CHAPTER-5
POST HARVEST VALUE CHAINS AND MARKET EFFICIENCY OF POTATO IN ASSAM COMPARED TO WEST BENGAL

5.1 Introduction:

The post harvest value chain of potato is the important factor that determines the competitiveness and efficiency of potato marketing. Post harvest value chains are the different channels through which potatoes move from the producers to the consumers. Different value chains are involved in post harvest management of potato crops in the state of Assam. Case studies have been conducted in Barpeta, Lakhimpur and Sonitpur district in Assam to examine the post harvest value chains and market efficiencies of potato crop. To make a comparative study of the post harvest value chains and market efficiency of potato in Assam with the post harvest value chains and market efficiency in the neighbouring West Bengal, case studies have also been conducted in Hooghly district in the state of West Bengal which is the established potato producer in the country.

5.2 Post Harvest Value Chains of Potato in Assam:

In the case studies conducted in Barpeta, Lakhimpur and Sonitpur district of Assam, three important post harvest value chains have been found. These are-

(i) **Value Chain – I:**
Producer – Commission Agent – Whole Seller – Retailer – Consumer

(ii) **Value Chain – II:**
Producer – Whole Seller – Retailer – Consumer

(iii) **Value Chain – III:**
Producer – Retailer – Consumer
Through these marketing value chains, potatoes move from the actual producers to the consumers. The value chain- I involves highest number of intermediaries. Value chain- II involves two intermediaries whereas the value chain- III involves only one intermediary. The price spread (difference of producer price and consumer price) depends on the number of intermediaries involved in the value chains. Involvement of more intermediaries results high price spread and hence less efficiency of marketing of potatoes. During the case study in Barpeta, Lakhimpur and Sonitpur district in Assam, it has been found that maximum quantity of potatoes move through the value chain- II that is “producer – wholeseller – retailer – consumer.

5.3 Price Spread and Marketing Efficiency of Potato in Assam:

As the competitiveness of potato marketing increases, the market becomes more efficient. It is the price spread which indicates the competitiveness and efficiency in the marketing of the potato crop. The potato price spread shows the difference between the price received by the potato producers and the price paid by the potato consumers. The higher difference between the two prices represents more price spread and lesser competitiveness and low efficiency in potato marketing. Inversely, lesser price spread indicates more competitiveness and higher marketing efficiency. As found in the study, marketing efficiency varies in the different areas and importantly in different seasons. Price spread and market efficiency in the harvesting season differs from the price spread and market efficiency in the non-harvesting season particularly in the pre-sowing season. Efficiency of potato marketing in the state of Assam for the different seasons has been investigated and presented in the following section.
5.3.1 Potato Marketing Efficiency in Harvesting Season in Assam:

The degree of efficiencies of marketing of potatoes is an important factor that determines the sustainability of potato sector. The nature of potato marketing has considerable impact on the profitability of potato growers. An investigation has been made on the marketing efficiencies of potato in the major potato producing districts of Assam across the different marketing value chains.

As responded by the potato growers interviewed in Barpeta, Lakhimpur and Sonitpur district of Assam, potatoes are harvested mainly in the months of February and March in every year. The marginal and small farmers sell the potatoes immediately after harvest. Moreover, most of the medium and large farmers also sell a major part of their total produce immediately after harvesting, generally in the months of February and March which is the potato harvesting season. This is mainly because there is no adequate cold storage facility to store potatoes. Moreover, the marginal and small farmers sell their potato output immediately after harvest due to the requirement of immediate cash money. A few numbers of large farmers keep a part of their potatoes in the cold storages. Generally, the small and the marginal farmers take loans from the non-institutional sources either from the village money lenders or from the traders. Thus, the farmers have to pay back the loans immediately after harvesting potato. This makes the farmers to sell their potato output at whatever prices are there in the markets.

Farmers’ choice of different marketing chains varies in different seasons, particularly in harvesting and non-harvesting seasons. Maximum of potatoes are sold through the marketing value chain- I and chain-II in the harvesting season. But, in the non-harvesting season, the producers’ choice value chain- II to sell their produce. The table
no. 5.1 shows prices received by the different selling agents, price spread and producer’s share in consumer’s rupee in the harvesting season.

From the table [refer table no. 5.1], it has been found that in Barpeta district, the value chain- I has the highest price spread (50%) among all the three value chains. As a result, producer’s share in consumer’s rupee is minimum (66.67%) in this marking value chain. But, the value chain- III has the lowest price spread (20%) among all the marketing chains in Barpeta district. Consequently, producer’s share in consumer’s rupee is maximum (83.33%) in value chain- III. Thus, value chain- III is the most competitive and efficient potato marketing value chain during the potato harvesting season (February – March) in Barpeta district.

Similarly, it has been found from the table [refer table no. 5.1] that in Lakhimpur district, the value chain- I has the highest price spread (42.86%) among all the three marketing value chains of potatoes. As a result, producer’s share in consumer’s rupee is the lowest (70%) in value chain- I. On the other hand, the value chain-III has the lowest price spread (17.65%) among all the potato marketing value chains in Lakhimpur district. Consequently, producer’s share in consumer’s rupee is the maximum (85%) in the value chain- III. Therefore, post harvest value chain- III is the most competitive and efficient during the potato harvesting season (February – March) in Lakhimpur district of Assam.
Table 5.1: Prices Received by the Potato Selling Agents, Price Spread and Producer’s Share in Consumer’s Rupee in Harvesting Season in Barpeta, Lakhimpur and Sonitpur District of Assam

| Selling Agents | Prices Received by Selling Agents in the Different Value Chains  
(Price in Rs per quintal) | Barpeta District | Lakhimpur District | Sonitpur District |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chain- I</td>
<td>Chain- II</td>
<td>Chain- III</td>
<td>Chain- I</td>
</tr>
<tr>
<td>Producer</td>
<td>800</td>
<td>900</td>
<td>1000</td>
<td>1400</td>
</tr>
<tr>
<td>Commission Agent</td>
<td>Commission</td>
<td>-</td>
<td>-</td>
<td>Commission</td>
</tr>
<tr>
<td>Whole Seller</td>
<td>1000</td>
<td>1000</td>
<td>-</td>
<td>1700</td>
</tr>
<tr>
<td>Retailer</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
<td>2000</td>
</tr>
<tr>
<td>Price Spread</td>
<td>400  (50%)</td>
<td>300  (33.33%)</td>
<td>200  (20%)</td>
<td>600  (42.86%)</td>
</tr>
<tr>
<td>Producer’s share in consumer’s rupee</td>
<td>66.67%</td>
<td>75%</td>
<td><strong>83.33%</strong></td>
<td>70%</td>
</tr>
</tbody>
</table>

Source: Self estimates based on the primary data collected during the case study in Barpeta, Lakhimpur and Sonitpur district, 2014.
It has also been observed from the table [refer table no. 5.1] that in Sonitpur district, the post harvest value chain-I has the highest price spread (55.56%) among all the value chains in the district during the potato harvesting season. Consequently, the producer’s share in consumer’s rupee is minimum (64.29%) in the value chain- I. Similar to other two districts, value chain- III has the lowest price spread (16.67%) among all the three marketing value chains available in Sonitpur district. As a result, producer’s share in consumer’s rupee is the highest (85.71%) in the value chain- III in Sonitpur district. So, value chain- III is the most competitive and efficient among all the marketing value chains in Sonitpur district during the potato harvesting season (February – March).

Thus, from the above analysis it has been revealed that price spread determines the producer’s share in consumer’s rupee that is the level of market efficiency. Higher price spread leads lesser efficiency of potato markets. Again, lower price spread leads more competitiveness and hence more efficiency in potato markets. In case of all the three districts under the study, potato marketing value chains- III are more competitive and efficient in comparison to the other two value chains available during the potato harvesting season (February – March). This is mainly because of lesser number of intermediaries involved in value chain- III.

5.3.2 Potato Marketing Efficiency in Non-harvesting Season:

In the non-harvesting season, particularly in the pre-seedling season, most of the potatoes in the markets of Assam come from the cold storages of the neighbouring state of West Bengal. The supply of potatoes from the available cold storages in Assam is not adequate in comparison to the market demand in the non-harvesting season in the state.
In fact, during the non-harvesting season, supply of local potato is very low in the markets of Assam.

Post harvest value chains of potato crop have been studied in non-harvesting season particularly, in pre seedling season (September – October) in the state of Assam. Accordingly, a case study has been conducted in the districts of Barpeta, Lakhimpur and Sonitpur in Assam in 2014. Generally, unloading of potatoes from cold storages starts in the month of May – June and continues till 31st November in every year. In the non-harvesting season, the potato growers collect potatoes from the cold storages by submitting the bonds issued to them. It is noted that some of the potato growers store potatoes traditionally in their homes for a few months. The farmers generally choose value chain-II that is “Producers – Whole Sellers – Retailers – Consumers” to sell their produce in the non-harvesting season. Prices received by the different potato selling agents, price spread and producer’s share in consumer’s rupee in the months of September – October in Barpeta, Lakhimpur and Sonitpur district have been studied and presented in the table no. 5.2.

**Table No. 5.2: Prices Received by the Potato Selling Agents, Price Spread and Producer’s Share in Consumer’s Rupee in the Month of September in major Potato Producing Districts in Assam.**

<table>
<thead>
<tr>
<th>Selling Agents</th>
<th>Prices received by the selling agents in value chain-II (Price in Rs per quintal)</th>
<th>Barpeta District</th>
<th>Lakhimpur District</th>
<th>Sonitpur District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producer</td>
<td></td>
<td>1800</td>
<td>2200</td>
<td>1800</td>
</tr>
<tr>
<td>Whole Seller</td>
<td></td>
<td>2200</td>
<td>2700</td>
<td>2300</td>
</tr>
<tr>
<td>Retailer</td>
<td></td>
<td>2500</td>
<td>3000</td>
<td>2600</td>
</tr>
<tr>
<td><strong>Price Spread</strong></td>
<td></td>
<td>700</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>(38.89%)</td>
<td>(36.36%)</td>
<td>(44.44%)</td>
<td></td>
</tr>
<tr>
<td><strong>Producer’s share in consumer’s rupee</strong></td>
<td></td>
<td>72%</td>
<td>73.33%</td>
<td>69.23%</td>
</tr>
</tbody>
</table>

Source: Self estimates based on the primary data collected during the case study in Barpeta, Lakhimpur and Sonitpur district, 2014.
It has been observed in the table [refer table no. 5.2] that the potato growers sell potato through the marketing value chain- II only in the non-harvesting season (in the month of September – October). In Barpeta district, price spread is 38.89% but in Lakhimpur district price spread is 36.36% which is slightly lower compared to Barpeta District. Again in Sonitpur district, price spread has been found 44.44%. Thus, the potato price spread is the highest in Sonitpur district among all the three districts under the study in marketing value chains- II during the non-harvesting season. It has also been found from the table [refer table no. 5.2] that producer’s share in consumer’s rupee is 72% in case of Barpeta district. In Lakhimpur district, producer’s share in consumer’s rupee is 73.33% and in case of Sonitpur district, it is 69.23%. Thus, in Lakhimpur district potato growers’ get the highest percentage share of the consumer’s rupee spent for purchasing potato.

Therefore, from the above analysis it is revealed that marketing of potato crop through value chain- II in Lakhimpur district is the most competitive and efficient in comparison to the marketing of potatoes through value chain- II in Barpeta and Sonitpur districts in the non-harvesting season particularly in the months of September – October.

5.4 Post Harvest Value Chains of Potato in West Bengal:

Post harvest value chains are the different marketing channels through which potatoes move from the actual producers to the consumers. Different value chains are involved with different intermediaries of potato marketing. In the case study of potato marketing in West Bengal, different post harvest value chains of potato have been examined. The important post harvest value chains are-
(i) **Value Chain – I:**
Producer – Commission Agent – Whole Seller – Retailer – Consumer

(ii) **Value Chain – II:**
Producer – Whole Seller – Retailer – Consumer

(iii) **Value Chain – III:**
Producer – Retailer – Consumer

Thus, potatoes move from the actual producers to the consumers through the above mentioned important marketing value chains. Value chain- I involves highest number of intermediaries in comparison to the other two value chains. The value chain- III has only one intermediary. The price spread (difference between producer price and consumer price) depends on the number of intermediaries involved in the particular value chain. Among the three marketing value chains, maximum quantity of potatoes move through the marketing value chain- I and value chain- II in the harvesting season (February – March) as reported in the case study conducted in the district of Hooghly of West Bengal. But, during the non-harvesting season, maximum quantity of potato is sold through the value chain- II that is “Producer – Whole Seller – Retailer – Consumer.

### 5.5 Price Spread and Marketing Efficiency of Potato in West Bengal:

As the competitiveness of potato marketing increases, the market becomes more efficient. It is the price spread which indicates the competitiveness and efficiency in the marketing of the potato crop. The Price spread indicates the difference between the price received by the producers and the price paid by the consumers. The higher difference between the two prices indicates higher price spread and less competitiveness and lower efficiency in potato marketing (Bhajantri, 2011). Inversely, lesser price spread indicates more competitiveness and higher marketing efficiency. As found in case the study in the state of West Bengal, marketing efficiency varies in the different
value chains and importantly in different seasons. Price spread of potato marketing in the harvesting season differs from the marketing in the non-harvesting season particularly in pre-sowing season. Efficiency of potato marketing in the state of West Bengal in case of different post harvest value chains and in the different seasons has been investigated.

5.5.1 Potato Marketing Efficiency in Harvesting Season in West Bengal:

As responded by the potato growers interviewed in Hooghly district of West Bengal, potatoes are harvested mainly in the months of February and March in every year. The marginal and small farmers sell the potato immediately after harvest. Moreover, some of the medium and large farmers also sell a part of their total produce immediately after harvest generally in the months of February and March. This is because; some of the large farmers are risk averters as they are not taking the risk of drastic price fall if any, in the non-harvesting season. Maximum quantity of potato has been sold through the marketing value chain- I and value chain- II in the harvesting season (February and March) in West Bengal as found in the study. The table no. 5.3 shows prices received by the different selling agents, price spread and producer’s share in consumer’s rupee in the harvesting season.

It has been found in the table [refer table no. 5.3] that out of the three value chains, the value chain- I has the highest price spread (33.33%) and the value chain- III has the lowest price spread (14.29%) in the harvesting season (February – March) in the Hooghly district of West Bengal under the study. Similarly, producer’s share in consumer’s rupee is lowest (75%) in case of the value chain- I among all the value
chains used to sell the potatoes. The producer’s share in consumer’s rupee in value chain- II is 81.25%. In case of the value chain- III, the producer’s share in consumer’s rupee is the highest (87.5%) among all the marketing value chains used during the harvesting season in Hooghly district.

Table 5.3: Prices Received by the Potato Selling Agents, Price Spread and Producer’s Share in Consumer’s Rupee in Harvesting Season in Hooghly District of West Bengal

<table>
<thead>
<tr>
<th>Selling Agents</th>
<th>Prices received by selling agents in the different channels (Price in Rs per quintal)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chain- I</td>
<td>Chain- II</td>
</tr>
<tr>
<td>Producer</td>
<td>600</td>
<td>650</td>
</tr>
<tr>
<td>Commission Agent</td>
<td>commission</td>
<td>-</td>
</tr>
<tr>
<td>Whole Seller</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>Retailer</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td><strong>Price Spread</strong></td>
<td><strong>200</strong></td>
<td><strong>150</strong></td>
</tr>
<tr>
<td></td>
<td>(33.33%)</td>
<td>(23.08%)</td>
</tr>
<tr>
<td><strong>Producer’s share in consumer’s rupee</strong></td>
<td><strong>75%</strong></td>
<td><strong>81.25%</strong></td>
</tr>
</tbody>
</table>

Source: Self estimates based on the primary data collected during the case study in Hooghly district, 2014. Note: Prices of kufri Jyoti variety of potato has been considered in the study which is mainly produced in the study area.

Therefore, from the case study conducted in Hooghly district of West Bengal in the month of September 2014, it has been found that the potato marketing value chain- III, which is “Producer – Retailer – Consumer”, is most efficient during the potato harvesting season. The producers get maximum share of consumers’ rupees paid as a price of potato. But, potato growers use this marketing chain only in the potato harvesting season, particularly in the months of February and March in every year. In the non-harvesting season, the farmers sell their produce to the whole sellers by using bonds of potato issued by the cold storage authorities. The potato growers prefer marketing value chain- I and value chain- III particularly in the harvesting season.
5.5.2 Marketing Efficiency in Non-Harvesting Season in West Bengal:

Marketing of potato crop has been studied in non-harvesting season in the state of West Bengal. Accordingly, a case study has been conducted in the district of Hooghly in West Bengal in the month of September, 2014. Generally, unloading of potato form cold storages starts in the month of May and continues till 31st November in every year. In the non-harvesting season, generally the potato growers sell potatoes not directly in terms of crops but in terms of potato bonds. The farmers generally prefer value chain-II that is “Producers – Whole Sellers – Retailers – Consumers” to sell their produce in the non-harvesting season. The bond holding farmers sell their bonds to the whole sellers and not to the retailers. Moreover, bonds contain huge quantity of potatoes which are generally beyond the purchasing capacity of the retailers. Prices received by the different potato selling agents, price spread and producer’s share in consumer’s rupee in the value chain- II in the month of September have been presented in the following table [refer table no. 5.4].

Table No. 5.4: Prices Received by the Potato Selling Agents, Price Spread and Producer’s Share in Consumer’s Rupee in the Month of September in Hooghly District of West Bengal

<table>
<thead>
<tr>
<th>Selling Agents</th>
<th>Prices received by the selling agents in value Chain-II (Price in Rs per quintal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producer</td>
<td>1300</td>
</tr>
<tr>
<td>Whole Seller</td>
<td>1800</td>
</tr>
<tr>
<td>Retailer</td>
<td>2000</td>
</tr>
<tr>
<td><strong>Price Spread</strong></td>
<td><strong>700</strong> (53.85%)</td>
</tr>
<tr>
<td><strong>Producer’s Share in Consumer’s Rupee</strong></td>
<td><strong>65%</strong></td>
</tr>
</tbody>
</table>

Source: Self estimates based on the primary data collected during the case study in Hooghly district of West Bengal in 2014.
It has been found in the table [refer table no. 5.4] that post harvest value chain-II which is mainly used in non-harvesting season has 53.85% price spread. As a result, producer’s share in consumer’s rupee is 65% in the value chain- II.

Therefore, from the above analysis, it can be concluded that marketing of potatoes during the harvesting season (February – March) is more competitive and efficient in comparison to the marketing of the crop during the non-harvesting season (September – October) in the state of West Bengal under the study. This is because, the potato growers receive lesser percentage share from the consumer’s rupee paid as the price of potato in the non-harvesting season in comparison to percentage shares from the consumer’s rupee in all the marketing channels used in the harvesting season in Hooghly district of West Bengal.

5.6 Comparative Analysis of Potato Marketing Efficiency between the State of Assam and West Bengal:

To have a clear understanding about the potato marketing competitiveness and efficiency in the state of Assam, a comparative analysis of potato marketing value chains, competitiveness and efficiencies of markets of potato crop between the state of Assam and West Bengal has been made. The state of West Bengal is already an established potato producing state in the country. It is the second highest potato producing state in India. Potatoes of West Bengal come into the markets in the state of Assam and in the other northeastern states of India. It is remarkable that even during the period of potato harvesting (February – March) in the state, supply of potatoes in the markets of Assam comes from neighbouring West Bengal. During the case study conducted in Barpeta, Lakhimpur and Sonitpur district of Assam, it has been found that
just during the pre-harvesting season, fresh (newly harvested) potatoes come into the markets of Assam from the state of Punjab. This indicates that the farmers in Punjab have large size of early harvesting potatoes that is in the months November – December. The table [refer table no. 5.5] represents price spreads and producer’s shares in consumer’s rupee spent for purchasing potato in the major potato producing districts of Assam and West Bengal.

From the table no. 5.5, it has been observed that price spreads in the potato marketing value chains I, II and III in the harvesting season (February – March) in the Hooghly district of West Bengal are lower compared to price spreads in the corresponding value chains in the potato harvesting season in Barpeta, Lakhimpur and Sonitpur district of Assam. Consequently, in harvesting season, potato producer’s shares in consumer’s rupee spent on purchasing potato are higher in the marketing value chain I, II and III in the state of West Bengal compared to producer’s share in consumer’s rupee spent on purchasing potato in the corresponding marketing value chains in each of the districts of Assam under the study. **This implies that in the harvesting season (February – March) markets of potatoes in the state of West Bengal are more competitive and efficient in comparison to the potato markets in the state of Assam.**

It has also been observed in the table [refer table no. 5.5] that in non-harvesting season [September – October], price spread in the potato marketing value chain II in the state of West Bengal is higher in comparison to the corresponding potato marketing value chains in Barpeta, Lakhimpur and Sonitpur district of Assam in the non-harvesting season. Price spread is 53.9 percent in value chain II in non-harvesting season in the state of West Bengal. But, in Barpeta, Lakhimpur and Sonitpur district of Assam, the corresponding price spreads are 38.9 percent, 36.4 percent and 44.4 percent respectively.
<table>
<thead>
<tr>
<th>States</th>
<th>Assam</th>
<th>West Bengal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Barpeta</td>
<td>Lakhimpur</td>
</tr>
<tr>
<td>Districts</td>
<td>Harvesting</td>
<td>Non-harvesting</td>
</tr>
<tr>
<td>Season</td>
<td>Harvesting</td>
<td>Non-harvesting</td>
</tr>
<tr>
<td>Value Chains</td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>Price Spreads (in percentage)</td>
<td>50</td>
<td>33.3</td>
</tr>
<tr>
<td>Producer’s Share in Consumer’s Rupee (in percentage)</td>
<td>66.7</td>
<td>75</td>
</tr>
</tbody>
</table>

Source: Self estimates based on the data collected in the case studies in Assam and West Bengal in 2014.
On the other hand, potato producer’s share in consumer’s rupee is 65 percent in the state of West Bengal in the non-harvesting season. But, producer’s shares in consumer’s rupee spent for buying potato in Barpeta, Lakhimpur and Sonitpur districts of Assam are 72 percent, 73.3 percent and 69.2 percent respectively in the non-harvesting season. This implies that in the non-harvesting season, particularly during the pre-seedling season [September – October], markets of potato crop in the state of Assam are more competitive and efficient in comparison to the markets of potatoes in the state of West Bengal. But, it is to be noted that during the period of non-harvesting season (September – October), supply of local potato in the markets of Assam is very low in comparison to the supply of local potatoes in the harvesting season (February – March). During the non-harvesting season, majority share of potatoes in the markets of Assam come from state of West Bengal and Uttar Pradesh.

5.7 Significance of Cold Storages in the Post Harvest Management of Potato:

The cold storages play an important role in the post harvest management of potato crop. Since, potato is a semi-perishable crop; it can be stored in cold storages scientifically for 7 to 8 months and can make the supply of the crop whole the year particularly in the non-harvesting season. Storing potato at homes results damages of the crop in terms of rotten, sprout, weight losses etc. This is mainly because, immediately after harvesting of potato crops, temperature of the environment increases. The high temperature is not suitable for storing potato without damages. Therefore, it is essential to store potatoes in the cold storages so as to control damages of the crop. The district of Hooghly has the highest number of cold storages among the entire districts in West Bengal. Cold storages are also concentrated in the Bankura, West Medinipore and Burdwan district in
West Bengal. Most of the cold storages are in private sector while a few among them are of the cooperative type.

From potato growers’ view point; storing potatoes at the cold storages are economically beneficial. Since, potato is a short duration crop and its harvesting period is also short. Supply of potatoes creates gluts in the markets during the harvesting seasons [February – March]. Consequently, prices of potato fall down drastically during the harvesting season. Price becomes so low that potato growers even cannot recover the cost of production of the crop. Some of the potato growers, particularly the small and marginal potato growers sell the potato at whatever pitiable price is available in the markets.

Therefore, some of the potato growers, particularly the medium and large size potato farmers store either whole or a part of their potato produce in the cold storage and wait till the price of potato rises in the markets after a few months. Moreover, during the case studies in the state of Assam and West Bengal, it has been found that some of the potato growers store potato for seed purpose for the next year.

It has also been found that some of the potato dealers such as potato whole sellers purchase potato at the low prices during the harvesting period and store them in the cold storage to sell at the high prices in the non-harvesting seasons. It is remarkable that some of the owners of cold storages themselves purchases potato during the harvesting seasons at the low prices and store them in their own cold storages as found in the case studies both in the state of Assam and West Bengal. The owners purchase potatoes to store in their own cold storages particularly when the total storage capacity of the cold storage is not fully used by the potatoes stored by the potato growers and potato dealers.
Moreover, in the non harvesting season, potatoes of West Bengal are transported to those states where its production is very low. This helps to stabilize potato prices in those states where production is not good. The developed cold storage system has contributed in supplying potatoes from West Bengal to the other deficient states even in the pre-sowing months. The development of cold storage system has the significant role in the growth of potato processing industries in the country and even in the globe. This is presented in the following section.

5.7.1 Cold Storage and Potato Processing Industries:

At present potato does not remain only a vegetable crop in our country, rather the crop partially becomes food substitute. Different processed products of potatoes have been using as supplementary foods or snack foods in the household consumptions, hotels, restaurants, canteens, etc. The main potato processed products in India are potato chips, potato sticks, French fries, potato flakes, potato powder, potato granules, alcohol, potato starch and other dehydrated products like alu bhujia, samosa, tikkis, etc. Still potato chips form the most common and popular potato processed product in the country. In India, the demand for potato processed products has been increasing continuously in the recent years. This is mainly because of the improvement in the living standard, increased urbanization, preference for fast foods, rise in per capita income, increase in the number of working women who prefer ready cooked items and expanding the tourist sector in the country.

The important industries engaged in potato processing in India are Frito Lay, Haldiram, Potato King, Balaji Wafers and Indian Tobacco Company (ITC). Moreover, multinational companies such as M/S Pepsi Co India Holdings Pvt. Ltd., M/S McCains
Food Ltd. are also producing potato processed products in India. Initially all major potato processing industries were located in and around Delhi and in Punjab. But, gradually in response to the growing demands of potato processed products all over the country, several new multinational and Indian potato processing industries have established their production units in different parts of the country. These industries have come particularly in Kolkata (West Bengal), Guwahati (Assam), Indore (MP), Rajkot and Mehsana (Gujrat), Haridwar (Uttaranchal), Pune (Maharastra), Coimbatore (Tamil Nadu) etc.

In the case studies in the state of West Bengal, it has been found that some of the potato processing industries such as M/S Pepsi Co India Holdings Pvt. Ltd engaged in contract potato farming for getting potatoes in assured prices and quantities determined previously.

The potato processing industries in the state of West Bengal, along with the country as a whole, demand potato whole the year as the raw materials. It is remarkable that for the purpose of processing, the processing industries demand potatoes which have some requisites qualities regarding size of potatoes, colour, level of reduced sugar contents of the potatoes etc. Preserving potatoes for whole the year with maintaining the requisite qualities of processing is only possible with the help of cold storage system. Thus, continuing potato processing round the year has been contributed significantly by the available cold storage system in the state of West Bengal as revealed in case study.

**5.8 A Comparative Study of Cold Storages in Assam and West Bengal:**

West Bengal is an established potato producing state in the country. Presently, West Bengal produces second largest quantity of potato crop among all the states in India.
The infrastructures of potato production and its post harvest managements are comparatively better in the state of West Bengal in comparison to the state of Assam. To have a clear understanding about the potato sector in the state Assam, a comparative analysis has been made of the number cold storage, storage capacity and the ratio of the number of cold storage to the total potato production and the ratio of the number of cold storage capacity to total production in Assam and its neighbouring state West Bengal.

The table no. 5.6 represents cold storage number, storage capacity, ratio of cold storage number to total production, ratio of cold storage capacity to total potato production in Assam and West Bengal.

**Table No.5.6: Number of Cold Storage, Storage Capacity and their Ratios with total Potato Production in Assam and West Bengal**

<table>
<thead>
<tr>
<th>Year</th>
<th>Assam</th>
<th></th>
<th>West Bengal</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Cold Storage</td>
<td>Cold Storage Capacity (in MT)</td>
<td>Ratio of Number of Storage to Total Potato Production (in MT)</td>
<td>Ratio of Storage Capacity to Total Potato Production (in MT)</td>
<td>No. of Cold Storage</td>
</tr>
<tr>
<td>2009</td>
<td>30</td>
<td>86,776</td>
<td>1 : 17200</td>
<td>1 : 5.94</td>
</tr>
<tr>
<td>2013</td>
<td>51</td>
<td>1,50,076</td>
<td>1 : 19123</td>
<td>1 : 6.50</td>
</tr>
</tbody>
</table>

Source: Author’s self estimates based on different published issues of Assam Small Farmers’ Agribusiness Consortium and West Bengal Marketing Board

From the table [refer table no.5.6] it is observed that the number of cold storage has increased in Assam from only 30 in 2009 to 51 in 2013. This shows that the number of cold storages has increased by 70 percent during 2009 to 2013. Similarly, the capacity of cold storage in Assam has increased by 73 percent during the same period. But, from the case study it is found that the number and capacity of cold storages are not adequate and accessible for the farmers. Moreover, cold storages are located far away from the production centers and farmers do not get bonds from the cold stores easily. On the
other hand, the number of cold storage in West Bengal was 390 in the year 2013 which are 7.6 times more in comparison to number of cold storage in Assam in the same year. Similarly, in 2013, capacity of cold storage in West Bengal was 27 times more than the capacity of cold storage in Assam.

It is important to note that the ratio of cold storage capacity to the total potato production in the state of West Bengal is more encouraging in comparison to the state of Assam in 2013. In Assam the ratio of cold storage capacity to total potato production was 1: 6.50 whereas in the state of West Bengal the ratio of cold storage capacity to total potato production was 1: 2.83. From this finding, it is clear that there is a considerable shortage of cold storage facility in the state of Assam in comparison to the neighbouring state of West Bengal.

**Number of Cold Storage, Storage Capacity and Ratio of Number as well as Capacity of Cold Storage to Total Potato Production in Assam and West Bengal.**

![Figure- 5.1](image-url)
In the case study in the state of West Bengal, it has been observed that cold storages are located in urban, semi-urban and even in the rural areas. Many, cold storages are located mainly in and around the production centers in the state. As a result, the potato growers need to spend negligible amount of money on the transportation of potatoes from the production fields to the cold storages. This provides incentive to the potato growers particularly the medium and small farmers to store their potato produce in the cold storage. Moreover, easy availability and accessibility of cold storage facilities motivate the farmers to increase the quantity of potato production.

The figure [refer figure- 5.1] shows clearly the comparative position of the cold storages, Storage capacities and their ratios with total potato production in the state of Assam and West Bengal.

5.9 Patterns of Storing in the Cold Storage and Selling of Potato by the Growers:

During the case studies in the state of Assam and West Bengal, the patterns of storing potatoes in the cold storages by the potato growers and selling of potatoes have been investigated. In the study, it has been found that the cold storage authorities issue bonds to the farmers who store potato in those particular stores at the time of storing potato. The bond contains the terms and conditions of storing potatoes in the storage. Moreover, the cold storage authorities also issues bonds to the whole sellers who store potato in that particular storage. In fact bonds are the agreements between the cold storage authorities and those who store potato in the cold storages. Bonds content the instructions regarding rent of potato storage, qualities of potatoes to be stored, number
of days to be stored, systems of taking away potatoes from the storage, system of compensation for the damage of potatoes if any etc.

It has been reported in the case study in Hooghly district of West Bengal that Storing of potato in the cold storages is completed within the month of April. The cold storages are opened from the month May in every year. The bond holders may receive their potatoes starting from the month of May to month of November. It is to be noted that the Government of West Bengal has instructed to the cold storage authorities that within the 31st of November in every year, all the potatoes should be unloaded from the storages. The State Government has been trying to control the prices of potato in the non-harvesting season particularly during the pre-sowing season when the price of the crop reaches its peak level.

It has been found during the case study in Assam and West Bengal that the potato farmers receive their potatoes from the cold storages with the deposit of the bonds issued to them. It is interesting to know that bond holding farmers may or may not receive their own products of potatoes. There is always a mixed up and exchanges of potato packets in the cold storages. It is remarkable that most of potato growers do not receive the potatoes from the cold storage. This section of the potato growers, sell their potato bonds to the potato dealers such as whole sellers. The whole sellers receive the potato from the cold storages in due time. So, there is a development of potato bond market particularly in the state of West Bengal.
5.10 Cold Storage and Post Harvest Processes of Potato Produced in Assam:

In the case studies conducted in the different districts in the state of Assam, it has been found that there is a shortage of the number as well as the storage capacity of the cold storages in Assam. As reported by the potato growers and the potato dealers, shortage of cold storage and cold chain facilities is one of the main reasons of low level production and inefficient post harvest management of potato crop in the different regions of Assam.

In course of the study, it has been found that Mandia and Barpeta Road ADO circles are the major potato producing circles in Barpeta district of Assam. But, there is no any cold storage facility either in Mandia or in Barpeta Road area. Some of the medium and large potato growers in Barpeta district particularly in Mandia and Barpeta Road area, store a part of their potato produce in the cold storages located far away in Guwahati. They have to carry their potato products a long distance of about 100 kms by incurring a considerable transportation costs. This discourages some of the small and medium farmers to store potatoes in the cold storage which are not locally available.

During the case study conducted in Barpeta district, it is found that there is a cold storage in nearby the Sorbhog town. This is Sorbhog Cold Storage which is cooperative type. This cold storage is small size having only 25000 quintals storage capacity. As reported by the Sorbhog Cold Storage authority, the potato growers store potatoes in that cold storage mainly for seed purpose. Total storage capacity is fully used in every year. Some of the potato growers in Mandia and Barpeta Road ADO circle state that it is difficult to get bonds of the Sorbhog Cold Storage. This is mainly because there is a competition to having bonds during the time of potato harvesting in Sorbhog Cold
Storage. Some of the potato growers both in Mandia and in Barpata Road circles store their potato products in the cold storage located in Kajolgaon, the head quarter of Chirang district. The Chirang cold storage is located about 50 kms away from the Mandia circle which is the main production center of potato in the district of Barpeta. Since, seeds prices remain very high during the period of seedling or sowing. Potato seeds come in the markets of Assam mainly from Punjab. These seeds of Punjab are sold at high prices in Assam. Therefore, to avoid from the purchasing of seeds at high prices, some of the potato growers store potatoes in cold storage for seed purpose. It has also been found in the case study that some of the potato growers particularly the large farmers store potatoes in the cold storage not for their own seed requirements but for commercial purpose. This section of farmers, sell their potato products as seeds during the seedling season. Prices of seed potatoes remain far higher in comparison to the potato used for consumption purpose.

In Lakhimpur district also, there is a shortage of cold storage facility as found in the case study. Some of the potato growers store potato by using traditional methods in their own homes. They store, potatoes at homes mainly because of seed purpose and partly because selling potato in the non-harvesting season when price of potato rises to a high level.

As found in the case study conducted in Sonitpur district, there is a cold storage in nearby Tezpur town, where potatoes are mainly stored by the potato dealers like whole sellers. In Sonitpur district, Gingia ADO circle is the highest potato producing circle in the district. Interestingly, there is a cold storage in Gingia where potato production is concentrated. The name of the cold storage is ‘Suniti Prova Cold Storage’. Thus, the
cold storage is located in the centre of potato production in Gingia area under the Biswanath Chariali subdivision of Sonitpur district. This cold storage is of private type.

As reported by the Gingia cold storage authority, total storage capacity of the cold storage is 1,00,000 quintals. The total storage capacity of Gingia cold storage is fully used by the potato growers by the local potatoes. Mostly, the potato growers of Gingia area store potato in this cold storage. A few potato dealers such as potato whole sellers also store potato but these are locally produced potatoes. As stated by the cold storage authority, total storage capacity of Gingia cold storage is fully utilized every year by the locally produced potatoes.

5.11 Problems of the Cold Storages in Assam:

During the case studies conducted in the major potato producing districts of Assam, the problems of the potato cold storages have been investigated. In this regard, some of the cold storage authorities have been interviewed. This has revealed that the cold storages in Assam have been suffering from some common problems. The cold storage authorities face some difficulties in the smooth and efficient management of the cold storages. These problems are stated in following points-

(i) Irregular Power Supply:

One of the serious problems of the cold storages in state of Assam is the irregular power supply in the cold storages. In the cold storages, refrigerators are to be on continuously after the potatoes are stored. To control the temperature in the cold storages to the stipulated level, the refrigerating machines have to be on for 24 hours of the day. Thus, there is a heavy requirement of electricity to manage the cold storages smoothly without damaging the stored potatoes. But, as stated by all the cold storage authorities
interviewed, power supply in the cold storages is not regular. They suffer from frequent
power cut and some time powers supply disrupts for long time.

The temperature in the cold store rises when the refrigerating machine cannot be run
due to power cut. This causes the rotten of potato in the store. It has been found in the
study that some of the cold storage authorities use power generator run by diesel to
continue the refrigerator on during the time of power cut. This, on the other leads
increase in the cost of management of the cold storages. As state by the Chirang
Logistic Cold Storage authority, there was an incident of damage of potatoes in large
quantity in the Chirang Cold storage in 2014.

(ii) High Electricity Charge:

Another acute problem of the potato cold storages under the study in the state of Assam
is that cold storages authorities have to pay high electricity charge every year. The
government does not provide any subsidy on the price of electricity used in the potato
cold storages. Sometimes the owners of the cold storages incur losses due to high
electricity bill paid by them. As a result, the cold storage authorities have nothing but to
increase the rent of potato storage in the cold store. Presently, the rent of potato storage
in the cold storages in Assam varies between Rs. 200 to Rs. 250 per quintal. This rent is
two times more in comparison to the rent available in the cold storages in the state of
West Bengal as found in the case study. The high rent of potato storage in the cold
storages in Assam discourages some of the potato growers to store their potato produce
in the cold storage. The cost of marketing at the farmers’ level rises due to high rent of
potato storage in the cold storages.
5.12 A Comparative Study of the Potato Storage Rents in Some Selected Cold Storages in Assam and West Bengal:

To have a deep insight into the potato cold storage facilities accessible to the farmers in the state of Assam, a comparative study has been made of the storage costs of the cold storages in terms rent per quintal between the state of Assam and West Bengal. Since, the size and storage capacities are more of the cold storages in the state of West Bengal in comparison to the cold storages in Assam; hence the managements of the cold storages in West Bengal have some economies of scale. This also causes the reduction of rent per quintal of potato storage in the cold storages in the neighbouring West Bengal.

The table no. 5.7 represents the storage rents along with the storage capacities of the different cold storages under study in the states of Assam and West Bengal. It has been observed from the table [refer table no. 5.7], that storage rent (in Rs.) per quintal of potato of all the cold storages in Assam are higher in comparison to the storage rent of all the cold storages in the state of West Bengal. The Sorbhog Cold Cstorage in Barpeta district charges highest storage rent among all the cold storages in the Assam under the present study. The storage rent in the Sorbhog Cold Storage is Rs. 240 per quintal of potato for one entire season (from the month of April to November). The Chirang Logistic Cold Storage in Chirang district and Suniti Prova Cold Storage (Gingia Cold Storage) in Sonitpur district charge potato storage rent of Rs. 210 per quintal and Rs. 200 per quintal respectively for the one entire season of storage that is from the month of April to November. It is noted that the Sorbhog Cold Storage charge highest rent per quintal of potato storage among all the cold storages in the state of Assam under the
present study. At the same time, it is noted that the total storage capacity of the Sorbhog Cold Storage is the lowest among all the cold storages in Assam under the study.

Table No. 5.7: Potato Storage Rents in Some Selected Cold Storages in Assam and West Bengal in 2014

<table>
<thead>
<tr>
<th>State</th>
<th>District</th>
<th>Name of Cold Storage</th>
<th>Total Storage Capacity (in quintal)</th>
<th>Rent per quintal (in Rs.)</th>
<th>Average Rent per quintal (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assam</td>
<td>Barpeta</td>
<td>Sorbhog Cold Storage</td>
<td>25,000</td>
<td>240</td>
<td>217</td>
</tr>
<tr>
<td></td>
<td>Chirang</td>
<td>Chirang Logistic Cold Storage</td>
<td>60,000</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sonitpur</td>
<td>Suniti Prova Cold Storage (Gingia)</td>
<td>1,00,000</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>Hooghly</td>
<td>Kalpataru Cold Storage</td>
<td>2,25,000</td>
<td>132</td>
<td>133</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chinsuria Cold Storage</td>
<td>2,00,000</td>
<td>131</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Narayanpur Cold Storage</td>
<td>1,00,000</td>
<td>135</td>
<td></td>
</tr>
</tbody>
</table>

Source: Self estimates based on data collected during the case studies in Assam and West Bengal in 2014

Similarly, it has also been found in the table [refer table no. 5.7] that Narayanpur Cold Storage in Hooghly district of West Bengal has the highest potato storage rent per quintal among all the cold storages under the study. The storage rent is Rs. 135 per quintal of potato in Narayanpur Cold Storage for the one entire season [from April to November]. The Kalpataru Cold Storage and the Chinsuria Cold Storage in Hooghly district of West Bengal charge potato storage rent of Rs. 132 per quintal and Rs. 131 per quintal respectively for the one entire season. It is to be noted that, rent per quintal of potato storage is the highest in Narayanpur Cold Storage among all the cold storages in Hooghly district under the present study. At the same time, it is to be noted that the Narayanpur Cold Storage has the lowest storage capacity among all the cold storages in Hooghly district under the study.
For having a more clear understanding about the potato storage rents in the cold storages in Assam and West Bengal, average storage rents per quintal of potato have been estimated. Accordingly, it has been found in the table [refer table no. 5.7] that average storage rent is Rs. 217 per quintal in the cold storages in Assam. On the other hand, average storage rent of potato is Rs. 133 per quintal in the cold storages in the state of West Bengal under the study. Therefore, from the above analysis, it is revealed that the potato cold storage cost is higher in the state of Assam in comparison to the potato storage cost in the cold storages in the neighbouring state of West Bengal. The figure no. 5.2 represents the potato storage rents of the different cold storages in the state of Assam and West Bengal.

**Potato Storage Rents in Some Selected Cold Storages in Assam and West Bengal in 2014**

![Figure 5.2](image)

**Note:** In the figure CS indicates cold storage.

From the figure [refer figure- 5.2], it has been observed that the rents of storage of potato in the cold storages in the Hooghly district of West Bengal are considerably lower in comparison to the rent of storage of potato in the cold storages in the different districts of Assam. This is because cost of refrigeration of the cold storages in the state
of West Bengal is lower in comparison to the cost of refrigeration of the cold storages in the state of Assam. The cold storage authorities in West Bengal pay comparatively lower rate of electricity charge per unit. But, in case of Assam, the cold storage authorities pay comparatively higher rate of electricity charge per unit.

5.13 Conclusion:

From the comparative study of the post harvest processes of potato in the state of Assam and West Bengal, it is clear that there are mainly three common post harvest value chains in both the state. During the harvesting season, maximum of potatoes are sold through the marketing value chain- I and chain-II. But, in the non-harvesting season, the producers’ choice value chain- II to sell their produce. In the state of Assam, potato marketing value chain- III is more competitive and efficient in comparison to the other two value chains available during the potato harvesting season. During the harvesting season markets of potatoes in the state of West Bengal are more efficient in comparison to the potato markets in the state of Assam. In the non-harvesting season, particularly during the pre-seedling season markets of potato in the state of Assam are more efficient in comparison to the markets of potatoes in the state of West Bengal.

Cold storages play a very important role in the post harvest processes of potato which is a semi-perishable crop. It helps in preserving and supplying potatoes whole the year at the stable prices both for the consumers and the potato processing industries. Shortage of cold storage and cold chain facilities is one of the main reasons of low level production and inefficient post harvest management of potato crop in Assam particularly in the area under study. To increase production and efficient marketing of potatoes in the state of Assam, cost effective cold storages and cold chain facilities are to be developed.