourage farmers to collectively delve into market operations to compete and design specific market solutions such as aggregation and sales of produce, operate custom hiring and composite input sales centres.

In the Wheat value chain, despite increasing input costs, all active players such as suppliers, transporters, processors, traders and corporates except producer farmers have benefitted and gained prosperity. For the farmer, increase in input costs, without corresponding increase in output prices, has rendered agriculture unviable. And, in the absence of any other locally available alternate livelihood options farmers cannot even move away from agriculture. Thus, RACP along with the market driven intervention of ABPF also aims towards integration of farmers and help them join hands for a collective cause, assist them to move up the agriculture value chains as to actively participate in market functions, an unexplored but lucrative territory for them so far. This would spur vertical business integration and diversify their market portfolios to reduce their vulnerabilities.

Value chain actors or stakeholders decide sale prices of their produce/products and compete effectively in the markets whereas farmers often depend on Minimum Support Price (MSP) fixed by government agencies to sell grains. Trader’s cartelisation ensures that MSP becomes the Maximum Gain Price (MGP) fetched by farmers, further squeezing their revenues. The end result has been a
declining contribution of agriculture to the national economy. It is also true that given farmers’ inability to deal effectively with market forces, in the absence of MSP, farmers would have been possibly in an much worse off situation.

The major role of ABPF- GT would in this circumstance also be to carry out capacity building initiatives of the potential leaders (BoDs) of the FPC, NGO staff and PMU staff line, conducting value chain studies of the crops (market led), plan interventions to improve the returns to the farmers in the 17 project clusters, develop the business plan for registered producer companies in clusters, support and assist agri start-ups in the region, and thus develop overall market linkages. The formation of FPC supported by RACP ABPF, local NGOs and facilitation centres like KVKs, provides the much needed opportunity to farmers to favourably and positively change their time in years to come.

Proposed outcome:

- 4% direct benefit due to direct procurement through FPC, 5% benefit through profit accumulated by FPC
- 2-5% price benefit on cost of inputs
- 1% saving on cost of transportation to APMC and associated charges
- Increased competition in input and output market resulting in higher earning potential for farmer
- Increased bargaining power of farmers
- Sustainable operations through community institution and assets through FPC and FCSC
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- http://krishikosh.egranth.ac.in/handle/1/65854
- Acknowledging inputs from RACP officials, related producers, processors, industry associations, NGOs, ATMA, Dept. of Agriculture and DR Rakesh Kumar, Agronomist KVK Bundi
Annexure 1: Stakeholder’s consulted over the study

1. Producers

5 Farmers in Palayatha Cluster

- Bhavnesh Nagar, Patunda, 9929745484
- Kamlesh Mali, Patunda, 9928718339
- Banwari Nagar, Patunda, 9829576832
- Kalu Lal Malau, Patunda, 7742034128
- Kalulal Nagar, Patunda, 8107030068

5 Farmers in Jakham Cluster

- Leela Devi, Samlopur, 8769394033
- Kailashi, Samlopur
- Kasana D/o Mukesh, Samlopur
- Pyari w/o Ramesh, Samlopur
- Mohani, Samlopur, 9116432779

5 Farmers in Gudha Cluster

- Kailash, Bhadarpura, 9571220441
- Lavkush Ram, Bhadarpura, 8769638100
- Bhadarpura, Bhadarpura, 9660032377
- Prem Shankar, Bhadarpura, 8094225186
- Pawan Kumar, Bhadarpura, 9549711861

5 Farmers in Orai Bassi Cluster

- Babu Ram, Palaka, 9166506632
- Shyam Lal, Palaka, 9929561520
- Mangi Ram, Palaka, 9680272174
- Uday Lal, Palaka, 9636522156
- Prabhu, Palaka, 9166533041

2. APMC

- Ms. Sheetal, Trader, APMC, Pratapgarh, 9785169735
- Mr. NemiChand, APMC, Pratapgarh, 9414418655
3. **NGO**
   - Suhail Ahamad, (T.L), Palayatha, 9214363655
   - Dipesh Mohan, (T.L), Orai bassi, 9001646200
   - Mr Shabbir Mishra, (T.L), Bundi, 8209399781

4. **Traders**
   - Sethia Associates, Vinod Sethia, Bundi, 8162801776
   - Satguru Inductries, Naresh Kumar, Bundi, 9928341932
   - Saurabh International, Saurabh Zawar, 9928433767
   - Goyal Trading Company, Lokesh Kumar, 9414176070
   - Bansal International, Vinod lakhotia, 9414175951
   - Lakki Traders, Radheshyam Garg, 9660601314
   - Laxmi traders, Narendra Jaju, 9414176140
   - Jain Traders, Hemant kumar, 9214316747

5. **Processors**
   - Parle Biscuits, Hemant Kapadiya, Bhiwadi, 022-67130367
   - ITC, Rohit Pajni, Jaipur, 9672911123
   - Alwar Roller Flour Mills, Ravi Shankar, Alwar, 7023398131
   - Nav Durga Roller Flour Mill, Naresh Agarwal, Bikaner, 9413386342
   - Jindal Prime food pvt. Ltd, Naresh Agarwal, Bikaner, 9413386342
   - Satguru food products, Mahesh Hotchandani, Ajmer, 9414709415
   - Laxmi roller flour mills pvt ltd, Gopal Sahani, Ajmer, 0145-2621600
### Annexure 2: List out Central Warehousing Corporation (CWCs) in Rajasthan

<table>
<thead>
<tr>
<th>Warehouse</th>
<th>Project Description</th>
<th>Manager</th>
<th>Phone</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHIWADI</td>
<td>C/o Jaquar &amp; Company Pvt. Ltd., SP-496, RIICO Indl Area, Bhiwadi – 301019</td>
<td>A. C. Yadav</td>
<td>01493 297825</td>
<td>4356</td>
</tr>
<tr>
<td>BARAN</td>
<td>Spl. No. 01 ,RIICO Indl Area, Baran Road, Baran</td>
<td>V. K. Jaiswal</td>
<td>9460079493</td>
<td>5000</td>
</tr>
<tr>
<td>BHARATPUR</td>
<td>Plot No. G-162 to 165 &amp; F-166 to 171, Brij Ind. Area, Behind Nafed Plant, Phase-II, Hathni Road, Bharatpur</td>
<td>Devendra Prakash</td>
<td>05644-228654</td>
<td>9674</td>
</tr>
<tr>
<td>BIKANER</td>
<td>Behind Sabzi Mandi, Pugal Road, Unit-I, Bikaner</td>
<td>Prit Pal</td>
<td>0151 2212399</td>
<td>25400</td>
</tr>
<tr>
<td>BIKANER-II</td>
<td>Opposite Govt. Engineering College, Karni Industrial Area, Ph.II Bikaner-334004</td>
<td>R. D. Punia</td>
<td>0151 211003</td>
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Annexure-4: Impact of GST

Product wise GST rates of Food Products

- **GST-28%**
  1. Molasses
  2. Chewing gum/bubble gum and white chocolate
  3. Cocoa butter, fat and oil
  4. Cocoa powder
  5. Cocoa chocolates
  6. Malt extract (other than for infant use and mixes and doughs of bakers)
  7. Waffles and wafers coated with or containing chocolate
  8. Extract, essences and concentrates of coffee
  9. Mustard flour and sauces thereof
  10. Sugar, lactose and glucose syrups
  11. Food flavouring material
  12. Churan for pan
  13. Custard powder
  14. Aerated waters containing added sugar or other sweeting matter

- **GST-18%**
  1. Condensed milk
  2. Malt, whether or not roasted
  3. Refined sugar, sugar cubes
  4. Sugar confectionery
  5. All preparations of cereals, flour, starch or milk for infant use and sold retail
6. Pasta, spaghetti, macaroni, noodles
7. Corn flakes and other cereal flakes
8. Waffles and wafers (other than chocolate coating)
9. Pastries and cakes
10. Extracts, essences and concentrates of tea or mate
11. Soups and broths
12. Ice cream and other edible ice
13. Instant food mixes, soft drink concentrates, sharbat, betel, supari, packaged food
14. Water, including natural or artificial mineral waters and aerated waters not sweetened
15. Ethyl alcohol and other spirits
16. Vinegar and substitutes
17. Curry paste, mayonnaise and salad dressing; mixed condiments and mixed

➤ GST – 12 %

1. All meat in unit containers put up in frozen, salted, dried, smoked state
2. All meat and marine products, prepared or preserved.
3. Butter, ghee, butter oil, cheese
4. All goods under Chapter 20 (preparations of vegetables, fruits, nuts or other parts of plants, including pickle, murabba, chutney, jam, jelly)
5. Ketchup & sauces, Mustard sauces
6. Dry fruits 2
7. Starches
8. Animal fats and oils
9. Fruit and vegetable juices
10. Roasted chicory and coffee substitutes
11. Yeasts and prepared baking powders
12. Namkeens, bhujia, mixture, chabena
13. Bari made of pulses including mungodi
14. Soya milk drinks
15. Fruit pulp or fruit juice based drinks
16. Tender coconut water (in unit container with brand name)
17. Beverages containing milk

➤ GST – 5 %

1. All fish variants (except seeds of fish, prawn & shrimp) processed, cured, frozen state
2. Ultra-high temperature milk
3. Milk and cream including skimmed milk powder but excluding condensed milk
4. Yoghurt and other fermented milk and cream
5. Chena or paneer in unit container and branded
6. Egg yolk, fresh or dried
7. Natural honey in branded unit container
8. Vegetables frozen or preserved (but unsuitable in that state for immediate consumption)
9. Edible fruits and nuts; peel of citrus fruit or melons, in frozen or preserved state
10. Coffee, tea, pepper, vanilla, cloves, cardamoms
11. Seeds of anise, coriander, cumin
12. Ginger (other than fresh ginger), saffron, turmeric, other spices
13. Cereal groats, meal and pellets in branded unit container
14. Cereal grains worked upon (hulled, rolled, flaked)
15. Meal, powder, flakes, granules and pellets of potatoes
16. Meal and powder of the dried leguminous vegetables (pulses, sago, tamarind)
17. Wheat gluten
18. Soya beans
19. Ground nuts
20. Copra
21. Linseed, rape seeds, sunflower seeds, other oilseeds like mustard, poppy,
22. Flour and meals of oilseeds
23. Sugar beet and sugar cane (frozen and dried)
24. Vegetable fats and oils (groundnut, olive, palm, sunflower oil etc)
25. Beet sugar, cane sugar, khandsari sugar
26. Cocoa beans, shells and paste
27. Mixes and doughs for preparation of bread, pastry and other baker's wares
28. Pizza bread
29. Seviyan
30. Rusks, toasted bread
31. Sweetmeats
32. Flours, meals, and pellets of meat, fish meant for animal consumption
33. Cashew nuts and cashew nut in shell
34. Raisin
35. Ice and snow

➤ GST – Nil %
1. Meat (Other than in frozen state and put up in container)
2. Bones and horn cores, bone grist, bone meal etc., hoof meal, horn meal, etc
3. Fish, prawn and shrimp seeds
4. All fish, fresh or chilled (but not processed, cured and frozen)
5. Fresh milk, pasteurized milk but not concentrated, sweetened
6. Eggs (in shell)
7. Curd, lassi, buttermilk
8. Chena or paneer (except in unit container with brand name)
9. Natural honey (no container-no brand)
10. Fresh fruits and vegetables, roots and tubers (except in frozen state or preserved)
11. Dried fruits
12. Leguminous vegetables, shelled or unshelled
13. Dried leguminous vegetables, shelled, whether or not skinned or split (pulses)
14. Coffee beans, unprocessed tea leaves, fresh spices
15. All cereals (no container-no brand)
16. Cereal grains hulled
17. Flour
18. Atta, maida, besan (no container-no brand)
19. Wheat or meslin flour
20. Cereal flour, groats and meals (no container-no brand)
21. Flour of potato, dried leguminous vegetables (no container-no brand)
22. Oilseeds of seed quality
23. Cane jiggery (gur)
24. Palmyra jaggery
25. Puffed, flattened and parched rice
26. Pappad (except when served for consumption)
27. Bread (branded or otherwise) (except when served for consumption and pizza bread)
28. Prasadam
29. Water (other than aerated, sealed etc)
30. Non-alcoholic toddy
31. Tender coconut powder
32. Aquatic, poultry and cattle feed
33. Salt, all types
Annexure-5: List of KVKs in Rajasthan under ICAR

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<tr>
<td></td>
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<td>22. Krishi Vigyan Kendra, P.Box No.29, Danta, Distt. Barmer-334 001</td>
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<td>22/03/2012 ICAR</td>
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Annexure 6: Detailed PIESTEC analysis of Wheat

Political circumstance
Typically farmers in Rajasthan have 2-3 acres of holdings each. The small and marginal farmers can hardly be expected to invest in better farming technologies, nor aggregate adequate volumes of commodities as to develop alternate marketing channels away from typical APMC or multiple-trader led channel in vogue. There is, therefore, need for aggregation of such farmers into FPOs / FPCs. Typically, such FPOs / FPCs may have a combined holding of 1000-1500 acres.

Institutional context
The globally preferred high income yielding variety of Wheat is malt Wheat. Given the fluctuations in prices as well as need for technology transfer for high yielding varieties, there is apparently need for contact farming agreements with processors. However, there are some limitations in the Contract Farming Act and mechanism in Rajasthan. These limitations need to be corrected to encourage and up-scale contract farming practices.

Economics
There is sound economics in Wheat flour production. In the case of Wheat presently, the gross yield per acre is 50 quintals/ha. A farmer is able to generate a profit of Rs 737 per quintal with an investment of Rs 863 per quintal. Wheat straw is also a major incentive for farmers as it fetches around Rs 250-300 per quintal. Overall, the gross sales from one ha land fetches around Rs 80000 out of which the farmer can earn around Rs 36850/ha.

Social
Typically, the small and marginal farmers in Rajasthan go in for wheat than Wheat. Wheat consumption has apparently a range of health benefits by way of regulation of blood sugar and reducing cholesterol levels in blood. Wheat is more tolerant of soil salinity than Wheat, has a short growing season and is also relatively drought tolerant. Malt Wheat can be cultivated as a Rabi season crop with maize as the kharif season crop. The fluctuations in market prices and relatively higher prices for wheat have discouraged intensification of cultivation of Wheat. However, there is scope for this crop which is less water intensive to be propagated.

Technology
The wheat productivity is already saturated at around 45060 quintals per ha depending upon soil condition, water availability and variety. However, System of Wheat intensification (SWI) can bring new hopes to farmers as it can increase productivity by around 25-40% in case of wheat with around 20% less inputs.
Environment
Wheat requires 5-6 watering and is currently a challenge for the farmers. Many places where, the farmer depends upon ground water, depletion of water bodies is a great threat.

Competition
Wheat due to its significance in the food value chain in India has no big immediate competition with other similar crops like barley. However, area under wheat is stagnant and other crops like pulses or mustard and to some extent barley is increasing in acreage.