“An Assessment of Logistics in Agriculture Sector with Special Reference to Rajasthan”.

A

THESIS

Submitted to

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Doctor of Philosophy

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SUPERVISOR'S CERTIFICATE

It is certified that the thesis entiltled " **An assessment of Logistics in Agriculture sector with special reference to Rajasthan**" is record of research work done by Mr Om Prakash Pathak, under my supervision. The thesis has not formed the basis for the award of any degree, diploma, associateship, fellowship or similar title to the candidate and it represents independent work on the part of candidate.

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Declaration

I declare that the conceptual framework of the thesis has been developed on the basis of Literature Review as shown in the bibliography section. I have quoted several statistics, notes, opinions, and other information directly from the various books, journals, periodicals, and other reference materials with clear mention of the source of the information in the references.

Apart from these, all other opinions, hypothesis, remarks, inferences, analysis and interpretations in this thesis are my own and original creation.

Moreover, I also declare that for the work done on the topic, entitled "An Assessment of Logistics in Agriculture sector with special reference to Rajasthan" is a record of independent research work carried out by me under the supervision of Dr R A Gupta , Principal , Government college Sikrai, (Dausa)

This work has not been submitted for the award of any diploma, degree, associate ship or other similar title.

Place: Kota Om Prakash Pathak

Date

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Date: Kota Om Prakash Pathak

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Preface

Logistics management for agriculture production priorities across the globe have evolved considerably over the past four decades, from being exclusively technical in their outlook, to being more precise for post harvest losses of foodgrains in logistics. The need for precise 'Estimation of Post Harvest Losses of Foodgrains' was being felt in the context of planning for the agricultural development, proper distribution of government programmes, pricing policies for agricultural commodities and to increase the availability of food. For accumulating the figure of foodgrains losses in different stages of logistics, for knowing the losses data a survey conducted by the researcher. This study was conducted in Rajasthan which have high yield production of some crops in India, but due to lack of proper logistics system farmers of this area suffer heavy losses and difficulty in procuring their agriculture production. Estimation of Logistics Losses' of some of the important cereals, namely, Oil Seeds, Wheat, Jowar, Bajra, Jo and Maize. To make it more realistic, as the survey throws up information not only on logistics losses of foodgrains but also on variety of other crucial items like farm retention for family consumption, seed, feed and wastages etc. In view of this, the researcher initiated a sample area survey for Estimation of Post Harvest Losses of selected foodgrains stretching over a period of the study. The research study has been conducted of five distiricts namely Jaipur, Alwar, Bhartpur ,Dausa and Kota from these districts 300 cultivator households and 50 intermediaries were selected through multistage stratified random sampling design.

The first chapter provides an introduction in line with the problem formulation and identification of the research topic together with theoretical framework and background of the Indian agriculture and logistics management of foodgrains.

In chapter two, research methodology has been elaborated in the required sequential steps.

Chapter three includes the profile of the sample area under study.

Chapter four covers logistics management of agriculture products with some important measures such as moisture management and grading system which help in reduction of PHL of foodgarins.

Chapter five covers Role of storage facilities in PHL with the introduction and present position of some public sector organization that plays an important role in foodgrains storage and procurement.

Chapter six covers analysis of the data collected from farmers and intermediaries with its statistical analysis with the help of econometric tools, along with their interpretations.

Chapter seven comprises of findings with overall conclusions and important suggestion to reduce theses foodgrians losses, limitations and further scope of the study.

Appendix contains a response sheet of farmers and intermediaries with the two set of questionnaire which contains the information about profile of both the respondents separately and the crops grown in this area along with the mode, problems and expectation from present logistics system, copy of estimated agriculture marketing plan for twelfth plan period (2012-17) and at the end, a bibliography of various books, journals and websites has been provided as the references of the study. Apart from these, at the end of each chapter, a brief summary of the analysis and references have also been given to facilitate quick identification.

This study is based on the recent practices and researches so that it will help in understanding the logistics management of foodgrains. And provide a clear picture of current logistics system with the problems faced by the farmers and intermediaries and the amount PHL of foodgrains losses due to lack of proper logistics system and less focused, unaware government support for logistics management. This study also provides some suggestion of further improvement of logistics management.

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List of Acronyms

S. No.	Abbreviation	Meaning
1	APL	Above Poverty Line
2	AEZ	Agri export zones
3	AGPLM	Adolescen Girls Pregnant & Lactating Mothers
4	APHLIS	African postharvest losses information system
5	BPL	Below Poverty Line
6	BOO	Build own & operate
7	BIS	Bureau of Indian Standards
8	BIDI	Board of infrastructure development & investment
9	CF	promotion
10	C&W	Conversion factor
11	CGIAR	Count & Weight
12	CWC	Consortium of international agriculture research
13	CAP	Central Warehouse corporation
14	CLM	Cover and Plinth
15	CIAE	Council of logistics management
16	DMIC	Central institute of agriculture engineering
17	FSC	Delhi Mumbai industrial corridor
18	GDP	Food Supply Chain
19	GIC	Gross Domestic product
20	GOI	Gramin Information Centers
21	HYV	Government Of India
22	IBA	High Yield varieties
23	ICAR	Indian Bankers Association
24	ITC	Indian council of agriculture research
25	IARI	Indian Tabacco company
26	KMS	Indian Agriculture research institute

27	LDPE	Kharif Marketing seasons
28	MDM	Low density polythylene
29	MSP	Mid-Day-Meal-Scheme
30	NCR	Minimum Support Price
31	NRHM	National capital region
32	NOAPS	National rural health mission
33	PDS	National old age system
34	PHL	Public distribution System
35	RIIPP	Post harvest losses
36	RMS	Rajasthan industrial & investment promotion policy
37	SEZ	Rabi Marketing Seasons
38	SVW	Special economic Zone
39	SWC	Standard volume weight
40	SGRY	State Warehouse Corportaion
41	TGM	Sampoorna Gramin Rozgar Yojna
42	WBNP	Thousands grain mass
43	WDRA	Wheat Based Nutrition Programme
44	WFP	Warehouse Development regularity authority
		World food Programme

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Chapter 1

Introduction

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1.1. Agriculture

"Slow agricultural growth is a concern for policymakers as some two-thirds of India's people depend on rural employment for a living. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation systems and almost universal lack of good extension services are among the factors responsible. Farmers' access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation."—World Bank

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It has to support almost 17 per cent of world population from 2.3 per cent of world geographical area and 4.2 per cent of world's water resources. The financial changes, started in the nation during the mid 1990s, have put the economy on a higher development direction. Annual growth rate in GDP has quickened from underneath 6 percent during the beginning years of changes to

more than 8 percent as of late. This happened basically because of quick development in non-agriculture sector. The workforce occupied with agribusiness between 1980-81 and 2006-07 saw a little decline; from 60.5 percent to 52 percentIndian agriculture is described by agro-biological diversities in soil, rainfall, temperature, and cropping system. Around 60% of Indian population depends straightforwardly on farming and it represents around 13.7% (2012-13) of GDP. Agriculture derives its significance from the fact that it has vital supply and demand links with the manufacturing sector. During the past five years agriculture sector has witnessed spectacular advances in the production and productivity of food grains, oilseeds, commercial crops, fruits, vegetables, food grains, poultry and dairy. India has emerged as the second largest producer of fruits and vegetables in the world in addition to being the largest overseas exporter of cashews and spices. Further, India is the highest producer of milk in the world.

1.1.1 Indian Agricultural background

The post independence, Indian policy makers has given importance to the agricultural sector. So that India can be self reliant in case of food production. For this purpose government had taken several steps like increasing the irrigation facilities, good seeds, creating storage infrastructure etc. One report from 2008 claimed India's population is growing faster than its ability to produce rice and wheat. Other recent studies claim India can easily feed its growing population, plus produce wheat and rice for global exports, if it can reduce food staple spoilage, improve its infrastructure and raise its farm productivity to those achieved by other developing countries such as Brazil and China. Now the snapshot on the Indian agriculture background, who’s progress started from the Bhakra Dam (completed 1963) is the largest dam in India. The Bhakra-Nangal multipurpose dam was among the earliest river valley development schemes undertaken by independent India, Preliminary works commenced in 1946. Construction of the dam started in 1948, and the dam was completed by the end of 1963. Successive stages were completed by the early 1970s.Tehri Dam on Bhagirathi River is the highest dam in India. Special programs were undertaken to improve food and cash crops supply The Grow More Food Campaign (1940s) and

the Integrated Production Programme (1950s) focused on food and cash crops supply respectively. Five-year plan of India - oriented towards agricultural development—soon followed. Land reclamation, land development, mechanization, electrification, use of chemicals—fertilizers in particular, and development of agriculture oriented 'package approach' of taking a set of actions instead of promoting single aspect soon followed under government supervision. The many 'production revolutions' initiated from 1960s onwards included Green Revolution in India (1960's) introduced by Dr. Norman Borlaug and its main focus was on HYV (High Yield Varieties),the reasons behind this Revolution were low irrigation, frequent occurrence of famines, lack of finance and self sufficing. Outcomes of this revolution are superior yielding, diseases resistance, and increase in varieties of wheat and improvement in productivity. Wheat revolution by Dr. B.P.Pal. Yellow Revolution (oilseed: 1986-1990) major contributing state in this revolution were Rajasthan, M.P. and Karnataka, Operation Food (dairy: 1970-1996), and Blue Revolution (fishing: 1973-2002) etc. Following the economic reforms of 1991, significant growth was registered in the agricultural sector, which was by now benefiting from the earlier reforms and the newer innovations of Agro-processing and Biotechnology. Various institutions for agriculture related research in India were organized under the ICAR – Indian Council of Agricultural Research (est. 1929). Other organizations such as the National dairy development Borad (est. 1965), and National Bank for Agriculture and Rural Development (est. 1982) aided the formation of cooperatives and improved financing.

India is a rich country as its land is very fertile. India has 2.4% land of total land of world. Our land has 89,000 different greens living under earth and masking land more fertile. Many inventions took place in agriculture but profitability of farming is decreasing year by year. The farmers are committing suicides even after implementation of prime minister's and state government packages for them. The liberalization of India's economy was adopted by India in 1991. Facing a severe economic crisis, India approached the IMF for a loan, and the IMF granted what is called a 'structural adjustment' loan, which is a loan with

certain conditions attached which relate to a structural change in the economy. The government ushered in a new era of economic reforms based on these conditions. These reforms (broadly called Liberalization by the Indian media) can be broadly classified into three areas: Liberalization, privatization and globalization. Farmer suicides were 12% of the total suicides in the country in 2000, the highest ever in independent India's history. (Unofficial estimates put them as high as 100,000 across the country, while government estimates are much lower at 25,000. This is largely because only those who hold the title of land in their names are considered farmers, and this ignores women farmers who rarely hold land titles, and other family members who run the farms.)

In terms of growth, the performance of agriculture during the post-independence era has been impressive as compared to that during the pre-independence period. The all crop output growth of around 2.7% per annum in the post-independence period (during 1949-50 to 1999- 00) was much higher than the negligible growth rate of around 0.4% per annum during the first half of the previous Century. As a result, India achieved self-sufficiency in food grains at the national level by mid-1970s. The growth in GDP in agriculture was around 2.2% to 2.5% per annum during 1950-51 to 1980-81. It recorded the highest growth rate of more than 3% per annum in the 1980s. During the post-reform period, the growth rate declined to 2.76% per annum. Growth in agriculture GDP, which was 4.7% per annum during Eighth Plan (1992-97), declined to 2.1% during Ninth plan (1997-2002) and to 1.8% per annum during Tenth Plan (2002-07). Thus, there has been a significant deterioration in the growth rate of agriculture since mid-1990s. However, there are signs of revival of agricultural growth to more than 3% per annum during the past few years. Over the years, the country witnessed a historic change-over from a subsistence agricultural production to market oriented surplus. Today agricultural sector occupies a strategic place in India’s economic development. The production of food grains increased considerably from 50.8 million tons in 1950-51, i.e., beginning of the first Five Year Plan to an all time record of 230.67 million tons.

A major portion of the total produce was sold by the farmers to the village traders and money lenders often at prices much lower than the market prices through middlemen. As a result, the return from agricultural produce to farmers was meager. As a consequence of no warehousing facilities in the villages, the farmer was compelled to store his produce in pits, mud-vessels and traditional store houses. These unscientific method of storing led to considerable wastage. At times, as much as one-third of farmer's produce was lost in this way.

1.1.2 Role of Agriculture in Indian Economy

Agriculture is the backbone of the **Indian economy**. Despite major emphasis on industrial development, agriculture continues to occupy a place of pride in Indian economy. The **importance of agriculture** can be brought out from the following facts:

Share in national income

Although the share of agriculture in the total national income has been gradually decreasing on account of the development of the secondary and tertiary sectors, it still contributed about 16.74% of nation income in 2012-13 but in 1950-51, it was 59%. Agriculture sector contributed Rs. 3484 billion in 1990-91 and Rs. 7618 billion in 2012-13.It shows that the contribution of agriculture in national income increased 118.65% in 23 years (1990-2013) and 5.39% per annum. It shows that contribution is increasing but percentage share of agriculture in national income is declining. It signifies that the share of other sectors in the economy is rising.

Source of employment

In India, agriculture is the main source of employment. Even in 2012-13, more than 51% of the total labour force of India was engaged in agriculture and depended on it for their livelihood (1950-51: 69.5%). It becomes evident from this fact that other sectors of the economy could not generate enough employment for the growing population.

Provision of foodgrains

In a developing country like India where a very large proportion of income is spent on food and the population is increasing rapidly, the demand for foodgrains has been increasing at a fast rate. Agriculture in India has played an important role in meeting almost the entire food needs of the people. The production of foodgrains in India has increased from 51 million tones in 1950-51 to 247.6 million tones in 2012-13, i.e. by a little more than 4 times since 1950-51. This has enabled the country to overcome the problems of foodgrain shortages. The country is almost self-sufficient in foodgrains and it no longer depends on import of foodgrains.

Supply of raw materials to industrial sector

Agriculture plays an important role in industrial development. Many industries like cotton textiles, jute, sugar, food processing, etc. depend on agriculture for their raw material requirements. Moreover, workers engaged in various industries depend on agriculture for their food requirements.

Market for industrial product

Agriculture provides markets for a large number of industrial products. Since about two third of India lives in rural areas, there is a large rural purchasing power which has created a large demand for all types of industrial products. Green revolution has considerably increased the purchasing power of the large farmer substantially. Thus for the demand for various products like soaps, detergents, clothes, cycles, scooters, radios, television, torches, lead batteries, etc. has witnessed a marked increase. Likewise, the demand for a variety of agricultural inputs like chemical fertilizer, tractors, pump-sets, pesticides etc. has increased sharply. This has stimulated the development of industries producing these inputs.

Contribution in foreign exchange

Agriculture plays an important role in Indian economy as an earner of foreign exchange through exports of agricultural commodities like Basmati rice, wheat, tea, cotton, coffee, jute, fruits, vegetables, spices, tobacco, sugar, oil, cashew kernels, etc. in the past, export of agricultural products accounted for about 70% of the export earnings of the country. However, with economic development and consequent diversification of our exports, the share of agriculture in total exports has come down to about 10% in 2012-13. All these exports bring valuable foreign exchange to pay for the increased imports of machinery and raw materials required in the non- agricultural sector.

Significance for trade and transport

Agriculture helps in the development of tertiary (or service) sector. For example various means of transport like roadways and railways get bulk of their business from the movement of agricultural commodities and raw materials. A significant part of internal trade constitutes mainly of agricultural products.

Source of revenue for the Government

Through the direct contribution of agricultural taxes to the central and state governments is not significant, they get a significant part of their total revenue in terms of land revenue, irrigation charges, taxes imposed on the commodities purchased by the cultivators etc. central government also earns revenue from export duties on agricultural production. Freight charges imposed by Indian Railways for carrying agricultural product generate huge revenue to the central excise.

1.1.3 Agribusiness Supply Chain in India

India appears poised for an expansion of investment to modernize agribusiness including input supply, distribution and marketing and food processing, despite the tardy pace of change in agricultural policy, trade and investment in the country. Significant investment opportunities are likely in the markets for both basic and high-value foods, where demand can be driven by

rising incomes and price reductions achieved through increased integration and efficiency in the supply chain.

Agribusiness Supply chain in India – Trends

The Indian rural market is characterized with a large number of buyers and sellers but at the same time, it is highly scattered. Although, there are a large number of buyers and sellers, the concept of perfect competition does not prevail here. The Indian agribusiness is featured by the presence of too many small intermediaries resulting in small size businesses so their amount of investment and potentiality to procure is substantially less. Moreover, the existence of too many small intermediaries result in increased result in an increased cost in the entire supply chain instead of adding value to it. Bulk procurement by the government or by any big agency is one of the ways to get out of this problem. This is expected as the decrease in the number of intermediaries and bulk procurement will narrow the gap between the price we pay and the price paid to the farmers at the time of procurement. Simultaneously, because of the presence of a large number of intermediaries, the margins of individual wholesalers and retailers are low as they transact in a very low quantity. Above all the stringent Agricultural Produce Markets Acts makes the consolidation of agricultural produce next to impossible. To understand the Indian agribusiness supply chain it is required to undergo a brief dissection of the prevalent supply chains of agri-business in India. India follows normally three methods in agribusiness supply chain :

1. **Farm Gate Purchases:** In this process, there is a prior arrangement between the buyers and the farmers. Keeping in view the unreliability of process-able varieties and variability of the procurement prices, the arrangement is normally made prior to the harvest. Buyers in this case are the marketing groups or the cooperative or a trader (contacted through a collection center). This is a normal process in the fruits market. The major advantage of this process is that it results in long-term relationship between the buyers and sellers. While checking quality is costly, the trust and the reputation of the sellers is the only parameter for the buyers to judge the quality of the product. Next, this process reduces the number of

intermediaries in the supply chain, thereby reducing the gap between the supplier price and the customer price. But, one of the lacunas of the system is that farmers cannot go to the best bid at the time of harvest. Another problem to implement the system due to poor road conditions in rural India.

2. **Local Markets:** This is alternatively known as Mandi system. Here, the farmers accumulate their produce and in specific days they sell it to the rural hats organized in a particular day in a central place in a village or district centre or beside a village's access road. Normally, the small traders or commission agents buy the agricultural produce from the farmers sell it to the district level mandis and the district lever traders and wholesalers sell the produce to the large traders and wholesalers. But in this system because of the presence of large number of intermediaries the cost of supply chain further increases. This results in the further increase in consumer price. As the assortment is made from various sources, the quality of processed food product cannot be guaranteed. This drags the supply chain of Indian agribusiness into the vicious cycle of low demand, low capacity consumption, high per unit cost and low demand.

3. **Assembly Markets :** In some places of the country, we find the existence of assembly markets where agricultural produce are traded in bulk, either by the producers themselves or by traders to the outside buyers. The buyers are mainly the collection agents of the urban wholesalers. These markets operate throughout the year (sometimes seasonal depending upon

the nature of the farm produce) and usually in combination with the local market are located on main highways, main roads, or ferri ghats

4. **Direct Sales to Urban Markets :** In this method, the farmers directly sell their products to the urban market, retailers or the wholesalers. However, due to lack of infrastructural facilities, poor road conditions and the precarious financial status of the poor marginal farmers, this method largely limited to very few states such as West Bengal.

In this context we can say that to strengthen the base of the Indian agribusiness, the enhancement of logistics and favorable law and order is necessary. Secondly, the food processing industry of the nation, which has not yet been in the limelight, must be improvised in parallel to the methods of increasing the agricultural produce. This is the only way of consolidation along the food chain followed by the development of markets through enhancement in the vertical integration in the Indian Agribusiness supply chain. But this kind of vertical integration calls for a huge initial investment. This necessitates the intervention of either the government or some giant private agribusiness investor.

1.1.4 Emerging Concepts in Agriculture Marketing

E-Choupal

ITC's Agri Business Division, one of India's largest exporters of agricultural commodities, has conceived E-Choupal as a more efficient supply chain aimed at delivering value to its customers around the world on a sustainable basis.

The E-Choupal model has been specifically designed to tackle the challenges of Indian agriculture such as fragmented farms, weak infrastructure and the involvement of numerous intermediaries, low investment, low productivity, weak market orientation, low value addition, low margin, and low

risk taking ability. This made Indian agribusiness sector globally uncompetitive, despite the country's rich & abundant natural resources.

To resolve the above issues ITC design a business model which can enhance the competitiveness of Indian agriculture and a cycle of higher productivity, higher incomes, and enlarged capacity for farmer risk management, larger investments and higher quality and productivity.

Business Model of ITC:

'E-Choupal' makes use of the physical transmission capabilities of current intermediaries' aggregation, logistics, counter-party risk, bridge financing and delivering the same benefits, while disintermediation them from the chain of information flow.

E-choupal provides information technology for which village internet kiosks managed by farmers called *sanchalaks* themselves, enable the agricultural community access ready information in their local language on the weather & market prices, disseminate knowledge on scientific farm practices & risk management, facilitate the sale of farm input and purchase farm produce from the farmers' doorsteps.

Real-time information and customized knowledge provided by 'e-Choupal' enhance the ability of farmers to take decisions and align their farm output with market demand and secure quality & productivity. The aggregation of the demand for farm inputs from individual farmers gives them access to high quality inputs from established and reputed manufacturers at fair prices. As a direct marketing channel, virtually linked to the 'mandi' system for price discovery, 'e-Choupal' eliminates wasteful intermediation and multiple handling. Thereby it significantly reduces transaction costs.

'E-Choupal' ensures world-class quality in delivering all these goods & services through several product / service specific partnerships with the leaders in the respective fields, in addition to ITC's own expertise.

While the farmers benefit through enhanced farm productivity and higher farm gate prices, ITC benefits from the lower net cost of procurement and eliminated costs from the supply chain.

Execution of the Model:

Launched in June 2000, 'e-Choupal', has already become the largest initiative among all Internet-based interventions in rural India. 'e-Choupal' services today reach out to over 4 million farmers growing a range of crops - soyabean, coffee, wheat, rice, pulses, and shrimp - in over 40,000 villages through nearly 6500 kiosks across ten states (Madhya Pradesh, Haryana, Uttarakhand, Karnataka, Andhra Pradesh, Uttar Pradesh, Maharashtra, Rajasthan, Kerala and Tamil Nadu).

1. **E-Commerce**

During the study it was observed that the use of e-commerce can make a big impact in creating a vertical coordination in the Indian food chain. It was also observed that there is a need for the latest information about market trends, RFID technology for tracing the production while logistics,weather forecast, crop cultivation procedures, post-harvest technology, water management through satellite tracking, commercial information, market information for grains, fruits and vegetables, processed food, low cost technology, government policies on agriculture and agribusiness can be made efficiently available to rural masses through information technology advancement at rural places. The Maharashtra Chamber of Commerce, Industries and Agriculture has proposed, setting up Gramin Information Centers (GIC) for facilitating the latest information on technology and market access, which will permit farmers and rural food processing industries to organise their activities on commercial lines for getting maximum value for their produce. In order to sustain, it is vital for the food industry, that it has well developed backward linkages. Information technology can play an important role in further strengthening these linkages

2. **E-Spot Trading**

India is witnessing a revolution in Information Communication Technology (ICT). Its application in linking farmers to markets is on the rise. Usage of modern ICT can facilitate agricultural marketing functions and processes, including buying and selling, payment, transportation and logistics in efficient manner. This will connect local markets nationally and will effectively do away with information arbitrage that exists in today‘s APMC (Agriculture Produce Market Committee) markets. ICT can also play a pivotal role in disseminating and using trade information. Adoption of ICTs for agricultural trade in the form of electronic spot trading will benefit farmers enormously. Thus, e-spot exchange is a marketplace where local farmers and traders can sell farm produce, while upcountry buyers, processors, exporters, and end-users can buy electronically through competitive bidding.

This screen-based trading will help small and marginal farmers participate as it will be possible to do trading in small quantities, without any dependence on middlemen to sell their small marketable surpluses. E-trading will also remove the problem of information asymmetry, as price information will be available instantaneously on all terminals and quality assessment will be done before the transaction. Such trading will help the producer get the best possible price for his commodity/produce.

E-spot exchange institute with their background, process and cost benefits to intermediaries and end consumers are explained in chapter no. 4 (logistics management)

3. Agricultural Cooperatives

An agricultural cooperative, also known as a farmers' co-op, is a cooperative where farmers pool their resources in certain areas of activity. A broad typology of agricultural cooperatives distinguishes between agricultural service cooperatives, which provide various services to their individually farming members, and agricultural production cooperatives, where production resources (land, machinery) are pooled and members farm jointly. There are two primary types of agricultural service cooperatives, supply cooperative and marketing

cooperative. Supply cooperatives supply their members with inputs for agricultural production, including seeds, fertilizers, fuel, and machinery services. Marketing cooperatives are established by farmers to undertake transportation, packaging, distribution, and marketing of farm products (both crop and livestock). Farmers also widely rely on credit cooperatives as a source of financing for both working capital and investments.

Functions of co-operative marketing societies:

The main functions of co-operative marketing societies are:

(i) To market the agriculture products of the members of the society at fair prices.

(ii) To safeguard the members for excessive marketing costs and malpractices.

(iii) To make credit facilities available to the members against the security of the produce brought for sale.

(iv) To make arrangements for the scientific storage of the members' produce.

(v)To provide the facilities of grading and market information this may help them to get a good price for their produce.

(vi) To introduce the system of pooling so as to acquire a better bargaining power than the individual members having a small quantity of produce for marketing purposes.

(vii) To act as an agent of the government for the procurement of foodgrains and for the implementation of the price support policy.

(viii) To arrange for the export of the produce of the members so that they may get better returns.

(ix)To make arrangements for the transport of the produce of the members from the villages to the market on collective basis and bring about a reduction in the cost of transportation; and

(x)To arrange for the supply of the inputs required by the farmers, such as improved seeds, fertilizers, insecticides and pesticides

1.2 Agriculture in Rajasthan

Rajasthan is an agrarian state, where eighty percent of the total population resides in rural area and largely dependent on agriculture as the source of their livelihood. The economy of state is mostly depended on agriculture. 22.5 percent of state's GDP comes from agriculture. Recognized as the largest state of India, Rajasthan has cultivated area of almost 20 million hectares but due to some unavoidable circumstances on 20% of the total cultivated area is irrigated.

The weather is dry and hot. Large portion of terrain is dry. Droughts are common in Rajasthan. Due to unstable weather conditions farmers have to depend on both rainfed and ground water agriculture. With the decreasing ground water level the cropping situation is more terrible as the farmers in the state have to survive mostly on ground water received from Punjab Rivers in the north, the Narmada River in the south and the Agra Canals from Haryana and Uttar Pradesh are the water providing sources to the dry land. Northwestern Rajasthan is irrigated by the Indira Gandhi Canal. Irrigation is done through electric pumps.

Despite of this the traditional cropping pattern is still continuing by using camels and buffaloes. Nowadays farmers are using tractors for this purpose. The use of chemical fertilizers and pesticides has increased the crop productivity and now the state is self sufficient in the production of food grains.

The Two Major Crops Grown in the Region are Rabi Crops and Kharif Crops.

Rabi Crops: It is also known as winter crops, which mainly depended on ground water irrigation. These are the crops which are cultivated in the months of October and November and are harvested in the months of March and April. The crops grown during rabi season are Barley, Wheat, Gram, Pulses and Oil Seeds. The major oil seeds are Rape seed and Mustard.

Khariff Crops: It is also known as rain fed crops are grown in the months of June and July and harvested in the months of September and October.

These are the crops which are totally depended on rains, where there is good rain there is bumper production. The crops of this season include Bajra, Pulses, Jowar, Maize and Ground Nuts.

The areas which have sufficient water for irrigation or have maximum water sources are involved in producing high-yielding varieties of rice. Some areas of Rajasthan have black soil which is suitable for the production of cash crops like cotton. In some areas vegetables and fruit crops are grown.

The Major Crops of Rajasthan can be mentioned as follows:

- **Bajra:** It is normally consumed by the rural poor, the tribal community migrating from one place to another. Rajasthan is the largest producer of bajra in India. Produce at Barmer, Jodhpur, Nagaur, Churu, Jalore, Sikar, Jhunjhunu, Jaipur, Alwar, Karauli.
- **Juar:** It is an important pulse crop grown during the monsoon. Produce at Ajmer, Pali, Tonk, Nagaur, Bharatpur, Alwar, Jodhpur, Bhilwara, Kota, Jhalawar and Chittore.
- **Gram:** It is also one of the major pulse crop grown in rabi season.
- **Wheat:** It is the major crop of Rajasthan grown almost in whole state. Produce at Ganganagar, Jaipur, Alwar, Bharatpur, Kota, Bundi, Hanumangarh, Baran Chittor, Bhilwara, S.Madhopur, Dausa, Tonk, Pali.
- **Barley:** It is the second largest crop in Rajasthan. Produce at Jaipur, Sikar, Alwar, G'Nagar, Hanumangarh, Nagaur, Bhilwara, Ajmer, Dausa.
- **Maize:** It is mostly consumed by the Bhil tribes in the Aravalli region. In northern Rajasthan, maize is interestingly eaten with butter and the green leaf of the mustard plant. Produce at Chittorgarh, Udaipur, Bhilwara, Banswara, Dungarpur, Rajasamand Jhalawar, Ajmer, Bundi, Baran.
- **Groundnut:** it is an oilseed cash crop grown in kharif season.
- **Sesame:** Rajasthan is the second highest producer sesame in India.
- **Cotton:** It is recognized as a cash crop. Cotton has played an important role in making Rajasthani textile industry famous in world.

- **Rice/Paddy**: Produced in the distiricts of Bundi, Hanumangarh, Banswara, Dungarpur, Kota, Ganga-Nagar, and Udaipur.

1.3 Overview of logistics in agriculture sector

Council of Logistic Management (1991) defines that logistics is a 'part of the supply chain process of procurement, movement and storage of materials, parts and finished inventory (and related information flows) through the organization and its marketing channels in such a way that current and future profitability are maximized through the cost-effective fulfilment of orders'. Johnson and Wood's definition (cited in Tilanus, 1997) uses 'five important key terms', which are logistics, inbound logistics, material management, physical distribution, and supply chain management, to interpret. Supply chain management is somewhat larger than logistics, and it links logistics more directly with the user's total communication network and within the firm's engineering staff.

Components of Logistics System

The closely linked components of the logistics system are:

a) **Logistics services**: Logistics services support the movement of materials and products from inputs through production to consumers, as well as associated waste disposal and reverse flows. They include activities undertaken in-house by the users of the services (e.g. storage or inventory control at a manufacturer's plant) and the operations of external service providers. They comprise physical and non-physical activities (e.g. transport, storage and supply chain design, selection of contractors, freightage negotiations respectively). Most activities of logistics services are bi-direction

b) **Information systems**: Information systems include modeling and management of decision making, and more important issues are tracking and tracing. It provides essential data and consultation in each step of the interaction among logistics services and the target stations.

c) Infrastructure/resources: Infrastructure comprises human resources, financial resources, packaging materials, warehouses, transport and communications. Most fixed capital is for building those infrastructures. They are concrete foundations and basements within logistics systems. In this context, logistics have become the crucial areas of management and national focus. Though India spends over 12 per cent of its GDP on logistic and supply chain management, customer value provided is unsatisfactory. This area becomes even more important in the sector of agribusiness because most of the agricultural products are perishable and have a very short shelf life. Logistics Management is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. Logistics management spans all movement and storage of raw materials, work-in-process inventory and finished goods from point-of-origin to point-of consumption. There are three main types of flow, such as the product flow, the information flow, the finances flow. The product flow includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs. The information flow involves transmitting orders and updating the status of delivery. The financial flow consists of credit terms, payment schedules etc., to ensure prompt, efficient and accurate monetary transactions within these categories, various other elements falls, which includes the sourcing of raw material, coordinating, manufacturing and assembly of products, maintaining accurate warehousing and inventory accounts, researching supply and demand, and much more. The challenge for us in logistics management is to maintain all three flows and all three unique in an efficient manner, resulting in optimal results for the company. Components of logistics management:

- **Production:** focuses on which suppliers to use, how much to produce, when to produce, where to produce (in source vs outsource, quantities, time, location)
- **Inventory:** decides where to store their produce and how much to store (make to order vs make to stock, consolidated vs break bulk, location).

- **Distribution /Logistics:** addresses issues about how the products should be moved and stored (Logistics methods own fleet vs 3PL).
- **Payments:** Looks for the best ways to pay suppliers and get paid to customers (Pricing policies, promotion and discounts).

The concept of Agriculture supply chain refers to the activities of procurement, order fulfillment, product design and development, distribution, delivery and customer service executed by two or more separate organizations in the agribusiness industry, to fulfill customer orders. Agriculture supply chain consists of small and medium enterprises, such as farmers and raw material producers, suppliers of agricultural inputs, processors of agricultural outputs, farmers co-operatives, brokers, suppliers, distributors, wholesalers and retailers, that either tend to operate independently or in co-operation, mainly in the last stages of supply chain. An efficient logistics can contribute to an increase in the marketable surplus by lowering down the inefficiencies in production, processing, storage and transportation. It ensures better prices to the farmers inducing them to invest more in the vital inputs so that productivity leaps frog. It widens market opportunities for products and thus helps in maintaining an ever increasing demand for the same. An organized retailing act as a stimulator to promote growth of agro based industries, helping the farmers in production planning in advance, based on demand forecast. Economic efficiency in a system can be examined as:

1. Technical efficiency
2. Allocative efficiency

In marketing the produce, the technical efficiency is said to have increased when operational cost is reduced for performing a function for each unit of output. This can be achieved by reducing physical losses and improvement in the technology to carry out particular function viz. storage, transportation, handling and processing. A change in the technique can result in the reduction of per unit cost. Allocative efficiency of farm products either over time or across the space among the traders, processors and consumers protects the economic interests of the producers and consumer. Alternative methods employed in agriculture in achieving the efficiencies in the system are:

1) Contract farming

2) Direct, uncontracted purchases from farmers

3) Purchases from wholesalers, who either work directly with farmers or through wholesale market

4) Purchases through government sponsored centers

5) Purchases through informal groups, farmers associations or co-operatives

6) Multiple channels

India is likely to become the food basket of the world considering 52 per cent of total land under cultivation as compared to global average of 11 per cent. Having the labor cost advantage; organized research is growing very speedily owing to these developments, farmers could get latest market prices and various products, weather reports and best farming practices.

There is also a requirement for value addition to agricultural produce in order to maximize their returns. Hence, there is an importance of supply chain in improving marketing activities of retail business in agricultural areas in Indian economy. The middlemen and poor supply chain facilities have resulted in the hike of agricultural prices up to 60 per cent without actually adding any value. By practicing improved logistics management practices, there will be significant reduction in the wastages of grains which in turn will benefit both the farmers as well as the consumers by means of increased returns and decrease in prices respectively. Important advantages of supply chain management are:

1. Reduction product losses in transportation and storage

2. Increasing of sales

3. Dissemination of technology, advanced techniques, capital and knowledge among chain partners

4. Better information about the flow of products, markets and technologies

5. Tracking and tracing to the source

6. Better control of product safety and quality

7. Large investments and risks are shared among partners in the chain

8. Increasing efficiencies and increasing the volume of trade

9. Customer satisfaction

Hence, logistics management is defined as the design and operation of physical, management information and financial systems needed to transfer goods and services from point of production to point of consumption in an efficient and effective manner. The entire logistics management process is a value chain where bottlenecks, value adding factors and liability factors are identified and addressed, thus enabling the retail organization to have an efficient supply chain. The supply is the part of retail operations that ensures that the right product is in the right place, at the right time and at the right cost. One of the most fundamental issues, which actually require research, is the method by which we can minimize the post harvest losses, which is quite substantial at present. This needs the designing of efficient and cost effective and also environment friendly storage systems.

1.4 Logistic Management of Agricultural Products in Rajasthan

Agriculture and allied sector plays an important role in State's economy. It contributes around 26% in GSDP. Around two third of Rajasthan's population is still dependent on agricultural activities for their livelihood. Agriculture in Rajasthan is largely dependent on rains, only 35% of the total agricultural area is irrigated. Out of the total area irrigated 65 to 70% area is under wells and tube well irrigation. Agriculture is the backbone of the Indian economy which contributes a major share of the National income. Being an agrarian country, nearly 75% of the country's population depends directly or indirectly on agriculture. However, for a long period of time Indian agriculture was mostly in the nature of subsistence farming. The farmers sold only a small part of their produce to pay-off rents, debts and meet other requirements. Such sale was usually done immediately after the harvesting of crops since there were no storing facilities. It was therefore, felt that in order to avoid exploitation of producers by the traders, and to preserve the produce from the ravages of insects and pests during post-harvest period, the infrastructure of warehousing facilities has to be taken to the rural areas. Likewise, as stated earlier, due to record production of food grains, the marketable surplus do posed a challenge to provide requisite

storage and warehousing facilities for proper upkeep and distribution of the commodities. As such, storage of food grains is necessary to bridge the time gap between periodic harvest and marketing.

The agriculture sector comprises of a number of inter-related value chains.

a) Agriculture Value Chain: The agriculture supply chain starts with the farmer who harvests food crops. The farmer sells its harvest to intermediaries such as regional agents, who comprises of millers and end consumers wholesalers, who in turn sell to distributors, retail shops and fair price shops who distribute the produce to the end consumer.

b) Supporting Manufacturing Services: The supporting value chain for agriculture comprises fertilizer producers and distributors, grain distributors, tractor, and farm equipment manufacturers. Logistics services play an important role in getting these goods to the farmer and in supporting the production of food crops. Financial institutions, Insurance agents, government agencies and other organizations play important supporting roles as well.

c) Processed Food Value Chain: The processed food value chain is responsible for converting food grains into processed/canned foods and getting it within reach of end consumers. Increasingly ready-to-eat food products are being targeted by a number of large manufacturing and the retail distribution companies. Also, linking the chain restaurants with the grain producers can induce efficiencies. Even though the Indian economy is driven by the agricultural sector, minimal attention is paid to the logistics in the agricultural sector. Furthermore, the problem is complicated by the fact that the bread baskets of India are quite distant from the urban consumer base. Herein exists an opportunity for a logistics service provider to focus on the inefficiencies in the agricultural sector and better plan and coordinate the movement of food products across the country.

1.5 Contract Framing

"An agreement between farmers and processing and/or marketing firm's fir the production and supply of agricultural products under forward agreements, frequently at predetermined prices."- Eaton and shepherd (2001)

It is not a new phenomenon as it has a long history dating back 1930s and 1940s.However it is taking a new perspective in India. The reasons for this can be summed under two opposing schools, one related to reduce waste, the other to maximizing income. With the waste factor, there has to be recognition that market linkages between farmers and retailers/processors are extensive and complex. Usually, for a particular product to travel from the farm gate to consumers it has to pass through many different hands. On the way it is packed, unpacked, graded, sorted, handled and transported many times. This has significant consequences not only for the quality of the product when it eventually reaches the end consumer, but also for the efficient organization of the agricultural marketing system. A lack of linkages between non-adjacent levels of the chain perpetuates a situation where there are multiple middlemen handling the produce from farm gate to consumers, with the attendance increase in postharvest losses and financial inefficiencies from multiple handling, packaging, storage and transportation. A second stream of thought associated with the emergence of contract farming in India is that contract farming can actually lessen public sector expenditure. That is, instead of large resources being spent by govt. providing agri-services for a large number of atomistic farmers, the same service can be provided by the private sector through contract farming.With the government's change in stand regarding contract farming, a stage is set for such vertical coordination in Indian agriculture. Such as:-

.*PepsiCo's contract farming in Punjab*

.*ITC's e-Choupal and*

.*Mahindra Shubhlabh services.*

1.6 Some Important Definatations:

Post Harvest

"POST HARVEST" means after separation from the medium and site of immediate growth or production of the food. Post harvest begins when the process of collecting or separating food of edible quality from its site of immediate production has been completed. The food need not be removed any great distance

from the harvest site, but it must be separated from the medium that produced it by a deliberate human act with the intention of starting it.

Three periods of time may be identified during which food may be lost, and each period has its characteristic problems, and means of overcoming these problems.

Preharvest are losses that occur before the process of harvesting begins, for example, losses in a growing crop due to insects, weeds and rusts.

Harvest losses occur between the onset and completion of the process of harvesting, for example, losses due to shattering during harvest of grain.

Post harvest losses occur between the completion of harvest and the moment of human consumption. Postharvest intermixes in varying degrees with portions of the maturing drying- processing period and often no sharp distinction can be made. Thus wheat held in the field for drying is also wheat held for storage and use.

Harvest and post harvest losses are sometimes combined into a single loss because there are some elements of common concern between them. A suitable descriptive term for these combined activities would be “post production losses". The following schematic representation shows the relationship among the various types of food losses:

1. Preharvest
2. Harvest — **Post Production**
3. Post Harvest

Threshing means it is the process of loosening the edible part of cereal grain (or other crop) from the scaly, inedible chaff that surrounds it. It is the step in grain preparation after harvesting and before winnowing, which separates the loosened chaff from the grain. Threshing may be done by beating the grain using a flail on a threshing floor.

Transportation means it is the movement of people, animals and goods from one location to another. Modes of transport include air, rail, road, water, cable,

pipeline and space. The field can be divided into infrastructure, vehicles and operations. Transport is important because it enables trade between people, which is essential for the development of civilizations

Storage and warehousing means it is an important marketing function, which involves holding and preserving goods from the time they are produced until they are needed for consumption.

- The storage of goods, therefore, from the time of production to the time of consumption, ensures a continuous flow of goods in the market.
- Storage protects the quality of perishable and semi-perishable products from deterioration;
- Some of the goods e.g., woolen garments, have a seasonal demand. To cope with this demand, production on a continuous basis and storage become necessary;
- It helps in the stabilization of prices by adjusting demand and supply;
- Storage is necessary for some period for performance of other marketing functions.
- Storage provides employment and income through price advantages.

Packaging has been defined as a socio scientific discipline which operates in society to ensure delivery of goods to the ultimate consumer of those goods in the best condition intended for their use it is the technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of design, evaluation, and production of packages. Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells

Grading means grain grading and specification system assures that a particular lot of grain meets the required set standards customer. In many countries grading of

grain depends on four main properties; (i) bushel (test) weight (ii) moisture contents (iii) broken foreign material or the percentage fragments example broken corn foreign materials (iv) damaged kernels (i.e. total and heat damaged)

"**FOOD"** means weight of wholesome edible material that would normally be consumed by humans, measured on a moisture-free basis. Inedible portions such as hulls, stalks, and leaves are not food Feed (intended for consumption by animals) is not food [unless specifically of interest to the individual assessment exercise]. The method of measuring the quantity of food in the post harvest chain should be on the basis of weight expressed on a moisture-free basis. There will be times when information on losses in nutritional units and economic losses will also be needed but these should not be the prime means of measuring post harvest food losses.

Losses

"GRAIN LOSS," as used in this manual, concerns the loss in weight of food that would have been eaten had it remained in the food pipeline.

"LOSS" means any change in the availability, edibility, wholesomeness or quality of the food that prevents it from being consumed by people.

Food losses may be direct or indirect. A direct loss is disappearance of food by spillage, or consumption by insects, rodents, and birds. An indirect loss is the lowering of quality to the point where people refuse to eat it. This definition is a people-centered definition. "Food" means those commodities that people normally eat and excludes the commodities that are not lost; if it is not consumed by people for any reason at all then it is considered a post harvest food loss. Food losses are, at times, simply as they are locally defined or as they locally occur. For example, grain which is discarded because of discoloration is a loss. Processing losses occur when edible portions of food arc removed from food channels by the process or by spillage or breakage from the' process. Rice hulls are inedible. Their removal does

not constitute a loss. Rice pieces diverted from the food-chain are a loss. Rice bran is edible to some, inedible to others. The handling of each similar situation needs to be clearly defined as it occurs

The flow of grain from its sources, i.e., the farm field or import docks, to the eventual consumer is depicted for the purposes of this study as a pipeline with many possible interconnecting pipes and reservoirs. Losses, or leaks, can occur along the entire pipeline - during harvesting, drying, transport, storage, and processing. As presented in the Preface, the purpose of viewing the food' grain supply system as a pipeline is to assign individual loss points (eg, on-farm losses) relative importance in terms of loss in other parts of the grain pipeline (eg, transport or warehousing losses). This relative perspective is necessary to see the importance of the total amount of grain actually lost in any given point as opposed to the percentage of grain lost which passes through that point. Failure to obtain such a perspective has resulted in overly high and low loss figures arrived at by extrapolating from observed losses at specific loss points without putting those losses into the perspective of the grain moving through the total system. Grain does not move in a straight line and uniform sequence from producer to consumer. Harvested grain can be specially dried and otherwise treated to go into special household use; some into an even more special seed-grain storage. This grain may remain there or move out for food or trade under special conditions influenced by factors such as family, weather, or government. It may even be replaced by other local or imported grains. A portion of the harvest may be held for short-term storage, a part for long-term storage, and the rest sold or otherwise traded off the farm.

Delineation of the test sites involves looking closely at general loss situations and careful on-site evaluations of specific individual sites. Selection of "amenable" sites (villages, cultivators, markets, transit systems, warehouses) requires incorporation of many factors.

Language can be a key barrier, and an absence of direct or completely competent and trusted lines of communication is unacceptable for loss survey teams. Sex roles must be considered as to who really does the harvesting, threshing/cleaning, storing, and marketing of the grain.

India lacks cold storage, food packaging as well as safe and efficient rural transport system. This causes one of the world's highest food spoilage rates, particularly during Indian monsoons and other adverse weather conditions. Food travels to the Indian consumer through a slow and inefficient chain of traders. Indian consumers buy agricultural produce in suburban markets known as 'sabzi mandi' such as one shown or from roadside vendors.

1.7 Food-grain storage capacity in India:

India has total agri warehousing capacity of around 91 MMT at present to store and conserve such large quantities with state agencies owning 41% of the capacity and the balance distributed among private entrepreneurs, cooperative societies, farmers, etc. However, these government agencies use 66% (60 MMT) of India's total agri storage capacity which also includes hired capacity of 23 MMT. The total state owned storage capacity of 37 MMT is held through three public sector agencies viz. Food Corporation of India (FCI), Central Warehousing Corporation (CWC) and State Warehousing Corporation (SWC).

The low productivity in India is a result of the following factors:

- The average size of land holdings is very small (less than 2 hectares) and is subject to fragmentation due to land ceiling acts, and in some cases, family disputes.
- Adoption of modern agricultural practices and use of technology is inadequate, hampered by ignorance of such practices, high costs and impracticality in the case of small land holdings.
- Overregulation of agriculture has increased costs, price risks and uncertainty. Government intervenes in labour, land, and credit markets. India has inadequate infrastructure and services.
- Illiteracy, general socio-economic backwardness, slow progress in implementing land reforms and inadequate or inefficient finance and marketing services for farm produce

- Inconsistent government policy. Agricultural subsidies and taxes often changed without notice for short term political ends.
- Irrigation facilities are inadequate, as revealed by the fact that only 52.6% of the land was irrigated in 2003–04.
- A third of all food that is produced rots due to inefficient supply chains

1.8 Food grain losses in Agriculture Logistics Management

By the year 2000, it is projected that world population will increase from 4 billion to between 6 and 7 billion. Since estimates indicate that between 450 million and 1 billion people do not have enough to eat now, this number is likely to increase with the population- (NRC, 1977)

The population of India is increasing very fast. It is the fastest growing country in the world and by the year 2025 India will surpass the China as the largest populated country of the world. India will need huge amount of food grains to feed their population. In case of food grains loss will make the task of government more difficult. To cope with current and future food demand, governments have traditionally emphasized two lines of action: reducing future demand by slowing population growth, and augmenting food supplies by expanding production.

Keeping these points in mind, there is a need of research in the field of logistics with specific reference to foodgrains in India as India is a country which has huge demand for foodgrains in future to feed its increasing population. For this purpose I had selected this area for research but it is confined only to the state of Rajasthan.

1.9 Summary

This research conducted on the basic question of logistics management of the foodgrains. For this purpose an introduction of the topic which start with the introduction of Indian agriculture and some important concept description such as post harvest, pre harvest and also different stages of supply chain management in order to have the basic understanding of the concept. The E-choupal is new and innovative step which can bring a change in the life of farmers and small traders. There are many benefits of E-choupal available to farmers and traders which can be used by them. It was found that the use of e-commerce can make a big impact in creating a vertical coordination in the Indian food chain. It was also observed that there is a need for the latest information about weather forecast, crop cultivation procedures, post-harvest technology, water management through satellite tracking, commercial information, market information for grains, fruits and vegetables, processed food, low cost technology, government policies on agriculture and agribusiness can be made effortlessly available to rural masses through information technology advancement at rural places.

In order to cope with current and future food demand, governments have traditionally emphasized two lines of action: reducing future demand by slowing population growth, and augmenting food supplies by expanding production. Keeping these points in mind, there is a need of research in the field of logistics with specific reference to foodgrains in India as India is a country which has huge demand for foodgrains in future to feed its increasing population. For this purpose I had selected this area for research but it is confined only to the state of Rajasthan. So in order to know more about the problem an review of present conditions of foodgrains storage and other contributing aspects were also studied and describe in the above chapter of study.

Chapter 2

Research Methodology

Chapter 2 - Research Methodology

2.1.1 Introduction of the topic

Indian economy continues to be an agrarian economy since time immemorial. The India is the second largest populated country of the world and by the 2020 it will become the largest country of the world. Rural India continues to sustain the nation, as nearly 17 per cent contribution in Indian economy is still agriculture based. Around 51 per cent of nation's population is rural based and is engaged in agricultural and allied activities. This holds true for Rajasthan economy also, with about 70 per cent of the total population depending on agriculture and allied activities and around 30 per cent of the total state's income generated by it. The Indian agricultural sector is seeing the down fall in the cultivation area as increasing industrialization and infrastructure development is taking up the agricultural land for their use, which is resulting in reducing the cultivation area for foodgrains and other crops. This problem is being aggravated with increasing

percentage of loss in food grains, which means it will be difficult for the government to feed its by population. In this background it becomes important to study this topic and find out the causes of the losses in foodgrains with specific reference to logistics and to suggest the measures to reduce such losses.

2.1.2 Statement of the problem

The agriculture sector in India faces pre and post harvesting losses in foodgrains, it reduces the productivity and income of the farmers. In the Rajasthan the losses in food grains are more relevant and inadequate logistic facilities. In this thesis, the researcher studied the logistical losses of food grains.

2.1.3 Objective of the study

Following were the objectives of the research:

1. To study the various causes and factors responsible for losses in foodgrains due to logistics.
2. To determine the extent of foodgrains losses during logistics process in post harvesting.
3. To study the impact and awareness of Agriculture supporting logistics schemes of Rajasthan government for reducing the losses.
4. To study the mode and impact of the transportation in Agriculture sector.
5. To study the extent of the utilization of the capacity of rural godowns

2.1.4 Literature Review on Agriculture and Supply Chain management

The review of literature review provides the frame work for the study and enables the researcher to develop the foundation for the research and in depth understanding of the subject. For this purpose I have conducted the review of literature on different aspects of the topic:

Gopalan and Gopalan (1991) explained with regard to agricultural marketing system in India which suffered from severe constraints like high costs, the existence of middlemen, storage and transport bottlenecks and a lack of market information among farmers. **Julie *et al.* (1994)** found in the study of supply chain management in cereal grains; a case study from the U.S. milling wheat industry, it

focuses on supply chain management in the grain industry by investigating the effects of wheat quality on marketing arrangements between producers, grain handling companies and processors, wheat quality is defined by many different characteristics, broadly categorized into physical and intrinsic quality attributes. **Biradar (1996)** studied the marketing costs, margins and price spread of selected agricultural commodities in Kolhapur district of Maharashtra during 1990-92. He identified the supply chains with commodity wise with mainly involvement of cooperative, wholesaler and millers making difference with village merchant and commission agent. Further he concluded that cooperative societies can play a greater role in processing, storing and transporting etc. for reducing cost of marketing especially the commission has to be reduced by encouraging the farmers to sell their produce without the commission agents. **Bridge (1996)** concluded that supply chain management is concerned with the linkages in the supply chain from primary producers to the final consumer. And the importance of supply chain management which can help in reducing the losses and cost of production if it is used properly in effective way. **Hugar and Vijay Kumar (1996)** observed that the personal attributes such as educational level and sex had significant influence on the quantity and frequency of purchase. Price had a high influence on quantity purchased among the lower income groups but the effect was not pronounced for high income groups. **Wilson (1996)** found out that, the supermarket chain was more important in the retail marketing of fresh products and he suggested that increased use of supply chain management techniques could increase the margins of the innovative and competitive firms that remain in the chain. He also found that the inherent cost of distribution networks and channels of fresh produce could be reduced substantially by using supply chain management. The fruit and vegetable supply chain has traditionally been fragmented. Some links have performed well but others have caused bottle necks. **Biradar (1996)** revealed that marketing margins, cost and price spread of different commodities in the two common channels under study was followed, it was found that the maximum average share of the farmer in the consumer's rupee is found in two commodities i.e., jaggery and groundnut, being 80 per cent and 72 per cent respectively, as compared to the food grain commodities, i.e., paddy and

wheat, being about 68 per cent and 56 per cent respectively. **Merrilees *et al.* (1997)** describing the success of superstores states that "the most essential ingredient is the greater ability of the organized retail format to meet the needs of the time poor consumers seeking a convenient, one stop way of shopping with benefits from a much wider range, lower prices and usually a brighter, more interactive store atmosphere. **Lars-Fek (1998)** conducted the study of understanding the modern cold chain in Sweden and concluded that frozen food consumption is estimated at 40 million tonnes a year and is a necessity for millions of families and institutional consumers in both developed and developing countries. It is no exaggeration to say that our food distribution systems are dependent on refrigeration. **Mohamed Zairi (1998)** has found in his study on the best practices of supply chain management in retail sector noted that the retail sector is undergoing major changes resulting from factors such as increased competition and tighter profit margins. He found out that integrated management through the extended supply chain is the most effective means to achieve good value provision to the end consumer, which can be achieved through better product, better quality, better assortment, better in-stock service, less cost throughout the chain, accurate and timely information and committed business leaders. **Devaraja (1998)** conducted a study in Hassan district on channels and price spread in potato marketing. The study identified 3 supply chain, first chain included commission agent and retailer for the movement of produce from producer and consumer in the nearby market of Hassan. Second chain included commission agent and retailer for the movement of produce from producer and consumer but distant market of Bangalore and third chain included commission agent and cart vendor from producer to consumer. The study also revealed that the producer's net price could be increased by taking suitable measures by government like (a) providing cold storage facilities to producers (b) present system of commission charges being collected from producers should be stopped (c) providing support price facilities to producers when there is heavy price fluctuations in peak seasons (d) efficient and cheap means of transportation by the market committee (e) fluctuations in the market prices of potatoes may be eliminated by regulating and streamlining the supply by establishing potato

processing plants in the production centers of manufacturing of processed potato products. **Sen and Maurya (1998)** revealed that for the total marketing charges (including cost of transport payable, 65.92 per cent and 66.98 per cent are payable by the sellers (producers) 12.22 per cent and 11.84 per cent by wholesalers and 21.86 per cent and 21.18 per cent by retailers in Chandwa and Kamachcha markets respectively and a little more than 28 per cent and 31 per cent of the marketing charges are accounted for by the cost of transport in the two respectively. It was also observed that the producers share in consumers' rupee for the vegetables was the lowest for tomato and highest for brinjal in both the markets. Totally, the share of the producers was highest for vegetables with less perishability or with facilities of cold storage while it was lowest for vegetables with greater perishability. The margin of wholesalers and retailers for such vegetables (like tomato, greenpea) was highest. Finally, the price spread accounted for more than 33 per cent of the price paid by the consumer for major vegetables under study. **Badiane, et. al., (1998)** in their study described that the importance of the rural transportation network for agricultural trading has to be highlighted in a separate platform so that there should be spatial integration of agricultural markets. **Gupta and Rathore (1999)** conducted a study on disposal pattern and constraints in vegetable marketing in Raipur district of Madhya Pradesh in 1995-96. The study followed two supply chains one was producer to consumer with the involvement of wholesaler and retailer and other one was directly from producer to consumer. The efficient use of means of transportation and distance covered by farmers may influence the transportation cost, expenditure incurred by farmers on packaging shared about 8 to 9 per cent of total marketing cost. The farmers spent almost equal amount for these two operations. They generally used gunny bag to pack the vegetables like brinjal, chilli and cauliflower, while bamboo baskets were used by them for tomato. Other expenditure incurred on octroi and mandi, combinedly were about 4-5 per cent of total marketing cost. **Gupta and Rathore (1999)** conducted a study on disposal pattern and constraints in vegetable marketing in Raipur district of Madhya Pradesh in 1995-96. The study followed two supply chains one was producer to consumer with the involvement of wholesaler and retailer and other one was

directly from producer to consumer. In the study they found that the various constraints faced by vegetable producers and also expectation suggested during the production and marketing are noted such as lack of resources was the main problem in vegetables production. **Fearne (1999)** suggested that farmers and growers should directly link with other sector of the marketing chain in order to supply the right and consistent quantity and quality of different products. The producer of raw material need to accept the fact that the financial benefit, which comes from partnership will invariably distributed in relation to value added. **Ricks (1999)** in his study revealed that the appropriate combination of vertical coordination arrangements like contracts, informal agreement and joint venture can improve supply chain performance by providing adequate supplies to the shippers from packers and growers, aiding standardization and packaging of fruit products and risk sharing between the shippers, packers and growers. **H.C. Gupta, Jagbir Singh and O.P. Kathuria (1999)** had studied about the often considerable losses of agricultural produce due to various causes occur at various Post-harvest stages. His study reveals that though the food grain losses at harvest and threshing stages can be estimated by both usual method and Projective Geometry approach, Projective Geometry approach provides the linear unbiased estimates with minimum variance indicating that the later approach is superior to usual method. **Francesco Goletti and Christiane Wolff (1999)** found that provides preliminary evidence on the impact of postharvest research on these goals; furthermore the study argues that postharvest research at international agricultural research organizations is justified by its international public good nature. He concludes presenting five reasons that justify an increased commitment to postharvest research by the International Agricultural System and the CGIAR in particular. **Choudhury *M.*** L. (1999) explained that the Food security, both in terms of availability and access to food, poses a challenge to rapidly growing populations, in environments of dwindling land and water resources. The horticultural sector has established its credibility for improving land use, and generating employment and nutritional security. Expenditure on crop production is required on an annual basis, while the establishment of infrastructural facilities for postharvest operations is a onetime capital investment which must be

undertaken and compensated for by the annual savings from reducing postharvest losses. Proper infrastructure, logistics and management and human resources are essential to improving postharvest management and marketing of fruits and vegetables. **Burma *et al.* (2000)** observed while **s**tudying the development of a sustainable agri supply chain which requires commitment of the various stakeholders like growers, traders and supermarkets. The aim of this study was to understand the interest and matching behavior of the various stakeholders in the supply chain for vegetables in Thailand and to recommend appropriate strategies for chain development, taking the respective interests into account. **Susanta (2000)** Conducted study on integrated post production management and food processing in India with the national objective. The study findings identifies that India produces over 200 million tones of food grains and about 132 million tones of fruits and vegetables. The wastage cost of fruits and vegetables is estimated to be Rs. 23, 000 each year in our country. He concluded that post harvest losses are more economically viable in future if they are not targeted. **Ricks (2000)** in his study revealed that the important area of need for fruit industry supply chain is consistent but not excessive supply of products to meet the market demand. This involved the supply of products balanced with demand in the same seasonal years and over a period of several years. **Boklemann and Lentz (2000)** found that present situation on the market for vegetables were indicated by over production and an unsatisfactory price situation for the producers in Germany. **Donald (2000)** conducted study on chain management and marketing performance in fruit industry with the use of specific examples from U.S. fruit industries, which includes how supply chain management of agricultural commodity industries can lead to performance enhancing industry which can improve the overall competitiveness and economic viability of these industries. ***Rosa S. Rolle (2000)*** *d*escribed that the fruit and vegetable sector has grown substantially both in volume and in variety of outputs traded globally. Rising incomes, falling transportation costs, improved technologies and evolving international agreements, have all contributed to this level of growth. This increased level of fruit and vegetable production has, unfortunately, not been matched by developments in supply chain management, or by vertical integration of

production with processing in many developing countries. Processing activities are of critical importance to expansion and diversification within the fruit and vegetable sector in that they increase market opportunities for fresh fruits and vegetables and add value while minimizing postharvest losses. After a review of cost-effective traditional and modern fruit and vegetable processing technologies appropriate to developing countries, this paper will discuss issues and constraints to improving the management of processing operations, and will highlight strategies to overcome these constraints, while citing successful case studies. Tremendous opportunity exists for vertical diversification within the fruit and vegetable sector through the application of both modern and traditional processing technologies. Taking advantage of these opportunities will necessitate that stronger backward linkages be developed with the production sector, and that strategic alliances be developed and fostered so as to upgrade technologies and skills, as well as to increase product competitiveness. Supportive government policies are pivotal. **Johnson, (2000)** in his study analyzed that as rural poor are engaged in agriculture, diversification and commercialization of agriculture are often regarded as essential preconditions for rural income growth and poverty reduction. **Burma, E. S. and Boselie, D.M., 2000**, studied that the development of a sustainable agri supplies chain which requires commitment of the various stakeholders like growers, traders and supermarkets. An important condition or even prerequisite for commitment is mutual understanding and benefit. The aim of this study was to understand the interest and matching behavior of the various stakeholders in the supply chain for vegetables in Thailand and to recommend appropriate strategies for chain development, taking the respective interests into account. The stakeholders considered in the vegetables supply chain are the general management of the super market organization, the management of the distribution centre, the buying of the super market organization, the vegetable suppliers, the vegetable growers and the input suppliers of the vegetable growers. The various stakeholders perceive weaknesses and threats in the misuse of pesticide, the delusion of good quality vegetables, the irregular supply of vegetables, the obscurity of cost of production and handling, the strong price fluctuations for vegetables and the strong competition in the market for inputs.

These weaknesses and threats can be surmounted by certification growers association and production system innovation along with cost monitoring**. J. L. Hine and S. D. Ellis, TRL Limited (2001)** described the research relating to the role that road transport has to play in maintaining rural development and food security. From case study material the relationship between accessibility, marketing and agricultural development is examined. It is argued that transport costs play a critical role in identifying the link between accessibility and agricultural development. **Somayajulu and Venkataramana (2002)** found that India is mainly a groceries market and in this area super markets have not been able to cut into the customer base of the small retailers. They concluded that, organized retailing has definitely made headway in the upper class. However, in this segment, items such as milk, fruits, vegetables and a significant portion of through the month purchases seem to be done traditional outlets. **Somayajulu and Venkataramana (2002**) found that first challenge facing the organized retail industry in India is competition from the unorganized sector. Organized retail in India is largely, a proposition of poor economies of scale. It was interesting to note that the unorganized sector are mostly owner operated, is very competitive and offers products to consumers at a lesser price since it has low operation costs, negligible real estate and labour cost and pay little or no taxes. **Thomas and Julio (2002)** found that there was acquisition of small retail chains by the larger ones and supermarkets spreading from urban areas to intermediate cities and from upper income neighborhoods to working middle class neighborhoods. **Douglas, (2002)** in his research paper analyzed that the process of structural change that transforms a traditional subsistence based self sufficient village economy into a more market oriented and specialized one is an important part of the long run evolution of an economy. **Udaya (2002)** shows that the price of preferred products was significant at 0.1 per cent with the help of econometrics test which he applied on the data collected and after its results the researcher says that it is sufficient to influencing the dealer's loyalty to the large extent. **Ioanna Reziti (2003)** facilitated that markets should be integrated in the long run, because in the long-run equilibrium relation exists between prices at different levels and price transmission is incomplete in the short-run. He found out that changes in the price

at one stage need some time to be transmitted to another stage for various reasons, such as policies, storage and inventory holding and delays caused in transportation and processing. **Vaswani et. al., (2003)** in their study concluded that the changing task environment is leading to change in priorities of Indian agriculture in the 21st century. In the emerging scenario, the core concern has to shift from food security to productivity and diversification. **Acharya, (2004)** reviewed that along with transportation costs to the nearest market, The characteristics of the nearest market can also influence the transaction costs of taking Products to markets. For instance, a highly congested market with few facilities can add substantially to waiting time, product deterioration and losses, and costs to farmers and traders. These concerns about marketing costs have, indeed, underpinned the renewed emphasis on investment in market facilities in a number of developing countries including our focus country, India. ***Dr. Somjate Sirivatanapa*** **(2004)** described that fresh fruits and vegetables are highly perishable. Farmers take care of their produce from seedling to harvest and therefore expect good returns. Postharvest losses which average between 24 and 40% in developing countries, and between 2 and 20% in developed countries are a major source of waste. High levels of waste result in higher prices for fresh produce, and the farmer increasingly facing poverty. Fruits and vegetables are generally produced by farmers for their families and for nearby markets. Farmers at the SME level, however, generate income by growing fruits and vegetables for local and distant markets. Appropriate preharvest practices, proper postharvest handling, packaging and transportation are, therefore, critical to maximizing returns to these small commercial farmers. Marketing must also be well planned. Fresh produce after harvest can be considered as being in a live form, as it continues the process of respiration and transpiration until its reserves of food and water are exhausted. Physiological changes or the rate of deterioration of fresh produce is influenced by the temperature, composition of the air surrounding the produce, and the humidity of the environment. No matter how good the quality, if packaging, transportation and marketing are not properly taken care of; fresh produce will be damaged and will undergo rapid decay. The causes of losses in fresh produce vary widely. He discuss that how packaging and transportation of fruits and vegetables can reduce

postharvest losses and improve marketing. Packaging and transportation can be manipulated in order to reduce postharvest losses in fruits and vegetables. Packaging technology allows supermarkets to reduce their labor costs and reduce waste, while providing the consumer with a selection of fresh produce which is safe and of a high quality. Reduction of postharvest losses in fruits and vegetables and expanding markets provide benefits for the seller and the buyer, and increases farmer income and alleviates poverty. **Bulent Sezen (2004)** conducted study on the pricing strategies for perishables products found out that Consumer are less likely to purchase perishable goods when their expiry dates are near.It is because due to perishable nature and risky to store and consumption which is loss of cost which incurred in purchase and storage of it. **McLaughten (2004)** concluded that major factor that contribute to the complicated price formation process at several levels of fruit and vegetables in the US were marketing channels, market structure changes, pricing techniques and promotional impacts, retail responses to supply changes, and price versus value. **Subha (2004)** in a study of managing supply chain, concluded that seeking sustainable and defensible competitive advantage has become the concern of every manager who is alert to the realities of the market place. Adding value through differentiation is a powerful means of achieving an edge in the market place. By suitably integrating the members of the supply chain and maintaining the information flow within the organization will surely help it to meet the demand in the market place providing satisfaction to the customer. **Ayieko *et al.* (2005**) showed that fresh produce consumption is influenced by education level, age and the gender of household head. The fresh produce consumers tend to be highly specialized in terms of their shopping patterns as compared to other food groups, often dominating the open-air markets and kiosks. **Suresh Reddy, J (2005)** explains that **g**aining competitive advantage through Supply chain management and explains that supply chain management (SCM) is the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole. Thus the focus of supply chain management is upon the management of the relationships in order to achieve a more profitable outcome for all parties in the chain. Organizations use SCM to reduce or eliminate the buffers

of inventory that exists between organization in a chain through the sharing of information on demand and current stock levels. **Fiala, (2005)** analyzed that supply chain partnership importance and the whole cycle of logistics which not only carry production but some other important components such as information e.tc. which leads to increased information flows, reduced uncertainty, and a more profitable supply chain. **N.Viswanadham (2005)** in his research tried to identify emerging opportunities in the food and cold chain sector in India and present ways in which existing market challenges in India can be overcome using technology and experience. He suggested that the surplus of cereals, fruits, vegetables, milk, fish, meat and poultry can be processed as value added food products and marketed aggressively both locally and internationally. Investments in cold chain infrastructure, applied research in post harvest technologies, installation of food processing plants in various sectors and development of food retailing sector are mandatory for achieving gains in this sector. Strategic growth plans for achieving both national and international competitiveness of the food industry are essential. India is all set to become the food supplier of the world. It has the cultivable land, all the seasons for production of all varieties of fruits and vegetables, well developed agribusiness system that works in its own way. The food supply chain needs the attention of the academics, the industry and the Government. **Adugna Haile (2006)** has conducted research with the objective of finding the damages caused by storage pests under farmers' situations. For which different types of methods used by farmers for storage were analyzed and the causes of types of losses created due to pests and other biological factors. Atlast the research suggested that to use is best seed for growing crops and small quantity food grain storage systems. **Suneel Arora and Mukesh Vyas., 2006**, discussed the importance of IT in organized retail management. With the use of information technology, a retailer can link with supplier order and planning systems to enable more accurate forecasting and production planning. With small cost increments, a retailer can provide better customer service and manage the inventory and get value propositions of such investments **Zhao Yingxia, Guo Xiangyu (2006)** studied **t**he level of the agricultural product logistics development has become one of the key aspects which decide the level of the whole development of one country

agricultural economy. There are such problems as high cost, low efficiency, low socialization and marketability degree, old logistics facility and technology, lacking talented persons, impeded information and so on. At present speeding up the development of the agricultural product logistics is a vital and urgent duty. Aim at existing problems of China agricultural product logistics development including high cost, low efficiency, low socialization and marketability degree, backward logistics facility and technology, lacking talented persons, and impeded information. He has proposed such countermeasures as exploring new agricultural production circulation pattern, cultivating and developing agricultural product logistics organization, enhancing education and training, enlarging government's support, speeding up agricultural product logistics informationization construction and standardization construction in order to provide certain theory instruction and policy-making reference for speeding up China agricultural product logistics development. **Gandhi, (2006)** concluded that studies from India have shown that improvement in market facility increases volume of trade at the market. Similarly, improvement in transport infrastructure is found to result in change in cropping pattern and agricultural productivity. **Anand and Ramesh (2006)** analyzed that efficiency of marketing of fertilizers; it is commonly worked out by price spread which refers to the difference between the price paid by the consumer and price received by the producer. Further he concluded that a cooperative was the most efficient chain. The price paid by the farmers for different fertilizers to co-operative was on an average Rs. 30 less than what they pay for the retailers. **Lokanadhan (2007)** conducted a study on supply chain management analysis of tomato from farm to modern retail outlet. The study was conducted in Hoskote taluk of Bangalore rural district. The specific objective of the study was (i) to identify the modern supply chain management's practices followed (ii) to evaluate the results of the first objective with traditional marketing supply of tomato through market intermediaries. they concluded that modern retail outlet management improved transparency, involvement of all levels of management, higher price to tomato growers and lesser price to consumers less spoilage of tomatoes than traditional system of marketing. **Sreenivasa *et al.* (2007)** conducted study on "marketing losses and their impact on marketing margins to estimate the

post harvest losses field level, transit and wholesale marketing level and retail marketing level was selected for the study and they found out that the margin of the retailers' after taking into account the physical loss during retailing has been found to be negative (loss), which otherwise, was positive (profit) in the conventional estimation. Similarly, the producers' net share and wholesalers' margins also decrease substantially. The need for specialized transport vehicles for perishable commodities has been highlighted **Vijaya (2007)** conducted a study on the spread of organized retailing in India with special references to Vijaywada city. The study also revealed that 54 percent of respondents visit shops because it is convenient for them to go and purchase goods. Quality of the goods is also a matter of concern for 24 percent of respondents **Brithal, et.al., (2007)** in their study suggested that by building efficient and effective supply chain using state of the art techniques it is possible to serve the population with value added food, while simultaneously ensuring remunerative prices to farmers. **Sharma, (2007)** analyzed that high value agriculture gives higher returns but it is also risky. Majority of farmers are small and marginal, who have poor link with the markets and low risk-bearing capacity, which restricts their participation in fast changing dynamic markets. The current crisis of Indian agriculture will increase unless prompt remedial actions are initiated by the government.. **Julian Parfitt Mark Barthel and Sarah Macnaughton (2007)** studied about Food waste in the global food supply chain is reviewed in relation to the prospects for feeding a population of nine billion by 2050. Different definitions of food waste with respect to the complexities of food supply chains (FSCs) are discussed. He found a dearth of data on food waste and estimates varied widely; those for post-harvest losses of grain in developing countries might be overestimated. They further analyses highlighted the scale of the problem, the scope for improved system efficiencies and the challenges of affecting behavioural change to reduce post-consumer waste in affluent populations**. Sreenivas Murthy, D., Gajanana, T.M., Sudha, M. and Dakshinamoorthy, V (2007)** found out that the margin of the retailers' after taking into account the physical loss during retailing has been found to be negative (loss), which otherwise, was positive (profit) in the conventional estimation. Similarly, the producers' net share and wholesalers' margins also

decrease substantially. It has been shown that marketing efficiency is inversely proportional to the marketing losses. The cooperative marketing has been found to be a more efficient system in terms of both operations and price. Marketing cost has been identified as the major constraint in the wholesale marketing channel and bringing down the costs, particularly the commission charges as demonstrated in the cooperative channel, will help in reducing the price-spread and increasing the producers' margin. The need for specialized transport vehicles for perishable commodities has been highlighted. **D. Sreenivasa et.al 2007**.The study has estimated post-harvest losses in two major food grains, viz. rice and wheat. It has been found that about 75 per cent of the total post-harvest losses occur at the farm level and about 25 per cent at the market level. The post-harvest losses at farm level have been observed as 1.68 q/ha in rice and 0.45 q/ha wheat. On per farm basis, these have been estimated to be 4.20 quintals in rice and 1.01 quintals in wheat. The storage losses at different stages have added up to about 35.80 per cent of the total post-harvest losses in rice and 33.52 per cent in wheat, while harvesting and threshing operations together have accounted for about 17 per cent of total losses in both the crops. The functional analysis has revealed that education level of farmers and bad weather conditions influence the post-harvest losses significantly at farm level in both the food grains, while inadequate availability of labour and faulty storage method influence the post-harvest losses positively and significantly in rice and wheat, respectively. Educating and training the farmers on post-harvest operations would greatly help in reducing the post-harvest losses in food grains. **H. Basavaraja, S.B. Mahajanashetti and Naveen C. Udagatti (2007)** has studied that the post-harvest losses have been estimated at different stages in two major food grains, viz. rice and wheat in India. The study has estimated post-harvest losses in two major food grains, viz. rice and wheat. The functional analysis has revealed that education level of farmers and bad weather conditions influence the post-harvest losses significantly at farm level in both the food grains, while inadequate availability of labour and faulty storage method influence the post-harvest losses positively and significantly in rice and wheat, respectively. Educating and training the farmers on post-harvest operations would greatly help in reducing the post-harvest losses in food grains. The

establishment of small-size cold storage units in the production centers would help reduces the storage losses. In this direction, the zero energy cool chambers technology developed by the Indian Council of Agricultural Research needs to be popularized. **Anderson, et. al., (2008)** found that in the international arena, food-exporting countries are concerned with access to markets in food-importing countries and unfair competition in third-country markets from subsidized food exporters, while food-importing countries are concerned with foreign competition in their home market **Elhadi M. Yahia (2008)** examined the significant advances in postharvest research over the last few decades that have led to the development of a diversity of appropriate technologies in many countries including several developing countries. However, there is a persistent problem in most of the world (especially in many developing countries), where significant quantities of perishable foods are lost every year. The problems in developing countries are very complex in nature, and are not only due to technical reasons. However, from the technical stand-point there are diverse problems related to 'unavailability of adequate technologies', 'unfamiliarity with available adequate technologies', 'inadequate use of or difficulties in the adaptation of available proper technologies', or even the 'refusal to use available proper technologies, due to different reasons'. He discusses some of the advances in postharvest R&D in developing countries and some of the 'technical' challenges still faced, and suggests ways for further improvements. There is excellent potential for improving food availability in DC and also in penetrating world markets by improving food production systems and reducing food losses. There is still a lack of available, locally-written publications on PH, and most are still written in foreign languages (especially English) which make it difficult for many people to understand and utilize the information.

Ajiboye, A. O. and O. Afolayan (2009), regarded transport as a crucial factor in improving agricultural productivity, enhancing quality of life of the people, create market for agricultural produce, facilitate interaction among geographical and economic regions and opened up new areas to economic focus. He revealed that an improved transportation will encourage farmers to work harder in the rural areas for increased production, add value to their products, reduce spoilage and

wastage, empower the farmers as well as having positive impact on their productivity, income, employment and reduce poverty level in the rural areas since it will be easier to move inputs and workers to farm as well as products to markets and agro-allied industry. He further explains that transport plays a significant role in the structure of food production and marketing and that easy transport to market can make all the difference in the level of rural incomes. He further explains that an improved transportation will encourage farmers to work harder in the rural areas for increased production, add value to their products, reduce spoilage and wastage, empower the farmers as well as having positive impact on the productivity, income, employment level and reduce poverty level in the rural areas. Finally, transport is also seen as a facilitating factor in the mobilisation of the farmers and other allied workers in the overall national development of the nations. **Gulati, (2009)** found that the next revolution in Indian agriculture be triggered by the corporate sector as there is an increasing role of the corporate sector in agriculture by infusing new technologies and accessing new markets. **Glendenning, (2010)** evaluated that despite the multiplicity of agricultural expansion approaches that operate in parallel and sometimes duplicate one another, the majority of farmers in India do not have access to any source of information **Simon C. Kimenju and Hugo De Groote(2010)** explains upcoming technologies for maize storage have sometimes been promoted without being subjected to trials and economic analysis. In the recent past, new storage technologies, actellic super, super grain bag and the metal silo have been developed. In this paper, the results of crop loss trials are combined with measures of project worth to determine the attractiveness of investing in new storage technologies. He explains that economic analysis of new storage technologies has been undertaken. His analysis was also subjected to a sensitivity analysis by varying the interest rates and length of investment period. The results showed that the three largest silos were attractive for all the scenarios used here. **Lisa Kitinoja, Sunil Saran, Susanta K Roy and Adel A Kader (2010),** explains the needs and challenges of developing good, science-based, simple methods for postharvest handling that can be made available in developing countries. Some of the traditional challenges have been successfully met (i.e. identifying causes and

sources of losses for key crops, identifying many potential postharvest technologies of practical use for reducing losses), but many challenges remain. These include the characterization of indigenous crops in terms of their unique postharvest physiology (e.g. respiration rate, susceptibility to water loss, chilling sensitivity, and ethylene sensitivity), ascertaining the differences between handling recommendations made for well-known varieties and the needs of local varieties of crops, and determining cost effectiveness of scale-appropriate postharvest technologies in each locale and for each crop. Key issues include building capacity at the local level in postharvest science, university teaching and extension, and continued adaptive research efforts to match emerging postharvest technologies to local needs as these continue to change over time. Development of appropriate postharvest technology relies upon many disciplines that are relevant to the overall success of horticulture, i.e. plant biology, engineering, agricultural economics, food processing, nutrition, food safety, and environmental conservation. The expanding pool of new information derived from postharvest research and outreach efforts in these areas can lead in many directions which are likely to have an impact on relieving poverty in developing countries. Increasing investments in postharvest horticultural technology R&E is long overdue, and can have a major impact on reducing waste and increasing the food supply, leading to improved incomes without increasing production and wasting the expenditures on all the inputs required (land, water, seeds, fertilizers, pesticides, labor, etc.). The most useful technological changes in production, harvesting, and postharvest handling systems for horticultural perishables have resulted from interdisciplinary team approaches in research and extension programs. Maintaining quality, especially flavor and nutritional content, and ensuring safety (avoiding chemical and microbial contamination) must be the focus of future research and extension activities in all countries. She gave her recommendations for meeting future challenges in postharvest Research and Education(R&E):

• An integrated approach for postharvest science and education from grade school through trade school or university could help to reduce global food losses, by integrating postharvest information into the general agricultural curriculum in each country or state and their extension services, with much more emphasis on

preventing losses, maintaining quality and nutritional value after harvest and ensuring food safety.

• Establishing a Postharvest Working Group in each country could be very useful in providing a forum for communications among all those concerned with postharvest biology and technology research and outreach. A link among the various Postharvest Working Groups in each region would further facilitate exchange of information and regional collaboration on training and other areas of mutual interest, and help to reduce duplication of efforts.

• Capacity-building efforts undertaken in postharvest technology in developing countries must be more comprehensive, and include technical knowledge on handling practices, research skills, access to tools and supplies, cost/benefit information, extension skill development (training needs assessment, teaching methods, advocacy), Internet/Web access, and provision of follow-up mentoring for young scientists and extension workers after formal training programs have been completed.

• A central site for conducting postharvest research and offering local extension programs such as a 'Postharvest Training and Services Center' is recommended for each developing country. This site is where local R&E personnel could meet and conduct practical adaptive research aimed at testing innovations under local conditions, identifying issues regarding practicality, costs, potential returns, providing demonstrations of those innovations determined to be feasible (both technically and financially), providing comprehensive, hands-on training on improved postharvest practices, and providing information of practical use to women involved in horticulture.

Rahul Goswami (2011), In May 2011, the Food and Agriculture Organization (FAO) released a short study on 'Global Food Losses and Food Waste'. Rather against the run of conventional wisdom on the matter, FAO said that "in developing countries 40% of losses occur at post-harvest and processing levels while in industrialized countries more than 40% of losses happen at retail and consumer levels." Until now, India's Ministry of Food Processing Industry, Ministry of Commerce (Department of Industrial Policy and Promotion), Ministry of Agriculture and our National Agricultural Research System have asserted that it

is encouraging investment in the retail 'back end' (collection, cold storage, logistics, warehousing, modern markets, etc), which will substantially reduce post-harvest food waste/loss, help farmers earn more and help control food inflation. The FAO study has provided some useful data to illustrate the global nature of food loss and waste. The study has shown that the per capita food loss in Europe and North-America is 280-300 kg per year. In Sub-Saharan Africa and South and Southeast Asia it is 120-170 kg per year. The total per capita production of edible parts of food for human consumption is, in Europe and North-America, about 900 kg per year and, in sub-Saharan Africa and South and Southeast Asia, 460 kg per year. Per capita food wasted by consumers in Europe and North-America is 95-115 kg per year, while this figure in sub-Saharan Africa and South and Southeast Asia is 6-11 kg per year. Food waste at consumer level in industrialised countries (222 million tons) is almost as high as the total net food production in sub-Saharan Africa (230 million tons). The difference between food waste in the North and in the South, if taken as averages and mapped to populations and their food wasting habits, then for Bangladesh in 2011 we have a total wastage of 1.275 million tons! To place that amount in perspective, FAO Stat (the organisation's statistics resource) places the total harvest of vegetables in Bangladesh in 2008 at 1.1 million tons. It is with the help of two charts that the "post-harvest losses" argument for increased investment in processing-related infrastructure can be shown as being much too weak on both data and analysis to aid policy.

Jaspreet Aulakh and Anita Regmi (2011), explains the conceptual model which will support the development of a template for estimating the post-harvest losses in different staple crops. He has highlighted the importance of reducing postharvest food losses as a necessary step in ensuring future global food security in a sustainable manner. Given the challenges posed by climate change and limited land and water resources, food security cannot be achieved merely through increases in agricultural productivity. Attention also needs to be given to measures to reduce losses along the farm-to-consumer chain. Reduced losses not only reflect an increase in food available for human consumption, but they also reflect

a more judicious use of our limited natural resources. There have been very few past studies conducted to estimate food losses. The existing studies have been mostly one-off and do not adopt any consistent methodologies. While the African Postharvest Losses Information System or APHLIS has recently made an effort to provide a framework to calculate food losses using a common methodology for south and east Africa, the input used in this process is based on work which may be outdated or not directly relevant. Therefore, it is critical that a more broader and updated effort be implemented to improve the ability to estimate postharvest food losses. The paper outlines a framework which can be adopted for consistent estimation of postharvest losses for different commodities and countries. As a follow-up to this work, using the methodology discussed here, surveys can be designed to conduct field work to estimate losses. Based on the survey data, econometric models can be used for selected commodities and countries to estimate the losses. **Jasbir Singh, Arshad Mahmood,(2011),** found that Vegetables in our country have been identified as most remunerative crops for replacing subsistence farming & play an important role for diversification of agriculture by improving the economic and social status of the people. The study showed that the majority of vegetable producer sold through well renowned marketing channel i.e. Producer – Wholesaler / Commission Agent – Retailer – Consumer. The major share of marketing cost appeared to be incurred on trader's commission, packing charges and transportation charges. The major problems observed in marketing were high cost transportation, trader's commission, packing materials, seasonal gluts, distress sale, losses at every stages, volatile behavior of prices, market imperfections & poor infrastructural facilities etc. **Ngatia C. M and Kimondo, M (2011),** tried to determine the weight loss of food grains for which Common methods of weight loss assessment in stored grain include the standard volume weight (SVW), count and weight (C&W), the thousand grain mass (TGM) and the indirect with a conversion factor (CF) which have been used in varying storage environments. Apart from accuracy and reliability, practical application may limit their use in rural areas. Three of the methods (SVW) or Bulk density (BD), C&W and CF were evaluated on maize stored in two farmer environments exposed to natural infestation. Baseline

damage parameters: bulk density, grain moisture, sieved dust, weevil damage and insect pests per kilogram were established and again after 24 weeks. All the three methods had closely related weight loss figures in the same storage environment suggesting the need for careful selection of the preferred method based on practical application. **Jenny Gustavsson Christel Cederberg Ulf Sonesson (2011)** has highlighted the losses occurring along the entire food chain, and makes assessments of their magnitude. The results of their study suggest that roughly one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year. This inevitably also means that huge amounts of the resources used in food production are used in vain, and that the greenhouse gas emissions caused by production of food that gets lost or wasted are also emissions in vain. Food is lost or wasted throughout the supply chain, from initial agricultural production down to final household consumption. In medium- and high-income countries food is to a significant extent wasted at the consumption stage, meaning that it is discarded even if it is still suitable for human consumption. The causes of food losses and waste in low-income countries are mainly connected to financial, managerial and technical limitations in harvesting techniques, storage and cooling facilities in difficult climatic conditions, infrastructure, packaging and marketing systems. The food supply chains in developing countries need to be strengthened by, *inter alia*, encouraging small farmers to organize and to diversify and upscale their production and marketing. Investments in infrastructure, transportation, food industries and packaging industries are also required. Both the public and private sectors have a role to play in achieving this. He further revealed that there are major data gaps in the knowledge of global food loss and waste. He has also suggested that further research in the area is urgent. Food security is a major concern in large parts of the developing world. This study illustrate that one of the first mean to fight imbalances and reduce tensions between the necessary increase in consumption and the challenging increase in production, is to also promote food loss reduction which alone has a considerable potential to increase the efficiency of the whole food chain. This study has compiled and analyzed a magnitude of data and reports on food losses and waste. Waste levels and waste volumes in each step of the food

supply chain were estimated. He further revealed the major data gaps in available knowledge of global food waste, especially with regard to the quantification of food losses by individual cause, and the cost of food loss prevention. The impact of growing international trade on food losses still has to be better assessed. **Ku.P.V. Pohare (2011)** observed that agriculture is the important of Indian Economy because of its high share in employment and livelihood creation to the nation's GDP. The share of agriculture in the gross domestic production has register 1983 to 18.5 in 2006-07.et this sector continues to support more than half a billion people providing employment 52% of the workforce. The farmers are committing suicides even after implementation of prime minister's and state government packages for them the volume of loan on Indian farmers arose to Rs. The liberalization of India's economy was adopted by India in 1991. Facing a severe economic crisis, India approached the IMF for a loan, and the IMF granted what is called a 'structural adjustment' loan, which is a loan with certain conditions attached which relate to a structural change in the economy. There was a considerable amount of debate in India at the time of the introduction of the reforms, it being a dramatic departure from the protectionist, socialist nature of the Indian economy up until then. It is also essential to break the link. India would have taken a very different course if there was no urgent need to borrow from the IMF. It is essential for the rest of the G8 to follow Britain's example in order to influence World Bank and IMF policy towards India to ensure blind liberalization is not pursued, and so that countries like India can adopt tailor-made reforms to suit their economy.

Shakeel-Ul-Rehman M. Selvaraj M.Syed Ibrahim (2011), has explained that the agriculture in India has directly or indirectly continued to be the source of livelihood to majority of the population. He had observed that better and easy market access and efficient information flow can bring much desired market orientation of the production system. Using modern ICT can bring out better solutions as it can facilitate agricultural marketing functions and processes include buying and selling, payment, grading, standardization, transportation in an efficient manner. **Begum (2011),** analyzed that agricultural marketing continued to be plagued by many market imperfections such as inadequate infrastructure,

lack of scientific grading system, defective weightiest and so on. The basic objective of regulating the marketing of agricultural products was to bring both producer and buyer/trader closer and to the same level of advantage. **Halder, et. al., (2011)** in their study concluded that the changing consumption dynamics coupled with the growth of modern retail sector, like the growing demand for the processed food offers a tremendous opportunity for all stakeholders in the areas of production, processing, marketing, supply chain, infrastructure development, technology up gradation and education. **Sengupta, (2011)** in his study found that Indian agriculture sector has suffered from low investment and policy neglect and farmers productive ability is constrained by grossly inadequate infrastructural facilities like road and transport system, marketing and storage facilities. Indian farmer enjoys a very little subsidy on agriculture **Shakeel-ul-rehman, dr. M. Selvaraj, dr. M. Syed ibrahim (2012),** Conducted a study in which India is among the world's leading producers of paddy rice, wheat, buffalo milk, cow milk and sugar cane. He explains the progress and performance of Foodgrains distribution in India especially by Food Corporation of India and Central Warehousing Corporation, as these corporations are responsible for the bulk storage and distribution of foodgrains in the country, the paper also brings into focus the problems and prospects in the current marketing system and brings out some challenges which these corporations face. Agriculture is fast becoming demand driven from the earlier supply driven situation. Farmers will have to grow specific varieties needed for processing or add value to their produce. Policy and legislation should be reformed to allow processors to purchase their produce requirement directly from the farmers. The creation of commodity-based management systems would be beneficial. These could advise the government and R&D institutions to take steps proactively, based on continuous tracking of the demand, supply, consumer needs and prices both in the domestic and international markets. The intelligent information collecting system should be networked with all user agencies and farmers in the country, using the latest IT technologies and infrastructure. Implementation of MSP is undertaken through procurement by central and state level agencies. However, the designated agencies intervention in the market for undertaking procurement operations assists market prices not to fall

below the MSPs fixed by the government. The increasing trend of agricultural production has brought in its wake, new challenges in terms of finding markets for the increased marketed surplus in the country. Challenges and opportunities that the global markets offer in the liberalized trade regime are also to be addressed. For the farming community to benefit from the new global market access opportunities, the internal agricultural marketing system in the country needs to be integrated and strengthened. Agricultural marketing reforms and the creation of marketing infrastructure has therefore been a prime concern of the government. Presently, there is limited warehousing capacity in the country. To create additional storage capacity the government launched on 1 April 2011, the Gramin Bhandaran Yojana aimed at the creation of scientific storage capacity with allied facilities in rural areas. This will meet the requirement of farmers in manifold ways such as, storing farm produce, processed farm produce, agricultural inputs, promotion of grading, standardization and quality control of agricultural produce to improve their marketability, prevention of distress sales immediately after harvest by providing the facility of pledge financing and marketing credit. It will strengthen the agricultural marketing infrastructure in the country by paving way for the introduction of a national system of warehouse receipts in respect of agricultural commodities stored in such godowns and will help to reverse the declining trend of investment in the agriculture sector by encouraging private and cooperative sector to invest in the creation of storage infrastructure in the country.

Esther Sany´e-Mengual, Ileana Ceron-Palma, Jordi Oliver-Sol Juan Ignacio Montero and Joan Rieradevall (2012), predicted the situation of 2050. He further explains that cities play a key role in the global environment as they are dependent on external sources of energy and goods. Moreover, urban areas contain 50.6% of the world's population, and it has been estimated that this proportion will continue to increase to 70% by 2050. As food is a basic human need, food supply for cities has become a key issue for their sustainability. Urban expansion has several consequences for food security: the demand for land for housing, industry and infrastructure competes with the land required for agricultural production within and around cities. Additionally, due to an increase in the quantities of food consumed, the expansion of urban areas, coupled with

changes in consumption habits and food purchasing behavior, has caused an increase in the number of food loaded consignments to cities. Freight is mainly transported by road, although airfreight and maritime transport have increased during the last decade, mainly in developed countries. Such changes could lead to an increase in traffic congestion and air pollution as well as putting additional stress on existing food distribution infrastructure and facilities. Furthermore, production could also be affected by the rise of real energy prices, as the cost of inputs and transport and the demand for agricultural products such as feedstock for biofuel production will increase. **Iliyasu Mohammed Utono(2012),** Grain storage losses due to insect pests have been a serious problem threatens the livelihood of small-scale farmers. Sampling and inspection of grain stores provide important information that is useful in identifying and managing insects problems associated with grain storage. The survey was intended to be a quick study to get an indication of which type of grain in which region was most in need of improvements to insect pest control. He explains that it requires intervention; low-income farmers, who cannot maintain conditions required to produce good quality stored grain, due to their financial status or access to good storage management facilities, are more liable to produce and live off of food of low nutrient value, thus are most in need of help with a better insects' control.

Dr. Vijay Intodia (2011-12) has undertaken the study to understand that to what extent reforms measures in terms of repeal of the act has affected investment in agricultural marketing infrastructure and has undertaken the study to analyze the investment in the investment in the agriculture marketing infrastructure and the factors which are influencing the investment in the food sector. The present study has been undertaken to analyze the investment in the agriculture marketing infrastructure and the factors which are influencing the investment in the food sector. The repeal of the act has definitely provided a suitable environment for the private investors but the same needs to be supplemented by the basic infrastructure. **Mst. Esmat Ara Begum Mohammad Ismail Hossain Dr. Evaggelos Papanagiotou(2012)** explained**,** They have estimated post-harvest losses in two major food grains, viz. rice and wheat. The functional analysis has

revealed that the post-harvest losses were positively and significantly conditioned by total production of aman rice and by total production of boro rice and total production of wheat, and irrigation area under boro rice. The results of the Logistic regression model showed that the household size and post-harvest loss of the farmers in both districts had negative and significant relationships with their probability of food security which means that small families are more food secured than large ones and families whom had less post-harvest loss are more food secured than had much ones. **Iwan Vanany Mohammad Arif Rohman (2012)** reflected that food product, with its diversity and number of supply chain actors, is a vital component for economic balance and social stability. Fresh agricultural products have a high defect rate, since they are nonperishable products. Improving management capability through modeling of logistics system for fresh agricultural supply chain, as in the wholesale market, is important to do. This paper presents a model for logistics systems for fresh agricultural products in wholesale market. The proposed model consists of a product flow modeling, thread diagrams, and business processes diagram. New department as mediator is needed to align order demand to customers and supply fresh agricultural products from farmers. The manager's case study believed that logistics system based on demand-driven approach is more robust than supply-driven approach. Detail of activities in three areas of business processes (receiving, processing and distributing) was also presented. The main opportunities to investigate for future research are (1) what the critical success factors of logistics system used to implement operations of logistics system based on demand-driven in wholesale market and (2) what the critical sources of risk can be disturbance logistics in internal operations of wholesale market, upstream and downstream side fresh agricultural supply chain. **Dana Gunders (2012)** this study describes that food is simply too good to waste. Even the most sustainably farmed food does us no good if the food is never eaten. He examines the inefficiencies in the U.S. food system from the farm to the fork to the landfill. By identifying food losses at every level of the food supply chain, this report provides the latest recommendations and examples of emerging solutions, such as making "baby carrots" out of carrots too bent (or "curvy") to meet retail standards. By increasing the efficiency of our food

system, we can make better use of our natural resources, provide financial saving opportunities along the entire supply chain, and enhance our ability to meet food demand. **Brian lipinski, craig hanson, james lomax, lisa kitinoja, richard waite and tim searchinger (2012)** explaine that Food and Agriculture Organization of the United Nations (FAO) estimates that 32 percent of all food produced in the world was lost or wasted in 2009. Food loss is the unintended result of an agricultural process or technical limitation in storage, infrastructure, packaging, or marketing. "Food waste" refers to food that is of good quality and fit for human Consumption but that does not get consumed because it is discarded either before or after it spoils. Food waste is the result of negligence or a conscious decision to throw food away. Big inefficiencies suggest big savings opportunities. Thus reducing food loss and waste could be one of the leading global strategies for achieving a sustainable food future. Many approaches can be used to reduce food loss and waste. This fact is ultimately a failure of economic and natural resource efficiency. The world faced an analogous failure of efficiency in the 1970s with energy. In the face of record oil prices and growing demand, the world essentially declared war on energy wastefulness and significantly improved its energy efficiency. Yet a "war on waste" has yet to be waged when it comes to food. Given that food prices recently hit historic highs and global food demand continues to rise, now is the time. **Rehman, et. al., (2012**) suggested that the need to strength the regulated agricultural market system arises from changing nature of linkages between agriculture and markets. It has also been observed that better and easy market access and efficient information flow can bring much desired market orientation of the production system. **Alexandratos and Bruinsma (2012),** found that food supplies would need to increase by 60% (estimated at 2005 food production levels) in order to meet the food demand in 2050. Food availability and accessibility can be increased by increasing production, improving distribution, and reducing the losses. Thus, reduction of post-harvest food losses is a critical component of ensuring future global food security

Research Gap:

Bases on the above review of literature, researcher has observed that agriculture in the backbone of any economy and as well as basic need which helps in feeding countries population and generating employment. It includes horticulture also which is facing have losses of it production due to lack of proper supply chain which results into price rise of the fruits and other products. Proper supply chain management plays an important role in 'losses free' flow of agriculture production (foodgrains) which can further help in reducing the gap of demand and supply of food. Because many studies says that after green revolution there is an significant growth in production but due to lack of storage and transportation facilities it converted into foodgrains loss. With the help of above review of literature a clears picture of present agriculture and it logistics management is shown not only of India but other countries also. From this review some very good practices also came out to support the logistics management of agriculture and some deficiency of present logistics system which is basically due to lack of storage facility and transportation, not only this from this review it shows that there is lack of government support also. And then on the bases of this review of literature the researcher creates the objectives and hypothesis of this study.

2.2 Hypothesis

To study the research topic we have taken three hypotheses:-

H1: Improper logistics management is the root cause of wastage of foodgrains

H2: Present logistic system is poor due to its low technology.

H3: Current proposals of government do not sufficiently support the development of distribution logistics.

2.3 Motivation for the study

Out of the post harvesting losses of food grains, the logistical Management plays an important part in the total losses. Hence the researcher has chosen this as part of study. In which the study describes about the production losses at various stage of logistic system such as harvesting, transportation, loading, unloading, storage

and packaging etc. Through detail review of literature on the logistics management of agriculture products which clearly reflects the need of the study on this issue to know more about it and try to find out some corrective measure to improve the condition and reduce the losses of agriculture products gives the motivation for the study.

2.4 Importance of Proposed Research Work

Food economy plays a prominent role in the income-generating processes of the Indian economy, in the country's active participation in international trade, in food supply and in ensuring high employment levels. India's geographical location and climate is favorable for producing high-quality goods, which enjoy a good reputation both locally and abroad, thanks to highly qualified specialists employed in the food economy. However, the Indian food economy is confronting several problems that hinder profitable sales. With the opening markets, foreign goods which are cheaper and of lower quality than local products, or cheaper but of a similar quality, are competing more successfully for customers. There may be a number of reasons for this phenomenon outside my field, such as the fragmentation of producers, or the extent, allocation and profitability of development resources. Within my professional fields – namely freight forwarding and logistics – This study also trying to ascertain the causes whose elimination would foster the development of sales practices of the Indian food economy.

"Logistics is the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and related information flows) through the organization and its marketing channels in such a way that current and future profitability are maximized through the cost-effective fulfilment of orders. With the use of logistics management, the goal is to link the marketplace and the operating activity business in such a way that customers are served at higher levels and at a lower cost. A broader definition of logistics management that is widely used comes from The Council of Logistics Management (CLM) and is as follows: "Logistics management is that part of the

supply chain process that plans, implements and controls the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers' requirements. Materials can be raw materials, components, parts, tools, consumables, services or any other types of item. The material flow represents the supply of product through the network in response to demand from the succeeding organization. Often it is difficult to see where the flow starts in the chain and where it ends. The negative effect of this is the build-ups of inventory and slow response to demands of the end customer Logistics is a cross-functional subject cutting across functional boundaries of the organization in focus into the supply chain. This implies the complexities of synchronizing the movement of materials and information between business processes.

The system's nature of logistics has proved a particularly difficult lesson to learn, and individual organizations still often think that they can optimize profit conditions for themselves by exploiting others in the supply chain. The emergence of logistics has been dependent on the development of a cross functional model of the organization and there has to be an understanding of the need to integrate business processes across the supply chain, both internally and externally. The future competitive advantage will come from responding to customers at the end of the supply chain better than competitors do, and in this response, logistics play a key role.

2.5 Research Design

The research for this study is exploratory in nature where different aspects of topics have been explored. For this purpose a detail process has been adopted during the process of research. This process is entailed below:

2.5.1 Sampling Design

This study is conducted in Rajasthan state which is a universe of this study. The sample area taken for the research was Five districts (Alwar, Jaipur, Dausa,, kota and Bharatpur) of this state. Whole agriculture sector of these districts were surveyed under this study for collecting the data.

Methods of data collection was convenient and random sampling method under which the data were collected as per convenience of the researcher and selected on random base among the farmers and intermediaries of this sample are who were respondents of the questionnaire and observed of the study. Final 300 farmers and 50 intermediaries were selected from the total no. of respondents interviewed. Data was collected through structured questionnaire and interviewed as the sources of primary data for this study and for secondary data a numbers of journals, books, magazine and official website and concerned headquarters data were review and the

2.5.2 Data collection plan:

1. Collect the data by using available government statistics and other inputs from key informants.
2. Conduct an initial survey of the postharvest grain system to establish who is handling, storing, transporting, and marketing the harvested crop; what part of the crop is handled and stored by each operator, and for how long, including farm storage for self-consumption purposes; and the condition of handling, storing, and processing.
3. Review all available data on quantitative and qualitative losses occurring in the system and identify the major causes and extent of loss.
4. Prepare an inventory of available storage, transport, marketing, and processing facilities and assess their adequacy in capacity, design and condition.
5. Review the present activities being undertaken to reduce postharvest losses and list the resources available for these activities from both internal and external sources.
6. Designed a phased action program to investigate or implement under the project terms of reference

2.5.3 DATA COLLECTION PROCESS

The data collection plan is divided into steps as follows:-

Step-I: Village Schedule

This step covered the relevant information such as population, total geographical area, cultivated area, area and production of foodgrain crops, sources of irrigation, marketing facilities, condition of feeder roads, storage facilities etc., in respect of villages selected for the study.

Step II: Household Schedule:

This step was meant for listing of all the cultivator households in the selected village along with the size of holding in terms of area cultivated under foodgrains and was filled only once during first round of the survey.

Step III: Particulars of selected cultivator households:

This step covered relevant particulars in respect of the cultivator households selected for this study such as crops cultivated i.e. area and production variety-wise, irrigated, unirrigated etc.

Step IV: Retention of foodgrains for different purposes:

This was an important step for this survey and covered information relating to retention of foodgrains by the producer for different purposes such as consumption, seed, feed, payments in kind, barter for goods etc.

Step V: Losses of foodgrains at the Producers' level:

This step related to losses of foodgrains at the operational level, i.e., in threshing, Winnowing, in transport from the field to storage and losses during storage at the producers' level.

Step VI – Sale of foodgrains

This schedule covered the sale of foodgrains by the producer to various agencies within the village and outside the village. The data and other related information were recorded in Step – III to VI during visits to the selected cultivator households by the researcher.

2.5.4 Data Collection Tool :

Separate questionnaires were prepared for each category of respondents and personal interview method was used to collect relevant information and to identify variables on pre-tested questionnaire.

- Primary data was on the Impact Evaluation of the rural godowns through direct Interview and Structured Questionnaire.
- Secondary data was collected from the NABARD Regional office, RIICO, Rajasthan State Agriculture Marketing Board (Agro park), BIDI, Private Mandis and other sources

2.5.5 Data Collected For The Study:

The total 328 farmers were approached with structured questionnaire in hindi . These questionnaires were filled by the farmers. However, 300 fully filled questionnaires were selected for research. There have been a total of 58 intermediaries who were interviewed in the context however due to incomplete and ambiguous responses only 50 were selected. Most of them are running this business as their parent and grandparent had started and was involved in this business since ages. However only few of them are new as this sector has seen growth in economy and few of them have the money and equipped with adequate knowledge to do this business.

This research demands multi stage stratified random sampling design for this survey. The selection of districts was done on aggregate method of production for all crops of foodgrains Accordingly, selection of districts was done on the bases of their production contribution in the state, agro industries existence, size of agricultural land holdings and also the largest producer of foodgrains such as oilseeds in this state.. The sampling design consisted of:

i) In this state five districts were selected for the survey.

ii) In each selected district, 6 villages were selected after grouping into three stratums, based on total area cultivated under foodgrains.

iii) In each selected village, 10 (Ten) cultivator households were selected after classifying them into two categories viz., Medium(5-15 acers of agricultural land) and Large(15 &above acers of agricultural land) Accordingly, the total number of districts selected on state basis worked out to 5, the total number of villages to be surveyed worked out to 6 (5 districts X 6 villages) and 10 cultivator households (6villages X 10 cultivator households), from whom the data were collected in prescribed schedules on two crop season over a period of study.

2.6 Hypothesis Testing

The researcher tested above said hypothesis by using t test and F test. The accuracy of the model is tested by using model selection criteria like R2 etc, and test to check the violation of classical assumptions. The hypothesis are tested with F , T and other tests which are explained below:

We will use following test for diagnose purpose.

T-Test

The t-test, also known as the student t test, is a test of significance that can be used to determine whether a significant relation exists or does not exist between dependent variable and independent variable (only one variable).

The null and alternative hypotheses for this type of test are:

$$H_0: \beta_i = 0$$

$$H_1: \beta_i \neq 0$$

This is a two tailed test because the Null Hypothesis does not specify a direction, only the condition of equality.

The assumptions are:

1. The data are Normal

2. The two samples come from distributions that may differ in their mean value, but not in the standard deviation

3. The observations are independent of each other.

Calculate a t-test value, and compare the value with a critical value of t. If the t value calculated from the data is equal to or larger than the critical value, you reject the Null hypothesis.

The *t*-test produces a test statistic, termed the *t*-score or *t*-ratio. This value is used to find the corresponding p-value by means of a *t*-table (see below). The *t*-ratio is

$$t = \frac{\beta_1}{SE_{\beta_1}}$$

Where SE= Standard error

Breusch-Pagan test for heteroskedasticity-

The Breusch-Pagan test assumes the error variance is a linear function of one or more variables. Suppose that the regression model is given by

$$Y_t = \beta_1 + \beta_2 X_t + \mu_t \qquad \text{for } t = 1, 2, \ldots, n$$

We postulate that all of the assumptions of classical linear regression model are satisfied, except for the assumption of constant error variance. Instead we assume the error variance is non-constant. We can write this assumption as follows

$$\text{Var}(\mu_t) = E(\mu_t^2) = \sigma_t^2 \qquad \text{for } t = 1, 2, \ldots, n$$

Suppose that we assume that the error variance is related to the explanatory variable X_t. The Breusch-Pagan test assumes that the error variance is a linear function of X_t. We can write this as follows.

$$\sigma_t^2 = \alpha_1 + \alpha_2 X_t \qquad \text{for } t = 1, 2, \ldots, n$$

The null-hypothesis of constant error variance (no heteroscedasticity) can be expressed as the following restriction on the parameters of the heteroscedasticity equation

$$H_o: \alpha_2 = 0$$

$$H_1: \alpha_2 \neq 0$$

To test the null-hypothesis of constant error variance (no heteroscedasticity), we can use a Lagrange multiplier test. This follows a chi-square distribution with degrees of freedom equal to the number of restrictions you are testing.

RESET test- The Ramsey Regression Equation Specification Error Test (RESET) test (Ramsey, 1969) is a general specification test for the linear regression model. More specifically, it tests whether non-linear combinations of the fitted values help explain the response variable. The intuition behind the test is that if non-linear combinations of the explanatory variables have any power in explaining the response variable, the model is mis-specified. The test employed is a test of *linear* specification against a *non-linear* specification.

The form of the test used may be illustrated as follows.

Suppose the model first estimated is:

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_{2i} + \hat{\beta}_{3i} X_{3i} \qquad \text{i=1, 2, … N}$$

[this is the regression estimate with the estimated coefficients].

The Reset test proceeds by estimating,

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_{2i} + \hat{\beta}_{3i} X_{3i} + \gamma \hat{Y}_i^2$$

So, two regressions are estimated where the latter is the former with squared fitted values obtained from the first regression. Note that the squared fitted values introduces the non-linearity into the specification.

We will test for *functional form* with an **F test**.

The **null hypothesis** is that **the correct specification is linear.**

The alternative hypothesis is the correct specification is **non-linear.**

We form the F test statistics as:

$$F_{(M;N-k-1)} = \frac{(SSR_{\hat{Y}} - SSR_{\hat{Y}^2})/M}{SSR_{\hat{Y}^2}/(N-K)}$$
$$= \frac{(SSR_R - SSR_{UR})/M}{SSR_{UR}/(N-K)}$$

Where **SSR**s are the **sum of squared residuals** for the respective regressions;

M is the number of restrictions;

N is the number of observations;

K is the number of parameters estimated in the unrestricted equation.

Note: we tend to use K to mean number of estimated parameters, this would mean that it is one greater than the number of explanatory variables because we also include the intercept parameter in the count. I noted in Studenmund (2001), however, that K is the number of explanatory variables. So we have to be aware of the definition that is being used. Essentially we have to be careful to ensure that the correct number for the degrees of freedom is used in the calculations.

If the F test statistics is greater than the F critical value we reject the null hypothesis that the true specification is linear (which implies that the true specification is non-linear).

If we are unable to reject the null then the results suggest that the true specification is linear and the equation passes the Ramsey Reset test.

DEBETA-

Outliers can sometimes cause problems with regression results. Outliers are defined by Gujarati (2004) as an observation with a large residual – a larger vertical distance between the observation and the predicted line than is generally true for the rest of the data. Such observations may have high "leverage" if they are disproportionately far away from the rest of the data points.

There are multiple methods for detecting outliers. Probably the most popular tools is DFBETA. DFBETA is a measure found for each observation in a dataset. The DFBETA for a particular observation is the difference between the regression coefficient for an included variable calculated for all of the data and the regression coefficient calculated with the observation deleted, scaled by the standard error calculated with the observation deleted. The cut-off value for DFBETAs is 2/sqrt(n), where n is the number of observations. However, another cut-off is to look for observations with a value greater than 1.00. Here cutoff means, "this observation could be overly influential on the estimated coefficient."

F TEST

The small sample F-test can be used to test a single fixed value restriction, two or more joint single fixed value restrictions, a single linear restriction, and two or more joint linear restrictions in the classical linear regression model. The test statistic is the F-statistic, which has an F-distribution.

$$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$$

$$H_1 : At\ least\ one\ of\ \beta\ is\ non\ zero$$

The restricted model is the model that imposes the restriction(s) that define the null hypothesis. Information is obtained from these to models to calculate the F-statistic. The F-statistic for this approach is written as

$$F = \frac{(RSS_r - RSS_u)/J}{RSS_u/(T\text{-}K)} \sim F(J, T\text{-}K)$$

RSS_r is the residual sum of squares from the restricted model; RSS_u is the residual sum of squares from the unrestricted model; J is the number of restrictions being tested; (*T-K*) is the degrees of freedom for the unrestricted model; and F(J, *T-K*) is the F-distribution with J degrees of freedom in the numerator and *T-K* degrees of freedom in the denominator.

ADJUSTED R2

R_Square (the Coefficient of Determination) is the percent of the Total Sum of Squares that is explained; i.e., Regression Sum of Squares (explained deviation) divided by Total Sum of Squares (total deviation). This calculation yields a percentage. It also has a weakness. The denominator is fixed (unchanging) and the numerator can ONLY increase. Therefore, each additional variable used in the equation will, at least, not decrease the numerator and will probably increase the numerator at least slightly, resulting in a higher R_Square, even when the new variable causes the equation to become less efficient(worse).

In theory, using an infinite number of independent variables to explain the change in a dependent variable would result in an R_ Square of ONE. In other words, the R_Square value can be manipulated and should be suspect.

The Adjusted R_Square value is an attempt to correct this short_coming by adjusting both the numerator and the denominator by their respective degrees of freedom.

R2 = 1- (1 - R2)((n - 1)/(n - k - 1))

where: R2 = Coefficient of Determination_

R2 = Adjusted Coefficient of Determination

n = number of observations

k = number of Independent Variables

Variance Inflation Factors (VIF)

Examine the ***variance inflation factors*** (VIF) for the predictors.

The quantity $\frac{1}{\left(1-R_j^2\right)}$ is called the *j*th *variance inflation factor*, where R_j^2 is the squared multiple correlation for predicting the *j*th predictor from all other predictors.

The variance inflation factor for a predictor indicates whether there is a strong linear association between it and all the remaining predictors. It is distinctly possible for a predictor to have only moderate and/or relatively weak associations with the other predictors in terms of simple correlations, and yet to have a quite high *R* when regressed on all the other predictors.

When is the value for the variance inflation factor large enough to cause concern? As indicated by Stevens (2002): While there is no set rule of thumb on numerical values to compare the VIF, it is generally believed that if any VIF exceeds 10, there is reason for at least some concern. In this case; then one should consider variable deletion or an alternative to least squares estimation.

2.7 Summary

This research is conducted on the basic question of post harvest losses in the foodgrains due to logistical problems. For this purpose the review of literature was conducted in order to have the basic understanding of the topic. The data was

collected from the primary and secondary sources. The data collected was analyzed with the statistical tools and models.

Chapter 3

Profile of the Rajasthan

Chapter 3 –Profile of the Rajasthan

3.1 Profile of the study area

3.1.1 Agriculture Policy

3.1.2 Economic Policy of Rajasthan

3.1.3 SEZ policy of Rajasthan

3.1.4 Rajasthan Agriculture

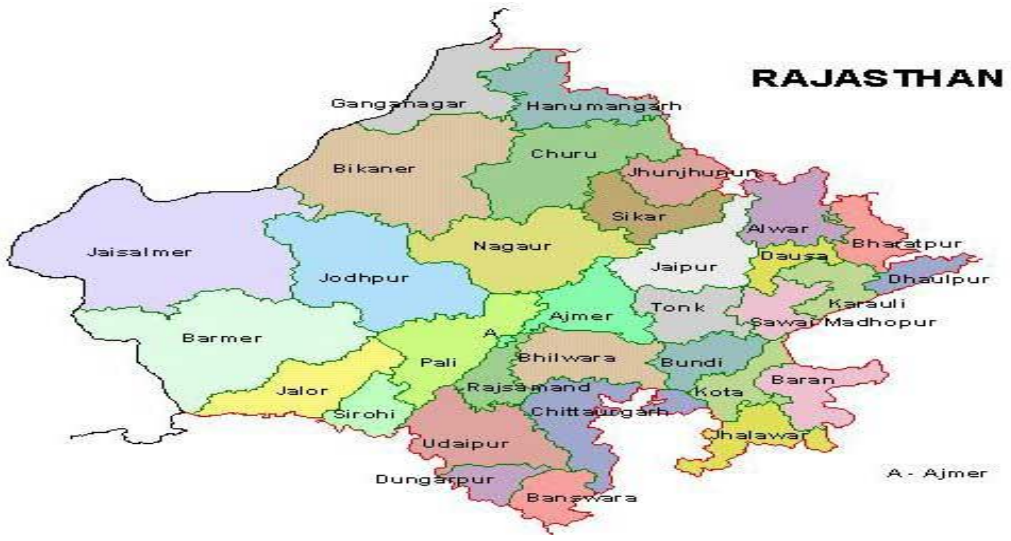
3.2 Profile of the sample area

3.3 Summary

3.1 Profile of the study area:

This research is conducted in the state of Rajasthan. Rajasthan is located in the north-western region of India. It is the largest State in the Republic of India. Rajasthan is a state where tradition and glory meet in the midst of colours. It is endowed with magnificent forts, palaces, havellies, natural resources, heritage beauty and culture. With the lofty hills of Aravali-one of the oldest mountain ranges of the world and the golden sand dunes of the Great Indian Desert, Rajasthan is the only desert of the sub-continent. Rajasthan is located in the north-western region of India. It is the largest State in the Republic of India. It forms a corridor between the northern and the western states in the country

<u>The Map of Rajasthan</u>



The Rajasthan's economy has shown a healthy growth path during the recent years. GSDP (at current prices) has almost doubled from Rs1, 17,274crore in FY05 to Rs3,03,358 crore in FY11. This has made Rajasthan one of India's faster growing states with the average growth rate of around 7.43% (real GSDP) during FY05-FY11. The services sector contributes around 47% in GSDP followed by the industry and agriculture sectors at 27% and 26% respectively. Over the last ten year period (FY01-10) the share to the GSDP has changed from 27% to 26%, from 28% to 27% and 45% to 47% in the agriculture, industry and, services sectors respectively.

Table No. 3.1 Summary of state agri statistics

S.No.	Components	Growth/ratio
1	Population dependent on agriculture	Two Thirds
2	Agriculture GDP at current prices	Rs79994.97Crore
3	Growth of Agriculture GDP (Avg. from FY2001 to FY 2011)	8.30%
4	Agricultural sectors contribution in GSDP	26%
5	Food Grain production (Thousand Tonnes)	11283.4
6	State's contribution to national food grain production	5.17%
7	State's rank in food grains production	7^{th}
8	Yield Kg/Hectare (of total food grains)	890
9	Total agricultural area irrigated	35%
10	Area under wells and tube well irrigation	60-70%
11	Rice Production (Thousand Tonnes)	228.3
12	Wheat Production (Thousand Tonnes)	6326.5
13	Oil Seeds production (Thousand Tonnes)	4469.2
14	Sugarcane production	135.4

Source: PHD RESEARCH BUREAU, Compiled from RBI and Economic Review of Rajasthan 2010-11.

Agriculture has been a way of life and continues to be the single most important livelihood of the masses. Agriculture and allied sector play an important role in the State's economy. Agriculture in Rajasthan is primarily rain-fed. The period of monsoon is short. Due to unstable weather conditions, farmers have to depend on both rainfed and ground water agriculture.

Some State level important initiations:

There are some state level institutes which are working for the developments of the agriculture in Rajasthan are given below:

- Fomentation of Rajasthan state seeds corporation, by Govt. of Rajasthan at Jaipur.
- Fomentation of Rajasthan state agriculture marketing board.
- RIICO-Agro parks at Alwar, Kota, Jodhpur and Ganganagar.
- State level agro- foods processing center at Bhartpur.
- Food grain Logistics hub for India.
- Private mandis/e-markets
- Interest Subsidy @ 6% for first 7 Years.
- Financial assistance up to 1 crore.
- Retail outlets for perishable product.
- Single window service.
- Minimum charges of electricity & water.
- Product specific agri export zones.
- Target of Rs. 6000 crore for crop loan.
- 3.84% state budget is allocated to agriculture.

3.1.1 Agriculture Policy

Agriculture and allied sector plays an important role in State’s economy. Though its contribution in NSDP has fallen from about 35 per cent in 1990-91 to around 23 percent in 2011-12, agriculture yet forms the backbone of state economy. Around two third of its population (56.5 million) is still dependent on agricultural

activities for their livelihood. Thus, a higher priority to agriculture will achieve the goals of reducing poverty and malnutrition as well as of inclusive growth. Since agriculture forms the resource base for a number of agro-based industries and agro-services, it would be more meaningful to view agriculture not as farming alone but as a holistic value chain, which includes farming, wholesaling, warehousing, processing, and retailing. Though agriculture forms the source of livelihood of the majority in the state, it is largely dependent on rainfall. Only 34.5 per cent of the net sown area is irrigated. Since the rainfall amount is very scanty and highly erratic, the expansion of irrigation provisions and efficient water management are major challenging tasks for the policy makers. The major challenges for agriculture sector in the state are:

(i) Frequent droughts leading to decline in productivity and educed performance and even death of animals

(ii) Climate change and global warming

(iii) Strengthening of comprehensive technology-based developmental approach to promote dryland/arid agriculture

(iv) Deteriorating soil health including imbalanced use of fertilizers, micronutrient deficiency, lack of organic matter content, inadequate soil microbial flora and fauna etc.

(v) Low productivity, unfavorable prices and practically very little value addition, distress sales, rising cost of cultivation

(vi) Lack of efforts for stabilization of sand dunes and for greening the desert through agro-forestry programmes

(vii) Missing mechanisms of export promotion, adherence to sanitation and phyto-sanitation (SPS) standards and measures for minimizing the export rejections

(viii) Lack of integrated farming approach

(ix) Lack of up-scaling of farm-validated modern technologies and agricultural Innovations

(x) Gender mainstreaming in agriculture and

(xi) Proper institutional mechanisms and organizational and management (O&M) reforms for overcoming the felt constraints coming in way of the farm prosperity in the state.

3.1.2 Economic policy of Rajasthan

Rajasthan enjoys a strategic geographical position wherein it is situated between Northern and Western growth hubs in the country and 40% of Delhi Mumbai Industrial Corridor (DMIC) runs through it. Rajasthan have been successful in attracting a large number of multinational as well as domestic companies to set up operations in the state. Investors have set up ventures in fields as diverse as Information Technology, Electronics, Textiles, Chemicals, Agro-processing, Cement, Granite, and Engineering. The state has 322 industrial areas at present and setting up of three new is in pipeline. Rajasthan is one of the favoured destinations for cement industry, being endowed with limestone which acts as the base for cement production and also the concessions provided by the state to the industry. The state boasts of tremendous bio diversity, rarely to be found in others state. Thus has a potential to create immense industrial activity in the field of biotechnology and modern biotech products like recombinant DNA products and Bio Informatics. Construction of four state-of-art Biotech Parks is under consideration. The recent Rajasthan budget for FY12 has made allocations of Rs 178 Crores to develop industry and minerals sectors. The economic agenda of Rajasthan focuses on the following four sectors, contributing over two-thirds of the state's economic output. Based on the strategic framework to improve the investment and business climate in the state, Rajasthan has identified immediate and long term actions necessary to achieve the target set for economic growth. Recently, state has initiated facilitation steps aimed at streamlining the approval processes, promotion of exports, promotion of knowledge intensive industries and better quality infrastructure. The key measures aimed at are:

Improving Business Climate of Rajasthan--focus on reducing the cost of delays and cost of doing business.

- **Developing High Quality Infrastructure--** Enhancing the competitiveness of enterprises by providing high quality infrastructure
- **Enhancing Skill Levels and Employability--s**etting up of different types of training institutes in partnership with private sector.
- **Ensuring easy availability of land for Projects--s**implification of the process of land use change, conversion of land and approvals of building plants.
- **Encouraging MSME--**the State facilitate cluster based development of MSMEs to make the produce competitive for the world market.
- **Promotion of Thrust Areas--s**pecial emphasis for promotion of mining and mineral processing, IT, tourism, handicraft, cottage and agro based industries.

Rajasthan Industrial & Investment Promotion Policy (RIIPP)

RIIPP was announced in 2010 with the view to improve the state's business climate, to upgrade the infrastructure, generate skill and employability and growth of MSMEs. The policy laid thrust on attracting private investments in core infrastructure projects by way of several incentive schemes on land, electricity, training and credit. The Single Window Clearance Mechanism for project approvals and the DMIC have ushered fresh growth opportunities for the state. Sustainable growth has been focused on by way of promotion and value addition in the MSME sector. Investment in social infrastructure and cluster development has also been encouraged.

To improve the competitiveness of enterprises, provision of strong road network, water and electricity, logistics hubs, industrial infrastructure and credit have been envisaged.

3.1.3 Agro business policy of Rajasthan

Agro business policy makes Rajasthan a destination for investors and processors both domestic as well as global. The agro business policy of Rajasthan focuses on strengthening the market infrastructure, creation of modern supply chains, providing assistance to small scale agro based units, increasing export value of Agri products, increasing the flow of investment in both skill and capital in agro industry. To attract private sector investment in agriculture produce industries, the policy provides attractive packages for agri-business and agro- products simultaneously with infrastructure, marketing, warehousing, and research& development. RIICO has developed four Agro parks at Kota, Jodhpur, Ganganagar and Alwar for development of Agriculture based industries. Agriculture and allied services account for 3.84% of 2011-12 state budget allocation.

Incentives taken by the government for agro- business in Rajasthan

There are some incentives which are given by the government for Agro-business in Rajasthan are given below:

- **Private mandis/e-markets:** The state government encourages the establishment of private mandis or e-markets so to strengthen the marketing infrastructure. It also encourages standardization, grading and setting up of world class facilities.
- **Interest subsidy:** The Government provides interest subsidies to tiny, Small, Medium and Large agri business and agri produce industrial units at the rate of 6% p.a. for first seven years from commencement of operations, so to make cost of credit viable for entrepreneur to set up any activity related to agri-produce.
- **Financial assistance**: The government has made provisions of financial assistance in terms of subsidy for establishing agro processing units at the rate of 50% of the total project cost or Rs. 1.00 crore whichever is less.

- **Infrastructure development**: The highest priority is given to creation of supply chain infrastructure and support services for the agro industrial sector to create modern infrastructure corridors integrated with appropriate surface transport connections, cold storages, auction centers and retail chains. Agri infrastructure projects may include-food and agro industrial parks, cold chain for horticulture produce, supply chain for agriculture produce, chain of retail outlets for perishable products, technology demonstration, terminal markets and warehouses.
- **Establishment of centers of excellence**: The state government will provide financial support in the establishment of centers of excellence, crop development institutes and will encourage private sector, apex co-operatives institutions, APMCs etc to also participate in setting up these centers.
- **Allotment of land**: Agri-business/ agro processing industries are commercial in nature; hence allotment of land to them near to urban areas is another main focus. The Government also made provisions for cluster development approach for SMEs ton encourages their development.
- **Single window service for establishing of private MSME clusters** -- The department of agriculture with Rajasthan State Agriculture Marketing Board as the nodal organization will provide a single window service for establishing of private MSME clusters. Allotment of land in mandi premises for associated activities such as cold storage, normal storage, ripening chambers, sorting, grading equipments and packing line, weigh bridges, testing laboratories etc.
- **Concession on charges of electricity and water:** Agro-industry as a seasonal industry is eligible for relaxation from the payment of minimum charges of electricity and water during closure period. Government will encourage the setting up of chains of retail outlets in different parts of the state as a crucial link between consumers and producers. Financial concessions will be admissible to the developers of food parks as per the provision of this policy. The state government intents to encourage the

export of agri products from the state, through the product specific Agri Export Zones (AEZ) under the Government of India.

- **Skill Development:** The state will encourage the private sector to commence courses in food packaging, processing, bio technology, information technology in agriculture and allied in state.

3.1.4 The SEZ policy of Rajasthan government

Rajasthan Government has adopted the SEZ policy for developing Special Economic Zones in the state. The SEZs, earmarked as duty-free enclaves, aimed at promoting rapid industrial development and employment generation. The State Government has worked out a package of concessions and incentives, along with the Board of Infrastructure Development and Investment Promotion (BIDI). There are 4 SEZs in Rajasthan at Jaipur, Jodhpur, Sitapur and Boranada.

Performance in six thrust areas in Agriculture and Agribusiness

There have been measures taken up by the state government towards improving agriculture on a whole, by providing irrigation facilities, promoting agro processing and agri business etc. Rajasthan ranks 7th in terms of food grain production in India. It is a leading producer of coarse cereals, pulses, grams etc. but on the contrary the contribution of the sector has been decreasing over time in states GDSP and also it has a low per hectare yield. So the outcome is mixed in terms of its overall performance. According to the survey published in India Today it ranks 10th amongst the 20 big states of India.

Education and Skill Development

Rajasthan stands out to be the only state which took a huge leap in terms of improvement in literacy rates but the high dropout ratios and lower enrollment rate amongst females is the reason for a lower ranking in comparison to the other states in India. The state ranks 7th in terms of Primary schools. But there is an altogether different scenario when we talk about the rank in primary education, it ranks 17th amongst the big 20 states. Much has been done, but still much more can be done.

Health The state government follows a three tier system of health services. Health indicators have improved overtime. It has shown improvement over time and has performed well in NRHM (National Rural Health Mission) too.

Housing In Rajasthan the total housing shortage projected for 2011, 2012, 2017 and 2021 is 12.42 lakh, 12.82 lakh, 14.94 lakh and 17.06 lakh respectively3. Out of which 85% shortage is expected to be in EWS/LIG category. There have been efforts made towards providing affordable houses. Year 2010 was declared as the year of affordable housing. More over general housing schemes and schemes for slums have been initiated from time to time The Rajasthan Housing Board has been working actively in the state ever since it was established. Yet, some more efforts are needed, to strengthen its grounding and working.

3.1.4 Rajasthan agriculture

Rajasthan, with its diverse agro-climatic conditions is richly endowed in the cultivation of a variety of crops.

- Rajasthan is the Second largest Producer (17.71%) of Oil Seeds
- Largest Producer of rape seed and Mustard (44.61%)
- Third largest Producer of Soyabean (9.18%)
- Third largest of coarse creeds (11.65%)
- Largest Producer of Bajra (31.28%)
- Second largest in spices (10.89%)

(Source: *Ministry of Agriculture Govt. of India*)

Key Products

1. **Agricultural produce:** The State is India's largest producer of oilseeds (rapeseed & mustard), seed spices (coriander, cumin and fenugreek) and coarse cereals. The State is major producer of soybean, food grains, gram, groundnut and pulses. Rajasthan's vibrant agriculture sector offers various opportunities for the successful establishment of vibrant and potentially profitable agro-processing units. The Spice board has identified Jodhpur

as one of the key regions in the Country for setting up a spices park. The park will have on depots potential of IN & 500 crore.

2. **Livestock:** The State has 3rd largest cattle population in India with some of the finest breeds of milch and draught cattle. Rajasthan is Third largest producer of Milk (8.48%)in the country and Largest Producer of Wool in India (28.99%).

Agro Food Parks at:

- Alwar
- Jodhpur
- Kota
- Sriganganagar

These food parks have been developed by RIICO.

Key Players of food processing industries

Policy/Incentives/Govt. Initiatives. Policy for Promotion of Agro Processing and Agri Business 2010 .Various incentives/concessions are available to promote industrial ventures in this sector:

- Under RIPS 2010
- Under Policy for Promotion of Agro Processing and Agri Business 2010

This policy is aimed at the following objectives:

- To increase the income in the hands of the farmers through more remunerative prices of their produce
- To encourage value addition in agricultural produce and to reduce post harvest losses
- To bring in new technologies and practices to modernize agro-processing and marketing
- To promote export of agri-products of the State and to build a strong State brand in the domestic and international market
- To attract private investment in agro processing and create new employment opportunities on a large scale.

Rajasthan offers opportunity for private investment in:

- Establishment of commercial dairy units
- Setting up units for wool processing and carpet manufacturing
- Setting up units for processing camel milk, known for its longer life and therapeutic utility
- Setting up livestock feed units
- Establishment of poultry and piggery units
- Export of horses

There is a vast opportunities of investment in the Agro Food Parks and also these Parks offers various lucrative incentives for investment.

Name of the crops other than foodgrains grown in the Rajasthan under both the seasons Rabi and Kharfi are shown in the given below table no 3.2.

Table No. 3.2 Major Crops grown in the Rajasthan

Fruit	Vegetable	Spices	Flower	Medicinal & Aromatic
Aonla	Brinjal	Ajwain	Marigold	Ashwagandha
Ber	Cole Crops	Chili	Rose	Isabgol
Guava	Cucurbits	Coriander		Mehandi
Kinnow	Musk melon	Cumin		Sonamukhi
Lime	Okra	Fennel		
Mango	Onion	Fenugreek		
Mosambi	Pea	Garlic		
Orange	Potato	Ginger		
Papaya	Tomato	Turmeric		
Pomegranate	Water melon			

Source: www.krishi.rajasthan.gov.in

Advantages/Strengths of Rajasthan agri-business.

- Nine agro-climatic zones and a variety of soils that support cultivation of crops .
- Availability of raw material such as millets, pulses, milk, fruits, cereals, etc.
- Availability of local work force and large number of marginal workers .
- Proximity to large consumer markets in the region, close to NCR which has a large share of food consumption in the country .
- Abundant sunshine for sun-drying .
- Dairy Development Programme is being implemented on the lines of world famous 'Amul Pattern' based on cooperative societies .
- Favorable policy and incentives are in place .
- With abundance of land, the State is well positioned to develop agro processing and agri business .

Rajasthan has two principal crop seasons-

- **Rabi :** The Rabi crops are winter crops and are sown in the months of October and November and are harvested in the months of March and April. The principal Rabi crops are Barley, Wheat, Gram, Pulses and Oil Seeds. The major oil seeds are Rape and Mustard.
- **Kharif:** The Kharif crops are the crops that are grown in the summer season and are seeded in the months of June and July. These crops are harvested in the months of September and October and include Bajra, Pulses, Jowar, Maize and Ground Nuts.

  The regions that are highly irrigated or receive abundant water supply are utilized for the cultivation of improved high-yielding varieties of rice. Some places of Rajasthan that has black soil nurture the growth of major cash crops like Cotton. In some regions Tobacco is also grown. Apart from this crops an assortment of fruits and vegetables are

also grown in Rajasthan in the local gardens and some fertile regions. These fruits include Oranges, Guavas, Lemon, Pomegranates and Mangoes. Rajasthan soil is also suited for the growth of some spice plants, especially red, hot chilies. These chilies give Rajasthan its distinct flavor. Other spices are cumin seeds and methi.

Table No 3.3 Rabi Productions

S.No.	Crop	Rabi Production(per hectare)
1	Wheat	193938
2	Jo	12977
3	Channa	4028
4	Musturd	234887
5	Methi	800
6	Matter	162
7	Masor	6
8	Other	3873

Source: *Rajasthan Agriculture Department 2012-13*

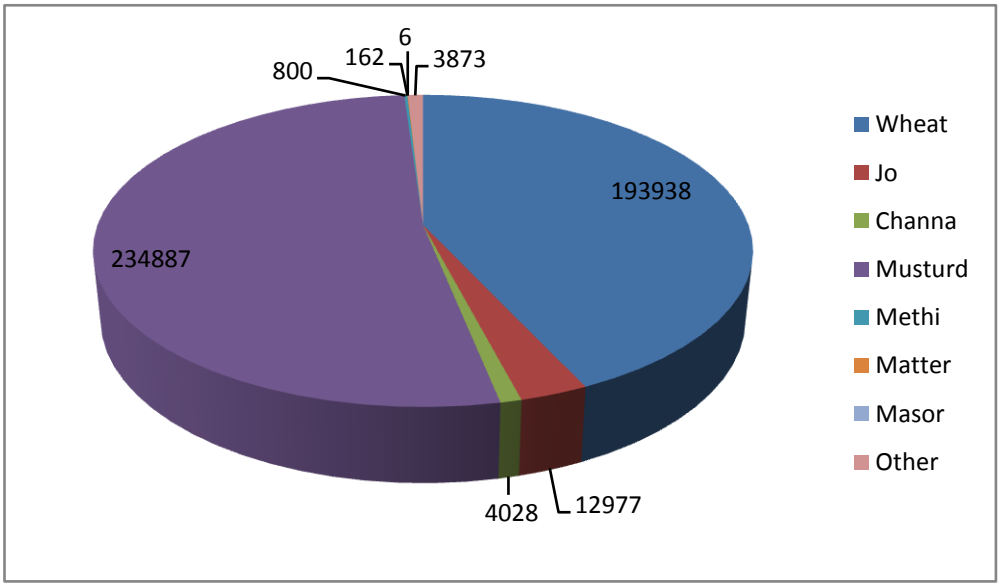


Figure No: 3.1 Rabi Production

The above drawn figure no. 3.1 reflects about the production of different crops with their produce quantity in Rajasthan year (2012-13). From the figure no. 3.1, we can see that the major crop produce in rabi season which start from October and the crops are harvested in the month of March-April. This area is the largest producer of mustard quantity 234887 followed by wheat 193938 and some more foodgrians such as Jo, Channa. Methi, Matter, Masor and few other crops. This figures show the potential of the foodgrains production in this area which made the Rajasthan highest producer of mustard and some other foodgrains in this country.

Table No 3.4 Kharif Productions

S.No.	Crop	Kharif Productions (per hectare)
1	Bazara	267650
2	Jwar	29813
3	Arhar	2058
4	Gwar	19074
5	Cotton	8751
6	Makka	6997
7	Til	3540
8	Other	11305

Source: *Rajasthan Agriculture Department 2012-13*

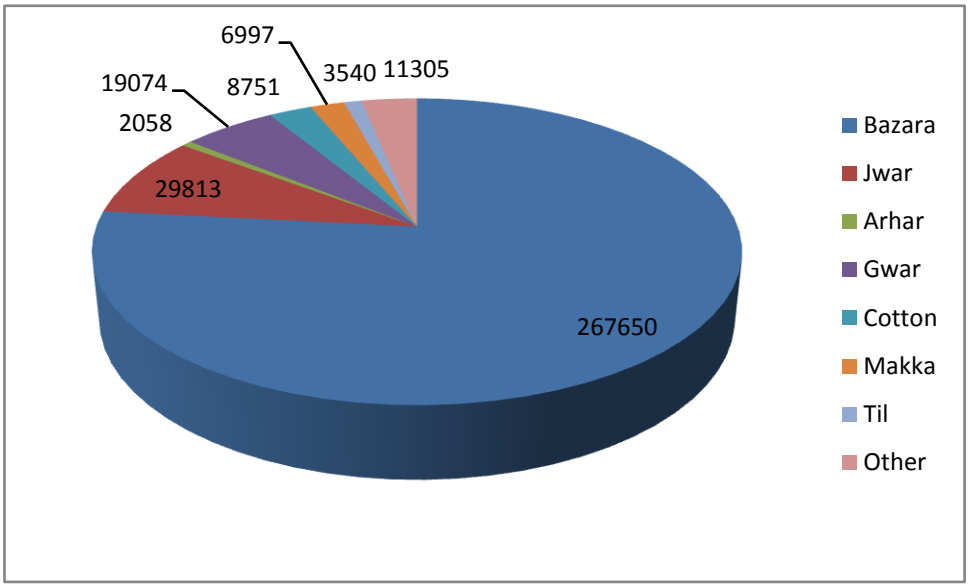


Figure No 3.2 Kharif Production

The above drawn figure no. 3.2 describes about the various crops production with their production quantity under kharif season in the study area Rajasthan year (2012-13).This kharif season start from the month of June-July and the crops are harvested in the month of September-October because of the duration of it is also known as summer crops. The major crops produce in this area are bajra quantity 267650 followed by jwar quantity 29813 and the many other crops such as arhar, Gwar, Cotton, Makka, Til and other.

So with the help of Figure no 3.1 & Figure no 3.2 we can understand about the production pattern of crops under two different season rabi and Kahrif .both the figure's reflects about the contribution of each crops in gross agriculture production of this study area Rajasthan. Both the figures shows that major crops produce in this area are Bajara, mustard and wheat then followed by many other crops such as jwar, Gwar, arhar and other. All the production data collected under this study duration (2012-13) so the production figure of crops many differ in other season.

AGRICULTURAL PRODUCTION

The detailed position of the area and production under kharif and rabi crops for the last three years is shown in the following Table No.3.5:

Table No.3.5 Area and Production of Kharif and Rabi crops in the State

	Area (in lakh hectares)			Production (in lakh tonnes)		
Crops	**2010-11**	**2011-12**	**2012-13**	**2010-11**	**2011-12**	**2012-13**
Cereals	**109.06**	**99.43**	**89.41**	**203.22**	**196.98**	**157.06**
Kharif	75.41	67.29	57.46	89.62	87.48	54.39
Rabi	33.65	32.14	31.65	113.60	109.50	102.67
Pulses	**47.52**	**44.49**	**34.47**	**32.52**	**23.52**	**21.32**
Kharif	29.15	29.71	19.28	16.03	13.13	7.79
Rabi	18.37	14.78	15.19	16.49	10.39	13.53
Food grains	**156.58**	**143.92**	**123.88**	**235.74**	**220.50**	**178.38**
Kharif	104.56	97.00	76.74	105.65	100.61	62.18
Rabi	52.02	46.92	47.14	130.09	119.89	116.20
Oil-seeds	**55.18**	**45.92**	**48.83**	**66.42**	**57.12**	**63.31**
Kharif	18.30	20.88	20.97	22.70	27.35	24.45
Rabi	36.88	25.04	27.86	43.72	29.77	38.86
Sugarcane	0.06	0.06	0.05	3.69	4.51	1.82
Cotton*	3.36	5.68	5.23	8.57	17.31	9.65

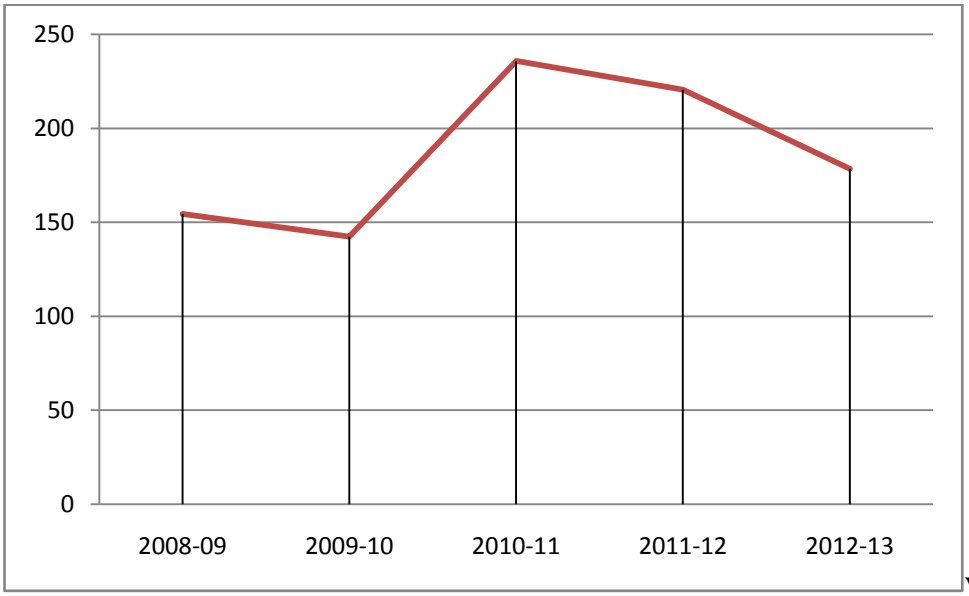
*production in lakh bales (each bale of 170 kg)

As per preliminary forecast for the year 2012-13, the total foodgrains production in the State is expected to be 178.38 lakh tonnes which is showing a decrease by 19.10 per cent as compared to that of 220.50 lakh tonnes in the previous year. The kharif foodgrains production in the year 2012-13 is expected to be at the level of 62.18 lakh tonnes as against 100.61 lakh tonnes during the previous year showing a decrease of 38.20 per cent. The rabi foodgrains production in the year 2012-13 is

expected to be lesser at the level of 116.20 lakh tonnes as against 119.89 lakh tonnes during the year 2011-12 showing a decrease of 3.08 per cent. Production of kharif cereals in the year 2012-13 is expected to be 54.39 lakh tonnes which is lower by 37.83 per cent than that of 87.48 lakh tonnes during the previous year. Production of rabi cereals in the year 2012-13 is expected to be 102.67 lakh tonnes against 109.50 lakh tonnes in the year 2011-12. The production of kharif pulses is estimated to be 7.79 lakh tonnes in the year 2012-13 against 13.13 lakh tonnes in the year 2011-12 which showing a decrease of 40.67 per cent. Oilseeds include Groundnut, Sesamum, Soyabean and Castor seed in kharif season and Rape & Mustard, Taramira and Linseed in rabi season. The production of oilseeds in the year 2012-13 is estimated at 63.31 lakh tones against 57.12 lakh tonnes in the year 2011-12 showing an increase of 10.84 per cent over the previous year. The production of kharif oilseeds is estimated to be 24.45 lakh tonnes in the year 2012-13 as against 27.35 lakh tonnes in the year 2011-12 showing a decrease of 10.60 per cent. The production of rabi oilseeds is likely to be 38.86 lakh tonnes in the year 2012-13 as against 29.77 lakh tonnes in the year 2011-12 showing an increase of 30.53 per cent. Production of Sugarcane is likely to be 1.82 lakh tonnes in the year 2012-13 as against 4.51 lakh tonnes in the year 2011-12 showing a decrease of 59.65 per cent. The production of Cotton is likely to be 9.65 lakh bales during the year 2012-13 as against 17.31 lakh bales in the year 2011-12 showing a decrease of 44.25 per cent.

Figure No.3.3 Production of Foodgrains

(In lakh Tonnes)



3.2 Profile of the Sample Area

Jaipur District is a district of the state of Rajasthan in Northern India. The city of Jaipur, which is Rajasthan's capital and largest city, is the district headquarters. It is the tenth most populous district in India (out of 640).Jaipur district has an area of 11,152 km². It is bounded by Sikar District on the north, Haryana state on the extreme northeast, Alwar and Dausa districts on the east, Sawai Madhopur District on the southeast, Tonk District on the south, Ajmer District on the west, and Nagaur District on the northwest. According to the 2011 census Jaipur district has a population of 6,663,971, roughly equal to the nation of Libya or the US state of Washington. This gives it a ranking of 10th in India (out of a total of 640). The district has a population density of 598 inhabitants per square kilometre (1,550 /sq mi). Its population growth rate over the decade 2001-2011 was 26.91%. Jaipur has a sex ratio of 909 females for every 1000 males, and a literacy rate of 76.44%.villages of jaipur district are Dhindha, hiranda,bobas,bassi jhajhed,akhepura,manpura,ganga ti kalan,ganga ti khurd.

Alwar District is a district in Rajasthan, a state in northern India, with capital in the city of Alwar. The district covers 8,380 km^2. It is bound on the north by Rewari district of Haryana, on the east by Bharatpur and Mewat district of Haryana, on the south by Dausa, and on the west by Jaipur districts. As of 2011 it is the third most populous district of Rajasthan (out of 33) after Jaipur and Jodhpur.

Dausa district is one of the district of Jaipur Division and surrounded with 6 districts, namely, Jaipur, Tonk, Sawai Madhopur, karauli, Bharatpur & Alwar. It has total area of 3404.78 sq. kms. in roughly semicircular or 'C' shape with tempering towards east and west at corners.The soil of the district is yellowish to dark brown dominantly fine taxtured, generally suitable for all type of crops. The district has 219575 hectares of arable land of which 128169 hectares (58.92%) is under irrigation. During Kharif, the groudnut crop is produced in irrigated areas. Maize also requires irrigation. Generally other crops are sown at the commencement of the rainy season. Groundnut, Maize and Cotton arre sown by broadcasting the seeds. Fertiliser is applied before sowing of groundnut and cotton. Dring Rabi, the mustard and gram is sown from September to October, in unirrigated land, while in the irrigated land, barley, gram and mustard are sown in October-November and wheat in November-December. The district has 94652 hectares of double cropped area with the crop cycle as moong-wheat, groundnut-wheat, moong-mustard, bajra-mustard, bajra-gram etc. The principal crop of the district in Kharif is Bajra. The most important food grain crop in Rabi is wheat.

Kota district formerly known as Kotah is a city located in the southeast of northern Indian state of Rajasthan. It is located Around 250 kilometres south of the state capital, Jaipur. Situated on the banks of Chambal River, it is the third most populous city of Rajasthan afterJaipur and Jodhpur and 46th most populous city of India. It serves as the administrative headquarters for Kota district and Kota Division. Kota has a number of engineering and medical coaching institutes

Bharatpur District is a district of Rajasthan state in western India. The town of Bharatpur is the district headquarters. Bharatpur district is a part of National Capital Region (NCR).The district has an area of 5,066 km². It is bounded by Gurgaon districts of Haryana on the north, Mathura and Agra districts of Uttar Pradesh on the east, and the Rajasthan districts of Dholpur on the south, Karauli on the southwest, and Dausa and Alwar on the west. Three rivers, the Ban Ganga, Rooparel, and Gambhir, cross the district. The Ban Ganga originates in Jaipur District, passes through Dausa and Bharatpur districts to meet the Yamuna River in Uttar Pradesh. The Gambhir River starts from Pachana Dam of Karauli District, and meets the Ban Ganga in Bayana Tehsil. The Rooparel River starts from hills of Alwar District and enters the district in Kaman Tehsil. Bharatpur District has ten revenue subdivisions and eleven tehsils. They have the same names and borders, except that Weir Subdivision is divided into Weir Tehsil and Bhusawar Tehsil. The other nine tehsils are: Bayana, Bharatpur, Deeg, Kaman, Kumher, Nadbai, Nagar, Pahari, and Roopwas (Rupbas).In the 2011 census Bharatpur district had a population of 2,549,121,roughly equal to the nation of Kuwait or the US state of Nevada. This gave it a ranking of 166th among districts of India (out of a total of 640) The district had a population density of 503 inhabitants per square kilometre (1,300 /sq mi). Its population growth rate over the decade 2001-2011 was 21.32%. Bharatpur had a sex ratio of 877 females for every 1000 males, and a literacy rate of 71.16%.

3.3 Summary:

This part of the study describes about the profile of the study area which is Rajasthan. Rajasthan is located in the north-western region of India. It is the largest State in the Republic of India. Rajasthan is a state where tradition and glory meet in the midst of colours. It is endowed with magnificent forts, palaces, havellies, natural resources, heritage beauty and culture. Along with the researcher describes the economic and agricultural statues of the state such as Agro business, food park locations, profile of sampled districts and the two seasons of crops rabi and kharif with its last production data figures.

Chapter-4

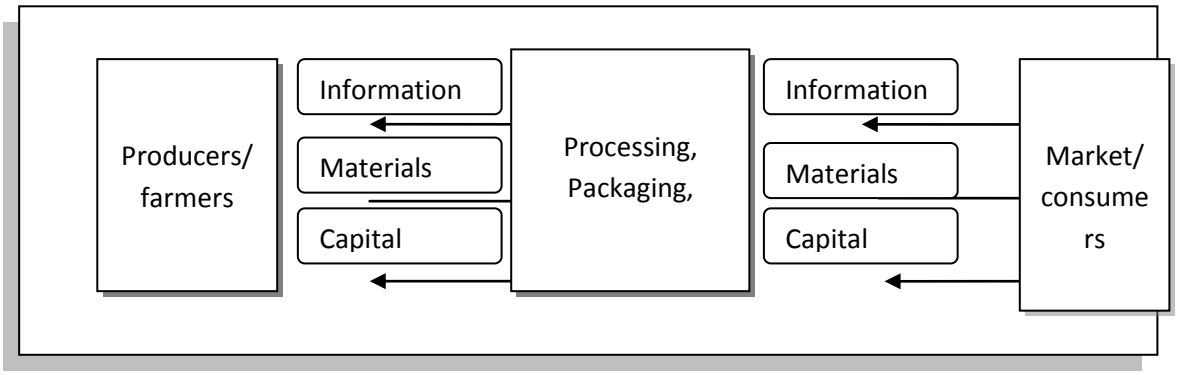
Logistic Management of Agriculture Products

Chapter-4 Logistic Management of Agriculture Products

4.1 Introduction of Logistics Management of Agriculture products

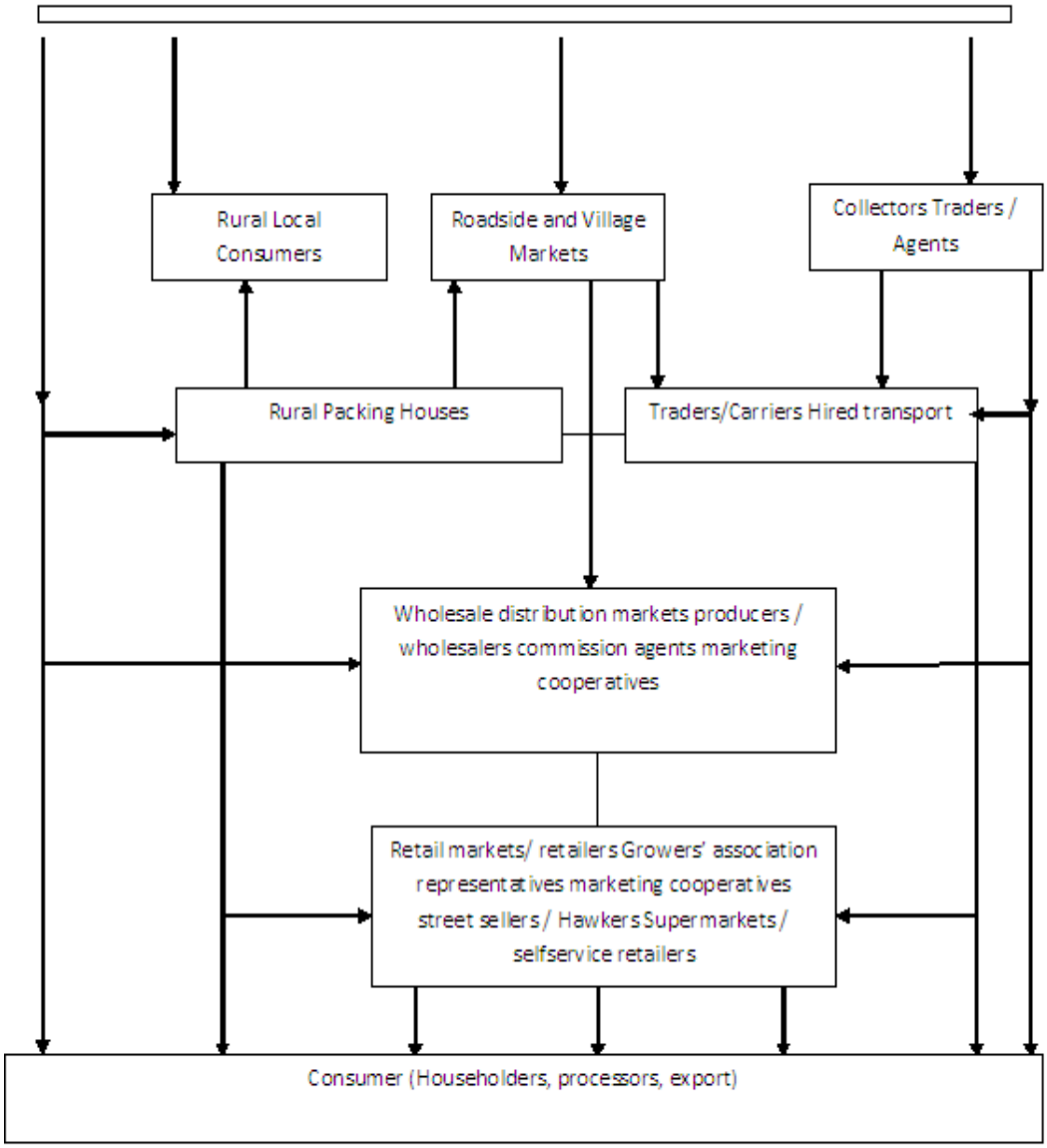
Logistics management in Agriculture sector refers to the aggregation, collection, storage and transportation of agriculture produce from farms to intermediate level(processing unit, mandis, retails) and to consumers. The benefits of applying these supply chain management techniques are numerous. It helps in reduction of food grain losses, reduction of transportation cost, increase in sales, better control of food grain quality and dissemination of technology, knowledge and capital among the chain partners .Logistic system used for the agriculture products which involves several channel members for the smooth flow of production with capital and information from one member to any other required member of the channel. Agriculture commodities produced within the farmer‘s discipline reaches the end consumer via a series of intermediaries. These intermediaries perform numerous features, such as transfer of ownership of commodities, its movement, maintenance and preservation of quantity & quality, payment to the seller and commodity delivery to the buyer. All the links from farmers to end user of the commodity represents supply chain of the agricultural commodities This process is further explained under with the help of model:

Fig.4.1. Material, capital and information flow between producers (farmers) and consumers



This figure no. 4.1 shows the flow of material, capital and information between producers (farmers) and consumers. To begin with the farmers puts forward the material (foodgrains) produce into this logistics system against of which he receives the cash inflow of capital which he make investments in the production and some information about demand and price of food grains from the intermediaries .When the intermediaries receives the output from farmers they put it into further process of processing raw food grains into finished with proper packaging if it is required to be stored or transported. After processing or transporting these intermediaries handed over or sale this food grains into open markets such as mandi, adtiya, consumers or to the government agency such as FCI and CWC for further distribution of food grains as per govt schemes such as mid-day meal or many other purpose against these foodgrains supply intermediaries receives capital and information regarding demand and supply of foodgrains with the current price fluctuation information of food grains.

Fig 4.2: ***foodgrains flow channels***



4.1.1 Foodgrain losses

“ FOODGRAIN LOSS," as used in this manual, concerns the loss in weight of food that would have been eaten had it remained in the food pipeline.

Gap in Agri-logistics management

Food wastage is hindrance in combating hunger and improving food security. While focus has been on improving production rather then reducing food supply chain losses . This issue remains a relatively unaddressed problem till very recently.

Issues in logistics management

- Inefficient price signals: The government has been engage in buying almost one-third of all rice and wheat produced through the PDS system, but in other food grains, fruits and vegetables (both being highly perishable), the role of the government is limited. This leads to MSPs being ineffective as both price signals and as insulators from the perspective of the larger agricultural population.
- Limited reach of mandis : This procurement approach has failed because on an normal, a farmer needs to travel 12 kms to arrive the nearest mandi and greater than 50 kms. At the same time according to the recommendations by way of National Farmers commission, availability of markets must be within a 5 km radius.
- Too many intermediaries, expertise asymmetry: These intermediaries have led to a price inflation of 250% (over the production cost) and have exacerbated the prevailing know-how asymmetries in agriculture, mainly for non-MSP products.
- Insufficient infrastructure for storage: The Planning commission has not too long ago estimated the gap between agri-warehousing supply and demand at 35 mn MT. Presently, public sector organizations just like the

FCI, Central Warehousing corporations (CWC) and the quite a lot of State Warehousing corporation (SWC) have a storage ability of 71 mn MT, at the same time the private sector has just about 25 mn MT. To put the shortage in perspective, food grain shares held most effective by the federal government was eighty mn MT last yr (peak) consistent with the FCI annual document.

- Skewed distribution of capacity: Skewed distribution of this capability is one other difficulty, area having entry to 60% of the total storage infrastructure. The Planning commission has not too long ago estimated the gap between agri-warehousing supply and demand at 35 mn MT.
- Lack of cold storage infrastructure: India's present cold storage capacity is insufficient.
- Lack of collateral management options: Collateral management refers to financing of agricultural goods stored at warehouses, and is estimated to be an Rs 3,500 cr opportunity by industry sources.

Different types of foodgrains losses

1.Weight loss: The value is obtained via pricing the burden loss consistent with the use to which the misplaced grain would were put and the effect of its loss on the shops-proprietor. For instance, if the grain would have been consumed by using the owner, its replacement rate as food would usually be used; in a similar fashion, if bought, its sale price, and, if used for seed, its rate of replacement. This subject was once debated at Slough and no actual consensus obtained. Some felt that information gatherers must now not have an understanding of their questions and that essentially the most dependable understanding was got when know-how was gathered in a fixed mechanical manner.

2. Quality Loss: This may be surveyed by receiving a standard of value and measuring loss as the contrast between this standard and that of the grain in the store. The pertinent standard will rely on upon the expected utilization of the grain however regularly it will be that set by a marketing authority. In the event that no such authority exists, an endeavor must be made to inspect how the grain utilization is influenced (if by any means) by the presence of varying qualities.

The standard which influences its utilization ought to be adopted . The monetary expense of the quality loss will be represented by:

Q_L=Vs.-Va
where Q_L = value of quality loss,
Vs = value of grain if it was all of a standard set,
Va = value of the quality of the grain in store when used.

Quality loss of grain expected to be utilized as seed is particularly important. In the event that the stores-proprietor does not understand that it is harmed, it might be planted and bring about a lower rate of germination. This loss is surveyed as the distinction between the estimation of the harvest anticipated from the undamaged seed and that which would be delivered from the damaged seed.

3 Aberrant Loss: This is the expense of any bug spray or other treatment utilized by the stores proprietor to minimize his misfortunes.

4Nutritious Loss: This can be esteemed similarly as quality misfortune by selection of a standard. Since this technique is at risk to a high level of subjectivity, the purposes behind utilizing a specific standard should be c1early expressed. Sometimes, dietary misfortune won't diminish the financial estimation of grain to a proprietor, for instance, it may not, taken without anyone else, fundamentally lessen its deal cost.

5. Other Losses: Stores-proprietors may endure other financial expenses because of losses, yet the valuation of these will be particular to specific circumstances and it is unrealistic to give more than the general standards of valuation effectively laid out. There are some different focuses identified with Evaluation::

a) Valuation ought to be founded on the time when the effect of loss is felt by the proprietor. This won't as a matter of course be when the loss

happens. This element will be of specific significance in situations when the cost of grain varies apparently amid storage season.

b) In landing at a final loss figure, the estimation of harmed grain in any option or auxiliary use ought to be considered.. For example, if grain intended for human consumption was damaged and, therefore, used to feed cattle, the loss suffered by the stores-owner would be:

Ln = Lf - Lc

Where Ln = net loss,

Lf = value as food,

Lc = value as feedingstuff.

Summation of the diverse sorts of economic costs happening as a consequence of physical loss will give an appraisal of the aggregate economic effect of losses. Such gauges ought to be identified with the "riches" of the stores-proprietors worried since loss of the same worth will influence poorer stores-proprietors to a more prominent degree. In this appreciation, consideration ought to be taken in citing normal qualities. Utilization of Data in Assessing Improved Methods of Storage . The advantages of an arrangement of system are evaluated by an examination of the costs included with its yield as measured by a valuation of grain leaving the store. Enhanced capacity may be reflected by a lessening both in weight and in quality losses per unit of storage expense. The estimation of any extra measures of grain made accessible by a diminishment in weight reduction ought to be founded on the utilization to which this additional grain would be put. The estimation of the grading so as to lessen in quality losses is acquired grain put away in both the typical and enhanced way as it leaves the store utilizing a typical standard. The amount of qualitative benefit will be:

Qb = Vi - Vu

where Qb= qualitative benefit,

Vi =total value of grain leaving improved store

Vu =total value of grain leaving unimproved store

In surveying the lessening both in weight and in quality losses, it is important to find out the level of these before changes away are made. Consideration ought to be taken that the figures acquired are illustrative since there may exist calculable

variety between distinctive seasons and stores. The costs included in adopting a specific arrangement of storage may be isolated into those of materials and work utilized as a part of developing the store and of any treatment connected to the grain. The expense of any acquired inputs, including work, will be the genuine sum paid. At whatever time spent by the stores-proprietor or his family on developing the store or treating the grain ought to be evaluated at a hypothetical or attributed pay rate. The rate utilized will typically mirror the compensation being offered in a kind of occupation like that in which the stores-proprietor is locked in. This rate ought to be taken just as a general rule. The target in utilizing a specific one is to express the expense (if any) to the proprietor of the time which he and his family spends on storage by the estimation of the time abandoned its option use. Sometimes, materials used to assemble a store won't be bought however accumulated from fields or woods. The expense of these free merchandise in assessment ought to be that of the time spent in acquiring them. In surveying the expense of time, consideration ought to be given to the occasional example of farming movement furthermore to the way that the estimation of time at a specific period may contrast between distinctive stores-proprietors as per the measure of area and work available to them. The three fundamental techniques for relating expenses of advantages are by method for a proportion (cost•benefit proportion), a rate of return, or by looking at the extra formal from making a specific move with the extra expenses acquired. The remainder of these methodologies is especially suitable where the progressions to a current arrangement of capacity are generally little. The rate of return idea is more suited to circumstances in which changes to the arrangement of capacity are broad and sizable capital ventures are included. Where the rate of return idea is utilized, the estimation of grain expelled from a store will be communicated as a rate of the store's expense. At long last, however critically, if advantages increased over a time of years are being contrasted and expenses caused at a point in time, they must be reduced utilizing a suitable rate of interest.

Presumptions with respect to the logistics management of foodgrains

Each experimental estimation depends on some sort of assumption with respect to this present reality about which the estimation should supply some data. Directing a study to quantify average grain losses such an estimation and it depends on the accompanying assumptions:

1. Social and monetary conditions, level of information of farmers, cultivating practice and harvesting and storing practices are basically uniform all through the region to be surveyed. On the off chance that this supposition is to be checked by nearby perception, one will need to comprehend the social milieu. In the event that it is non uniform in ways that can influence what is to be contemplated, sampling turns out to be more complicated and the counsel of specialists ought to be looked for.

2. All grain to be considered is put away in the same way in units of around the same size. That is, the biggest unit is no bigger than five times the littlest. In the event that the size variety is more noteworthy, then they ought to be examined and broke down independently as two or more populations.

3. Size of farms is uniform to inside of a variable of 5. That is, the biggest farm is no bigger than five times the littlest farm . Once more, if the size variety is more noteworthy, then they ought to be inspected and investigated independently as two or more populations.

These above suppositions are taken while conducting research on logistics management related to foodgrains . This is all that can be possible using the simple sampling plan discussed under the research methodology chapter. More

entangled arrangements ought to include the assistance of specialists in inspecting and in addition in foodgrains loss evaluation.

Rules which are followed for gathering food grain Storage Losses

There are some guidelines which are adopted for calculating the losses of foodgrains during storage period. These are given below:

1. The researcher should have knowledge of at least as a storage technologist and an economist, is necessary. The researcher arrives in the area early enough before harvest to enable it to plan effectively.

2. The sampling frame for investigations on both technical and economic aspects should be determined and stratified. Areas chosen for fieldwork should be as representative as possible of traditional practices, both preharvest and particularly postharvest. Information on the technical aspects of losses should be obtained by:

a. Collecting the necessary baseline data on the moisture content, damage, and bulk density (bushel weight) of the commodity immediately prior to storage, and recording any procedures involving selection or treatment of the product for storage.

b. Recording the quantity of the commodity placed in storage.

3. Recording the date on which some of the commodity is first removed from the store. Thereafter samples of the commodity should be taken at monthly intervals. The sampling method used should be pre-tested, prior to large-scale use, for its acceptability to both the investigator and the farmer.

4. Collecting information on the rate of consumption of the stored commodity over the storage period. This should be done on each sampling visit.

5. Analyzing the samples to obtain estimates of loss and applying these to the consumption pattern to obtain an estimate of loss over the complete storage period. Weight of a standard volume of grain corrected for moisture content changes should be used to assess losses in samples when regular sampling is performed. If this is not possible the formula method may be used to estimate losses within individual samples, but with less accuracy.

6. Setting up simulation stores, if necessary, which are under the control of the investigator and simulate the farmers' pattern of consumption. The commodity should be accurately weighed in and out of the store. Care should be taken that the grain placed in these stores is of the same quality and selected in the same way as that placed in the farmers' stores. Information on economic aspects will be obtained:

a. By a questionnaire survey on a once-only basis, conducted with a representative sample of farmers.

b. On a regular basis from farmers from whom grain samples are taken, if this is part of the research, and from official sources.

Procedures for Measuring Losses Occurring During Processing of foodgrains post harvesting

Processes may be continuous or batch. In the former, samples of input and output should be taken at regular and measured intervals. The amount (1, 5, or 10 min) of production taken from various lines in the system can be weighed to give the quantity of stock carried in that line in proportion to other lines. Samples may be taken in the usual way from the bags of grain entering the process and bags of products leaving. Overall mass balances must be measured and converted to standard moisture content or to dry weight. Two fundamental methods are used: measurement of total system (mass balance), and comparison with a standard.

I. **Measurement of total system.** The loss itself may be weighed. The optimum process gives zero loss. Examples are threshing (loss on stalk) and maize shelling (loss on cob). In some cases the loss itself cannot be measured, but the input of grain and output of products can be weighed, the difference being the loss. In other cases, loss will be a comparison of the traditional or commercial system as against a perfect hand-stripping standard.

II. **Comparison with laboratory standard***:* Comparison is not against a perfect (100% recovery) standard but with an optimum standard, usually taking each unit operation (stage) separately. Although this method is not ideal, if the standard of comparison is adequately described, the

comparison will produce useful information. It is important also that unit operations (eg, hulling and polishing) subsequent to that under consideration (eg, drying) be investigated or that information be obtained on the entire flow in the best possible and most standardized way.

1. **Sampling :** Sampling procedures are simple for batch processes such as are carried out in small mills and homes. If a loss of material is looked for, then a weigh-in weigh-out procedure will be adopted. Where a lowering of quality is suspected, a sample should be taken before the process and put through a parallel but optimum process (eg, in a laboratory mill) to compare the products. In continuous systems, the unit operation (stage) can be scrutinized while representative samples of substrate are taken at regular intervals before and after. The condition of the inputs and outputs is determined by laboratory examination. The amount (weight) of the outputs is obtained by comparing the total weight of the streams over a fixed period of time so that the comparative amounts of grain going to food, feed, waste, etc., can be determined. For example, in a continuous flour-milling operation, weights taken over a I-min period of flour, bran, shorts, and dust will show what proportion goes into each product. If dust is O.SO/o of the flour + bran + shorts, and dust is used for fuel while flour, bran, and shorts are all food, then the loss in this stage is 0.50/0. Operators Where losses depend on operator efficiency, there will always be the problem of deciding whether the operator is working normally or at an enhanced efficiency to impress the assessor. The following examples can be used as a guide for other unit operations:

a) THRESHING LOSS 1: Unzipped Grain : A suggested method is as follows. Random samples of bundles of cut grain are chosen and threshed by the customary method. The threshed grain (sample 1) and straw are retained. Directly supervised labor hand-strips every grain (sample 2) from and out of the straw. The two grain samples are then hand winnowed carefully to bring hand-stripped and mechanical material to the same quality. The good grain is weighed, moisture content measured, and the

weights converted to a standard moisture content. It is important to examine the two samples and estimate as accurately as possible (eg, by hand sorting of a representative subsample) the proportion of useful quality grain. Note and record unfilled, immature, or green grains that would be rejected during subsequent processing. Then the total of these plus extraneous matter should be determined and the estimated total weight subtracted respectively from the main threshed sample and the hand-stripped material. The good hand-stripped grain would normally be lost, and the loss is the percentage ratio of this to the total good grain, hand-stripped plus normally threshed. Losses due to scattering and spillage, which may occur with certain threshing procedures, would be evaluated separately by recovering scattered or spilled grain from known or controlled amounts of threshed grain or by weigh-in and weigh-outs if these are known or can be determined.

b) THRESHING LOSS 2: Damage to Grain : The method to be followed for estimating grain damage during threshing is basically the same as that for any other processing stage: One must standardize all other processing steps leading to the final product and do the threshing by the normal (local) method and by an optimal method which will give maximum yield of undamaged grain. As with estimating loss with the straw (threshing loss 1 above), the estimator selects random bundles of cut grain. These are randomly divided into two lots of approximately equal weight. The methodology consists essentially of weighing initially and at the end to compare the traditional (or any other processing procedure) with a processing procedure that gives 1000/0 recovery. Lot 1 is threshed in the manner under evaluation. This may include a final hand-stripping, depending on local custom. The threshed grain, including dry hand-stripped, is bulked. Lot 2 is hand-stripped carefully and bulked. (Note: Subsamples of each lot may be taken if laboratory equipment is available.) The separate samples are processed carefully to avoid loss or damage through the locally used processing system (cleaning, parboiling, drying, or milling) if this is a batch system in which the samples can retain their

identity. The products are then analyzed for broken grains and damaged grains. This is especially important for rice, which is desired as a whole grain, and grains such as red sorghum which undergo a two-stage grinding system wherein bran or husk is first removed from the whole grain before grinding. If local labor is available, separation of whole from broken grain may be performed by the local method (eg, hand-winnowing): The out-turn of whole grain is calculated and the results for threshing (by one or more local methods) compared with those for hand-stripping. If the identity of the samples would be lost by processing through the local system (large dryers or large continuous mills), then subsamples should be taken and processed in the laboratory.

c) DRYING LOSS ASSESSMENT: Loss by Damage: In this section the grain under consideration will be raw paddy rice, though the methodology can be applied in principle if not in detail to other grains and to parboiled paddy. The method is used to compare three drying methods: 1) yard (sun), 2) batch (Lister), and· 3) continuous.

d) GRINDING LOSS : Comparative Assessment by Weight Grains such RS wheat, maize, and sorghum may be ground in stone mills, in mortars, or in steel plate or steel roller mills. If the objective is not only to provide a flour or meal but to remove bran, the optimum milling will remove all the bran and leave all the endosperm (inner part) of the grain as flour. The separation of bran from flour is usually done periodically during the grinding; sieves of cloth are frequently used. Winnowing (air classification or purification) may also be used. The bran and other offal's will usually be used for animal feed. The problem in assessing the yield of desired product (flour) is that of comparative weighing of various mill fractions over measured time periods. Quality of flour (eg, amount of bran) also may be a factor. Standard procedures have been evolved for milling wheat on an experimental mill, but this equipment is extremely expensive and of little use for other grains. The methods proposed below may be used to compare the yields of acceptable flour derived from different varieties of

the grain or to compare the performance of different operators, and to obtain information on other factors.

2. Comparison of Operators

With the above procedure (1), a series of milling yields is obtained for a given variety of the grain for a number of operators. If the products obtained were all acceptable to users, the operator attaining the highest yield can be employed to improve the communities' out-turns of edible flour or meal.

3. Comparison of Mills

The procedure of (1) is followed with anyone variety to compare the milling yields (extraction rates) for a series of mills.

4. Insect Damage

A constant volume of each grain sample is weighed and milled by a standard milling process and input-to-output of food and nonfood product measured. Insect-damaged grain will give a lower yield of flour than undamaged grain.

4.2 Grading:

1. It is a procedure of isolating a commodity into diverse quality relying on the consumer's acceptance and demand.

2. Grading of a commodity should be possible at Producer,Maker and Wholesaler, Retailer level contingent on its last utilize, either for Industrial purpose or

3. Graded produce brings better cost as well as open a venue to his preferred buyer to choose product of his choice.

Grading & standardisation:-

- Essential segments of sound quality control framework
- Ensure general effectiveness in agricultural marketing system
- Help in consumer protection

Grading Process:

For grading, the example of 500 gm. should be poured over the strainers. The strainer set organized in the request of size with the biggest puncturing at the top. The sifter might be disturbed to strain out the foreign matter at different level. In the wake of isolating the sifters foreign matter might be gotten and the foreign matter gathered on the base dish should be added to work out the % of remote matter. The substance of the strainers might then be combined and spread out equitably on a glass surface in thin layer. From this precisely 50 gm. might be scooped out from distinctive sides and center. At that point distinctive refraction should be isolated and reviewed according to CSP/Uniform specification proclaimed by Govt. of India consistently.

Agricultural produce (grading & marking) act, 1937:-

In order to facilitate formulation of standards on scientific basis and grading of agricultural produce as per the prescribed standards, GOI enacted this Act

Implementing authority:

- Directorate of Marketing & Inspection under Ministry of Agriculture.
- Standards notified under this Act are popularly known as “AGMARK” Standards

4.2.1 Agmark standards

On tenacious interest from merchants, packers, exporters, shoppers and quality control associations the tenets revering AGMARK Guidelines for different things confined/informed occasionally. The different parameters for evaluating under AGMARK Measures are given beneath

1. Grade Designation : implies an assignment endorsed as demonstrative of the nature of any booked article.
2. Quality: - in relation to any article includes the state and condition of the article.
3. Prescribed:-means endorsed by rules made under this Act.
4. Scheduled Article:-means an article included in the schedule.

Table 4.1 . Indian standards for storage structures and storage management.

S.No.	IS Number	Title
1	IS 607-1972	Bagged food grain storage structures
2	IS 8453-1977	Bins, earthern, polyethylene embedded for bulk storage of food grains
3	IS 7715-1975	Bins for safe storage of food grain, method to test suitability of.
4	IS 600-1955	Code of practice for 'Bukhari' type food grain storage structure
5	IS 5826-1970	Flat storage structure for food grains (cap. 200 t)
6	IS 6201-1971	Flat storage structure (100-200 t)
7	IS 601-1955	Code of practice for construction of Kothar type rural grain storage structure
8	IS 602-1969	Silos for grain storage (Part I) construction requirements

9	IS 5503-1973	Part II-Grain handling equipment and accessories
10	IS 7174-1973	Steel bins for domestic storage (Part I)
11	IS 5606-1970	Steel bins for grain storage
12	IS 6151-1971	Part lI-General care in handling and storage of agricultural produce
13	IS 603-1960	Underground rural food grain storage structure

Source Agricultural Engineering Directory 1983

Parameters of grading

For evaluation to any produce keeping in mind the end goal to characterize its quality guidelines, it is fundamental to decide:-

- Size
- Shape
- Colour
- Variety
- Maturity
- Physical Properties
- Chemical Characteristics
- Foreign matter(%)
- Admixture(%)
- Moisture content(%)
- Damaged content (%)
- Uric Acid
- Poisonous Metals
- Insecticides

Certifying agencies

- Bureau of Indian Standards (BIS)
- AGMARK
- Codex Alimentarius Commission
- Central & State Seed Certification Authorities

4.3 Moisture

Moisture assumes a critical part in safe stockpiling of foodgrains. High moisture deteriorates the foodgrains quickly amid storage. Discolouration of foodgrains especially in rice amid capacity is because of the high moisture. Besides, the highmoisture draws in the creepy crawlies and mold to further harm the foodgrains low or safe dampness expands the storability of foodgrains and checks the development of bugs and forms. Grain moisture is the most vital basic grain administration factor that manages the storability of grain. More elevated amount of moisture draws in the bugs and forms which gamage the grain quickly during storage. Low or safe moisture of foodgrains expands their storability. Thus, estimation of right moisture of the foodgrains before storage is essential. Electronic versatile moisture meters are accessible for the estimation of moisture substance of foodgrains.

Categorisation and classification:

Categorisation empowers I O to assess state of stock, while, Classification aides in receiving convenient disinfestation measures. Categorisation is done to survey the state of oats by analyzing % of refractions like weevilled, stained, harmed grains present in the specimen. Foodgrain stocks are sorted as class A B C D in view of the % of these refractions

- The premise of categorisation is by gravimetric. Twenty gram of the agent tests are taken for investigation.
- The weevilled grain and the touched/germ eaten grains might be chosen and weighed independently.
- The rate of weevilled grains could be figured straightforwardly by the weight got as against 20 gm.

The % of germ eaten/touched grains should be landed at by partitioning the weight by three and recorded independently and not considered for choosing the categoring.

Table No. 4.2 Grading standards

Category	**Percentage of weevilled grain**
A	upto 1%
B	above 1% upto 4%
C	above 4% and upto 7%
D	above 7% and upto 10%

During the exploration the researcher met with diverse association, for example, FCI and CWC who gives the data that there are distinctive sort of flawed grain which is because of weevilled grains it is a direct result of creepy crawlies who taint it. The various types of weevilled grains are notice in the above table where A class demonstrates that upto 1% weevilled grain in the generation and same as in B, C and D where above 7% and upto 10% weevilled grain.

WHEAT/ BARLEY/ BAJRA/ MAIZE

The premise of classification is the same as on account of wheat with the exception of fusing the "assignment" to show the force of somewhat

harmed/stained portions. Assignment will be spoken to by including 1, 2, 3, 4 to the classification as underneat:

Table No. 4.3 Grading system

Designation	**Percentage of slightly damaged/stained grains**
1.	upto 5%
2.	above 5 upto 10
3.	above 10 upto 15
4.	above 15 upto 20

During research process I have interacted with different authority at university of agribusiness Gwalior, Food corporation of India, Central warehousing corporation. These association proposed certain parameters for the loss in foodgrains amid their storage. This is spoken to with the assistance of above notice Table which clarify that there are four classes/standard for foodgrains losses, for example, classification 1 speak to the losses upto 5% where as 4 classification demonstrates the losses above 15 to 20%.

Table no. 4.4 Categorization of Raw

Classification	Damaged grain (%)	Discoloured grain (%)
A	Upto 3%	Upto 3%
B	Above 3% upto 4%	Above 3% upto 5%
C	Above 4% upto 5%	Above 5% upto7%
D	Lot showing appreciable quantity of loose bran (more than 0.5%) or giving unpleasant smell cat stock should be issued after cleaning where necessary.	

In the above mention table, with the help of the public sector players of logistics such as FCI and CWC provides the various categorization of raw for putting foodgarins into different category which is based on the percentage of damaged grain and discoloured grain in the produce foodgrain .which is being explain and classified in this table where A category shows that it hace 3% of damaged grain and 3% of discoloured grain or some foreign material and same as following in B,C and D.

1 Transportation:

An all around created and proficient arrangement of transportation aides in the development of business sectors, lessens the transportation time and expenses of transportation of the items.. Village roads in India is around 26.50 lakh Km. Larger part of the rural produce, maker of the tribal territories and perishable ranch items are still kept to town markets available to be purchased of their produce for need of surfaced streets and adequate method for transportation. The road density per sq. km. of territory in the nation is much beneath the proposals of Shillong plan (1981) of 32.5-km. road per 100-sq. km. region. In spite of the fact that India, have one of the biggest road system of 3.314 million km, comprising of National Highways, Expressways (70548 Km), State Highways (1.28 Lakh Km), Major District Roads, Other District Roads (4.70 Lakh Km). The rate of Single Lane/Intermediate path 20,849 km (30%), Double lane 37,646 km (53%) and Four Lane/Six lane/Eight Lane 12,053 km (17%). The absence of double road lane negatively affects the pace of transport means. The fast extension and fortifying of the road system, hence, is basic, to accommodate both present and future movement and for enhanced availability to the hinterland. Furthermore, road transport should be directed for better vitality proficiency, less pollution and improved road security.

Railroad wagons are additionally utilized for transportation of rural items from wholesale markets to utilization focuses. Railroad course length in the nation is not adequate and electrified track is not in any case absolute minimum. The current rail offices in the nation are very deficient. Rail lines even don't join a portion of the areas in the nation. The air cargo facilities are likewise accessible in

predetermined number of States. Existing air cargo facilities are in poor condition and much underneath the worldwide norms.

Reliance of Agricultural Production on Transport

The enhanced transport offices significantly influence the agriculture productions. The decreased transport expense effectsly affects farming creation (i) On profitability and (ii) On marketability (Schuster, 1973). Profitability is basically influenced by the decreased expense of inputs, particularly fertilizers and so on at the rural generation site. It becomes profitable to increase the use of fertilisers as long as the input costs are below the volume of increased production . The cost of fertilizer at the specific generation site under thought was higher than the estimation of the increment underway possible from it. So fertilizers were used.Marketability can be evaluated by relating the adjustment altogether generation cost, including transport expense of market cost. The decreased transport cost for the item and for inputs will build the region inside which marketable creation may happen. The interstate providing so as to undertake can increment rural creation portability for inputs to encourage a green upheaval. The movement in the independence arranged cultivating to market situated business cultivating is the ensuing consequence of the parkways. The change of transport offices will likewise change the harvest design. By lowering transport cost, and thus production cost, crops may be considered which were previously ruled out. Given the cost of agricultural production per unit of output, then the market cost per unit will increase as distance to the market increases. The total cost consists of total cost of input, transport cost of inputs, unloading, and cost of input, loading cost of products, transport cost of products and unloading cost of productsThe distance within which market production is worthwhile can be increased by appropriate transportation facilities, which would lower the transportation unit cost by either reducing the slope of the cost curve or by reducing the jumps occasioned by handling charges. This is the primary objective of transportation policy for agriculture. Also transport speed determines marketability of

agricultural products and this is especially so in the case of perishables like vegetables, fruits, milk and diary products. These will spoil if the transport time exceeds certain limits. So transport time and marketability are directly related.

The road transport best satisfies the prerequisites of nearby agriculture transport which is at first worried with get-together items from an expansive number of broadly dispersed focuses in any given range and conveying them to the market place. Agriculturists rely on upon roads for transporting their items to markets. There is presently a developing accentuation on expanded agrarian generation to empower the agriculturist to gain more and convey more ranch items to the urban shoppers.. Nourishment, in light of its mass, puts an especially substantial weight on transportation offices. At the point when the railroad stretches out into agrarian regions, the settlement example appears to change particularly. Places which once have given just insignificant administrations to moderately little zone are quickly changed into focuses which amass process and offer the surpluses delivered by their tributory regions These exercises combined with an augmented market zone, create the capital for the procurement of good and administrations already ridiculous in remote and out of reach spots. The engine vehicle changes country examples of utilization as well as strategies for creation and there are Keynesian multiplier and increasing speed impacts because of this. Expanded agrarian proficiency and expanded capital from horticulture likewise pull in more business and administrations to farming groups.

4.4 Summary

This study depicts in point of interest the logistics administration of agriculture items which is clarified in the beginning of this section with the assistance of a model and afterward advance the losses of different sorts at distinctive stages are attempted to ascertained with some fundamental presumptions and afterward clarified through straight mathematical statements. In point of interest this section incorporates logistics administration of foodgrains and after that the different sorts of foodgarins losses in production network administration and other than this evaluating and moisture issue are likewise clarified.

Chapter 5

Role of storage facility in Logistic Management

Chapter 5- Role of storage facility in post harvest losses

In this part the researcher has clarified the part of storage in logistics management. In logistics management storage assumes a critical part. There are various types of present day and conventional facilities are available to the farmers for storage of foodgrains, for example, farm storage and warehouse. Because of improper storage facilities and absence of storage facilities it changes over into fooodgrains losses in tremendous losses. The storage facility does decrease the wastage of foodgrains as well as ensures the supply of foodgrains amid off seasons. This guarantees the best possible cost of foodgrains for the farmers and traders.

5.1 Introduction of Storage Management

Storage is utilized as a part of a smaller scale sense while 'Warehousing" is utilized as a part of large scale sense. Storage' is the particular movement restricted to the product while "Warehousing" is the aggregate business action. 'Storage is a procedure while 'Warehousing is a framework. "Storage" and "Warehousing" utilized synonymous to one another WDRA Established under warehousing (advancement and regulation) Act 2007. Under this Act, all the warehouses (public or private) issuing negotiable warehouse receipts are to be registered under WDRA. The warehouses shall be inspected in all respects for accreditation and subsequently by the authority. The accredited warehouses shall follow the rules and regulations framed under the act by the authority.

Figure No. 5.1 Warehouse in supply chain

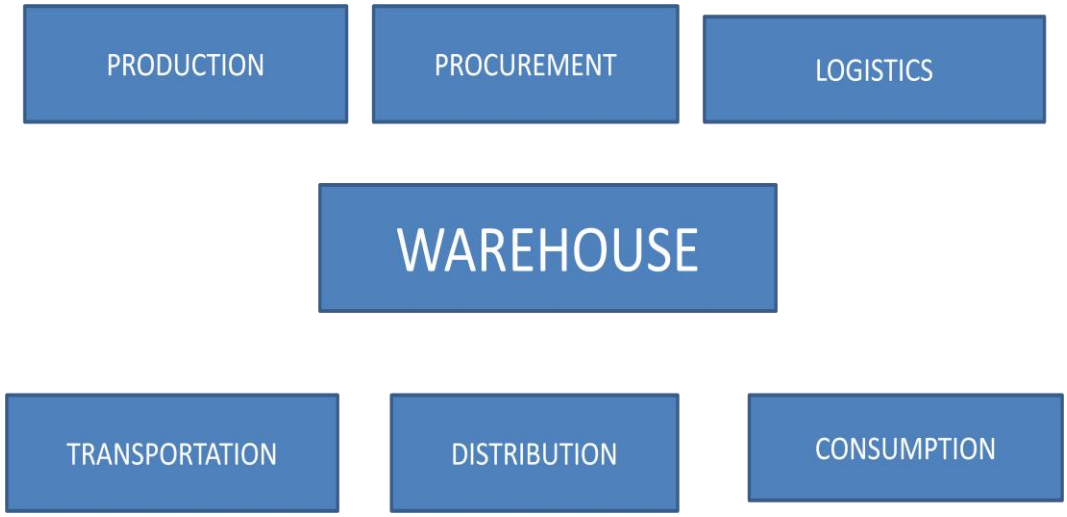
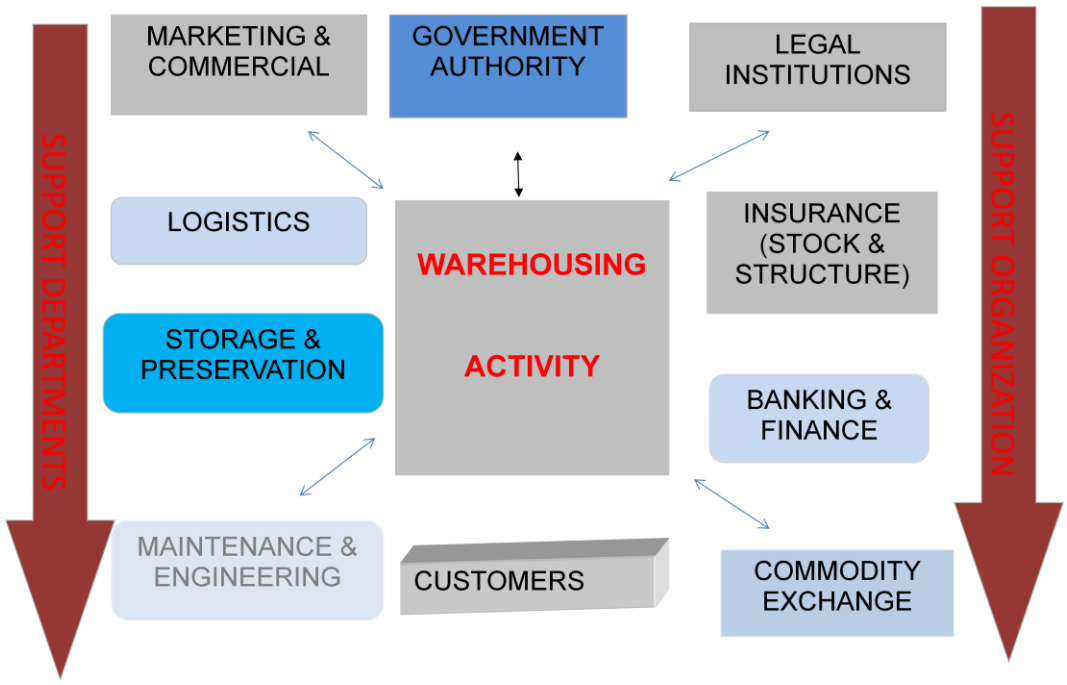


Figure No. 5.2



Above drawn both the figure demonstrates the significance of warehouse in logistics management of foodgrains. As they portrays about the different exercises which they performs beginning from the foodgrains procurement and logistics

management which implies transportation, bundling (pacakaging) and storage as a part of logistics management. Other then this they have numerous more other essential exercises, for example, assuming part of marketing channels helping government organizations (FCI and CWC) in food supply chain. At that point helping farmers in safeguarding of their yields or storage facilities for their creation and numerous more activities, for example ,commodity exchange, support and supply of foodgrains to purchasers.

5.2 Warehouse Management

Warehouses are facilities that provide a proper environment for the purpose of storing goods and material that require protection from the elements. Warehouses must be designed to accommodate the loads of the material to be stored, the associated handling equipment, the receiving and shipping operations and associated trucking, and the needs of the operating personnel.

India is seeing a spurt in warehousing framework with the obsolete inventory network management offices going for a makeover and limit expansion. There is a component of dynamism and the online merchandise fates business sector is hurrying the change. With the cold chain management rising as practical business, a few private players have ventured into contribute.

Benefits of Warehousing

Better storage facility will doubtlessly make better monetary conditions for farmers. The foodgrains wasted at the farmyard because of improper storage facility or low return to farmers pricing during peak time will provide a second thought to farmers to store surplus. In turn, farmers will get storage receipts. Presently, banks are lending loans to farmers against warehouse receipts Thus, farmers will get storage receipts. This procedure urges farmers to store more food grains.

Farmers can in this manner get advances and put resources into agri-inputs and farm machinery, which will increment agrarian production and the economic

condition of farmers. Perishable products require more care and may get more return to farmers. Then again, with storage of perishable things, customers might likewise get unseasonal products of the soil consistently, which will enhance consumption pattern.

Types of Warehousing

Diverse sorts of agrarian items need distinctive storage facilities. While some need to keep up an ideal temperature and dampness, others may should be kept free from bug and pest attack. Building a storage framework includes heavy investment and variable expenses.

- Fixed cost involves capital cost, interest on capital cost, depreciation of infrastructure, taxes, premium costs and wages of permanent employees.
- Variable expenses incorporate repairs and maintenance cost, electricity costs, cost of protective material and wages of temporary employees etc.

The types of warehousing are as follows:

- **Based on type of commodities stored**
    - General – It is a normal warehouse to store general things, e.g. foodgrains.
    - Special items warehousing – It is made to store particular products e.g. tobacco, cotton, fleece and so on because of particular storage necessities.
    - Refrigerators – it stores perishable items in a temperature controlled environment
- **Based on ownership**
    - Private – Owned by private parties
    - Public – Owned by Government agencies e.g. CWC and SWC
    - Bonded – Licensed by the administration and is developed close-by airplane terminals/seaports. It stores imported merchandise till the installment/custom leeway is finished by the Import.

Criteria for Good Warehousing

The following are the criteria for good warehousing:

- Enough space for bulk, rack and other storage, i.e. maximum utilization of space.
- Freeze and chilled environment, depending on requirement for various commodities
- Sophisticated material handling equipment
- Optimum light and humidity, light colored roofs and energy efficient operational equipments.
- Wide distribution network and access to nearby roads, ports and railways.
- Safety measures like fire extinguishers

As with other elements in a distribution system, the objective of a warehouse is to minimize cost and maximize customer service. To do this, efficient warehouse operations perform the following:

1. Provide timely customer service
2. Keep track of items so they can be found readily and correctly
3. Minimize the total physical effort and thus the cost of moving goods into and out of storage.
4. Provide communication links with customers.

Warehouse Activities

Operating a warehouse involves several processing activities, and the efficient operation of the warehouse depends upon how well these are performed. These activities are as follows:

1. Receive Goods: The warehouse accepts goods from outside transportation and accepts responsibility for them. This means the warehouse must:

    a. Check the goods against Invoice/Delivery Challan/other inward documents
    b. Check the quantities and match it with inward documents
    c. Check for damage/shortage and endorse the discrepancies on the LR/GCN/AWB
    d. Inspect goods if required
2. Identify the goods: Items are identified with the appropriate stock keeping unit (SKU) number and the quantity received is recorded.
3. Put away: Goods are sorted and moved to the storage locations inside the warehouse, and bin cards are updated.
4. Hold Goods: Goods are kept in storage and under proper protection until needed.
5. Preservation: Depending on nature of commodities, do necessary preservation/fumigation of the goods for preventing any kind of infestation/deterioration.
6. Pick goods: Items required against an order to be picked from storage locations and moved to the dispatch area. Goods making up a single order are kept together in the dispatch area, and checked for omissions or errors.
7. Dispatch the shipment: Orders are packaged, shipping documents are prepared and goods loaded on the right vehicle.
8. Operate an information system: A record must be maintained for each item in stock showing the quantity in hand, quantity received, quantity issued, and the location in the warehouse. The system can be as simple as a set of manual registers, or it may be a sophisticated computer based system.

In various ways, all these activities take place in any warehouse. The complexity depends on the number of SKUs handled, the quantities of each SKU, and the number of orders received and filled. To maximize productivity and minimize cost, warehouse management must work with the following:

1. Maximum utilization of space: Usually the biggest capital expense is for space. This implies floor space as well as cubic space too since merchandise are put away in the space over the floor and also on it.

2. Effective utilization of labour and equipment: Materials taking care of hardware speaks to the second biggest capital cost and work the biggest working expense. There is an exchange off between the two, and in that labour cost can be diminished by utilizing more materials handling equipment. Warehouse management should:
    - Select the optimum mix of labor and equipment to optimize the overall productivity of the operation.
    - Move merchandise effectively: Most of the action that goes ahead in a warehouse is materials taking care of: the development of products into and out of the stock locations.

Space Requirements Planning

A warehouse layout should be based on the space requisites for and the between individual warehouse processes. The initial step is to decide the general space prerequisite for the procedures. Accepting and delivering arranging space is a component of the quantity of getting and dispatching dock entryways and the pivot time for every dock. A typical practice is to sufficiently designate organizing space behind every dock way to suit a truck load worth of material. Floor space prerequisites for bed storage and recovery, case picking and broken case picking ought to be registered as a component of picking mode financial analysis. Space for packing and unitizing, altering and collection ought to be arranged appropriately. Warehouse office space is basically a component of the quantity of workplaces required.

Table No.5.1 Standard specifications of 5000 m.t. godown

❖ **Length**	**125.9 meter**
❖ **Width**	**21.34 M (internal width)**
❖ **Height**	**5.48 M.**
❖ **Length of varandah**	**126.01 M.**

❖ **Width of varandah**	**1.83 M.**
❖ **Total no. of doors**	**12**
❖ **Total no. of ventilators**	**54**
❖ **Plinth height**	**0.61 M.**
❖ **No. of stacks**	**36**
❖ **Load bearing capacity**	**11 Tonne sq. Mtr.**

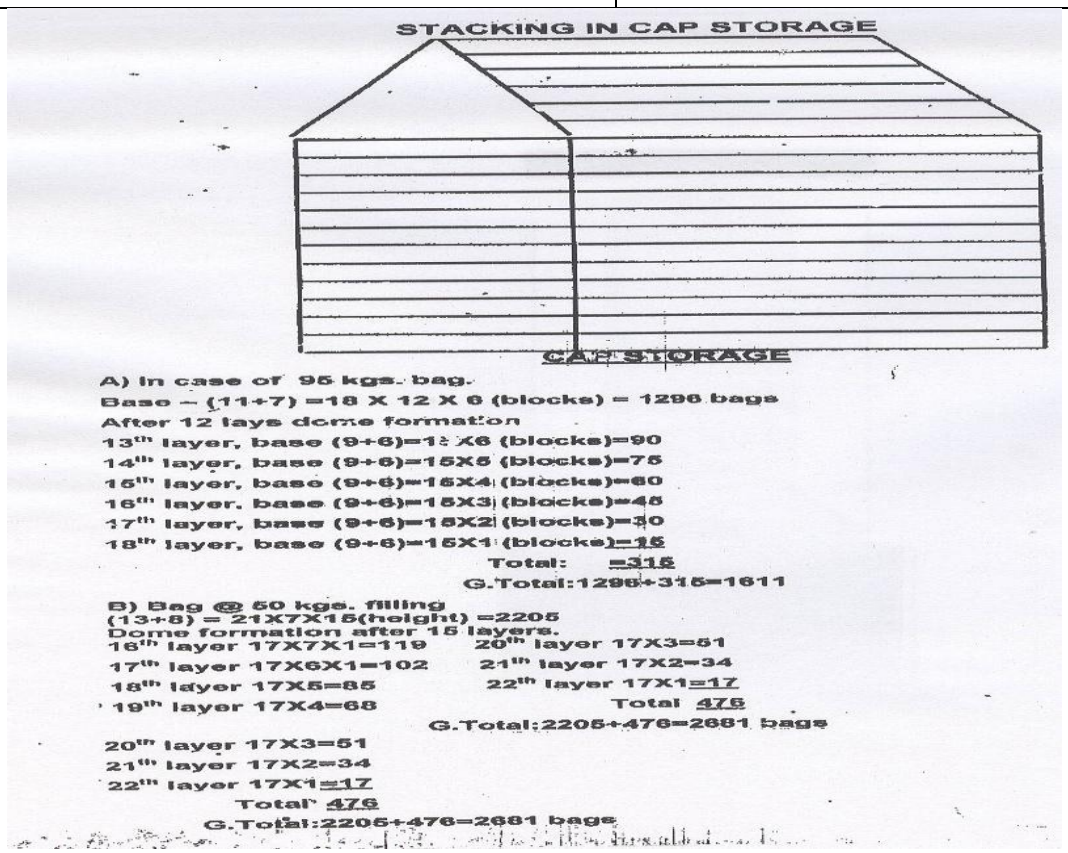


Figure No.5.3 CAP Storage *Source: FCI-Alwar*

Material Flow Planning

In a commonplace case, items stream in at accepting, move into storage in the back of the warehouse and after that to dispatching which is found neighboring getting on the same size of the building. A U-formed stream configuration has various favorable circumstances over other stream plans, including:

- Excellent use of dock assets .
- Facilitating cross-docking subsequent to the accepting and sending docks are contiguous each other .
- Excellent lift truck use since set away and recovery outings are effortlessly.

Contiguousness Planning

Construct essentially in light of material stream examples, forms with high nearness prerequisites ought to be found near each other. For instance, reserve storage ought to be situated close accepting following there is commonly a ton of material stream in the middle of getting and reserve storage. The common stream relationship regularly prompts the U-shape outline. The key rule in procedure area is to relegate forms with high storage prerequisites to high-sound space and work serious procedures to low-bay space.

Warehouse Layout

Warehouse layout is concerned with the location of individual things in the warehouse. There is no single all inclusive stock area framework suitable for all events, yet there are various premise framework that can be utilized. Which framework, or blend of frameworks, is utilized relies on upon the kind of merchandise put away, the sort of storage facility required, the throughput, and the measure of order size. Whatever the framework, management must keep up enough stock of wellbeing and working stock to give the required level of client service, monitor things so they can be discovered effectively, and decrease the aggregate exertion required to get merchandise, store them, and recover them for shipment.

The following are some basic systems of locating stock:

- **Group practically related things together:** Group together things comparative in their utilization (practically related). In the event that practically related things are requested together, request picking is simpler. Warehouse work force get comfortable with the areas of thing.
- **Group quick moving things together:** If quick moving things are put near the receiving and shipping area, the work of moving them all through storage is decreased. Moderate moving things can be set in more remote ranges of the warehouse..
- **Group physically comparative things together**: Physically comparable things regularly require their own specific storage facilities and handling equipment. Small packaged things may require racking while, overwhelming things, for example, tires or drums, require distinctive storage and handling equipment. Frozen foods need freezer storage space..
- **Locate working and reserve stock separately**: Relatively small quantities of working stock can be located close to the shipping area, whereas reserve stock used to replenish the working stock can be located more remotely. This allows order picking to occur in a compact area, far more efficiently.

There are two basic systems for assigning specific locations to individual stock items: fixed location and floating location.

- **Fixed Location:** In a fixed location system, a SKU is relegated a perpetual area or areas, and no different things are put away there. This framework makes it conceivable to store and recover things with at least record keeping .However, fixed location systems usually have poor cube utilization. Fixed location systems are regularly used in warehouses where demand is uniform, space is not at a premium and throughput is little, and where there are couple of SKU

- **Floating Location :**In a floating location system, goods are put away wherever there is proper space for them. The same SKU may be put away in a few areas in the meantime and diverse areas at distinctive times. The favorable position to this framework is enhanced cube utilization use. However, it requires accurate and up-to-date information on item location and availability of empty storage space so items can be put away and retrieved efficiently. Cutting edge warehouses utilizing drifting area frameworks are generally PC based. The PC allots free areas to approaching things, recollects what things are close by and where they are found, and guides the request picker to the right area to discover the thing. Thus, cube utilization and warehouse efficiency are greatly improved.

Alternatives Storage facilities available in foodgrains

1) **Floor Storage –**Bulk storage of foodgrains is regularly done on the floor in the warehouses utilizing Wooden Pallets, or Tarpaulin sheets to shield from termite, leakage and other defilement.

2) **Silo Bags -** Silo Bags permits the maker an ideal opportunity to take control of his own harvest and to market it later to accomplish a superior primary concern!.
   - Eliminates exorbitant on-farm storage frameworks (especially valuable in regions where security of residency is an issue).
   - Suitable for an extensive variety of products from dry grains, wet grains, dried organic products, rummages, nuts and numerous other important commodities.
   - Very low cost per ton stored.
   - System is totally mobile and can be moved from

location to location.

- Size ranges from a single 220+/- mt Silo Bag to a 50,000 mt Silo Bag site.
- Logistics savings and benefits - from lower freight costs to better management of available logistics and timing.
- Store on-farm with no wastage or slippage. Can fundamentally reduce wastage.
- Allows the monetary advantages of isolation; grains can be put away as to variety,grade, protein or whatever other classification.
- Storage should be possible in a bumper season and the produce can be sold at better cost later.
- Grain holds its quality and shading.
- The pack is air sealed; along these lines no chemicals are required (ideal for organic marketing)

1) Grain Storage Silos

Grain Storage Silos are generally utilized for cereal and grain stockpiling. The round and hollow body of the storehouse is for the most part made of ridged iron boards strengthened by solid outer uprights in molded metal sheet. The material utilized for the capacity storehouse is a steel of a high resistance with galvanization, while the rooftop is made of trapezoidal components in stirred and ribbed steel plate, suitable to convey overwhelming burdens.

Table 5.2 Comparative costs for silo and godown storage.

ITEM	**SILO SYSTEM (Rs.*)**	**GODOWN SYSTEM (Rs.*)**
Capital costs		
Land	20 0000 (1850 m²)	60 000 (5550 m²)
Construction	6 500 000	3 940 000
Total	6 520 000	4 000 000
Recurring costs/year: grains/year		For grain-1 For oilseeds 4- 6

		year of storage	months storage
Loss due to moisture	40 000 (0.2%)	200 000 (1%)	100 000 (0.5%)
Loss due to rodents, insects, fungi, and handling	40 000 (0.2%)	1 600 000 (8%)	800 000 (496)
Operational costs			
Electric power	27 500	80 000	40 000 (Fumigation)
Fuel for dryer	37 500	25 000	25000(Manual handling)
Total	145 000	1905 000	965 000

Source Sawant (1984)

*Conversion rate adopted: 1 = 10 Indian Rupees

Physical Control and Security

As stock comprises of unmistakable things, things have a terrible propensity for getting to be lost, strayed, or stolen, or of vanishing in the night. It is not that individuals are dishonest, rather that they are absent minded. What is required is a framework that makes it troublesome for individuals to commit errors or be exploitative. There are a few components that offer assistance:

- A great part numbering framework
- A basic, very much recorded transaction system: When goods are received, issued or moved in any way, an exchange happens. There are four stages in any exchange

1. **Identify the Item**: Numerous blunders happen due to off base ID. At the point when getting a thing, the buy request, part number, and amount must be legitimately distinguished. At the point when goods are put away, the area must be precisely indicated.

Whenever issued, the amount, area, and part number must be recorded.

2. **Verify quantity:** Quantity is checked by a physical number of the thing, by weighting or by measuring. Infrequently, standard-sized compartments are valuable in tallying.
3. **Record the transaction** :Before any exchange is physically completed, all the data about the exchange must be recorded.
4. **Physically execute the transaction**: Move the goods in, about, or out of the storage area.

- **Limited Access:** stock must be kept in a protected, secure spot with constrained general access. In the event that ought to be locked with the exception of during typical working hours. This is less to avoid robbery than to guarantee individuals don't take things without finishing the exchange steps. On the off chance that individuals can meander into the stores zone whenever and take something, the exchange system comes up short..
- **A well trained workforce**: Not just ought to the stores staff be all around prepared in taking care of and putting away material and in recording exchanges, yet other faculty who associate with stores must be prepared to guarantee exchanges are recorded properly.

Inventory record accuracy

The helpfulness of stock record is straightforwardly identified with its exactness. Taking into account the stock record, an organization decides net prerequisites for a thing, discharges orders in light of material accessibility, and performs stock examination. In the event that the records are not exact, there will be deficiencies or material, disturbed calendars, late deliveries, lost deals, low efficiency, and overabundance stock (of the wrong things). These three bits of data must be precise: part depiction, amount, and area.

Exact stock record empower firms to:

Operate a viable materials administration system: If stock records are off base, gross-to-net computations will be in mistake.

• Maintain attractive client administration: If records demonstrate the thing is in stock when it is not, any request promising it will be in mistake.

• Operate viably and productively: Planner can arrange, certain that the parts will be accessible.

• Analyze stock: Any investigation of stock is just in the same class as the information it depends on.

Wrong inventory records will result in:

- Lost sales
- Shortages and disrupted schedules
- Excess stock (of wrong things)
- Low profitability
- Poor delivery performance
- Excessive expediting, since people will always be reacting to a bad situation rather than planning for the future.

Causes of Inventory record errors:

- Poor stock record exactness can be brought about by numerous things, however they all outcome from poor record keeping frameworks and ineffectively prepared work force. A few cases of reasons for stock record blunder are:
- Unauthorized withdrawal of material
- Unsecured stockroom
- Poorly trained work force

- Inaccurate exchange recording: Errors can happen as a result of wrong piece checks, unrecorded exchanges, delay in recording exchanges, mistaken material area, and erroneously recognized parts.
- Poor exchange recording frameworks: Most frameworks today are PC based and can give the way to record exchanges properly. Mistakes when they happen are generally the broken of human information to the system. The documentation reporting system ought to be intended to lessen the probability of human mistake.
- Lack of audit capability: Some program of verifying the inventory counts and locations is necessary. The most popular one today is cycle counting.

Measuring Inventory Record Accuracy

Inventory accuracy ideally should be 100%. Banks and other financial institutions reach this level. Other companies can move toward this potential.

Tolerance: To judge stock precision, a tolerance level for every part must be indicated. For a few things, this may mean no fluctuation, for others, it might be exceptionally troublesome or exorbitant to gauge and control to 100% precision. A case of the recent may be nuts or screws requested and utilized as a part of the thousands. Hence, tolerance are set for everything . Tolerance is the measure of passable variety between a stock record and a physical check.

Tolerances are set on individual items basis value, critical nature of the item, availability, lead time, ability to stop production, safety problems, or the difficulty of getting precise measurement.

Auditing Inventory Records

Mistakes happen, and they must be recognized so stock precision is kept up. There are two fundamental strategies for checking the exactness of stock records: Periodic numbers of all things, and cyclic tallies of indicated things. It is vital to review record precision, however it is more essential to review the framework to

discover the reasons for record mistake and dispense with them. Cycle numbering does these occasional reviews tend not to.

Periodic inventory:

The basic role of an occasional stock (primarily yearly) is to fulfill the financial auditor related to the stock records represents the valuation of stock. To organizers, the physical stock speaks to a chance to right any mistakes in the records. While financial auditors are worried with the aggregate estimation of the stock, organizers are worried with the item detail.

The obligation regarding taking the physical stock for the most part rests with the materials manager who ought to guarantee that a decent arrangement exists and it is taken after. There are three elements in great readiness: housekeeping, identification and training.

Housekeeping: Inventory must be sorted, and the same parts collected together so they can easily be counted. Sometimes, items can be pre-counted and put into sealed cartons.

Identification: Parts must be plainly recognized and labeled with part numbers. This should and ought to be possible before stock is taken. Work force who are acquainted with parts ID should be included and all inquiries determined before the physical stock begins.

Training: The individuals why should going do the stock must be properly educated and prepared in taking stock. Physical inventories are normally taken once per year, and the strategy is not never forgot from year to year.

Process: Taking a physical inventory consists of four steps:

- Count items and record the count on inventory sheet against respective item.
- Verify this count by recounting or by sampling.

- Reconcile stock records for contrasts between the physical tally and book stock.
- Pass important adjustment entries in books to correct differences, after taking necessary approvals.

Cycle counting

Cycle checking is an arrangement of tallying stock consistently. Physical stock numbers are planned so that every thing is relied on a predetermined schedule. Contingent upon their significance, a few things are numbered every now and again consistently, though others are definitely not. The thought is to check chose things every day

The advantages of cycle counting are:

- Timely identification and revision of issues: The reason for the tally is first to discover the reason for mistake and to correct the cause so the error is less inclined to happen once again.
- Complete or partial reduction of lost production.
- Utilization of work force, prepared and devoted to cycle numbering; this gives experienced stock takers who won't make the mistakes "once-a-year" staff do. Cycle counters are additionally prepared to distinguish issues and to correct them.

Count frequency: The essential thought is to count a few things every day so all things are checked a predetermined number of times every year, called count frequency. For a thing, the consider recurrence ought to expand the estimation of the thing and number of exchanges increment. A few techniques can be utilized to decide the frequency. Three basic ones are ABC technique, zone method, and area and review strategy.

- ABC strategy: In this technique, inventories are arranged by ABC framework. Some guideline is set up for counting frequency. For example, A items might be counted weekly or monthly. B items

bimonthly or quarterly and C items biannually or once a year. On this basis a count schedule can be established.

- Zone method: Items are assembled by zones to make counting more effective. The system is used when a fixed location system is utilized, or when work-in-progress or transit stock is being counted.
- Location audit system: In a floating location system, goods can be stored anywhere, and the system records where they are. On account of human mistake, these areas may not be 100% right. If material is mis located, normal cycle counting may not find it. In using location audits, a predetermined number of stock locations are checked each period. The item numbers of the material in each bin are checked against inventory records to verify stock point locations.

5.3 Agencies Involved in Warehousing of Agri Commodities

In India, the Central Warehousing Corporations (CWC), State Warehousing Corporations (SWC) and Food Corporation of India (FCI) are engaged in storing the major Agri commodities. Private parties like ITC, Cargill, Reliance have also become key player in this sector. Government is also promising private participation in this sector.

Central Warehousing Corporation

A premium Warehousing Agency in India, set up during 1957 giving logistics backing to the agriculture sector, is one of the biggest public warehouse operators in the country offering logistics services to a diverse group of clients.

CWC is working 490 Warehouses the nation over with a capacity limit of 9.8 million tones giving warehousing administrations to an extensive variety of items running from rural produce to sophisticated industrial products. Warehousing activities of CWC incorporate food-grain warehouses, industrial warehousing,

custom bonded warehouses, container freight stations, inland clearance depots and air-cargo complexes.

Aside from storage and handling, CWC additionally offers services in the area of clearing and sending ,handling and transportation, procurement & distribution, disinfestations services, fumigation services and other subordinate activities. CWC additionally offers consultancy services/training for the development of warehousing infrastructure to different agencies.

CWC OFFERS FOLLOWING SERVICES:

- Dedicated Warehousing Facility
- Logistic Support for handling & movement.
- Storage space for Food grains
- Hire godowns for ensured usage.
- Provide disinfestations and fumigation services.
- Manage food grain stored godowns of others.
- Training and consultancy on scientific storage.
- Construction of godowns for other Agencies.

Food Corporation of India

The food corporation of India was setup under the food corporations act 1964, in order to fulfill following objectives of the food policy:

- Effective price support operations for safeguarding the interests of the farmers.
- Distribution of foodgrains througout the country for public distribution system; and
- Maintaining satisfactory level of operational and buffer stocks of foodgrains to ensure National Food Security.

Since its origin in 1965, having taken care of different circumstances of plenty and scarcity, FCI has successfully met the challenge of managing the complex task of providing food security for the nation. It has constantly worked towards creation of strong food security system which has helped to sustain the high growth rate and maintain regular supply of wheat and rice right through the year. The efficiency with which FCI tackled one of the worst droughts of the century not only proved its role as the premier organization in charge of food security in India, additionally brought it honors from worldwide associations.

Today it can take credit for having contributed a great deal in transforming India from a chronically food deficit country to one that is self-sufficient.

Procurement of Foodgrains

To sustain the Green Revolution, the Government of India presented the scheme of guaranteed minimum cost of foodgrains which are announced well before the commencement of the crop seasons, after taking into account the cost of production \ inter-crop price parity, market prices and other relevant factors.

- The Food Corporation of India alongside other Government organizations gives compelling value confirmation to wheat, paddy and coarse grains.
- FCI and the State Govt. organizations in consultation with the concerned State Governments set up expansive number of procurement(purchase) centers all through the state to encourage buy of foodgrains.
- Centers are chosen in such a way, to the point that the farmers are not required to cover more than 10 kms to convey their produce to the closest buy centers of major procuring states.
- Price support buys are sorted out in more than 12,000 communities for wheat furthermore more than 12,000 places for paddy consistently in the immediate post-harvest season. Such extensive and effective price support operations have resulted in sustaining the income of farmers

over a period and in providing the required impetus for higher investment in agriculture for improved productivity.

- India today produces more than 200 million tons of foodgrains as against a negligible 50 million tons in 1950.
- In recent two decades, foodgrain obtainment by Government agencies has seen a quantum increased from 4 million tons to more than 25 million tons per annum.
- Foodgrains are procured according to the Government prescribed quality standards.
- Each year, the Food Corporation buys around 15-20% of India's wheat production and 12-15% of its rice production..
- This helps to meet the responsibility of the Public Distribution System and for building pipeline and buffer stock.

Storage Management

Another fact of the corporation's manifold activities is the provision of scientific storage for the millions of tones of foodgrains procured by it.in order to provide easy physical access in deficit, remote and inaccessible areas, the FCI has a network of storage depots strategically located all over India.These depots include silos, godowns and an indigenous method developed by FCI, called Cover and Plinth (CAP).

CAP storage is a term given to storage of foodgrains in the open with adequate precautions such as rat and damp proof plinths, use of dunn age and covering of stacks with specially fabricated polthene covers etc.

FCI has 24.18 million tones (possessed and contracted) of capacity limit in more than 1451 godowns all over India.

With a specific end goal to reduce storage and transmit losses of foodgrains and to bring extra assets through Private Sectors investments. Govt. of India had declared a National Policy on Handling Storage and Transportation of Foodgrains in June, 2004 for Bulk and routine godowns. In the Ist stage, after a progression of considerations, it was affirmed that aggregate limit of lakhs MT be made at the distinguished based depots and field depots through private division cooperation on Build-Own and Operate (BOO) Basis. RITES were named as specialists for the task. A letter of acknowledgment of proposition of the venture in two circuits has been awarded to M/s. Advani Exports Ltd., the least bidder to finish the Project in 3 years from the date of execution of the service agreement.

Table No. 5.3 FCI storage status *(Figs. in Million Tonnes)*

Capacity	1st Apr. 2007	1st Apr. 2008	1st Apr. 2009	1st Apr. 2010	1st Apr. 2011	1st Apr. 2012	1st Dec. 2012
Covered							
Owned	**12.82**	**12.82**	**12.91**	**12.93**	12.94	**12.95**	12.97
Hired	**13.77**	**10.85**	**10.46**	**9.9**	9.34	**8.71**	8.96
Total	**26.59**	**23.67**	**23.37**	**22.83**	**22.28**	**21.66**	**21.93**
CAP (Cover and Plinth)							
Owned	2.26	2.21	2.25	2.21	2.29	2.2	2.21
Hired	2.88	1.36	0.41	0.51	0.63	0.03	0.32
Total	**5.14**	**3.57**	**2.66**	**2.72**	**2.92**	**2.23**	**2.53**
Grand Total	**31.73**	**27.24**	**26.03**	**25.55**	**25.2**	**23.89**	**24.46**

Quality Control and Scientific Preservation

- The Food Corporation of India has a broad and experimental stock preservation system. An on-going system sees that both prophylactic and curative treatment is done auspicious and sufficiently. Grain in storage is consistently graded, disinfected,fumigated and aerated by qualified and experienced personnel.
- FCI's testing laboratories spread across the country for effective monitoring of quality of foodgrains providing quality assurance as per PFA leading improved satisfaction level in producers (farmers) and customers (consumers).
- The conservation of foodgrain begins, the moment it lands in the godowns. The sacks themselves are kept on wooden crater/poly beds to maintain a strategic distance from dampness on contact with the floor. Further till the packs are dispatched/issued, fumigation to counteract infestation and so on of stocks is done on a normal like clockwork with MALATHION and once in three months with DELTAMETHRIN and so forth. on hints of infestation, remedial treatment is finished with Al. PHOSPHIDE

Table No. 5.4 Status of FCI Lab

FCI's testing laboratories spread across the country (188) ensure that the stored foodgrains retain their essential nutritional qualities as per FAQ.			
Central Lab	Zonal Labs	Regional Labs	District Labs
1	5	18	164

WDRA (Warehousing Development and Regulation Act)

It is established under warehousing development and regulation act 2007. Under this act, all the warehouses (public or private) issuing negotiable warehouse receipts are to be registered under WDRA. The warehouses shall be inspected in all respects for accreditation and subsequently by the authority. The accredited warehouses shall follow the rules and regulations framed under the act by the authority**.**

Requirements for registration of warehouses

The warehouse should be built according to Bureau of Indian Standards (BIS)/FCI/CWC details. The stockrooms ought to be stockpiling commendable for distinctive goods to be put away. The warehouse should be outfitted with all important hardware/protection for measuring, taking care of, examining, evaluating, putting out fires and buginsect management. The warehouse should have positive networth ensured by a Chartered Accountant or credit value declaration from a booked bank for individual warehouse or for its association.. The warehouses should have well trained human resource with expertise and knowledge for the scientific storage of goods to be stored in the warehouses. The warehouses should have effective fire fighting and security arrangements.

Advantages of registered warehouse

NWR will provide competitive all India market to all stakeholders, for getting the best prices. Assured quality and quantity to the consumer. That will provide more comfort to the bankers due to uniformity in the format which has been finalised in consultation with Indian Bankers Association (IBA).

Transport Management

- The foodgrians are transported from the surplus states to the shortfall states. Ensuring accessibility to food in a nation of India's size is a gigantic undertaking.
- The foodgrains surplus is for the most part kept toward the northern states, transportation includes long distance through out the nation. stocks obtained in the business sectors and buy focuses is initially gathered in the closest terminal and from that point dispatched to the beneficiary states inside of a constrained time.
- FCI moves around 270 lakh tones of foodgrians over a average distance of 1500 km

.**Movement**

- Regularly rice and wheat obtained in the Northern States is moved to far flung corners Imphal, Manipur or Kanyakumari in Tamnilnadu and to the higher scopes of the Himalayas in the North.
- An normal of 1,20,0000 sacks (50 Kg) of foodgrains are transported each day from the producing States to the consuming territories, by rail, street and so forth..
- The stocks to Kashmir valley, H.P, NE, Sikkim and so forth., which don't have rail connection, are transported through roads.
- Thus by successful arranging and Management of the transport System FCI routinely moves foodgrain and sugar from the producing Region to the concerning region.

The national target of development with social equity and dynamic changes in the expectations for everyday comforts of the populace make it basic to guarantee that foodgrain is made accessible at sensible costs.

- Public Distribution of foodgrains has dependably been an essential part of India's overall food policy. It has been advanced to achieve the urban and also the rustic populace keeping in mind the end goal to shield the purchasers from the fluctuating and heightening value disorder..

- Continuous accessibility of foodgrain is guaranteed through around 4.5 lakhs reasonable cost shops spread all through the nation.
- A consistent accessibility of foodgrains at fixed price is guaranteed which is lower than real expenses because of Govt. approach providing subsidy that absorbs a part of the economic cost (about 45%).
    - **a)** The Govt. of India presented a plan called Targeted Public Distribution Scheme (TPDS) successful from June, 1997. The stocks are issued under this plan in the accompanying two classes
    - **b)** Below Poverty Line (BPL): Determination of the families under this class in different states depends on the suggestion of the Planning Commission. A fixed amount of 35 Kg. foodgrains per family every month is issued under this class. The stocks are issued at very highly subsidized price of Rs.4.15 per Kg. of wheat and Rs. 5.65 for each Kg. of rice. Antyodaya Anna Yojna - During the year 2000-2001 Govt. of India chose to discharge foodgrains under Antyodaya Anna Yojna. Under this plan the poorest strata of populace out of prior distinguished BPL population is secured. Foodgrains are being given to 1.5 crores poorest of the poor families out of the BPL families at exceptionally financed rates of Rs.2/ - per kg. of wheat and Rs.3/ - per kg. of rice by FCI. This is the greatest food security scheme of the world.
    - **c)** Above Poverty Line **(APL)** – Families which are not covered under BPL are placed under this category. The stocks are issued at Central Issue Price of Rs. 6.10 per Kg. of wheat and Rs. 8.30 per Kg. of rice.

Distribution of Foodgrains

5.4 Welfare schemes of the Govt. of India:

(1)Mid-Day-Meal-Scheme (MDM)- The Govt. of India have presented MDM – National Program of Nutrition Support to Primary Education in Primary Schools w.e.f. 15.8.1995. Under the plan each type is entitled for 3 Kgs. of wheat/rice every month @ 100 Grams.

The Scheme is somewhat keep running by Govt./Aided Schools/Local Bodies to serve free cooked/prepared hot feast. FCI is supplying foodgrains free of cost to the State/UTs. This plan is somewhat financed by Ministry of HR

(2)PDS (public distribution system) is a food security framework. Set up by the GOI under MCA, Food, and public circulation and manged mutually with state governments in India,it conveys subsized sustenance a non-food iteams to India's poor..major commodities distributed incorporate staple foodgrains, for example, wheat, rice, sugar, and kerosene, through a system of public distribution shop shops, otherwise called ration shops built up in a few states over the country.FCI an government owned organization, procures and maintains the public distribution system.

(3) **Wheat Based Nutrition Programme (WBNP)** - A scheme run by Department of Women and Child Development, Ministry of HRD for providing nutritious food to children below 6 years of age and expectant/lactating women. Foodgrains supplied by FCI at BPL rates.

(4**)SC/ST/OBC Hostels & Welfare Institutions & Hostels**The Ministry of CAF&PD and the Ministry of Social equity and Empowerment direction to screen of the Scheme for giving foodgrains to SC/ST/OBC Hostels. Hostels having students belonging to SC/ST/OBC classes are qualified to draw 15 Kgs. Foodgrains per occupant every month.

The Government of India chose that w.e.f. 2.11.2000 foodgrains (wheat/rice) will likewise be distributed to the state Governments at the rate of 5 Kg for every head every month for needy individuals living in Welfare Institutions, for example, Bum Homes, Home for Nari Niketan and so on supported by the State Govts. what's more, the concerned organization. Foodgrains are supplied by FCI at BPL rates. It might be elucidated that from the year 2002-03, the MOCAF&PD has been making the necessity of the State/UT under the head "Welfare Institutions and Hostels" to meet the prerequisite of the State/UT for giving foodgrains to diverse kind of welfare foundations. Since April 2005, the Ministry of CAF &PD has upgraded quantity of assignment under this plan to 5% of the month to month portion made under BPL and AAY.

(**5) Annapurna Scheme**Indigent Senior Citizens of 65 years old or above qualified for National Old Age Pension under NOAPS, however not getting benefits can get 10 Kgs of foodgrains every month. FCI is issuing foodgrains under this plan to State/UT Govts. at BPL rates.

Under this plan of Ministry of Social Justice and Empowerment, Indigent individuals living in Welfare establishments like Beggar Homes, Orphanages, Nari Niketans and so on are given 15 kgs of foodgrains per individual every month. Foodgrains are supplied by FCI at BPL rates.

(6)Special Component of Sampoorna Gramin Rozgar Yojna - Under the Special part of the SGRY financed by Ministry of Rural Development for enlarging sustenance security through extra wage livelihood during natural disaster. FCI discharge foodgrains free of expense to the State/UTs.

(**7) Sampoorna Gramin Rozgar Yojana**A plan financially supported by Ministry of Rural Development in which foodgrains are supplied to the States/UTs by FCI free of expense.

(8)**Foodgrains to Adolescent Girls -** Pregnant and Lactating Mothers (AGPLM). GOI presented this Scheme w.e.f January, 2003. Under this plan foodgrains is being supplied by FCI at BPL costs to the State/UT Govt. for Adolescent Girls,

Pregnant and Lactating Mothers (AGPLM). The distinguished under nourished women/girl is give 6 Kg. of foodgrains (wheat/rice)/month. The plan is somewhat supported by Planning Commission.

(**9) World Food Programme (WFP) -** FCI is sparing stocks to WFP projects from the Central Pool stocks as and when required by them. FCI is working as 'FOOD BANK' for World Food Programme (WFP) projects in India. When India was deficit of foodgrains, WFP used to get stocks to meet the deficiency through import.

(10) Emergency Feeding Programme : Under this plan, Ministry of CAF and PD discharges allotment of rice at BPL rates, for KBK Districts (Bolangir, Kalahandi, Koraput, Malakangiri, Nabarangpur, Naupada, Rayagada and Sonepur) of Orissa State on monthly basis. Under this plan, rice @ 6 kg/recipient/month is issued for 2 lakh recipients. This project is said by Ministry of Social, Justice and Empowerment at Central level**.**

(12)Gramin bhandaran yojana:- fundamental targets of plan incorporate production of exploratory stockpiling limit with partnered offices in rustic ranges. under the plan, the business person will be allowed to build godown at wherever, according to his/her business judgment with the exception of the confinement that it would be outside the points of confinement of metropolitan partnership region. Country godowns built in the sustenance parks advanced by the ministry of food processing industries shall also be eligible under the scheme for assistance.

(13) Grain Bank - this plan gives Grants to foundation of town Grain Bank to anticipate passings of Schedule Tribes extraordinarily youngsters in remote and in reverse tribal towns confronting or liable to face starvation furthermore to enhance dietary benchmarks. The plan gives assets to building storage, obtainment of weights and measures and for the buy of beginning supply of one quintal of foodgrains of neighborhood assortment for every gang. The distribution of foodgrains was made by the GOI, Ministry of Tribal Affairs . Under this plan foodgrains are assigned to States at BPL rate. Designation under this plan has not been received from the year 2003-2004.

(14) National Food for Work Programme - this project has been propelled by the Prime Minister amid November 2004 for giving foodgrains in recognized 150 most in reverse areas of the nation. Foodgrains is given as a component of wages under the plan to the provincial poor at the rate of 5 kg. per man day. More than 5 kg foodgrains can be given to the workers under this project in extraordinary cases subject to at least 25% of wages to be paid in real money. Under this system foodgrains are issued to states/UTs free of expense. This plan is guided by Ministry of Rural Development.

Stock Management

- The central pool stock is maintained by FCI, state govts. and their agencies
- The total stock in central pool as on 31/12/2012 is 354.16 (figs. In lakh MT)

Table No. 5.5 storage capacity for central pool stocks

	Storage capacity for central pool stocks(in lakhs tones)									
State	**Covered**			**Covered and plinth (CAP)**			**Total Storage Capacity with state agencies**			**Grand total (FCI+States)**
	Owned	**Hired**	**Total (covered)**	**Owned**	**Hired**	**Total (FCI)**	**Covered**	**CAP**	**Total**	
Rajasthan	**7.06**	**8.76**	**15.82**	**1.85**	**4.08**	**21.75**	**0**	**0**	**0**	**21.75**
Source: *FCI (Rajasthan)*										

Table No. 5.6 Cold storage status

Statewise distribution of cold storage		
State	**Total no.**	**Total capacity in MT's**
	No.	**capacity**
Rajasthan	**132**	**404585**

Source : FCI (Rajasthan)

5.5 Preservation practice

Physical maintenance:

- Infrastructure
- Ventillation
- Cleanliness & hygiene

Chemical treatment:

- Prophylactic (disinfestation)
- Curative (fumigation)

Monitoring& inspection :

- Fortnightly
- Monthly
- Quarterly

Mechanical installation:

- Light traps.
- Heating system.

Biological measures:

- Predators.
- Parasitoids

Factors affecting storage loss/ gain

- Type of godown.
- Commodity
- Type of packaging.
- Moisture content.
- Mode of weighment
- Period of storage
- Condition of stock at the time of receipt.

- Quality control measures.
- Type of dunnage.
- Damage of stocks due to birds, rodents, fire,flood, etc.

Shelling of grain

Stripping of grain from the cob is known as shelling. Misfortunes happen wherever mechanical shelling is not trailed by hand-stripping of the grains staying on the cob. Certain shellers harm the grain, making insect penetration simpler and consequent storage losses higher.

Threshing

losses happen during sifting by spillage, by inadequate expulsion of grain from stalk, or by harm to grain amid sifting. They additionally happen in the wake of sifting because of poor division of grain during cleaning or winnowing. Inadequate stripping as a rule happens in areas of moderately high work cost at harvest time, where the technique for sifting abandons some grain unthreshed however work is excessively costly, making it impossible to justify hand-stripping. workers are observed that grains were lost by falling outside the sifting tub. Certain mechanical threshers have cleaning hardware intended for dry grain. On the off chance that the sifting floor is sloppy or broke, grain will be lost. There can be an increment in split and broken grains after combined harvesting.

Cleaning and Winnowing

Cleaning is standard before processing. At the home, hand-cleaning is a blend of hand winnowing with hand evacuation (eg, of stones); losses can be low when carefully done or high when siftings are permitted to scramble on the ground or winnowing finished with the same result. With rightequipment , losses should be low in factories, however gear undersized for the amount of incidental material, for example, soil(mud), will bring about lossess of grain by evacuation with the

mud/soil or by the mud being conveyed forward into the processing stages. losses appraisal is troublesome as losses are typically low; high losses are spotted by operators and the superfluous matter is recleaned.

Drying

Two losses are habitually brought about by drying: evacuation of grain and divides of grain from the drying framework, and harm to the grain leading to loss. Grain which is dried in yards, on distribution center floors, or on streets will be halfway consumed by winged creatures and rodents. Twist, either common or from passing vehicles on account of road drying, will clear some grain out. Although next to no grain is uprooted on vehicle tires, harm by vehicles might bring about ensuing losses. Mechanical dryers might bring about harm prompting evacuation of parts of the grain, (for example, wheat) from the system either in the wind current or in consequent cleaning operations. The essential loss element happening during drying is brought about by part splitting ("checking") of grains, for example, rice, which are eaten entirety. Typically the best harm happens through re-wetting which happens when grains of distinctive dampness substance are blended in a dryer, and when downpour or dew re-wets grain in a yard. The harm is showed as broken grains amid processing, particularly in the polishers.

Primary Processing (Milling)

This incorporates all handling operations did on grain in the home or mill, for example, cleaning, parboiling, hulling, de-branning, grinding, and separating. Secondary processing (cooking, baking, fermenting, extruding) is barred; such losses as happen are typically unavoidable, being natural for the procedure and preventable just by a change of process more a subject for the humanist than technologist. In the home and small mill, grain preparing is successfully a group process in which generally little amounts of grain are handled by one or more operations and the item gathered, then united available to be purchased or other handling.

In substantial mills, the procedures are constant and loss estimation is performed occasionally by testing product streams.

Grinding

In a few procedures, for example, wheat processing, evacuation of a palatable piece of the grain, eg, the germ, is ponder and sought by the purchaser. Whether this is a loss relies on upon the terms of a specific study. On the other hand, mechanical losses of craved ground items much of the time happen, regularly brought about by maloperation of the procedure or worn hardware. Normal procedures are beating in a

mortar, crushing between stones or toothed steel plates, and the mind boggling Hungarian framework for processing wheat into flour.

Separation

Whether the partition of consumable from less craved items is done in the home (eg, winnowing structures and grain from rice) or plant (eg, sieving flour from wheat), complete division is infrequently accomplished. With rice, it is hard to particular the all the more finely broken grains from grain, and with wheat, flour holds fast to wheat and uncommon gear is utilized to evacuate the greater part of this as flour.

Nonuniformity

Preparing of blends that are nonuniform on account of such components as hardness and delicateness of grains, size (length, stoutness, and so on.), and dampness content contrast is itself a reason for losses.

Capacity of item and by items for off-season use is regular need. Capacity to store logically without over the top losses empowers agriculturists to arrange with strengths of promoting at better costs. By capacity and off-season deal, 20-half a greater amount of the cost can be earned. Failure of the agriculturists to store their

produce and never-ending obligation forces them to offer their produce not long after harvest when business sector costs are for the most part low, bringing about monetary losses. Enhanced homestead stockpiling and rustic exploratory stockpiling systems can be of awesome help to producers for better pay. For capacity, ranchers for the most part utilized mud-containers and godown sort capacity structures prior. Use of mud - containers brought about substantial losses of grain in amount and also 10 quality because of impact of dampness and bugs. R and D chip away at safe stockpiling of sustenance grains at homestead level was started by the IGSI, Hapur; CFTRI, Mysore; IIT, Kharagpur; CIAE, Bhopal; Rajasthan Agricultural University (RAU), Udaipur;PKKV, Akola; TNALL, Combatore and PAU, Ludhiana. Metal bins designed by IGSI, Hapur have gained considerable popularity among farmer. Silo type structures and scientifically designed warehouse /storage has replaced traditional godown type structures.

5.6 Storage & transit losses

- The capacity of nourishment grains has been an age long practice with cultivators and traders. More bug free storage is required for taking care of products at harvest time and to persist saves from year to year. Significant losses both in quality and amount of nourishment grains occur away because of various components. Life forms specifically in charge of creating losses in put away items are insects, parasites, rodents, organisms and microscopic organism

Among them, insects and mites are the most important hazards to the safe storage of grains. The insects that attack stored grains are rather general feeders, but some of them prefer certain grains. It is estimated that 5-10 per cent of the stored grain is lost every year

Storage losses:

Storage loss is uncovered as and when the stock of food grains in a stack is totally issued or cleared and speaks to the contrast between the stock equalization according to books and physical stock issued.

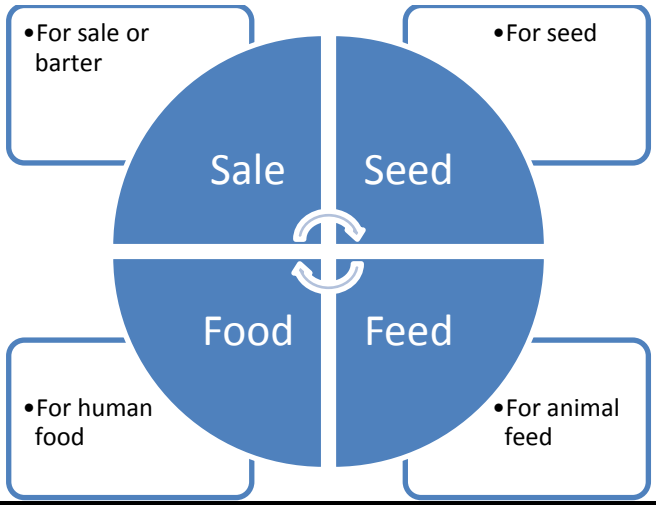
Wastage in Agricultural Commodities

A. Wastage Farmer/ VLA Level Crop Damage Techniques	1. Improper Harvesting
	2. Poor Packaging
	3. Poor Transportation
B. Wholesaler/ Semi Moisture Loss Poor Handling	1. Wholesaler Level
	2. Poor Transportation
	3. Multiple handling
	4. Storage
	5. Grading sorting by retailers
C. Retailer Level Poor handling	1. Poor Transportation
	2. Handling by customers
	3. Moisture Loss

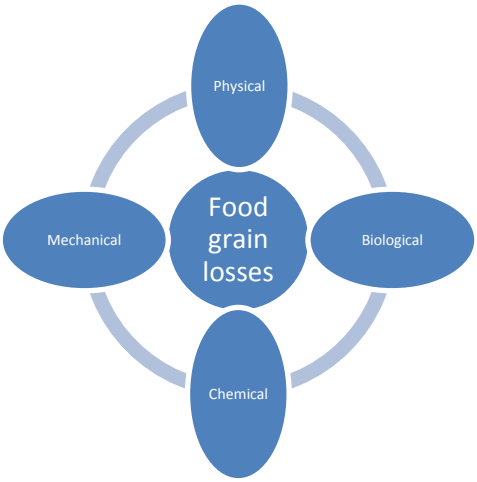
Dr. V. C. Panse committee

Various assessments of losses of foodgrains during post harvest operations have been made. The Govt. of India had constituted a council for the appraisal of storage losses in 1966 under the chairmanship of Dr. V. C. Panse. As per the interval report of the board of trustees, the post-harvest losses have been assessed about 9.33%.

The Break-up is as under:-



During storage the food grains deteriote due to the following factors



Mechanical	Physical	Biological	Chemical
•Mode of storage & handling •mode of preservation	•Temperature •Relative Humidity/Moisture	•Rodents •Insects •Birds	•Breakdownof producce •Pesticides

Great storage are vital to the farmers everywhere throughout the world. They guarantee family and group sustenance security until the following harvest and things available to be purchased can be kept down so farmers can abstain from being compelled to offer at low costs in the overabundance that regularly takes after a harvest. In spite of the fact that significant losses happen in the field, both before and during harvest, the best losses are seen during storage.

1. Loss in quantity: Losses of the food grains as far as weight are quantitative losses.Insects, rodents, birds etc feeds on the item bringing about weight reduction. These weight losses are not generally clear. For instance, a few bugs eat just the focuses of grain portions along these lines, despite the fact that the volume of grain may seem to continue as before, there can be extensive weight reduction.

2. Loss in quality: losses of this sort can be wholesome, substance, through defilement with poisonous molds or foreign matter. Bugs that specifically eat a piece of the nourishment stuff, (for example, the nutritious germ of the grain) will lessen the estimation of the food stuff overall. Likewise, there is the loss of vitamins through the action of sunlight and temperature. Concoction changes are especially basic in fatty foods through the improvement of rancidity. Aflatoxin (a dangerous substance) creating molds like Aspergillus niger, can develop on numerous items which represent a long term haelth problem. As maize, coconut and peanuts are especially vulnerable, storage of these items need uncommon consideration.

Factors responsible for Storage losses:

- Most developing nations are in the tropics, regularly in territories of high rainfall and humadity. These conditions are perfect for the improvement of micro-organism and insects which cause abnormal amounts of deterioration of foodgrains in store. food losses during storage are the consequence of organic, compound or physical harm. With a specific end goal to decrease the measure of foodgrains lost, the environment in the store should be controlled in order to lower the likelihood of:

- Physical damage through crushing, breaking, etc.

Good storage thus involves controlling the factors, like temperature, moisture, light, pests and hygiene.

Transit Losses

The distinction between the dispatch weight and receipt weight speaks to the transit loss during movement of stocks starting with one centre then onto the next centre either by road or rail. The following are the reasons which add to transit losses:

(i) Pilferage and burglary enroute

(ii) Drainage of dampness during long transit

(iii) Multiple handling

(iv) Use of hooks by labour

(v) Weak texture of gunnies & bursting of bags/sacks

(vi) Spillage through wagon holes /cleavages and flap doors

(vii) Spillage and theft at transhipment points

(viii) Different modes of weighment.

(ix) Qualified said to contain RRs issued by Railways

Table 5.7: Procurement of wheat during last seven Rabi Marketing Seasons (RMS)

(Figs in lakh metric tonnes)

RMS 2006-07	RMS 2007-08	RMS 2008-9	RMS 2009-10	RMS 2010-11	RMS 2011-12	RMS 2012—13
92.36	111.28	226.89	253.82	225.25	283.34	386.67

Note: Wheat Procured by Rajasthan during RMS 2012-13 is 19.57

The above table demonstrates the obtainment of wheatduring last seven Rabi seasons. Which mirrors that in most recent seven year obtainment limit increment as well as it is according to expanded generation/yield of wheat which may proceed in future for which the acquisition limit additionally required to be increase.

Table 5.8: Procurement of Rice during the last eight Kharif Marketing Seasons (KMS)

(**Figs in lakh metric tonnes**)

KMS 2004-05	KMS 2005-06	KMS 2006-07	KMS 2007-08	KMS 2008-09	KMS 2009-10	KMS 20010-11	KMS 20011-12
246.85	276.56	251.07	284.91	336.83	320.00	341.97	344.63

The above table demonstrates the acquirement of Rice during most recent seven years Kharif seasons.Which mirrors that in last seven not acquisition limit increment but rather it is according to expanded creation/yield of Rice which may proceed in future for which the obtainment limit likewise required to be increase.

5.7 Status of cold storage facilities in Rajasthan:

Rajasthan has around 89 working cold storages. A large portion of the cold storages are worked by private gatherings while a couple of the cold storage being worked by cooperatives. The greatest no. (32) of cold storages are in no time working in Jaipur distt, while in Barmer distt, one and only cold storage is accessible for cultivating group. Different things like coriander seed being put away in Ram Ganj Mandi cold storage orange are for the most part put away in Bhawani distt while in Kota and Udaipur distt predominantly Karyana and potato are put away.

Sample area wise there storage status

Kota

Kota is also one of the important district with area of 54806 sq. k.m. and population of 2 lakh. Wheat, Gram, Potato, Mango, Guava, Lime, Jamun, Papaya, Orange, Berand Mausami are main crop grown in the district. The total cold storage capacity at present in the district is 13114 MT. with 5 number of cold storages. Mainly private cold stroage are meant for multipurpose are available in the district.

The arrival of commodities in the district are as follows:

S.No	Commodity	Arrival (Qtls)
1	Spices	1398641
2	Gur	18861
3	Sugar	253848
4	Desighee	2113
5	Potato	3158
6	Mehandi	3074
7	Garlic	2476
8	Guar	10124
9	Dhania	717551

Dausa

The city of Dausa is situated in the north-eastern region of Rajasthan, a region widely known as Dhundhar it was ruled by Bargujars. It is one of the 7 Districts of Jaipur division and is surrounded by Jaipur, Alwar, Sawai Madhopur, Karauli, Bharatpur and Tonk. The total area is 3404.78 km2 in roughly C shape tampering towards east and west at corners. The soil of the district is yellowish to dark brown dominantly fine textured, generally suitable for all type of crops

JAIPUR

It is an important historical city. Jaipur is the capital of Rajasthan. It is a district having largest cold storage capacity in the Rajasthan. Out of 89 cold storages in Rajasthan this district has 32 cold storages for 122340 MT. capacity Area of Jaipur district is 11,1178 with the population of 47 lakh. Barely Jawar, Potato, Mango, Guava, Lime, Pomegranate, Amla. Mausmi and Date Palm are main crops grown in Jaipur district. As per the data available the arrival of the commodities in the district are as follows:

Table No. 5.9 Commodity Arrival (Qtls)

S.No.	commodity	Quantity
1	Spices	181471
2	Gur	422806
3	Sugar	1236805
4	Khand	95067
5	Desighee	142265
6	Garlic	92
7	Guar	75831
8	Tomato	272669
9	Cillies	186655
10	Onion	411424
11	Potato	1938744
12	Banana	722124
13	Apple	40736
14	Orange	113911
15	Chiku	189727
16	Mosambi	189727
17	Grapes	28083
18	Avanash	256583
19	Guava	135423
20	Mango	244877

Source: *Rajasthan Agriculture Department 2012-13*

Data shows that Jaipur has more than sufficient numbers of the cold storages in the district.

ALWAR

Alwar is one of important district of Rajasthan with the population of 2286701 lakh. At present this district has three cold storages with a capacity of appx. 4648.00 MT. Potato, Gram and pulses are mainly grown in Alwar district. As per the record of 2011-2012 the agricultural and allied produce arrivals of these commodities in the Alwar district are as follows: -

Table No. 5.10 Commodity Arrival (Qtls)

S.No.	Commodity	Quantity
1.	F & V	730633
2.	Gur	395754
3.	Kapas	54054
4.	Sugar	98891
5.	Desighee	10511
6.	Gwar	87917
7.	Spices	6259

As per the records the study observes that there is good scope for new cold storage in this district. It will be beneficial for the district farmer/traders.

BHARATPUR

The population of Bharatpur district is 16 Lakhs. Bharatpur is second largest district of Rajasthan in terms of cold storage capacity. Out of 89 functioning cold storages in Rajasthan, this district has 13 cold storages of 52535MT. capacity. Potato is mainly stored in cold storage. In Bharatpur district mainly Wheat, Berley, Sugarecane, Mango, Guava, Lime, Papaya & Ber are grown,. The main commodities arrival in the district are as follows :

Table No. 5.11 Commodity Arrival (Qtls)

S.No.	Commodity	Quantity
1	Spices	3730
2	Gur	24571
3	Sugar	187108
4	Khand	9546
5	F & V	193907
6	Guar	16817

As per the data, Bharatpur has enough cold storage capacity. While surrounding districts like, Mathura in U.P and Dholpur, Dosa in Rajasthan have more than sufficient, cold storage capacity for storing the agricultural produce. All the functioning cold storages are belong to private sector.

5.8 Summary

In the above written Chapter of the study the researcher tried to discuss the role of storage facility in post harvest losses for which the researcher describes the various stages of storage and factors responsible of Storage & transit losses. With the help of diagrams and models tried to explain the channels and factors involve in the storage. And in the last this study briefies about cold storage facility of Rajasthan with its studied district status of requirement and production of various commodity.

Chapter 6

Analysis of the logistics Management in Food Grains

Chapter -6 Analysis of the logistics Management in Foodgrains

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This is a vital part of this study in which the researcher clarify about the logistics management of foodgrains. For which analyst draws the reasonable structure of post harvest food Management . And after that with the assistance of information gathered through Questionnaire from agriculturists and middle people, which he showed through bar graphs, pie charts and table. For the interpretation of data a few econometrics tools are utilized, for example, mean,t-test, The Breusch-Pagan regression model and so on to get the loss of foodgrains in this research area.

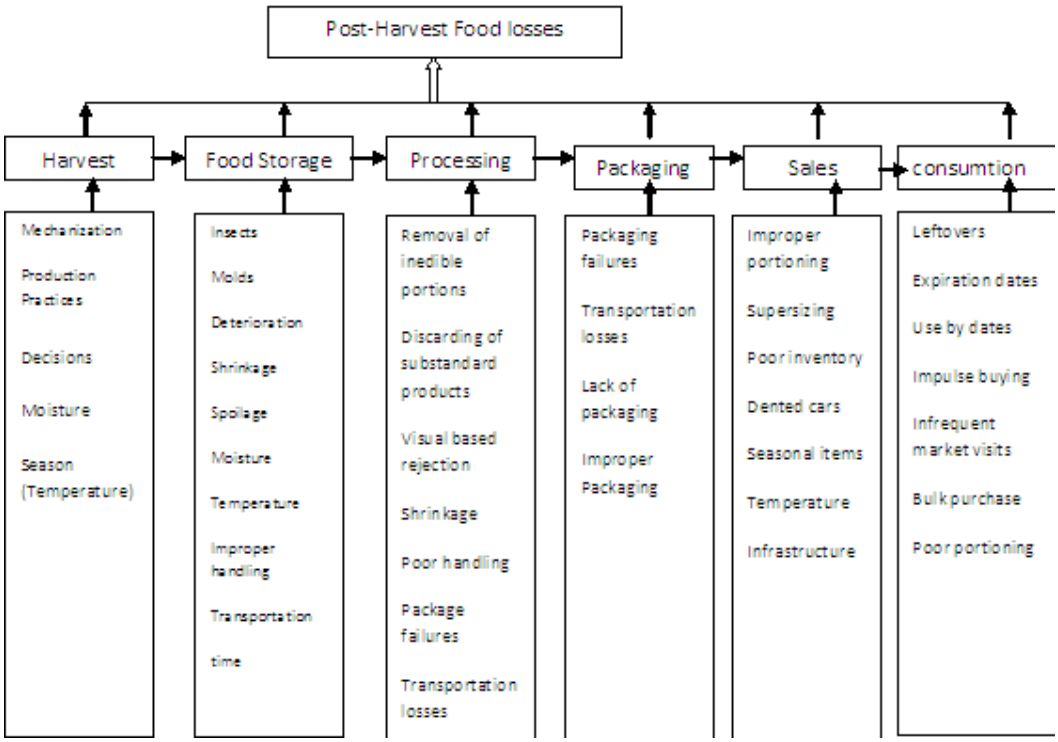
6.1 Introduction of Post Harvest Losses in Foodgrains

Food losses in developed nations happen fundamentally at the purchaser level, although a few losses happen on the fields or at different phases of the supply chaun. Field losses happen as a result of agriculturists' choices to do without reaping because of extreme business sector benchmarks. Losses in developing nations, conversely, happen generally during the field-to-market stages, with the littlest share of losses happening at the buyer level. The United Nations predicts that 1.3 billion tons of food is lost all around consistently (Gustavsson et. al, 2011). Food losses in Europe and America range from 280-300 kgs/year, and are around 120-170 kgs/year in Sub-Saharan Africa and South/Southeast Asia (Gustavasson et. al., 2011). With the present world population anticipated that would reach 10.5 billion by 2050, this food loss, if managed and prevented, can feed future generation. These losses are likely an reflection of the undeveloped

way of the farm to-retail supply chain networkUntimely reaping, poor storage, absence of infrastructure, absence of processing facilities, and inadequate market facilities cause high food losses in developing nations along the whole Food Supply Chain (FSC). Food goes along the value chain from harvest to consumption. Losses happen at every stage along the chain and contribute to PHL. The losses at every stage is driven by diverse components, illustrations of which are portrayed in figure 6.1. The relative significance of a specific stage or calculate toward adding to add up to PHL will differ crosswise over nations and products. For instance, evaluating losses for a modern, vertically incorporated production network will probably require thought of less elements than for a less coordinated inventory network where the item experiences a few exchanges before coming to the retail outlet. In this way, while the theoretical structure is the same, the genuine econometric model utilized for PHL will change.

Figure No. 6.1

Applied structure for assessing post-harvest food losses



According to the research point logistics management of food garins, it is required to comprehend the procedure of post harvest losses of food under supply chain management which begin from harvest of foodgrains to final utilization of food and to comprehend and clarify the above given figure comprehends the entire procedure and distinctive phases of foodgrains losses after harvest. So as indicated by the above drawn figure the initial step is harvesting of the foodgrains in which improper automation, production practise and moisture cause into foodgarins losses. Atthat point comes storage and in this Insects, Molds, Deterioration, Shrinkage, Spoilage, improper handling inappropriate taking care of and transporatation are the reasons for foodgrains losses. Once the foodgrians are gathered it gets for preparing and which outside materials, sub standard items, poor taking care of, lose packaging and transportation make foodgrains losses. And after that as examined insufficient packaging facilities, inefficient sales management and careless consumption design makes losses food from its food supply chain and on the off chance that it is spared then it might valuable to bolster numerous more individuals, who are kicking the bucket in light of absence of food.

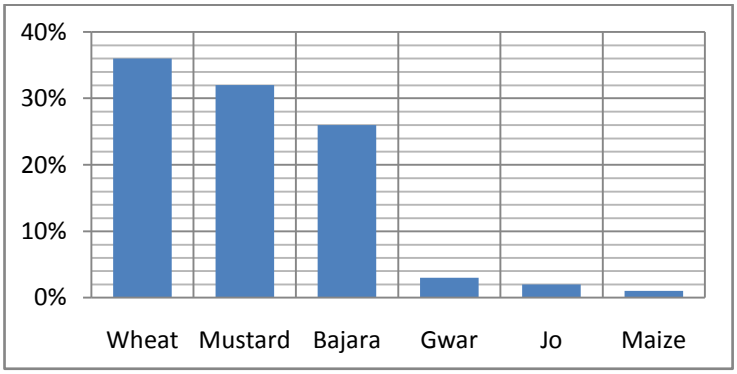
6.2 Analysis of Intermediaries

There have been an aggregate of 62 intermediaries who were interviewed in the connection however because of incomplete and uncertain responses just 50 were chosen. The greater part of them are maintaining this business as their guardian and grandparent had begun and was included in this business since ages. However just few of them are new as this area has seen development in economy and few of them have the cash and equipped with sufficient knowledge to do this business. The question wise analysis is given underneath:

1. Food grain handled: Based on the responses it has been observed that the majority of the farmers grow two yields in a year (Rabi and Kharfi) notwithstanding they have cultivated a combination of different crops at one time. for instance if an agriculturist has 10 acre of land of area then 5 acre of land will be utilized for wheat, 3 sections of land for onion

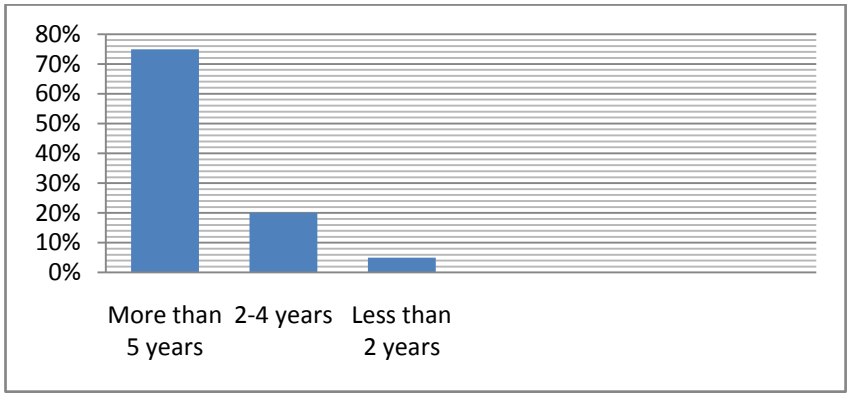
and the vast majority of 2 acre of land for different grains. This leads the researcher a conclusion that there are more than 5 crops in which an Adhtiya (agent/stockiest/middle person/intermediary) deals in one season or would be managing in 10 crops in a years' chance. Adhitya(broker/stockiest/intermediary) predominantly manages three harvests (wheat, bajara and mustard).In terms of percentage, major food crops in which Adhtiya (merchant/stockiest/middle person) deals are Wheat 36%,Mustard 32% and Bajara 26%. The graphical representation of analysis is as under:

Figure 6.2 Food grain handled



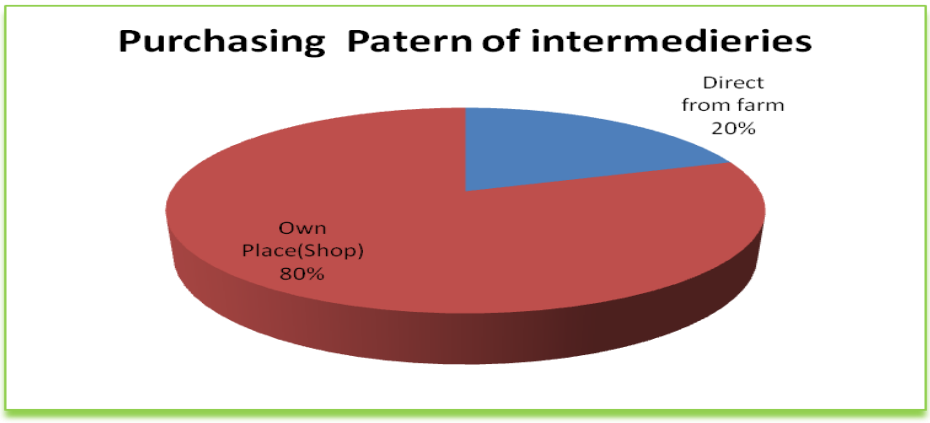
2. As Per the data given by the respondents of different classifications in the Questionnaire. It has been found that there are about 75% of respondent intermediaries are engaged in this business for over 5 years, 20% of intermediaries are operating with an experience of 2-4 years and remaining have an experience of under 2 year in this specific business.

Figure No. 6.3 Experience. Of Intermediaries



3. Researcher has observed that just 20% of intermediaries buy produce of farmers straightforwardly from their farms under contract cultivating (it is an agreement between the intermediaries and agriculturist against the bases of cash loaned for cultivating) by utilizing their own particular transports and rest of them purchase the grains at their place (shop) in anaj mandi.

Figure No. 6.4 Purchasing Pattern of intermediaries



3. Following data have been revealed by survey of 50 intermediaries.

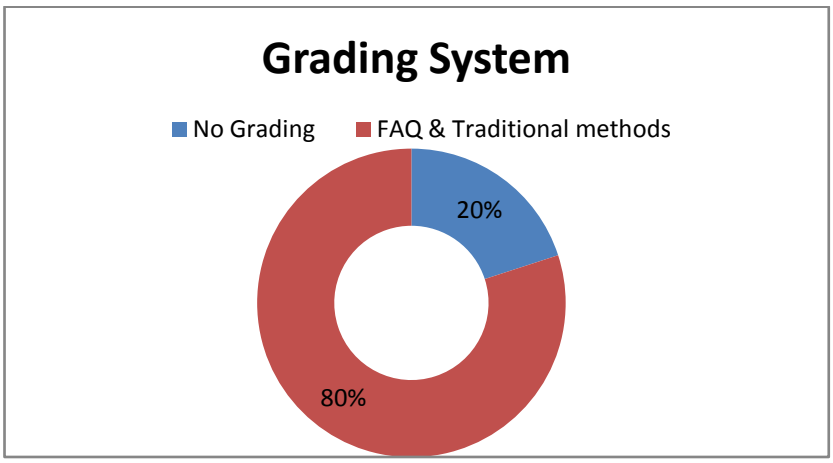
Table No. 6.1 Facilities provided by Intermediaries

S.NO	Particulars	% of facilities provided by the intermediaries to the respondent
1	Supply of credit	45
2	Supply of Fertilizer	20
3	Supply of Seeds	10
4	Supply of Pesticides	20
5	Procuring at the farmer door step	15
6	Provides the transport facility	15
7	Packaging activities	5
8	Grading activity	15
9	Advisory role	12
10	Storage activities	3

3. The table 6.1 gives that farmers gets different facilities from the intermediaries, for example, supply of pesticides, seeds ,fertilizers and among all the most prevailing facility is supply of credits. It offers the farmers to get the short term assistance with financing It was likewise observed that farmers get helps for packaging , transportation and storage by mediators(intermediaries) which helps in lessening the food grain wastage(loss).Intermediaries additionally play a advisory role to farmers.

4. Evaluation have demonstrated to on generally accepted methods to review quality of grains, that 80% of intermediaries review the food grains under different classifications by either FAQ system or Traditional methodology rest of the 20% of intermediaries don't review the food grains at all and the majority of them are these who buy grains from farmers under contract cultivating.

Figure No. 6.5 Grading System



5. In reference of the questions regarding awareness of govt plans/Schemes which support their business. It has been found that public sector

intermediaries are very much aware about the government schemes which support logistic management of business and some of them are agree on the questionnaire's statement in light of the fact that numerous Central and State government plans/schemes are running and empower their business, for example, PDS,mid day meal, Aant uday scheme and so forth. Yet at the same time there are some private sector intermediaries, for example, Star agri ,jayanti agro who differ on the same on the grounds that according to all of them such plans/schemes keep running by the government help and support public sector intermediaries only. However there are different bodies, which support private division intermediaries for example, NABARD, WC.

6. In this section, Researcher found that there is deficient infrastructure for food grain storage and absence of cold storage .It is a result of storage of other farming items, for example, potato, onion and bumper production of a particular crop .so as indicated by the observation insufficiency percentage of storage limits fall between 10-20%. This insufficiency is satisfied by contracting other private and small godowns on rent for a specific period.

7. There are numerous owned/hired vehicles are utilized, for example, ,tractor trolly, mini tempo, truck . For transporting agriculture product, for example, wheat,bazaar,musterd and rice and so on starting with one place then onto the next. The greater part of government and private intermediiaries use hired vehicles for transportation of agriculture yield in which some are under the agreement of transportation yield from field to mandies, mandies to Warehouse.The majority of them covered the distance of 20-30 km from cultivating field to warehouse and around 5-10 km from mandies to distribution center. Furthermore, they charges around 15-20/ - Rs per sack with loading and unloading charges. Most of the intermediaries do not provide this facility to farmers. Farmers have to bring their production by their own to the intermediaries.

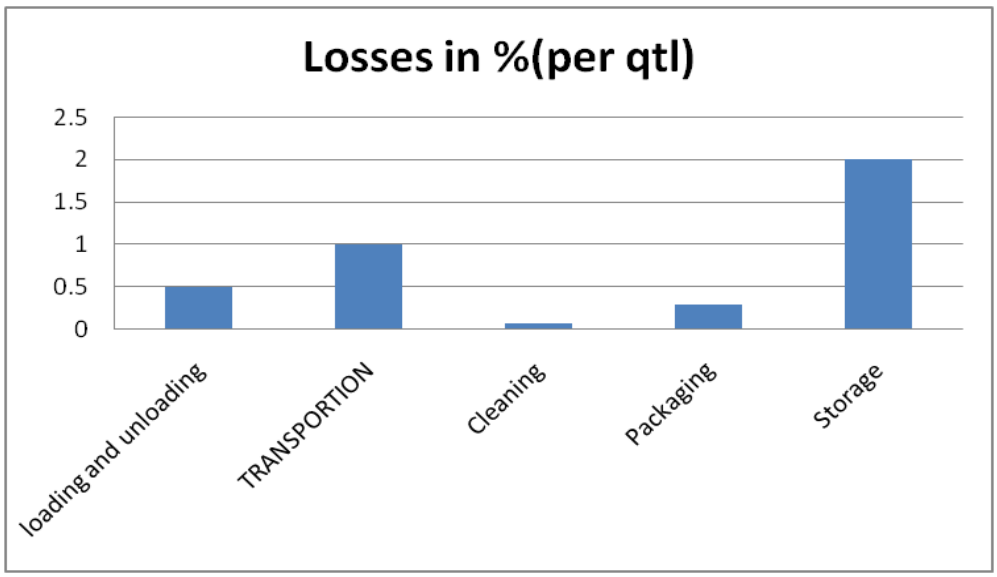
8. Physical losses about foodgrain in different activities are as follows:-

Table No. 6.2 Physical losses of foodgrians in logistics

S.No.	Activity	Losses in %
1	Loading and unloading	0.5
2	Transportion	1.0
3	Cleaning	0.075
4.	Packaging	0.3
5	Storage	2.0
	Total	3.875

The table no 6.2 clarifies the physical losses of food grains during the logistics process. It had been found that there is complete loss of 3.875% because of logistical process of grains. Out of the aggregate loss, larger part loss is because of storage facility at 2% and 1%during the transportation. While loading procedure is .5% and packaging 0.3%. In this way it can be said that there is loss of about 4% of food grain during logistical process between the farmer to intermediaries. This implies almost 4% of the toatl produce is lost at the intial stage .

Figure No. 6.6 Losses of foodgrains in logistics



9. Thus it can be said that intermediaries are providing various facilities to farmers like procurement at doorstep and credit facilities. In case of the loss during the logistics process majority loss is caused due to storage and transportation during the logistical process.

We likewise found that because of unethical weighting practices or absence of standard estimation there is 0.2% losses.

In case of wheat storage we found that there is 1% gain in weight because of moisture which comes from splashing chemicals in dissolved water to shield from organic losses and vise verse in the case of rice there is loss of 1% because of drying.

10. According to the respondent we found that issues are faced by them.which are listed according to their priority (Ranking Method)?

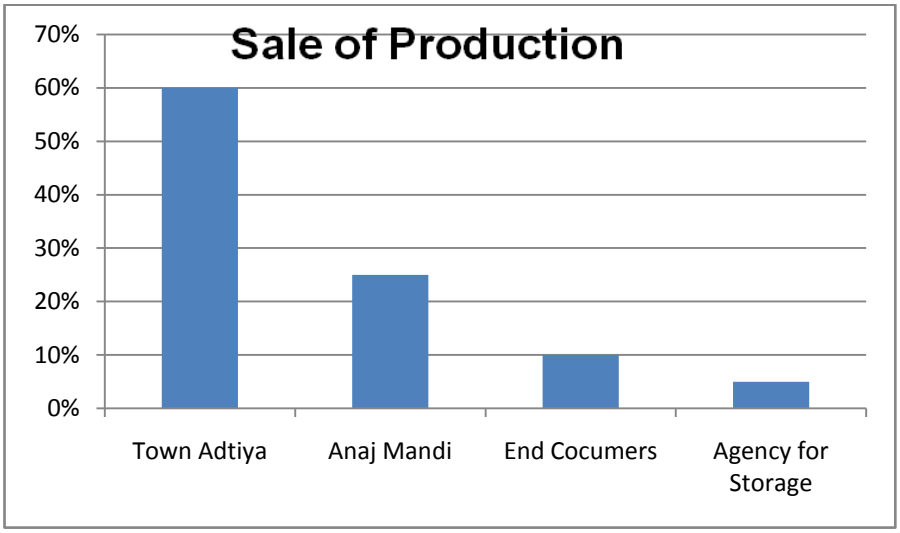
1. Lack of transporting facilities.
2. Lack of storage capacity
3. High rent charges
4. Low sale absorption capacity of market
5. Too much price fluctuation
6. Lack of market knowledge
7. High tax payment
8. High licenses fee

6.3 Analysis of Farmer

There have been total 334 farmer were interviewed however due to incomplete responses only 300 were selected. The farmers were selected based on their land holdings which were having more than five acre.

1. According to study, the researcher found that 60% of the farmer sell their produce to town's adtiya against the sum lended to them for agricultural activities along with that other reason is lack of storage facilities. 25% of farmers sell their produce at the town level or transport their produce to mandies by their own vehicals, 10% of them offer their creation to end buyers and 5% of them keep their production for storage.

Figure No. 6.7 Sale of production



4. Major crop produced in this research area are:-

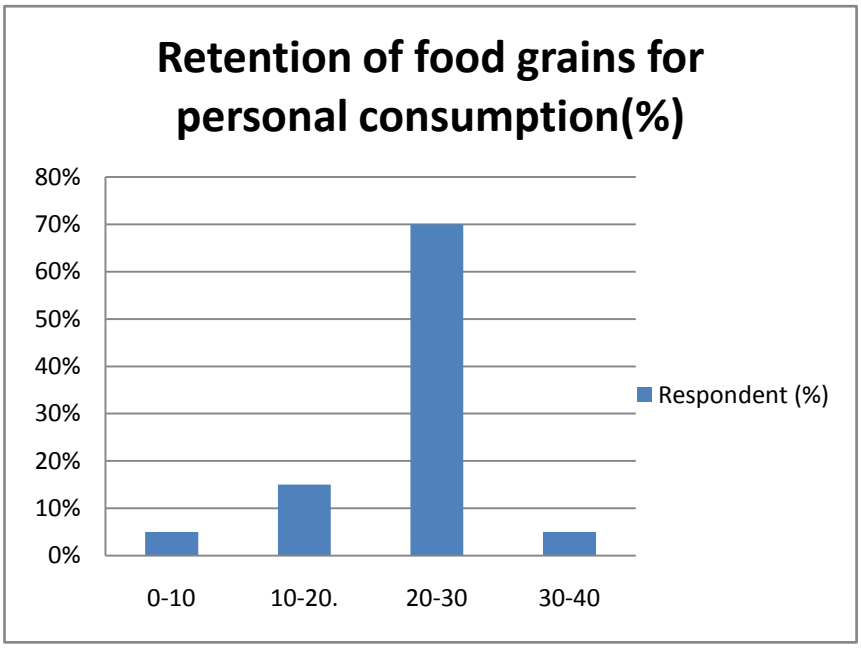
I. Wheat 10224672
II. Bajra 3957720
III. Mustrad 3756107
IV. Jwar 377805
V. Gwar 2201145

5. As per need wheat is a major food grain retained by the farmers for personal consumption. The remaining portion of farm yield is sold. In the business sector Bajra , Mustard, Gwar, Jo and numerous more other grain are hold in little amount and remaining portion of their yields are sold.

Table no. 6.3 Retention of foodgrains for personal consumption

S.No.	Retention of food grains for Personal consumption (%)	Respondent (%)
1	0-10	5
2	10-20	15
3	20-30	70
4	30-40	5
5	40-60	5

Figure no. 6.8 Retention of foodgrains



6. The study demonstrates that 0-10 % of food grains are held by 5% of agriculturists for the personal consumption.10-20 % of food grains are held by 15 % of farmers for personal utilization. Also 20-30 % of food grains by 70% and 30-40% of food grains by 5% and 40-60% of food grains is held for personal utilization by 5% of agriculturist.

7. In this research we haven't discovered any official contract farming.

8. There are major two principal crops (Rabi & kharif) are harvested in a year. In which farmer sale their production to their nearest intermediaries at its current market price.

9. Most of the farmer transports their yield through tractor, tractor trolly and mini tempo. According to the information the majority of the farmer use transportation facilities which charges 15-25/ - Rs per bag and covers 5-20 km distance from production place.

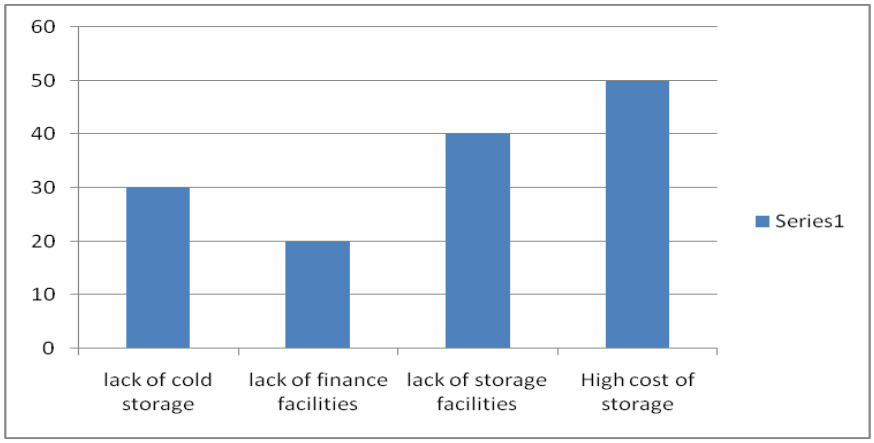
10. As per the survey, researches' found that in this area while transporting their production farmers are facing the problem of:-

    1. High transportation cost (which becomes obstacle in storage)
    2. Remoteness of sale unit
    3. Absence of proper packaging facilities.

11. As per the survey, farmers keep 0-20% of their production preserve in the warehouse, it is because of division of land into small area, lack of storage facilities, advance based farming and many other reasons.

12. According to the respondent we observe the following problems are faced by them while storing their production.

Figure No. 6.9 *Problems faced while storing the production*



11. As per the study among storage problems

(a) 50% problem is of high cost of storage,

(b) 40% problem is of lack of storage facilities,

(c) 20 % problem is of lack of finance facilities and

(d) 30 % problem is of lack of cold storage.

12. Their are different government schemes which are running and known by the farmers for encouraging agriculture but when effectiveness of these government policy/schemes for encouraging agriculture logistics management such as storage, packaging and transportation is asked they hardly agree on it.

13. As they are not aware of any schemes so they are highly disagree from the statement, which says that these schemes support in increasing their production.

Table No.6.4 Losses during logistics of agricultural production.

S.No.	Activities	Quantity of loss/quintal	
1	Transportation	Farm to warehouse 1 kg	farm to market 1.5 kg
2	Packaging*	1.5 kg	

*packaging losses figures includes various other losses of different activity such as threshing, winnowing, cleaning etc.

It has been observed there is a total loss of 2.5 kg per quintal. Out of which 1 kg is lost during farm to warehouse and 1.5 during the farm to market is lost. Further 1.5 kg is lost during the packaging. It means total 4.5% is lost during the logistical process.

6.4 Statistical analysis:

The data which was collected with the help of primary and secondary sources was tabulated with the help of statistical tools and models. These tools and models are explained below:

a. *Mean (Average):* The mean is the most powerful, and usually the most accurate and reliable, measure of central tendency. When we usually hear the word "average", what we are really thinking about is the mean. To find the mean for a set of data, we take the sum of all of the values, and divide the sum by how many values there are. The mean, or "average", is the most widely used measure of central tendency. The mean is defined technically as the sum of all the data scores divided by n (the number of scores in the distribution). In a sample, we often symbolise the mean with a letter with a line over it. If the letter is "X", then the mean is symbolised as $\overline{X}$, pronounced "X-bar." If we use the letter X to represent the variable being measured, and then symbolically, the mean is defined as-

The formula for the sample mean is $\overline{x} = \frac{\sum x}{n}$, where:

$\overline{x}$ is the mean of the sample,

$\sum x$ is the sum of all the values, and

n is the number of values in the set.

If we are looking for the mean of a population, we denote that mean by the Greek letter μ, mu. The way to calculate this mean is the same. The difference in notation is to tell a sample statistic, $\overline{x}$, from a population parameter, μ. We will always use our own alphabet when discussing a sample statistic, and the Greek alphabet to discuss a population parameter.

The formula for the population mean is $\mu = \frac{\sum x}{N}$, where

μ is the mean of the population,

$\sum x$ is the sum of all the values, and

N is the number of values in the set.

(b) Pearson's correlation

The purpose of a **Correlation Coefficient** (r) is to show the strength of a linear relationship between two variables. In other words, if you have two sets of scores: Are they related? If so, how strong is the relationship? Does one score predict the other?

R^2 can be calculated by squaring the correlation coefficient. This provides the proportion of explained variance; in other words, how much of the variation of the Y variable can be explained by variation of the X variable. In the previous example of age and visits r = -0.897 and R^2 (the proportion of explained variance) = 0.805. R^2 could be multiplied by 100 to produce the percent explained variance and we could say "80% of the variation of visits can be explained by age."

6.4.1 Econometric Tools

Analytical Model

To study the impact of different determinants involved in post harvest losses, multiple linear regression model will be used. As most of the past studies only use descriptive analysis like Ayandiji et al.,2009, Gangwar et al.,2007, Murthy et al.,2007 etc.

Only a couple of studies are conducted so far in which econometric model was used to estimate post harvest losses in fruits at producer/contractor level i.e. Bari, 2004 and Basavaraja et al., 2007. In this study we will develop three different multiple linear regression models for three different levels of post harvest losses

(farm, transportation & wholesale market and retail levels) with descriptive analysis.

The general form of the function at farm level is as follows:

$$Losses = f(X_1, X_2, X_3, X_4, X_5)$$

Where

X1 = Foodgrain production

X2= Dummy variable for Knowledge of various scheme run by government. It is equal to 1 if yes and equal to 0 for otherwise

X3= Dummy variable for warehouse- it is equal to 1 if warehouse is not adequate, 0 otherwise.

X4=Dummy variable for adequacy of transportation- 1 if it is inadequate, 0 otherwise.

X5= Dummy variable for contract farming. It is equal to 1 for contract farming, 0 otherwise

Simple regression model was used for analysis and the specific model used was

$$Production\ loss = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e$$

Where e indicates error, which satisfies all classical assumptions (by assumption)

We will use following test for diagnose purpose.

T-Test

The t-test, also known as the student t test, is a test of significance that can be used to determine whether a significant relation exists or does not exist between dependent variable and independent variable (only one variable). The null and alternative hypotheses for this type of test are:

$$H_0: \beta_i = 0$$

$$H_1: \beta_i \neq 0$$

This is a two tailed test because the Null Hypothesis does not specify a direction, only the condition of equality.

The assumptions are:

1. The data are Normal

2. The two samples come from distributions that may differ in their mean value, but not in the standard deviation

3. The observations are independent of each other.

Calculate a t-test value, and compare the value with a critical value of t. If the t value calculated from the data is equal to or larger than the critical value, you reject the Null hypothesis.

The *t*-test produces a test statistic, termed the *t*-score or *t*-ratio. This value is used to find the corresponding p-value by means of a *t*-table (see below). The *t*-ratio is

$$t = \frac{\beta_1}{SE_{\beta_1}}$$

Where SE= Standard error

Breusch-Pagan test for heteroskedasticity-

The Breusch-Pagan test assumes the error variance is a linear function of one or more variables. Suppose that the regression model is given by

$$Y_t = \beta_1 + \beta_2 X_t + \mu_t \qquad \text{for } t = 1, 2, \ldots, n$$

We postulate that all of the assumptions of classical linear regression model are satisfied, except for the assumption of constant error variance. Instead we assume the error variance is non-constant. We can write this assumption as follows

$$\text{Var}(\mu_t) = E(\mu_t^2) = \sigma_t^2 \qquad \text{for } t = 1, 2, \ldots, n$$

Suppose that we assume that the error variance is related to the explanatory variable X_t. The Breusch-Pagan test assumes that the error variance is a linear function of X_t. We can write this as follows.

$$\sigma_t^2 = \alpha_1 + \alpha_2 X_t \qquad \text{for } t = 1, 2, \ldots, n$$

The null-hypothesis of constant error variance (no heteroscedasticity) can be expressed as the following restriction on the parameters of the heteroscedasticity equation

$$H_o: \alpha_2 = 0$$

$$H_1: \alpha_2 \neq 0$$

To test the null-hypothesis of constant error variance (no heteroscedasticity), we can use a Lagrange multiplier test. This follows a chi-square distribution with degrees of freedom equal to the number of restrictions you are testing.

RESET test- The Ramsey Regression Equation Specification Error Test (RESET) test (Ramsey, 1969) is a general specification test for the linear regression model. More specifically, it tests whether non-linear combinations of the fitted values help explain the response variable. The intuition behind the test is that if non-linear combinations of the explanatory variables have any power in explaining the response variable, the model is mis-specified. The test employed is a test of *linear* specification against a *non-linear* specification.

The form of the test used may be illustrated as follows.

Suppose the model first estimated is:

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_{2i} + \hat{\beta}_{3i} X_{3i} \qquad \text{i=1, 2, … N}$$

[this is the regression estimate with the estimated coefficients].

The Reset test proceeds by estimating,

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_{2i} + \hat{\beta}_{3i} X_{3i} + \gamma \hat{Y}_i^2$$

So, two regressions are estimated where the latter is the former with squared fitted values obtained from the first regression. Note that the squared fitted values introduces the non-linearity into the specification.

We will test for *functional form* with an **F test**.

The **null hypothesis** is that **the correct specification is linear.**

The alternative hypothesis is the correct specification is **non-linear.**

We form the F test statistics as:

$$F_{(M;N-k-1)} = \frac{(SSR_{\hat{Y}} - SSR_{\hat{Y}^2})/M}{SSR_{\hat{Y}^2}/(N-K)} = \frac{(SSR_R - SSR_{UR})/M}{SSR_{UR}/(N-K)}$$

Where **SSR**s are the **sum of squared residuals** for the respective regressions;

M is the number of restrictions;

N is the number of observations;

K is the number of parameters estimated in the unrestricted equation.

Note: we tend to use K to mean number of estimated parameters, this would mean that it is one greater than the number of explanatory variables because we also include the intercept parameter in the count. I noted in Studenmund (2001), however, that K is the number of explanatory variables. So we have to be aware of the definition that is being used. Essentially we have to be careful to ensure that the correct number for the degrees of freedom is used in the calculations.

If the F test statistics is greater than the F critical value we reject the null hypothesis that the true specification is linear (which implies that the true specification is non-linear).

If we are unable to reject the null then the results suggest that the true specification is linear and the equation passes the Ramsey Reset test.

DEBETA-

Outliers can sometimes cause problems with regression results. Outliers are defined by Gujarati (2004) as an observation with a large residual – a larger vertical distance between the observation and the predicted line than is generally true for the rest of the data. Such observations may have high "leverage" if they are disproportionately far away from the rest of the data points.

There are multiple methods for detecting outliers. Probably the most popular tools is DFBETA. DFBETA is a measure found for each observation in a dataset. The DFBETA for a particular observation is the difference between the regression coefficient for an included variable calculated for all of the data and the regression coefficient calculated with the observation deleted, scaled by the standard error calculated with the observation deleted. The cut-off value for DFBETAs is 2/sqrt(n), where n is the number of observations. However, another cut-off is to look for observations with a value greater than 1.00. Here cutoff means, "this observation could be overly influential on the estimated coefficient."

F TEST

The small sample F-test can be used to test a single fixed value restriction, two or more joint single fixed value restrictions, a single linear restriction, and two or more joint linear restrictions in the classical linear regression model. The test statistic is the F-statistic, which has an F-distribution.

$$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$$

$$H_1 : At\ least\ one\ of\ \beta\ is\ non\ zero$$

The restricted model is the model that imposes the restriction(s) that define the null hypothesis. Information is obtained from these to models to calculate the F-statistic. The F-statistic for this approach is written as

$$F = \frac{(RSS_r - RSS_u)/J}{RSS_u/(T-K)} \sim F(J, T-K)$$

RSS_r is the residual sum of squares from the restricted model; RSS_u is the residual sum of squares from the unrestricted model; J is the number of restrictions being tested; (T-K) is the degrees of freedom for the unrestricted model; and F(J, T-K) is the F-distribution with J degrees of freedom in the numerator and T-K degrees of freedom in the denominator.

ADJUSTED R2

R_Square (the Coefficient of Determination) is the percent of the Total Sum of Squares that is explained; i.e., Regression Sum of Squares (explained deviation) divided by Total Sum of Squares (total deviation). This calculation yields a percentage. It also has a weakness. The denominator is fixed (unchanging) and the numerator can ONLY increase. Therefore, each additional variable used in the equation will, at least, not decrease the numerator and will probably increase the numerator at least slightly, resulting in a higher R_Square, even when the new variable causes the equation to become less efficient(worse). In theory, using an infinite number of independent variables to explain the change in a dependent variable would result in an R_ Square of ONE. In other words, the R_Square value can be manipulated and should be suspect.

The Adjusted R_Square value is an attempt to correct this short_coming by adjusting both the numerator and the denominator by their respective degrees of freedom.

R2 = 1- (1 - R2)((n - 1)/(n - k - 1))

where: R2 = Coefficient of Determination_

R2 = Adjusted Coefficient of Determination

n = number of observations

k = number of Independent Variables

Variance Inflation Factors (VIF)

Examine the ***variance inflation factors*** (VIF) for the predictors.

The quantity $\frac{1}{\left(1-R_j^2\right)}$ is called the *j*th *variance inflation factor*, where R_j^2 is the squared multiple correlation for predicting the *j*th predictor from all other predictors.

The variance inflation factor for a predictor indicates whether there is a strong linear association between it and all the remaining predictors. It is distinctly possible for a predictor to have only moderate and/or relatively weak associations with the other predictors in terms of simple correlations, and yet to have a quite high *R* when regressed on all the other predictors.When is the value for the variance inflation factor large enough to cause concern? As indicated by Stevens (2002): While there is no set rule of thumb on numerical values to compare the VIF, it is generally believed that if any VIF exceeds 10, there is reason for at least some concern..

Estimated Model

As discussed in Methodology, we estimated linear regression model, the result of this regression model is shown in following Table No. 6.5.

Table 6.5 Regression Model 1

	Model 1	Model 2 (with Robust SE)
dum_cont_farming	-61.668	-61.668
	(-0.81)	(-0.86)
dum_transport	-66.889	-66.889
	(-0.86)	(-0.89)
dum_warehouse_prb	64.696	64.696
	(0.64)	(0.87)
dum_govt_scheme	-132.132	-132.132
	(-1.5)	(-1.39)
Production	0.025	0.025
	(5.87)**	(4.95)**
Constant	3.935	3.935
	(-0.04)	(-0.04)
Adjusted R2	0.5136	
R-squared	0.5744	0.5744
	t statistics in parentheses	Robust t statistics in parentheses
* significant at 5%; ** significant at 1%		

Our result indicates that contract farming have negative effect on production loss. It indicates towards important fact that in contract farming, producer uses superior technology. So due to superior technology, production loss is bound to decrease.

The effect of transportation was positive, however our results demonstrates this impact as negative but insignificant. It may indicates that mode of transportation is also important as mode of transportation, and distance of farmhouse from Mandi also plays important role in production loss.

The normal impact of insufficient warehouse was positive. It is being confirmed by our result. The coefficient of dummy variable for lacking of warehouse is positive but not significant.

The level of production positively influences the level of loss, as indicated by simple economic theory. This impact is very significant at any reasonable significant level .

It has been called attention to different market analysts that learning assumes significant part in economy. The same idea is being affirmed by our outcome. The coefficient of dummy variable for knowledge of various schemes is certain as well as positive, and significant on 15% level of significance. So it is important for government to not only introduce various schemes, but also advertise about scheme so that common people can know and take advantages of these schemes. The diagnostic table no. 6.5 for model is given in table no. 6.6.

Table 6.6: Regression diagnostic for Model 1

	Test Statistic	p-value
Ramsey RESET test	0.17	0.9175
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	7.56	0.006
VIF	1.15	

The Ramsey RESET test demonstrates that the linear model is corrected specified, at any reasonable level of significance. The Variance inflation factor (VIF) mean value indicates the non-existence of multicolinearity problem in our model. But Breusch-Pagan / Cook-Weisberg test for heteroskedasticity indicates the problem of heteroskedasticity in our model 1. **Heteroskedasticity** occurs when the variance of the error term is NOT the same for all individuals in the population. Heteroskedasticity occurs more often in cross-section datasets than in time-series datasets.

Consequences of Heteroskedasticity:

1.The estimates of the b's are still unbiased if heteroskedasticity is present (and that's good),

2. But, the s.e.'s of the b's will be biased, and we don't know whether they will be biased upward or downward, so we could make incorrect conclusions about whether the X's affect Y

3.The estimate of S.E.R. is biased, so we could make incorrect conclusions about model fit

Because the estimates of b's are still unbiased and SE of b's are biased so we can use robust option in STATA to correct standard error of coefficients. In practice, we usually do not know the structure of hetroskedasticity. Thus, it is safe to use the robust standard error. Thus, the robust standard errors are more appropriate. The regression with robust option is denoted as model 2 in table 6.6.

With robust model, production level significantly affects production loss. The other dummy variables included in model does not affect significantly to production loss but their effect is largely confirms to basic economic theory.

Analysis of other Objectives

- To measure the extent of post-harvest losses in food grains, and
- To study the factors affecting post-harvest losses

Analytical Techniques

For computing the growth in area, production and productivity of selected food grains, compound growth equation of the form $Y= ab^T$ was estimated. Averages and percentages were used to compute the post-harvest losses. Information about post-harvest losses was obtained from the farmers during following operations:

(i) Harvesting,

(ii) Threshing,

(iii) Cleaning/winnowing, and

(iv) Drying.

The information on following losses was collected from the farmers as well as market intermediaries: (i) storage, and (ii) transportation. The total post-harvest losses were estimated as a sum of all these losses. Functional analysis was carried out to examine the factors affecting post-harvest losses in food grains. The following multiple linear regression function was specified in the present study:

$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 +\ldots\ldots\ldots\ldots\ldots\ldots+a_6X_6+ e$

Where,

Y = Post-harvest losses of oil seeds/wheat at farm level in quintals per hac.

X1= storage dummy which takes the value ‘0’ if the storage facility was adequate and value ‘1’ otherwise

X2= weather dummy which takes the value ‘0’ if the weather during harvesting

was favourable and value ‘1’ otherwise

X3= Transportation dummy which takes the value ‘0’ if the transport facility was adequate and value ‘1’ otherwise

X4= Threshing machine dummy which takes the value ‘0’ if the availability of threshing machine during harvesting was adequate, ‘1’ otherwise

X5= Weather dummy which takes the value ‘0’ if the weather during harvesting was favorable and value ‘1’ otherwise

X6= Grading dummy which takes the value ‘0’ if grading facility was adequate and value ‘1’ otherwise

e = Random-error

Development in Area , Production and Productivity of Oil seeds and Wheat. To analysis the production pattern of oil seeds and wheat, the improvement examination was directed concerning their area ,production and productivity in the study AreaThe territory under oil seeds in the Alwar region enlisted a positive yearly development of 1.59 percentage(Table 6.7) and the production increase at a moderate rate of 0.87 percentage yearly . However , there is a mellow decrease in the profitability with a yearly growth of - 0.81 percent. In this manner, in the study area , increase in oil seeds generation was Estimated Post-harvest Losses in Oil seeds and Wheat.

Table 6.7. Growth in area, production and productivity of oil seeds and wheat

	Particulars→	Area	Production	Productivity
Wheat	Kota District	-0.40	0.61	2.24
	Rajasthan State	-0.20	0.83	2.08
	India	1.67	3.81	2.11
Oil Seeds	Alwar District	1.56	0.87	-0.81
	Rajasthan State	1.40	2.88	1.51
	India	0.62	1.90	1.27

The study data uncovered that average size of farm holding was 5 hac for oil seeds producers, and 6.24 ha for wheat cultivators. The sample farmers were discovered developing oil seeds over a range of 2.50 ha and wheat more than 2.25 ha. These sample farmers acquired a normal yield of 43.96 q/ha of oil seeds and 13.70 q/ha of wheat. A majority of oil seeds-producers (44.00%) and wheat-cultivators (52.00%) had a place with middle age group of 35-50 years.

Estimation of Post-harvest Losses

The assessed post-harvest losses per quintal of food grains produced or handled at distinctive stages are shown in Table 2. These were assessed to be 3.82 kg/q in oil seeds and 3.28kg/q in wheat at the farm level. These losses were most extreme because improper storage(1.20 kg/q in oil seeds and 0.95 kg/q in wheat) in both the yields.Main factors leading to storage losses were

(i) Poor storage structures,
(ii) Presence of rodents, insects and dampness,
(iii) Non-availability of separate godowns for storage and
(iv) Improper drainage at storage places.

The grain losses during the threshing activity were estimated to be 0.52 kg/q in oil seeds and 0.44 kg/q in wheat. The threshing losses were mainly in the form of broken grains, which were slightly higher, when the produce was threshed by machine as compared to manual threshing.The threshing losses were still higher when power threshers were used. However a majority of the producers preferred power threshers due to their cost and time advantage

Table 6.8 Estimated post-harvest losses at different stages in wheat and oil seeds

Stages	Wheat		Oil seeds	
	Loss (Kg/q)	Loss (%)	Loss (Kg/q)	Loss (%)
I farm level losses				
• Harvesting	0.36	8.33	0.40	7.70
• Threshing	0.44	10.19	0.52	10.02
• Cleaning/Winnowing	0.14	3.24	0.20	3.85
• Drying	0.66	15.28	0.80	15.41
• Storage	0.95	21.99	1.20	23.11
• Transportation	0.51	11.81	0.50	9.63
• Packaging	0.22	5.09	0.20	3.85
Total losses at farm level	3.28	75.93	3.82	73.57
II Wholesale level losses				
• Storage	0.08	1.85	0.12	2.31
• Transit	0.12	2.78	0.17	3.27
Total losses at wholesale level	0.20	4.63	0.29	5.59
III Processor level losses				
• Storage	0.01	0.19	0.01	0.17
• Transit	0.01	0.14	0.01	0.15
• Grain scattering	0.01	0.14	0.01	0.10
Total losses at processor level	0.03	0.46	0.03	0.42
IV Retailer level losses				
• Storage	0.41	9.49	0.53	10.21

• Transit	0.25	5.79	0.32	6.16
• Handling	0.16	3.70	0.21	4.04
Total losses at retailer level	0.82	18.98	1.06	20.42
Total post-harvest losses	4.32	100.00	5.19	100.00

Above drawn table portrays about the losses because of drying operation in grains were evaluated to be 0.66 kg/q in wheat and 0.80 kg/q in oil seeds t. These were mainly due to use of traditional methods of drying by the farmers. The grain losses due to improper transportation were estimated to be 0.51 kg/q in wheat and 0.50kg/q in oil seeds. A majority of the producers used bullock trucks and tractors to transport the produce to diverse commercial centers. The losses were noticed during loading and unloading of produce during transportation. During harvesting it was estimated that Grain losses in wheat to be 0.36 kg/q and in oil seeds is 0.40kg/q. These losses were primarily because of shedding of grains. The amount of losses depended on the crop stage and time of harvesting. The losses during cleaning/winnowing operation were evaluated to be 0.14 kg/q in wheat and 0.20 kg/q in oil seeds. The packing losses were evaluated to be 0.22 kg/q in wheat and 0.20 kg/q in oil seeds. The average post-harvest losses per farm were estimated at 1.01 quintals for wheat and 4.20 quintals for oil seeds. The average losses per ha worked out to be 0.45 quintals for wheat and 1.68 quintals for oil seeds Nag et al. (2000) have reported that post-harvest losses in chickpea were 6.97 per cent of production.

Market Level Losses

The aggregate post-harvest losses at wholesale level were 0.20 kg/q in wheat and 0.29 kg/q in oil seeds. The storage losses in wheat and oil seeds at the wholesale level were 0.08 kg/q and 0.12 kg/q, , respectively. The other component of post-harvest losses at this stage was transit losses of 0.12 kg/q in wheat and 0.17 kg/q in oil seeds. The transit losses were more because of the use of unsuitable transport containers, negligent driving and rough roads. The post-harvest losses at

the processor level were negligible (0.03 kg/q) at less than one per cent of the quantity handled in both the food grains. The post-harvest losses at the retail level were 0.82 kg/q in wheat and 1.06 kg/q in oil seeds. The transit loss was 0.25 kg/q in wheat and 0.32 kg/q in oil seeds.

The losses due to spoilage and multiple-handling of produce during retailing were 0.16 kg/q in wheat and 0.21 kg/q in oil seeds. The post-harvest losses at the retailer level due to storage were 0.41 kg/q in wheat and 0.53 kg/q in oil seeds .

6.5 Summary:Total Post-harvest Losses in Food Grains

This chapter of the study analyses and interpreted about the data collected from both the kinds of respondent's intermediaries and farmers. It also includes the interpretation and results of the econometrics tools the researcher used to find out the probable out comes the tools such as regression model, linear equation, t-test, f-test and other required test to find out the results of the objectives taken under study with the help of bar graphs and pie chart to explain in more simpler way for understanding the results.

The total post-harvest losses worked out to be 4.32 kg/q in wheat and 5.19 kg/q in oil seeds. The losses were maximum at the farm level (3.28 kg/q in wheat and 3.82 kg/q in oil seeds) accounting for 75.93 per cent and 73.57 per cent of the total post-harvest losses, respectively. The market level losses were 4.63 per cent in wheat and 5.59 per cent in oil seeds of total post-harvest losses.

The losses at processor level were less than 0.50 per cent of the total losses. The losses at retail level were 18.98 per cent in wheat and 20.42 per cent in oil seeds. The post-harvest losses were relatively more at retail than at wholesale level. Hence, proper storage facility at retail level are needed. The food grains losses due to logistics problems in the Rajasthan region were subject to assessment and their financial evaluation. It is about to find out the losses and to suggest the ways to overcome the losses and increase the productivity of the farmers and intermediaries in the Rajasthan region.

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Chapter 7

Findings & Conclusion

Chapter 7-Conclusion and Suggestions

7.1 Findings

The information which was gathered and put to factual test in the light of the objectives of the research was analyzed. The data analysis has shown certain outcomes which were interpreted based the respondents' feedback and existing literature on the above subject.

This study is an attempt to find the estimated loss of agricultural production during the logistics system. These losses in different phases of logistics such as harvest, storage, transportation, loading, unloading and improper facilities of packaging. The foodgrains losses because of logistics issues in the Rajasthan locale were liable to appraisal and their financial assessment. It is going to figure out the losses and to propose the approaches to reduce the losses and expand the productivity of the agriculturists and intermediaries in the Rajasthan area.

This study includes the losses from two perspectives, initial one is from the farmers who produce the foodgrains harvest it and afterward performed different activites, for example, storage and deal it to the middle people or to the retailers and second one is from intermediaries who provide the facilites, for example, storage, sale and purchase of the foodgrains. Further it was additionally figured out that the primary cause of loss is inadequate of storage facilites available in the region.

The researcher attempted to know the impact and effect of contract farming likewise to evaluate the support and significance of it in reducing the logistics losses of foodgrains which is not another idea but rather for this area of study with respect to logistical losses of foodgrains, it is the situation of interlinkage marketing of food grains in the Rajasthan area. Under which private middle people or other private persons provide credit facilities to the farmers to produce the foodgrains and

afterward buy it same from the agriculturists. For estimating the loss figure at different stages of logistics management for example harvest, storage, transportation, loading, unloading and improper facilities of packaging are clubbed together to aggregating the gross loss figure of foodgrains which can be in Quantity and Quality wise . Furthermore attempted to discover the underlying driver of the looses of foodgrains. These losses are evaluate under the area of study.

The researcher has likewise attempted to figure out the awareness and impact level of government plans which are acquaint with support and minimize the losses of foodgrains amid the logistics management. For which as a matter of first importance the researcher attempted to know the different government schemes which are running by the government to support rural logistics and the attempted to know its awareness level and the impact of schemes which really support in rural logistics of foodgrains which can be capacity or transportation of foodgrains. In the same the researcher also includes the support system of various state government, central government and private sector intermediaries such as FCI,CWC and various other private player of the system.

A brief summary of the critical findings is given underneath:

For this study the researcher gathered the information from farmers and intermediaries, who assume an essential part in logistics management of agriculture through a survey which depicts the significant yields delivered by the farmers are Bajara ,wheat, maize and oil seeds numerous more around there of the

study. As there are two season of yields present viz rabi and kharif. This study demonstrates that when the yield is prepared for harvest then logistics management come into part in which first of all the farmers at the mature stage harvest the crops then properly thresh it and take it from farm to house or farm to mandi for sale or farm to storage.

1. In the study, it is found that there is tremendous losses of foodgrains are happening because of improper logistics management of the foodgarins. It is a direct result of ill-advised and absence of logistics facilities under the different phases of supply chain network of food grains which begins from the harvest of yields by the farmers upto they reaches to the end customers.
2. It is likewise found that the real reason of losses is absence of transportation and poor infrastructure facilities. What's more, it is likewise because of high cost of storage which are a far from the scope of the normal farmers in both the sense of distance and cost. The storagefacilities are insufficient in the research area as well as their no cold storage facility in the Alwar area of the storage. There are different government and private players playing their part yet it is insufficient for appropriate storage and in case of bumper crops it is unmanageable.The point which is to be noticed regarding storage facilities provided by the public or private sector player is that they count the open spaces known as (CAP) of keeping foodgrains under their storage facilities which is not at all safe from external environment such as rain and other unpleasant wheather. futher it converts into huge losses of food grains.

Other major reason of losses which are found due the same factor is that farmer does not have proper storage facilities by their own because they use traditional concept of storage of foodgrains which is not safe and if you talk focus on modern concept it hardly found due to heavy installation cost.

3. In this study it is found that the transportation and packaging facilities are not appropriate .Transportation facilities are many of the time hired from the others this is because of high investment cost. Packaging facilities are additionally not proper which brings about likage and hopeless losses of foodgrains.
4. In this study the researcher attempted to discover the effect and awareness level of government, in which by the assistance of Questionnaire and interview of responding, the finding is that individuals hardly think about any state or private schemes which helps in enhancing the current states of agriculture supply chain network. The respondents not only farmers but also the intermediaries player also respondent in the same sense. And the respondents which are aware of the schemes say that these schemes does not make any remarkable performance in reducing the losses or in improving its present situation.

5. At last the researcher attempted to know the expected services for the improvement of present logistics system. Furthermore evaluate the services provided by the intermediaries such as credit, supply of seeds, fertilizer and pesticides etc.

6. By analyzing the financial resources and support systems for developing the logistics management, this study proved that in their present form they are not suitable and inadequate to reduces the losses acquired during the transportation or storage of food grains.

7.2 Conclusion:

This research was undertaken with the primary objective of assessing the logistic management of agriculture sector with special reference to Rajasthan which includes kota ,Dausa ,Jaipur, Alwar and Bharatpur. For which a few ideas and hypotheses concerning the theme were surveyed for the study.

All the stages of logistics of post harvest viz. harvest, threshing, transportation, storage and packaging etc. are assessed independently for this study so that the losses of foodgrains can be calculated on distinctively on each stage and after that clubbed together to know the gross figure of losses.

The researcher utilized econometrics model of regression analyses to test the proposition that improper logistics management is the root cause of wastage of foodgrains. Our outcomes support this recommendation. Furthermore to check the different perspectives which are considered under the study and the significant products of foodgrains taken under the study are bajara ,wheat,maize, jawar, jo and oilseeds and so forth.

The researcher additionally explored the awareness and impact level of central and state government schemes which support supply chain management of foodgrains to know whether the farmers and middle people really aware about such schemes or not and if so then how they helps in enhancing the current conditions of logistics management of agriculture products.

The last conclusion is as per the following:

1. Logistics management assume an imperative part in securely transporting production from farmers to end purchasers for which the foodgrains need to different phases of supply chain management. Under which this study discovered approx 9.68% of losses of foodgrains in ordinary circumstances during the study. This may increase by sudden normal calamities.

2. Through this study the researcher infer that if the idea of contract farming is introduced or supported in this area of study, it will help in providing so as to decrease the logistics losses of foodgrains unrivaled innovation of production which farmers may not know or can't get it due it its high cost and support the small farmers to offer their yields at market/contracted price and credit facilities at standard rate of interest.

3. This study demonstrates that roads are critical as well as in the meantime mode of transportation, and distance of farmhouse from Mandi also plays important part in production loss.

4. In this study the researcher interviewed farmers as well as to the intermediaries so that the losses at storage, unethical methods for measurement and handling etc losses can came into observation under which the reseracher interviewed not just private player, for example, Star agri, jayanti and etc additionally to FCI and CWC warehouses to know the different kind of losses and problem faced by them.

5. As the part of this study the researcher evaluate the awareness and support system gave by the government through diverse policies which helps in logistics management of agriculture production. Under this government is recommended to present a few logistics particular plans as well as need to make strong awareness for them.

6. Finally the researcher through its study attempted to know the normal services which can be useful for the farmers and intermediaries in decreasing the losses and support in smooth flow of foodgrains in supply chain management system.

At last the researcher concludes that present logistics management of agricultural product should be supported and enhanced to minimise the loss of foodgrains. This system needs some backing from government to concentrate it on particularly and take some action for decreasing the losses and this might turned out to be simple by introducing Public private association.

7.3 Suggestion for Improvement of logistics management of agriculture products

In this study, around 70% of farm produce is stored by farmers for their own utilization. Farmers store grain in bulk, utilizing different types storage structures constructed using locally available materials. The pre-treatment essential for better storage life is cleaning and drying of the grain, yet storage structure plan and its development additionally assume a key part which effects the losses during storage. Among all other factors of food grain losses, storage losses constitute a major share in postproduction operations.

At the point when scientifically developed capacity structures are available, it is important that the grain being stored is of good quality. Hence, the grain is cleaned to evacuate impurities, fungus infestation, and spoiled seeds, and after that dried to a protected storage dampness level. The present pattern is to reap the harvest at a high moisture content. In this way, grain moisture is by and large double the safe limit at the time of harvesting. Oilseeds and vegetable seeds are harvested at 3-7 times higher moisture than their safe storage moisture content. The safe storage moisture limits for major food grains are given in Table 1.

- **Preventive Measures and Monitoring of Losses**

1. Adoption of **50kg packing** to avoid use of hooks
2. Introduce the concept of **silo bag** for storage of foodgrains.
3. **Education and Training** to the farmers.
4. Try to develop the concept on **co-operative societies** like as in Maharashtra.
5. **Double line machine stitching of bags**.
6. Supervision of **loading/unloading** operations
7. Monitoring of Storage & Transit Losses during Monthly Performance

8. **Transit Insurance** of stocks
9. Establising cold storage at the approach of farmers.
10. Establish **AEZ's (agriculture economic zone).**
11. Increase the use **Airtight Hermetic storage** (low O2/High CO2 environment kills living insects without pesticides)
12. **Gas-tight storage facilities**
13. Development of suitable technologies for value addition,handling, packaging, storage, transportation and marketing of agricultural products for safe and quality.

- **Storage Structures at Farmer Level**

The major construction materials for storage construction in rural areas are mud, bamboo, stones, and plant materials. They are neither secure from fungal and insect attack nor rodent secure proof. By and large, out of an aggregate 6% loss of food grain in such storage facilites about half is because of rodents, and half to bugs and organisms. A portion of the significant consideration in building a storage structure to minimize losses are:

- As far as could reasonably be expected, the structure should be air proof, even at loading and unloading ports;
- The structure should be elevated and away from moist places in the house;
- Rodent-proof materials should be used for construction of rural storages;
- The area surrounding the structure should be clean to minimise insect breeding; and
- The structure should be plastered with an impervious clay layer to avoid termite attack, or attack by other insects.

Different innovative work associations in India have recognized some demonstrated, age-old structures from specific areas of the nation and taking into account these, some improvised structures have also been developed and prescribed for use at farm level.

Coal Tar Drum Bin

This simple device has brought a noteworthy change in the storage system at farmer level. Agriculturists indicated little resistance to this innovation, for the most part because of its low cost and simple accessibility. It was produced at the Central Institute of Agricultural Engineering (CIAE) and contrasts exceptionally well and other metal structures. Basically, it is a used or empty bitumen drum After the street development power has utilized the coal tar, the drums are tossed as garbage or are now and then utilized for ensuring roadside plantations. The drum is warmed by open flame to uproot any excess tar. A layer of tar stays inside, and serves as an insulator and additionally a protective covering for the galvanised iron sheet. The nearby artisan can convert this drum to an attractive shape and can likewise manufacture a cover and a release chute. contingent upon the thickness of the galvanized iron sheet utilized. At CIAE the neighborhood artisans have been prepared to create these bins to suit village requirements and have in this way produced beneficial employement for them.

Domestic Hapur Bin

The Indian Grain Storage Institute, which is occupied with the improvement and spread of advances away innovation to clients, has created metal bins for domestics storage of food grains. They are made of galvanised iron and/or aluminum sheets. The bins are accessible from 200 to 1000 kg limit and cost (Rs 350-1200) per bins.

Chittore Stone Bin

As depicted before, locally available materials should , wherever possible, be utilized as a part of the development of grain bins. In Rajasthan, stones labs are actually accessible and plentiful. At the College of Agricultural Engineering, Udaipur, a stone bin called the Chittore bin has been produced utilizing 40 mm stone slabs. It is a rectangular container of 250 kg limit and is developed by the farmers themselves utilizing mud as a cementing material.

Double-Walled, Polyethylene-Lined Bamboo Bin

Customarily, the bamboo canister fitted with a top and with a putting of mud inside and outside is an exceptionally normal storage structure utilized by farmers in India It gives business to a specific group in rural area who are expert in making these bins. The average life of bins is around three years They are not impenetrable and are inclined to attack by insects. The alteration of these bins by coating them with polyethylene has been observed to be exceptionally effective. One such bin, created at the College of Agricultural Engineering, Akola, can store around 500 kg of grain and it costs about (Rs 220/ -). The main extra cost acquired is for the polyethylene and metal parts presented in the changes. At the release end, the utilization of a metal cone has made emptying simple without spillage of grainIt guarantees air tightness of the opening because of the constant pressure head of grain (Chouksey 1984).

Food grain storage on-farm

Farmers need storages of 1-4 time ability to store grain. On the off chance that the capacity time is short (2-3 weeks) an adaptable PVC sheet covering (30-50 micron size) known as a harvest umbrella is utilized. Some of the time coverings or expansive campaign sheets are additionally used to ensure the grain, particularly around evening time to maintain a strategic distance from the surface layer of the grain getting to be clammy with dew. In any case, for 2-3 months storage periods, the bins created at the Indian Agricultural Research Institute (IARI) is the most suitable. It is a LDPE (low density polyethylene) sandwiched container, famously

known as Pusa bins. It is beneficial clarifying here the nitty gritty development technique of the Pusa canister which can be broadly received in India as well as in a few developing countries. Aside from the LDPE which is acquired by the farmers the bin is made with mud. The performance of this bin is like some other metal or solid structure. In fact, because of the good insulation properties of the mud bricks used for construction the issue of dampness relocation amid capacity is insignificant in the Pusa bin.. About 9.5 million tonnes of food grain are stored in such bins in India (IPCL 1985).

Method of Constructing Pusa Bins

The bin is built on a hard surface to avoid rat attack. On the off chance that the surface is not hard, a platform of bricks is built. The dark LDPE film (700 gage) is spread over the stage, broadening 60 mm from every one of the four sides Another stage of unburnt blocks is built ova the LDPE layer. The inside wall is fabricated to the required tallness, depending upon the limit of the structure. The surface of the wall is put with mud. A wooden edge with an extra pole at a separation of 450 mm from the end of the structure is arranged and is put at the highest point of the internal divider to support the rooftop. An extra shaft is put 250 mm from the external side of the structure to give further backing. A little gap, 90 mm in diameter, is cut at the base in the middle of the front wall for delivery of the grain. A mud section, 50 mm thick, is put over the raised internal wall to serve as a rooftop, leaving a manhole of measurements 500 x 500 mm at one comer. The structure is then put with mud on top and on each of the four sides, and is left to dry well. A LDPE film front of 700 gage dark sheet made as a mosquito net is then put over the dried structure At this stage, a pocket made out of aroused iron or plastic funnel 90 mm in distance across with a top, is fitted into the delivery gap. The LDPE spread is pulled down to meet the extending part of the prior layer on the stage. The edges of both the films are warmth fixed. A little gap is sliced in the LDPE spread to accommodate exit pocket and the pocket is pulled out through this opening. Somewhat delicate wax is applied around the pocket touching the LDPE film to make the segment totally hermetically sealed The LDPE film covering the sewer vent is cut diagonally. The external wall of the structure is

raised using burnt bricks up to 450 mm and unburnt blocks for whatever remains of the segmentThen again, a band of metal is given at 450 mm to make it rodent proof. The entire structure is again put with mud on top and on each of the four sides and permitted to dry before use.

In the wake of filling the structure with grain, the diagonal cut on the film covering the manhole is fixed with sticky tape and the hole is stopped with mud. For productive execution, the Pusa bin is utilized strictly when it is totally dried and filled completely so to avoid free space.The bins can be made of different limits.

Food grains storage in Bulk in India

The grain is stoma in bull: for the most part by merchants, enormous agriculturists, cooperatives and government organizations, for example, the Food Corporation of India (FCI). The accessible storage limit of these segments is of the request of 18.55 million tons which is around 12% of aggregate production and 41% of excess (i.e. 30% of aggregate production) production which comes to market for sale. The main agencies, and the amounts involved, are as follows:

- Central Warehousing Corporation 2 Mt
- The FCI-7.7 million tonnes (Mt)
- State Warehousing Corporation-24 Mt
- grain marketing cooperatives-4.5 Mt
- Some state governments 1.9 Mt.

There are many kinds of storage systems followed depending on the length of storage and the product to be stored.

Cover and Plinth Storage

This is an improvised arrangement for storing grains in the open, by and large on a plinth which is clammy and rodent proof. The grain sacks are stacked in a standard size on wooden dunnage. The stacks are secured with 250 micron LDPE sheets from the top and every one of the four sides. Nourishment grains, for example, wheATl, maize, gram, paddy, and sorghum are by and large put away in CAP (spread and plinth) stockpiling for 6-12 month periods. It is the most efficient storage structure and is in effect broadly utilized by the FCI for stowed grains.

Community Storage Structures

Bulk storage structures of higher capacity, ranging from 25-100 t are termed community storage structures (Birewar 1985They are produced using strengthened blocks, folded aroused sheets and aluminum sheets in limits going from 25 to 57

Rural Godowns

The rural godowns are fundamentally implied for giving warehousing facilities to the agriculturistsThe godowns are of 100 to 1000 mt limit. They are claimed by FCI,central and state warehousing organizations, market advisory groups, or cooperatives looking to the requirement for having capacity structures or offices for agriculture produce. The Government of India (GOI) designated a specialist council (1979-1980) which concluded that there was a requirement for storerooms for 2 million tons of food grains grain. The GOI, keeping in perspective these suggestions, has given a half subsidy for the development of godowns. Along these lines, godowns are being built on a substantial scale in Indian towns.

Large-Scale Modern Storage Structures

Silos are being utilized on an expansive scale for mass storage of oil seeds (soybeans) and grains by the Oil Federation of India and FCI. Bulk storage has advantages over bag storage, as follows:

- Low running expenses;
- Low work necessities;
- Rapid taking care of;
- Low through spillage and rodents;
- Efficient and successful fumigation operation;
- Less area zone prerequisite;
- Complete control of air circulation;
- Possible to store the grain for more periods;
- Possible to motorize all operations; and
- Possible to store moist grain for short periods.

The storehouses are either metal or cement. Metal storehouses are less expensive than the solid ones by 1520% relying upon their size. The distinction is more in little limit units, e.g. 200 t. For the most part, the storehouse framework is outfitted with other preliminary units like cleaning and drying hardware. comparison of godowns and storehouse frameworks of 10 000 tons stockpiling limit, as given in table shows that under Indian conditions the storehouses are at first half more costly than a godowns framework, however that this extra cost ought to be recuperated inside of 2 - 4 years and from that point a sparing of Rs 1-

1.9 million for each annum can be figured it out. The misfortune because of moisture is just 0.2% contrasted and 1% in the godowns framework. The misfortune brought on by rodents, bugs, parasites, and taking care of is as high as 8% in the godowns framework, contrasted and just 0.2% in the storehouse framework (Sawant 1984). A grain spared is a grain created and the appropriation of such structures has been taken up by the administration through cooperatives and different storage associations in the nation.

Standards for Storage Structures

To accomplish uniform execution from any structure, it is fundamental that the development material and the strategy for development should conform to a predetermined. The same applies on account of capacity structures, and for this reason the Indian Bureau of Standards, New Delhi, has contrived guidelines after cautious examination of the capacity needs. To minimize losses during storage , users are exhorted to hold fast to these principles during development.

- Safeguards for Movement & Storage
    1. Inspection and checking of adjustment of measure extensions.
    2. Ensuring that all godowns are built and kept up on exploratory lines for capacity of nourishment grains.
    3. Movement of nourishment grains starting with one place then onto the next by safe means i.e. typically secured wagons and so on.
    4. Loading of institutionalized packs quite far and leaving 18 inches space close to the fold entryways.
    5. Proper weighment and bookkeeping at the season of receipt and issue.
    6. Internal Audit and Physical check of stock .

- Tips for grain storage

  1. Grains got for capacity should to be appropriately cleaned.

  2.Grains got for capacity ought to be appropriately dried. The dampness content in the foodgrains might not surpass the recommended safe stockpiling limit. Foodgrains got by high dampness are delicate and promptly inclined to creepy crawly infestation and parasitic assault prompting quality weakening .

  3. The grains got for capacity ought to be kept in cool and dry spot.

  4. Manage as opposed to kill your bug populace.

  5. Sanitation is irritation control.

  6. When tidying up, bear in mind the territory outside the storeroom.

  7. Know the irritation – distinguish it before endeavoring to oversee it.

- Security and Safety of Storage Complexes

1. Physical measures like installation of barbed wire fencing of the boundary walls,

2. Procurement of road lights for enlightenment of godowns and

3. Legitimate locking of the sheds are taken to secure the godowns.

4. Security staff and in addition different Agencies like Home Guards,

Table No. 7.1 Safe Moisture of Foodgrains for Storage

S.No.	**Commodity**	**Moisture content (% wet basis)**
1	Paddy, rice (raw)	14
2	Rice (Parboiled)	15
3	Bengal gram	12
4	Wheat, sorghum, maize, barley, bajra, ragi, wheat atta and basin	12.5
5	Ground nut in pods	6-7
6	Mustard seeds	5-6

Source: Agricultural Engineering Directory.

- Inspections

1. Security Inspections and in addition surprise checks of the Depots are likewise led every now and then at different levels to recognize and plug the security lapses.

2. Special Squad checking at chose rail-heads, transhipment and destination/despatch focuses.

3. Identification of vulnerable points.

4. Inspection of Depots by Senior Officers

- Quality Control Measures

1. Periodical prophylactic and curative treatment of stocks, as endorsed.
2. Maintaining priority list for issue of stocks observing the FIFO guideline.
3. Undertaking pre-monsoon fumigation.
4. Improvement in dunnage material.
5. Ensuring proper quality checking of foodgrains at the time of procurement

7.4 Limitation of the study

1. This study is restricted to Rajasthan state just and result might vary if directed in different districts.

2. There are other variables besides logistics management which influence the agricultural production.

3. Evaluation will be founded on the essential information produced through questionnaire and exactness of the findings altogether relies on upon the precision of such information and fair reactions of the reacted.

7.5 Scope of the study

The present research has considered just on foodgrains to measures the losses of foodgrains while logistic management. For, other than foodgrains this kind of examination can be performed. This research study has taken set number of post harvest variables as independent variables hence aspiring researchers can conduct the research considering more pre-post harvest variables and might turn out with interesting results.

Further research can be led at the national level as this research has been led at the Rajasthan state level Logistics losses at different stages, for example, harvest, threshing, transportation, storage and packaging have been taken as variables for the estimation of losses in the study and further there is an extent of adding more variables to this study. In this study different stages, for example, harvest, threshing, transportation, storage and packaging are clubbed together however they could be isolated for the future studies.

The present research is based on logistics management and government schemes impact on decrease of losses of foodgrians while research can likewise be led considering the financial related and pre harvest aspects of foodgrains.

Another interesting measurement will be to discover the differential losses of foodgrains between Indian and foreign logistics management and in addition the private and public sector performance of logistics management.

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Questionnaire-I

प्रश्नावली

FARMER (कृषक)

नोटः आपके द्वारा दी गई सूचना पूर्णतः गोपनीय रखी जायेगी एवं इसका उपयोग केवल शोध कार्य हेतु किया जायेगा।

क्रमांकः .....

दिनांक .....

1.उत्तरदाता का नाम :

2 परिवार में सदस्यो की संख्या

3. गाँव :

4. तहसील :

5. आपके पास कृषि योग्य भूमि : .....

6. दूरभाष नं.

7. आप किस–किस प्रकार फसल उगाते हैंः

.....

.....

8. आप किसे अपना अनाज बेचते हैं

1) गांव के आढ़तिया को 2) कस्बे के आढ़तिया को 3) ग्राहक को

9. आप एक ऋतु में कितना अनाज उपज करते हैं?

अनाज के नाम व वजन

10. आप अपनी उपज में से घरेलू /व्यक्तिगत उपयोग हेतु कितना अनाज रखते हैंघ

11. क्या आपने अपनी उपज/उत्पादन के लिए किसी ऐजेन्सी/व्यक्ति से करार किया है? हाँ/ना

यदि हाँ तो

क्र.सं.	उपज	उपज की आवृति	समय विशेष पर माल की क्षमता	माल भेजने का स्थान	मूल्य (प्रति क्विंटल)	कुल राशि
1. 2. 3. 4. 5.	निजी ऐजेन्सी सरकारी ऐजेन्सी सहकारी ऐजेन्सी व्यक्तिगत ऐजेन्सी अन्य					

12. आप अपनी उपज का वितरण किन–ऐजेन्सी/व्यक्तियों को करते हैं?

क्र. सं.	उपज	बिक्री समय की आवृति	विक्रय मात्रा	विक्रय स्थान	मूल्य प्रतिदर	कुल राशि

13. आप अपनी कृषि उपज के ढुलाई हेतु कौन–कौनसे परिवहन साधनों का उपयोग करते हैं?

क्र. सं	परिवहन का साधन	परिवहन से उपज भेजने की मात्र	दूरी	स्वयं या किराया	परिवहन में माल की हानि (अनुमानित)
1.					
2.					
3.					
4.					
5.					
6.					

14. आपको कृषि उपज के वितरण में कौन–कौनसी परिवहन समस्यायें आतीं हैं?

–विक्रय इकाई की दूरी ☐ पैकिंग सुविधाओं की कमी ☐

– परिवहन सुविधा

☐

अपर्याप्त

. मंहगी ☐

15. आप गोदामों में कितना प्रतिशत उत्पादन /उपज रखते हैं?

0-20% ☐ 20-40% ☐ 40-60% ☐ 60-80% 8☐% ☐

16. आपको गोदामें में उत्पादन/उपज रखने में क्या–क्या समस्याऐं आतीं हैं?

1. अपर्याप्त शीतल गृह भण्डार ☐ 2. भण्डार सुविधाओं की कमी ☐

3. वित्तीय साधनों की कमी ☐ 4. भण्डारण की उच्च दरें ☐

17 क्या आप राज्य सरकार द्वारा संचालित कृड्डि योजनाओ के बारे में जानतें है ☐

17(B). कृषि उपज के लिये राजस्थान सरकार की कौन–कौनसी योजनाऐं वर्तमान में कार्यरत हैं?

1.....

2.....

3.....

4.....

5.....

18. उपर्युक्त योजनाऐं आपकी उपज को बढ़ाने में कहाँ तक सहयोगी हैं

पूर्णतः सहमत	सहमत	कुछ कह नहीं सकते	असहमत	पूर्णतः असहमत

19. विविध कार्याविधियों में भौतिक हानि का विवरण :–

1. **परिवहन एवं वितरण**

a) परिवहन से भण्डारगृह तक

क्र. सं.	उपज का नाम	छीजत का प्रतिशत	छीजत की मात्रा	मूल्य
1.				
2.				
3.				
4				
5.				

b) **परिवहन से बाजार तक**

क्र. सं.	उपज का नाम	छीजत का प्रतिशत	छीजत की मात्रा	मूल्य
1.				
2.				
3.				
4				
5.				

2. **भण्डार गृह में**

क्र. सं.	उपज का नाम	छीजत का प्रतिशत	छीजत की मात्रा	मूल्य
1.				
2.				
3.				
4				
5.				

3. **उत्पादन की गणना करने में**

क्र. सं.	उपज का नाम	छीजत का प्रतिशत	छीजत की मात्रा	मूल्य
1.				
2.				
3.				
4				
5.				

4. **संधारण (पैकेजिंग) में**

क्र. सं.	उपज का नाम	छीजत का प्रतिशत	छीजत की मात्रा	मूल्य
1.				
2.				
3.				
4				
5.				

20. कृषकों की अपेक्षाऐं क्या–क्या हैं:

(अपनी प्राथमिकताऐं क्रम में दें)

1ण नजदीकी विक्रेता इकाई ☐
2ण नजदीकी भण्डारण इकाई ☐
3ण अच्छी माल परिवहन सुविधा ☐
4ण बजार की सही समय पर जानकारी ☐
5ण विक्रेता इकाई पर अनुचित गतिविधियों का ना होना ☐
6ण अच्छी भण्डार गृह सुविधा ☐
7ण अच्छी पैकेजिंग की सुविधा ☐
8ण शीतल भण्डारगृह की सुविधा ☐
9ण उधार वित्त सुविधा ☐
10ण विक्रय पश्चात् शीघ्र भुगतान सुविधा ☐

अन्य यदि कोई हो

I. .....

II. .....

III. .....

आपके सहयोग के लिए धन्यवाद। (हस्ताक्षर)

Questionnaire – II

INTERMEDIARIES

Note:-*Information provided will be kept strictly confidential as this is only for academic purpose.*

1. Name of Respondent:

2. Place:

3. Type of ownership: Individual/partnership /Govt./Semi-Govt./Cooperative/ any other

4. Food grain handled:

a…… e……..

b…… f……..

c……. g……..

d…… h……..

5. From how long you are in the business:

6. Do you make direct purchases in the field and transport on your own?

7. What facilities do you provide to the producer who brings his produce for sale?

S. No.	Particulars	Yes/No	Qty.	Price	Total cost
1.	Supplying the pesticides				
2.	Supplying the seeds				
3.	Supplying the fertilizers				
4.	Supplying the credit				
5.	Procuring at the farmer door steps				

6.	Provides the transport facility				
7.	Packaging activities				
8.	Storage activities				
9.	Advisory role				
	(Timing/verities planning)				
10.	Quantity procured				
11.	Grading activity				

8. Do you grade the foodgarins) (Yes/No)

- If yes, what is the basis for it a. WDRA act ☐

b. Gravity grading system ☐

c. Traditional approach ☐

9. Name the various Govt. schemes which support in your business.

1……

2……

3……

4……

5……

10. These schemes help in encouraging your business

Strongly Agree	Agree	Neutral	Disagree	Strongly disagree

11. Do you have adequate infrastructure for storage Yes ☐ No ☐

12. If inadequate then by what percentage

0-10% ☐ 10-20% ☐ 20-30% ☐ 30-40% ☐ 40-50% ☐

13. What kind of vehicles you used for transportation and its cost

S.No.	Kind of vehicles	Name of crop	Qty transported	Distance covered	Hired/ owned	Cost
1. 2. 3. 4. 5.						

14. Physical loss in different activity

1. Assembling and transportation

S.No.	Name of the grain	% of waste	Qty waste	Total cost
1. 2. 3. 4. 5.				

2. Cleaning

S.No.	Name of the grain	% of waste	Qty waste	Total cost
1. 2. 3. 4. 5.				

3. Losses in packing and its cost

S.No.	Mode of packing	Qty Packed	Qty waste	Total cost
1. 2. 3. 4. 5.				

4. Sales and distribution

S.No.	Name of the grain	% of waste	Qty waste	Total cost
1. 2. 3. 4. 5.				

15. Which of the following problem do you face?

I. Lack of transporting facilities
II. Low sale absorption capacity of market ☐
III. Too much price fluctuation ☐
IV. Lack of storage capacity ☐
V. Lack of market knowledge ☐
VI. High tax payment ☐
VII. High license fee ☐
VIII. High rent charges ☐

IX. Other specify

a) ……

b) ……

c) ……..

16. Expectation

(Rank them according to your priority)

I.	Good physical facilities	☐
II.	Less establishment /maintenance charges	☐
III.	Less price fluctuation	☐
IV.	Good transportation facilities	☐
V.	Less handling loss of production	☐
VI.	Timely supply to consumer	
VII.	Assessing the demand at right time	☐
VIII.	Right market information	☐

******Thanks for valuable information********

Signature

Estimated Budgetary Requirement for Agricultural Marketing for Twelfth Plan		
S.No.		Rs. Crore
1.	Development of Marketing Infrastructure, of which Terminal Markets Wholesale Markets Up-gradation of Regulated Markets Rural periodic markets Livestock markets Specific Commodity Markets Grading standardization and certification	**7703** 2400 2500 1250 188 125 1000 240
2.	Development of virtual markets (covering market information dissemination, development of spot exchangers, market research, consumer awareness, etc.)	925
3.	Warehousing and bulk handling, of which Cold Chain development Grameen Bhandaran Yojana Silo storage Integrated Bulk Logistics Modernisation of existing warehouses	**8675** 3600 4200 550 225 100
4.	Linking Farmers to Markets (development of value chain, support to farmer groups)	1295
5.	Training and Capacity Building	300
6.	Secondary agriculture (medicinal & aromatic plants, organic farming etc.)	1100
7	Trade facilitation	210
Total		**20208**
Source: Working Group on Agricultural Marketing for the Twelfth Plan		

Estimated Budgetary Requirement for Strengthening Supply Chain during the Twelfth Plan Period (2012-17)		
Sl. No.	**Programmes**	**Rs. crore**
1.	Marketing infrastructures excluding Cold Storages (includes Mega Perishable Commodity Complex, refrigerated containers including insulated pre-cooled vans, mobile pre-coolers, Mega Food Parks/ Mini Food Parks Scheme, modernization of Abattoirs, wholesale markets, terminal markets etc.)	10,000
2.	Creation of additional capacity for cold storages and modernization of existing capacities	5,000
3.	Creation of Godowns for Foodgrain storage@	1,000
4.	National Mission for Food Processing (covering schemes for technology upgradation/ modernization of food processing industries, modernization of abattoirs, meat shops, HRD, promotional activities, etc.)	5,000
5.	Strengthening of institutions including skill development	2,000
6.	Development of virtual markets (covering market information dissemination, development of spot exchangers, market research, consumer awareness, etc.)	700
7.	Food safety, R&D and promotional activities	800
8.	Others including Innovation/ Venture Capital Fund	500
Total		**25,000**
@For foodgrain storage, the proposed expenditure of Rs.11,000 crore (approx.) over the next 10 years is of non-plan nature as it would be in form of lease rentals. This includes storage capacity of around 15 million tonnes under Private Entrepreneurs Guarantee Scheme, 2008 (costing Rs.9,000 crore) and additional 2 million tonnes in form of silos		

(costing around Rs.2,000 crore). Plan assistance is limited to the extent of meeting the requirements of North East region (about Rs.400 crore) and remaining Rs.600 crore may be for Village Grain Bank Scheme or for providing assistance to State Governments, etc.

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Research Article

A Study on Post-harvest Losses of Food Grains in Rajasthan

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Abstract:
The post-harvest losses have been estimated at different stages in major food grains in Rajasthan. The data from 2007-08 to 2012-13 on area, production and productivity of two food grains have been under researcher analysis. The post-harvest losses have been estimated using the stratified sampling, data collected from farmers, wholesalers, processors and retailers in each crop in Rajasthan for the year 2012-13. Tabular analysis has been used to calculate approximately the post-harvest losses at different stages, and operative analysis has been used to assess the influence of socio-economic factors on post-harvest losses.

Wheat output has been increased due to increased wheat productivity in India. The post-harvest losses at the farm level have been estimated to be 3.82 kg/ q for Oil seeds and 3.28 kg/q for wheat. The losses have been highest during storage in both the crops. The factors that influence the post-harvest losses significantly at the farm level have been identified and some policy implications have been suggested.

I. INTRODUCTION

Produced Food grains have to undergo a series of operations such as harvesting, threshing, winnowing, bagging, transportation, storage and processing before they reach the end consumer, and there are appreciable losses in crop output at all the above mention stages.

A recent estimate by the Ministry of Food and Civil Supplies, Government of India, puts the total preventable post-harvest losses of food grains at 10 per cent of the total production or about 20 Mt, which is equivalent to the total food grains produced in Australia annually. In a country where 20 per cent of the population is undernourished, post-harvest losses of 20 Mt annually is a substantial avoidable waste. According to a World Bank study (2009), post-harvest losses of food grains in India are 8-10 per cent of the total production from farm to market level and 4-5 per cent at market and distribution levels. For the system as a whole, such losses have been worked out to be 11-15 Mt of food grains annually, which included 3-4 Mt of wheat and 5-7 million tonnnes of oil seeds. With an average per capita consumption of about 15 kg of food grains per month, these losses would be enough to feed about 70-100 million people, i.e. about 1/3rd of India's poor or the entire population of the states of the Bihar and Haryana together for about one year. Thus, the post-harvest losses have impact at both the micro and macro levels of the economy.

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Table I: Summary of Rajasthan agri-statistics

S.No.	Components	Growth/ratio
1	Population dependent on agriculture	Two Thirds
2	Agriculture GDP at current poil seedss	Rs79994.97Crore
3	Growth of Agriculture GDP (Avg. from FY2001 to FY 2011)	8.30%
4	Agricultural sectors contribution in GSDP	26%
5	Food Grain production (Thousand Tonnes)	11283.4
6	State's contribution to national food grain production	5.17%
7	State's rank in food grains production	7^{th}
8	Yield Kg/Hectare (of total food grains)	890
9	Total agricultural area irrigated	35%
10	Area under wells and tube well irrigation	60-70%
11	Rice Production (Thousand Tonnes)	228.3
12	Wheat Production (Thousand Tonnes)	6326.5
13	Oil Seeds production (Thousand Tonnes)	4469.2

Source: PHD RESEARCH BUREAU, Compiled from RBI and Economic Review of Rajasthan 2010-11

The study on post-harvest losses in food grains at different stages of their handling would help assess the extent and magnitude of losses and identify the factors responsible for such losses. This in turn would help develop proper measures to reduce these losses. Evolving correct policies for minimizing post-harvest losses would crucially depend on reliable and objective estimates of such losses at different stages. This information is important for scientists, technologists, policymakers, administrators and industrialists.

The specific objectives of the present study are:

i. To measure the extent of post-harvest losses in food grains, and
ii. To study the factors affecting post-harvest losses.

II. METHODOLOGY

Review of Literature

Basappa et al. (2007) reported the estimates of post-harvest losses of rice and wheat in India at different stages of post harvest operations and the post-harvest losses were estimated using the survey data collected from 100 farmers, 20 wholesalers, 20 processors and 20 retailers in each crop in Karnataka for the year 2003-04. Tabular analysis was used to estimate the post-harvest losses at different stages, and functional analysis was used to assess the influence of socio-economic factors on post harvest losses at the farm level. The post harvest losses at the farm level were estimated to be 3.82 kg/q for rice and 3.28 kg/q for wheat. The losses have been highest during storage in both the crops. The factors that influence the post-harvest losses significantly at the farm level were identified and some policy implications were highlighted.

Bala et al. (2010) found that the post harvest losses at national level from producer to retailer were 10.74 percent for Aman 11.71 percent for Boro, and 11.59 percent for Aus rice. The estimated total post harvest losses of rice at farm level in Bangladesh were 9.16 percent, 10.10 percent and 10.17 percent for Aman, Boro and Aus respectively. Total post harvest losses of rice at farm level is 85.28 – 87.77 percent of the total post harvest losses

and the storage loss is 33.92 – 40.99 percent of total losses at farm level. The storage loss of rice is (3.45 – 4.14 percent) and it is followed by drying (2.19-2.37 percent), harvesting (1.60-1.91 percent), threshing (1.10-1.79 percent) and transportation (0.87-1.13 percent). The estimated total post harvest losses of rice at processor level in Bangladesh were 1.30%, 1.30% and 1.13 percent for Aman, Boro and Aus respectively while the estimated total post harvest losses of rice at wholesale level were 0.17 percent, 0.18 percent and 0.19 percent for Aman, Boro and Aus respectively and at retail level were 0.27 percent, 0.31 percent and 0.28 percent for Aman, Boro and Aus respectively.

Therefore, reducing the post harvest losses as much as possible is a vital concerning issue in achieving food security of Bangladesh. Clearly the estimation of post-harvest grain losses and its management practices and capacities would minimize the magnitude of loss for the achievement of food security objective.

Sampling

A stratified sampling design was adopted for the ultimate selection of foodgrain-growing farmers. The Alwar district (Rajasthan) with a oil seeds production of 234887 per hectare in the state topped the list of oil seeds-growing districts. Hence, this district was selected for choosing oil seeds-growing cultivators in the preliminary stage of sampling. For wheat, kota district with production of 193938 per hectare the district stood first in the state. Hence, it was considered for selecting wheat-growing cultivators in the first stage of sampling. In the second stage, two talukas were chosen from each of the selected districts and then five villages predominantly growing the selected food grains were chosen from each of the selected talukas. Finally,10 foodgrains-growing farmers in each village were randomly interviewed. In all, 50 cultivators growing oil seeds in Alwar district and 50 cultivators growing wheat in the Kota districts were selected at the rate of 25 farmers from each taluka. From each of the selected districts, 10 wholesalers, 05 processors and 10 retailers dealing in each of these crops were also interviewed for eliciting information on post-harvest losses.

Analytical Techniques

For computing the growth in area, production and productivity of selected food grains, compound growth equation of the form $Y= ab^T$ was estimated. Averages and percentages were used to compute the post-harvest losses. Information about post-harvest losses was obtained from the farmers during following operations:

(i) harvesting,
(ii) threshing,
(iii) cleaning/winnowing, and
(iv) drying.

The information on following losses was collected from the farmers as well as market intermediaries: (i) storage, and (ii) transit. The total post-harvest losses were estimated as a sum of all these losses.

Functional analysis was carried out to examine the factors affecting post-harvest losses in food grains. The following multiple linear regression function was specified in the present study:

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + \ldots\ldots\ldots\ldots\ldots\ldots + a_6X_6 + e$$

where,

Y = Post-harvest losses of oil seeds/wheat at farm level in quintals per hac.
X_1 = Storage dummy which takes the value '0' if the storage facility was adequate and value '1' otherwise
X_2 = Weather dummy which takes the value '0' if the weather during harvesting was favourable and value '1', otherwise
$^{x}3$ = Transportation dummy which takes the value '0' if transport facility was adequate and value '1' otherwise
X_4 = Threshing machine dummy which takes the value '0' if availability of threshing machine during harvesting was adequate, '1', otherwise
X_5 = Weather dummy which takes the value '0' if the weather during harvesting was favourable and value '1', otherwise
X_6 = Grading dummy which takes the value '0' if grading facility was adequate and value '1' otherwise
e = Random-error

III. GROWTH IN AREA, PRODUCTION AND PRODUCTIVITY OF OIL SEEDS AND WHEAT

To examine the temporal production pattern of oil seeds and wheat, the growth analysis was conducted with respect to their area, production and productivity in the study districts, state and country. The area under oil seeds in the Alwar district registered a positive annual growth of 1.59 per cent (Table 1) and the production increased at a moderate rate of 0.87 per cent annually. However, the productivity witnessed a mild declining annual growth of -0.81 per cent. Thus, in the study district, increase in oil seeds production was Estimated Post-harvest Losses in Oil seeds and Wheat

Table II: Growth in area, production and productivity of oil seeds and wheat

Particulars	Oil seeds			Wheat		
	Alwar district	Rajasthan state	India	Kota district	Rajasthan state	India
Area	1.59	1.40	0.62	-0.40	-0.20	1.67
Production	0.87	2.88	1.90	0.61	0.83	3.81
Productivity	-0.81	1.51	1.27	2.24	2.08	2.11

The survey data revealed that average size of farm holding was 5.00 ha for oil seeds growers, and 6.24 ha for wheat growers. The sample farmers were found growing oil seeds over an area of 2.50 ha and wheat over 2.25 ha. These sample farmers obtained an average yield of 43.96 q/ha of oil seeds and 13.70 q/ ha of wheat. A majority of oil seeds-growers (44.00%) and wheat-growers (52.00%) belonged to middle age group of 35-50 years. The proportion of illiterate farmers in the sample was 19.67 per cent for oil seeds cultivators and 21.67 per cent for wheat cultivators.

IV. ESTIMATION OF POST-HARVEST LOSSES

The estimated post-harvest losses per quintal of food grains produced or handled at different stages are presented in Table 2. These were estimated to be 3.82 kg/q in oil seeds and 3.28kg/q in wheat at the farm level. These losses were maximum due to faulty storage (1.20 kg/q in oil seeds and 0.95 kg/q in wheat) in both the crops. Important factors leading to storage losses were

(i) non-availability of separate godowns for storage,
(ii) poor storage structures,
(iii) presence of rodents, insects and dampness, and
(iv) improper drainage at storage places.

The grain losses during the threshing activity were estimated to be 0.52 kg/q in oil seeds and 0.44 kg/q in wheat. The threshing losses were mainly in the form of broken grains, which were slightly higher, when the produce was threshed by machine as compared to manual threshing. The threshing losses were still higher when power threshers were used. However a majority of the producers preferred power threshers due to their cost and time advantage.

Table III: Estimated post-harvest losses at different stages in oil seeds and wheat :

Stages	Oil seeds		Wheat	
	Loss (kg/q)	Loss (%)	Loss (kg/q)	Loss (%)
I Farm level losses				
• Harvesting	0.40	7.70	0.36	8.33
• Threshing	0.52	10.02	0.44	10.19
• Cleaning/Winnowing	0.20	3.85	0.14	3.24
• Drying	0.80	15.41	0.66	15.28
• Storage	1.20	23.11	0.95	21.99
• Transportation	0.50	9.63	0.51	11.81
• Packaging	0.20	3.85	0.22	5.09
Total losses at farm level	3.82	73.57	3.28	75.93
II Wholesale level losses				
• Storage	0.12	2.31	0.08	1.85
• Transit	0.17	3.27	0.12	2.78
Total losses at wholesale level	0.29	5.59	0.20	4.63
III Processor level losses				
• Storage	0.01	0.17	0.01	0.19

• Transit	0.01	0.15	0.01	0.14
• Grain scattering	0.01	0.10	0.01	0.14
Total losses at processor level	0.03	0.42	0.03	0.46
IV Retailer level losses				
• Storage	0.53	10.21	0.41	9.49
• Transit	0.32	6.16	0.25	5.79
• Handling	0.21	4.04	0.16	3.70
Total losses at retailer level	1.06	20.42	0.82	18.98
Total post-harvest losses	5.19	100.00	4.32	100.00

The losses due to drying operation in grains were estimated to be 0.80 kg/q in oil seeds and 0.66 kg/q in wheat. These were mainly due to use of traditional methods of drying by the farmers. The grain losses as a result of faulty transportation were estimated to be 0.50kg/q in oil seeds and 0.51 kg/q in wheat. A majority of the producers used bullock carts and tractors to transport the produce to different market places. The losses were noticed during loading and unloading of produce during transportation.

Grain losses during harvesting were estimated to be 0.40kg/q in oil seeds and 0.36 kg/q in wheat. These losses were mainly due to shedding of grains. The amount of losses depended on the crop stage and time of harvesting. The losses during cleaning/winnowing operation were estimated to be 0.20 kg/q in oil seeds and 0.14 kg/q in wheat. The packing losses were estimated to be 0.20 kg/q in oil seeds and 0.22 kg/q in wheat.

The average post-harvest losses per farm were estimated at 4.20 quintals for oil seeds and 1.01 quintals for wheat. The average losses per ha worked out to be 1.68 quintals for oil seeds and 0.45 quintals for wheat. Nag et al. (2000) have reported that post-harvest losses in chickpea were 6.97 per cent of production.

V. MARKET LEVEL LOSSES

The total post-harvest losses at wholesaler level were 0.29 kg/q in oil seeds and 0.20 kg/q in wheat. The storage losses in oil seeds and wheat at the wholesaler level were 0.12 kg/q, and 0.08 kg/q, respectively. The other component of post-harvest losses at this stage was transit losses of 0.17 kg/q in oil seeds and 0.12 kg/q in wheat. The transit losses were more because of the use of unsuitable transport containers, negligent driving and rough roads.

The post-harvest losses at the processor level were negligible (0.03 kg/q) at less than one per cent of the quantity handled in both the food grains. The post-harvest losses at the retail level were 1.06 kg/q in oil seeds and 0.82 kg/q in wheat. The transit loss was 0.32 kg/q in oil seeds and 0.25 kg/q in wheat. The losses due to spoilage and multiple-handling of produce during retailing were 0.21 kg/q in oil seeds and 0.16 kg/q in wheat. The post-harvest losses at the retailer level due to storage were 0.53 kg/q in oil seeds and 0.41 kg/q in wheat.

VI.TOTAL POST-HARVEST LOSSES IN FOOD GRAINS

The total post-harvest losses worked out to be 5.19 kg/q in oil seeds and 4.32 kg/q in wheat. The losses were maximum at the farm level (3.82 kg/q in oil seeds and 3.28 kg/q in wheat) accounting for 73.57 per cent and 75.93 per cent of the total post-harvest losses, respectively. The market level losses were 5.59 per cent in oil seeds and 4.63 per cent in wheat of total post-harvest losses. The losses at processor level were less than 0.50 per cent of the total losses. The losses at retail level were 20.42 per cent in oil seeds and 18.98 per cent in wheat. The post-harvest losses were relatively more at retail than at wholesale level. Hence, proper storage arrangements at retail level are needed.

VII. CONCLUSIONS AND POLICY IMPLICATIONS

The study has estimated post-harvest losses in two major food grains, viz. oil seeds and wheat. It has been found that about 75 per cent of the total post-harvest losses occurr at the farm level and about 25 per cent at the market level. The post-harvest losses at farm level have been observed as 1.68 q/ha in oil seeds and 0.45 q/ha wheat. On per farm basis, these have been estimated to be 4.20 quintals in oil seeds and 1.01 quintals in wheat. The storage losses at different stages have added up to about 35.80 per cent of the total post-harvest losses in oil seeds and 33.52 per cent in wheat, while harvesting and threshing operations together have accounted for about 17 per cent of total losses in both the crops. Transit losses at different levels have been important component of post-harvest losses, contributing to about 20 per cent of the total losses. The functional analysis has revealed that education level of farmers and bad weather conditions influence the post-harvest losses significantly at farm level in both the food grains, while inadequate availability of labour and faulty storage method influence the post-harvest losses positively and significantly in oil seeds and wheat, respectively. Educating and training the farmers on post-harvest operations would greatly help in reducing the post-harvest losses in food grains. The establishment of small-size cold storage units in the production centres would help reduce the storage losses. In this direction, the zero energy cool chambers technology developed by the Indian Council of Agricultural Research needs to be popularized.

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