Feasibility Study

Rural Grain Storage in Punjab









Agriculture Department
Government of Punjab

Acronyms

Acronym	Description
AMIS	Agriculture Marketing Information System
BMR	Balancing, Modernization & Replacement
CPI	Consumer Price Index
DFI	Development Finance Institution
EU	European Union
FAQ	Fair Average Quality
FFSAP	Financial Facility for Storage of Agriculture Produce
GDP	Gross Domestic Product
HR	Human Resource
IFC	International Finance Corporation
IRR	Internal Rate of Return
NPV	Net Present Value
PASSCO	Pakistan Agriculture Storage and Service Corporation
PBS	Pakistan Bureau of Statistics
PFD	Punjab Food Department
PKR	Pakistani Rupee
R&D	Research and Development
SBP	State Bank of Pakistan
SMEDA	Small and Medium Enterprise Development Authority
SWOT	Strengths, Weaknesses, Opportunities, Threats
UAE	United Arab Emirates
UC	Union Council
UCM	Unit Contribution Margin
USD	United States Dollar
ZTBL	Zarai Taraqiati Bank Limited

Table of Contents

Table of Tables

Table of Figures

Disclaimer

This document has been prepared with the objective to provide basic information about the subject business proposition. The content of the document has been derived from data and information collected from various reliable secondary and primary sources and is based on certain assumptions. While reasonable due diligence has been carried out during information collection and working out the presented calculations, the reader is strongly encouraged to carry out any further scrutiny and diligence to collect any other information that may be deemed necessary to take an informed decision. Professional advice from qualified technical expert/consultant should preferably be sought before taking any decision to act upon the information presented in the document. Department of Agriculture, Government of Punjab does not assume any liability for any financial or other loss in consequence of undertaking any activity on the basis of the information provided in the document.

1.0 EXECUTIVE SUMMARY

Pakistan is an agriculture-based economy. Agriculture accounts for 19.5% of the GDP, 42.3% of labor force and supplies raw material to several value added sectors of the economy. Punjab is the most populated province and the largest agriculture producer. In 2014-15, the province produced 27.32 million tons of cereal crops from a total cultivated area of 10.13 million hectares; accounting for 72.9% share in national production and 72.5% share in national cultivated area. From the year 1998 to 2015, the cereal production of Punjab grew from 16.5 million tons to 26.9 million tons; which translates into a growth of 63%. Wheat, rice and maize production in Punjab in 2015 respectively were 19.2 million tons, 3.71 million tons and 4.0 million tons.

The current grain storage and marketing system in the province operates inefficiently. Lack of proper warehouses and storage places leads to a situation where a significant share of the total production is wasted. As per estimates, 13.8% of the grain production in Punjab is wasted due to losses at different stages. Absence of storage facilities for the farmers weakens their bargaining position, and forces them to sell their produce at lower prices. Increased supply in the market in an uncontrolled manner contributes towards further lowering the prices to reduce farmer's profitability. Inability to store his produce also deprives the farmer to take advantage of any possible price hike in the later months.

The government plans to address the above-mentioned issues by building storage facilities in rural areas; that may be used by farmers and other value chain actors to store their produce. The idea is to implement this idea by inviting private sector to invest in such ventures. The current feasibility study is an effort to analyze the business model of a warehouse in the rural areas of Punjab that offers storage facility on a paid basis to local farmers and other value chain actors. The option had been analyzed in terms of its value for the farmer as well as for the investor. The study has been conducted in close consultation with grain farmers, traders and processors, government departments and the suppliers of grain storage systems. Available secondary data has also been used. Three main grains, wheat, rice and maize have been included as part of the analysis.

Wheat is the staple food and the most commonly grown crop in Punjab. It is grown in Rabi season in November and harvested in April. The government maintains the necessary strategic stocks and ensures stability of wheat prices by procuring wheat through provincial food departments and PAASCO. The support price for the year 2017 was set as Rs 1300 per 40 kilograms. Wheat procurement by the government is plagued with the issues of delayed provision of Gunny bags to farmers, false eligible farmers, under-weighing, unfair practices and a cumbersome procurement process. Along with the government, wheat is also stored by farmers, traders, and flour mills. However, there is no practice of storing wheat in commercial warehouses.

Rice is an important crop of Kharif season; cultivated in July and harvested in November. The harvested paddy is sold in the open market with no intervention by the government. Unlike wheat, there is no support price for rice and it is decided by market forces. Demand in international market also affects the rice price in the local market. Paddy is sold in grain

markets through open auction by the farmers. The representatives of the rice mills also directly contact the farmers to buy paddy. Major storage of paddy is carried out by rice mills. Farmers, traders and commercial exporters also store rice; mostly in finished form to take the benefit of price rise in the following months.

Maize is cultivated twice during a year. The spring crop is cultivated in February/March and harvested in May/June. The autumn crop is cultivated in July/August and/harvested in October/November. Around two third of the total annual maize production is obtained from the autumn crop. Maize is sold by farmers in open market without any intervention by the government. Maize may be dried as cobs and the grain separated; or the cobs may be sold as such after harvesting. There is no support price for maize and the price of the grain is decided by market's demand-supply situation. Corn processing and poultry feed industries are the biggest buyers and the holders of maize. Some storage is also carried out by traders and farmers in their informal storages. Some farmers store maize in the form of a *Ganji* where it remains exposed to attacks by pests, insects, squirrels and birds; resulting in an average wastage of 5-10% which may increase up to 15-20% in case of a rainfall on the stored maize bags. There is no facility for commercial storage of maize.

The success of the proposed commercial grain warehouse depends upon the farmer's/trader's decision to store or sell the harvested grain; which in turn will be driven by the associated costs and benefits. Farmer's cost will mainly include the warehouse storage charges, the cost of grain cleaning and drying and possibly some added transportation cost. The benefit for the farmer will be derived mainly from reduction in storage losses and the potential increase in grain's prices in the following months. Some price increase may also be realized from perceived high quality of the product. Another future benefit can be as the increased access to agriculture finance by developing linkage with the Warehouse Receipt Scheme.

Majority of the farmers contacted during the course of the study were found to appreciate the importance of storage and were interested to store their produce. However, they were also found to lack the financial strength to do so. This was especially relevant for small farmers with land holding of up to 20 acres who remain indebted to formal and information money lenders. They need immediate cash to pay their current debts and to sow their next crop; thereby making it difficult for them to store their produce without a support from the government. The farmers willing to store their produce expect to increase their bargaining position against the grain traders, increase market price stability by controlling grain flow into the market, increase profits by realizing higher prices in later months, reduce grain wastages and ensure protection from thefts.

The opportunity of benefiting from potential increase in prices in the months following the harvesting month was analyzed by looking at the historical data of monthly wholesale prices. In case of wheat, the price was seen to drop immediately after the harvesting and seen to rise in the following months reaching higher than the April price in six to seven months. Wheat storage thus does not appear to be an attractive option to store in short term. The price movement of rice was found to be more predictable and showed a rising trend in the months following November. The price trend for maize was more complicated due to two harvesting seasons. Maize storage in May for two to three months does not appear to be a profitable proposition. The price trends during the last two years have been downward. Storing maize

after the harvesting month of October appears to be a good option if stored for three to four months.

Government's price data analysis of all the three grains also showed that the price trends also varied with different markets. For the same grain, the prices movement during the same month of the same year was found to be different in different markets. It was thus difficult to accurately predict the price change. This observation was different from the generally accepted perception of stakeholders that the price is bound to increase in the months following the harvesting month. The data indicated that it may increase or decrease; driven by the local market dynamics. It is therefore very important to collect field data to accurately predict the market price changes following the harvesting.

Grain storage may be done in traditional storages comprising of covered warehouses where the grain is stored in bags; or in bulk form in which silos storage is an important option. Traditional warehouse storage is simpler to construct and knowhow is easily available. Most of the warehouses in Punjab, being used for grain storage, are simple sheds without following any proper warehouse standards. The quality of the stored grain thus is not protected properly and the losses percentage remains high. Silos are the bins, commonly used for bulk storage of grains. These may be concrete silos, tower silos, bunker silos, bag silos, silo bins, etc. Tower silo is used more commonly for grain storage. Steel is the most commonly used material for making large silos. A silo incurs a higher cost but offers more benefits in terms of preservation of grain quality, lower wastage, easier handling, saving bags cost, lower loading/unloading cost and lesser land requirement. In case silo storage is considered an option in a commercial grain warehouse, it should be the one with smaller capacity to accommodate the smaller grain volumes brought by the small to medium farmers. It is important to provide the required comfort to the farmer that the grain stored by him has not been exchanged with the grain of some other farmer and he is getting back his own grain.

The proposed business focuses on establishing a grain warehouse in the rural areas to be used by farmers and traders. The project will derive its revenues from the service charges for the offered storage facility. The model has been built on storing three grains; wheat, rice and maize. The mix of the storage space between the three commodities will vary with the location of the facility. District Okara is the suggested location for this feasibility study. In line with the industry norms, a warehouse storage capacity of 5,000 tons has been proposed.

The suggested project has a total cost of Rs 97.07 million with land and building as the major cost components. Total land requirement for the project was estimated to be 3 acres at a total cost of Rs 1.5 million. The cost of building and civil works was calculated to be Rs 58.89 million. This included the space for warehouse storage, allied services and ancillary buildings. Working capital requirement was calculated as Rs 3.19 million which constituted 4.8% of the total project cost. Key machinery and equipment included grain cleaners, grain dryers, boiler, weigh bridge, generator, etc.

Project's operating revenues were calculated assuming a storage calendar that allocated the available storage space between the three grains during different months of the year. Total available bags storage capacity in terms of ton-months is 60,000 (the product of 5,000 tons and 12 months). The suggested capacity plan has 36% available capacity allocated each for

maize and rice and 28% capacity allocated for wheat. The highest capacity allocation of 40% for wheat was assumed for the five months from May to September. Maize gets 50% capacity in the months of October and November during the autumn harvesting season. During June, July and August, maize was given 40% capacity allocation; equal to that of wheat during the same months. Rice got the highest 50% capacity allocation during five months from December to April.

Storage charges per maund per month were assumed to be Rs 15, Rs 50 and Rs 30 respectively for wheat, rice and maize. Allied service charges were assumed to be Rs 10 per maund for grain cleaning and Rs 20 per maund for grain drying. Storage capacity utilization was assumed to be 60% during the first year, increasing to 80% in the second year and 100% in the third year of operations. Based on these assumptions, the project's first year revenues were calculated to be Rs 31.65 million. Storage charges growth was assumed to be modest; 5% for the second year, 6% during the third year, 7% in the next year and 10% from seventh years onwards.

Direct costs of the project included direct HR cost, electricity, boiler fuel and machine maintenance. Electricity cost was calculated for an electricity connection of 200 KVA. Total manpower requirement for the project was estimated to be 24; incurring Rs 4.38 million as direct and Rs 1.62 million as indirect cost. Depreciation was the major indirect cost.

The project was found to be financially viable with a positive NPV of Rs 16.22 million and an IRR of 24.31%. Payback period of the project was calculated to be 4.61 years. Gross profit and net profit margins for the first year of operations were 72% and 18% respectively. Breakeven capacity of the project was found to be 31.8% which translated into 1,657 maunds.

Project's sensitivity to different variables was also analyzed. Project's viability decreased by decreasing the storage charges; remaining viable up to a 12% drop. Project's viability was found to be not very sensitive to land price and NPV remained positive even if land was acquired at double the rate of the assumed rate. The project was found to have lower capacity to absorb debt cost since it became unviable at around 33% share of debt of the total project cost.

The concept of establishing rural warehouses in Punjab is new and its implementation requires a careful approach. It is suggested that in Phase I, the government should conduct pilot testing of the idea by establishing few rural grain warehouses in different areas of Punjab for different grains. The established warehouses should be operated by private sector on commercial basis. Private sector operators should hire their own employees, inject the required working capital, market the project and manage its routine operations. Government should facilitate the project by offering incentives, supervising the operations and sharing the projects' marketing cost. Major share of operating profits may be retained by the private sector. Smaller farmers should be offered support by the government to enable them to store their grain. In parallel, the government should initiate a formal survey to accurately assess the demand for such rural warehouses in different parts of Punjab. Another research should be initiated to indigenize the modern silo technology.

Following a successful demonstration of the commercial viability of the venture, the second phase of the project may be initiated that should include launching a scheme inviting the private sector to invest in commercial grain warehouses in rural areas. Government should offer incentives to the investors which may include land at subsidized rates, subsidized loans, facilitative import duty structure, financial support to small farmers and operational subsidy for first year of operations.

1.1 Project Summary Sheet

Project's Concept	
Objective	Establish rural grain storage
Grains Stored	Wheat, rice, maize
Operative Capacity	5,000 tons storage
Location	Rural areas in Punjab
Target Market	Farmers and traders
Technology Employed	Traditional warehouse storage in bags

Project Cost (Rs Million)	
Total Project Cost	Rs 97.07 million
Capital Cost	Rs 93.88 million
Working Capital	Rs 3.19 million

Financing Plan (Rs Million)		*% Share*
Equity	Rs 97.07 million	100%

First Year's Summary Income Statement (Rs Million)		*% of Revenues*
Revenues	Rs 31.65 million	100%
Cost of Sales	Rs 8.96 million	28.0%
Gross Profit	Rs 22.69 million	72.0%
Operating Costs	Rs 13.82 million	44.0%
Earnings Before Interest and Tax	Rs 8.87 million	28.0%
Earnings Before Tax	Rs 8.87 million	28.0%
Tax	Rs 3.10 million	10.0%
Net Income	**Rs 5.77 million**	18.0%

Financial Feasibility	
Internal Rate of Return (IRR)	24.31%
Net Present Value (NPV) @ 20%	Rs 16.22 million
Payback Period (years)	4.61 years
Conclusion	
The project is financially viable keeping in view all the bases and assumptions used for technical and financial assessments/calculations.	

2.0 INTRODUCTION

2.1 Agriculture Sector Overview

Pakistan is an agriculture-based economy. Agriculture accounts for 19.5% of the GDP, 42.3% of labor force and supplying raw material to several value added sectors.[1] Agriculture GDP is derived from four major subsectors. Livestock is the biggest contributor to GDP that accounted for 58.3% of the total value in 2016-17. Crops was the second largest subsector accounting for 37.2%; followed by two smaller subsectors, Fishing and Forestry, accounting for 2.1% and 2.3% shares respectively. Sub-sector-wise distribution of the national agriculture GDP is shown in Figure 1.

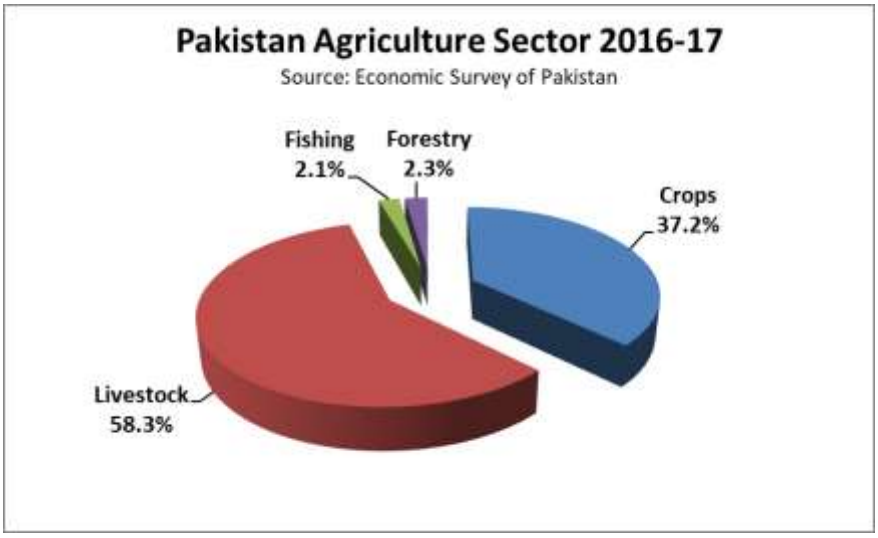


Figure 1 - Pakistan Agriculture Subsectors Distribution

The crops subsector is further divided into three categories. 'In 2016-17, Important Crops' accounted for 64.1%, 'Other crops' 29.6% and 'Cotton Ginning' 6.3% of the total value of crops in 2014-15. Horticultural crops, including fruits, vegetables and condiments are included in the 'Other crops' category.

Punjab is the most populated province and the largest agriculture producer in the country. The province holds the largest shares in cultivated areas and productions of majority of the agricultural commodities. Cereal crops[2] were cultivated over an area of 10.13 million hectares to produce 27.32 million tons. The production translates into 72.5% share in cultivated area and 72.9% share in the overall national production of cereal crops. Similarly, the province also holds a leading position in cash crops[3] where during the same year, it produced 51.5 million tons; that accounted for 66.8% of the national production. During the same year, Pakistan's total production of edible oilseeds[4] was 581 thousand tons of which 51% was contributed by Punjab.

[1] Economic Survey of Pakistan, 2016-17
[2] Includes Wheat, Rice, Maize, Jowar, Bajra and Barley
[3] Includes Cotton, Sugarcane, Tobacco, Jute, Sugar beet, Guar and Sunhemp
[4] Includes Rapeseed, Mustard, Canola, Sesame, Groundnut, Soybean, Sunflower and Safflower

In horticultural production as well, Punjab maintains a leading position. In 2014-15, fruit cultivation in Pakistan was carried out on an area of 775 thousand acres to produce 6.79 million tons. Punjab held a share of 45.5% in total cultivated area and 62.6% in total national fruit production. Vegetable production in Punjab was 1.96 million tons that accounted for 63.4% share of the total national production. In case of potato, Punjab holds 93.4% share of the total national cultivated area and 96.6% share of the total production of potato. A similar situation also exists for pulses and fodder crops where Punjab's shares in total national production respectively were 82% and 84.5%. Figure 2 and Figure 3 provide a snapshot of Punjab's contribution in the production of different agriculture commodity groups during the year 2014-15.

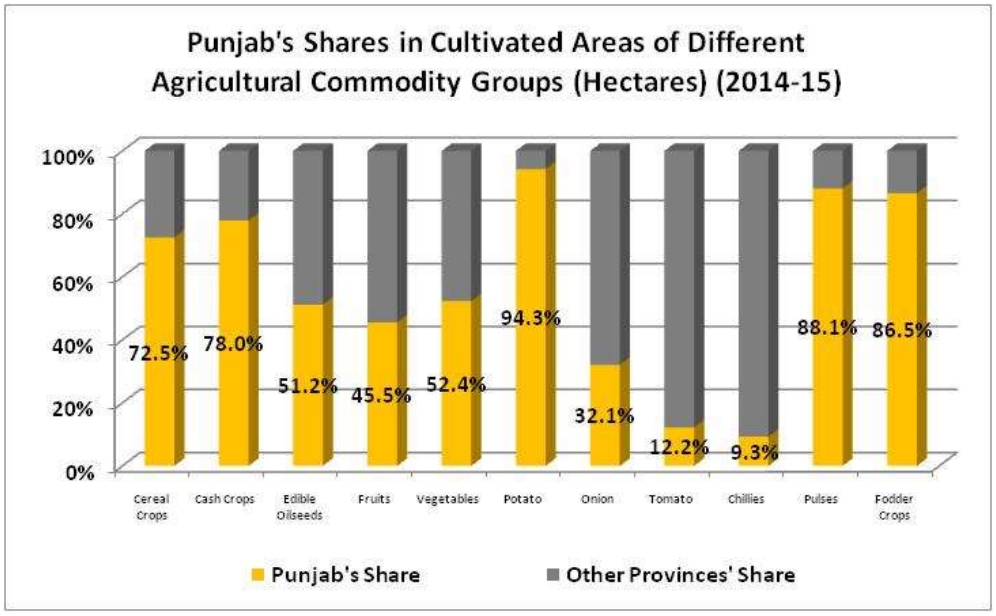


Figure 2 - Punjab's Share in Cultivated Areas of Different Commodity Groups

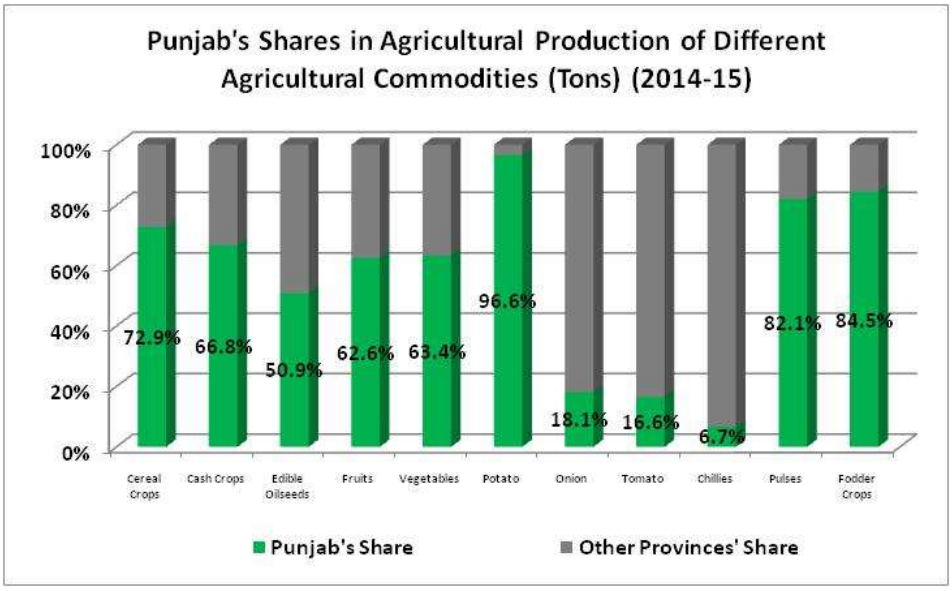


Figure 3 - Punjab's Share in Production of Different Commodity Groups

In some horticultural commodities, Punjab is a smaller producer; such as onion, tomato and chillies; where in 2014-15, the province respectively held 18.1%, 16.6% and 6.7% shares in the total national production of these commodities.

2.2 Grains Sector of Punjab

The cereal sector of Punjab has grown over the years. On national level, the cereal production of the three major crops (wheat, rice, maize) grew from 24.5 million tons in 1998 to 37 million tons in 2015; representing an overall growth of 51%. During the same period, the cereal production of Punjab grew from 16.5 million tons to 26.9 million tons; which represent a growth of 63%. This indicates that cereal production in Punjab grew at a higher rate compared to that in other regions of the country. Growth trend of the production of three cereal crops combined is shown in Figure 4.

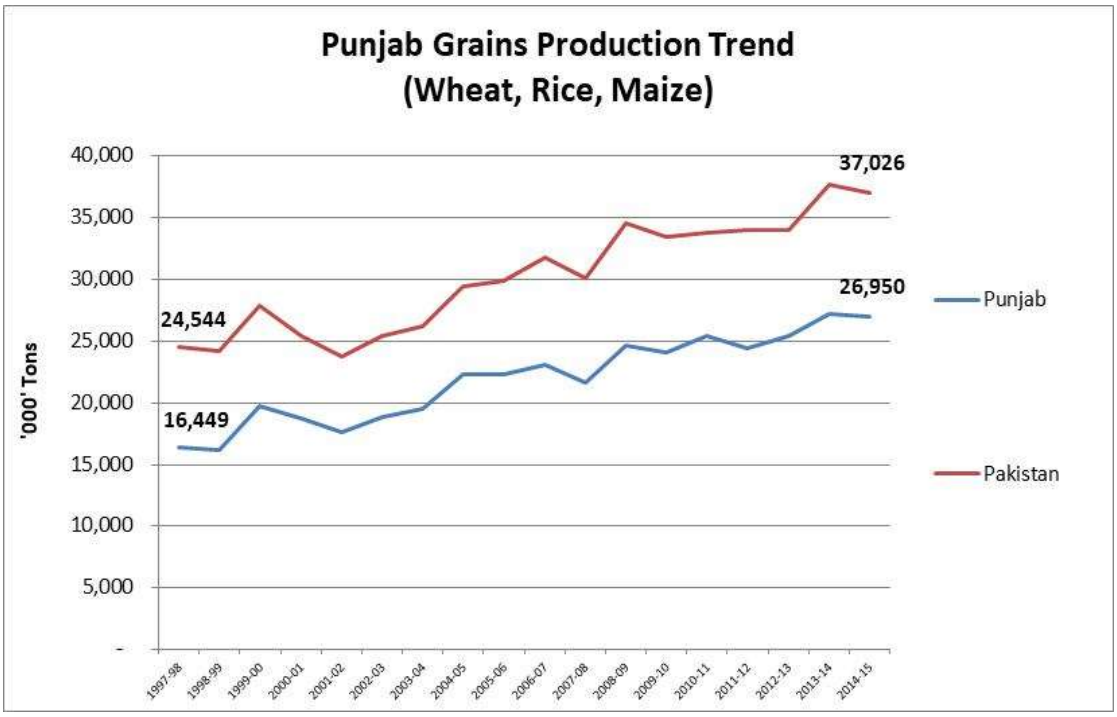


Figure 4 - Punjab's Grains (Wheat, Rice, Maize) Production 1998-2015

Wheat is the largest grown cereal and the staple food of the local population. Wheat production in Punjab grew from 13.8 million tons in 1998 to 19.2 million tons in 2015; representing an overall growth of 39% and a compounded annual growth rate of 2%. Punjab accounted for 77% of the national wheat production in 2015. Figure 5 shows the 18-year wheat production trend in Punjab.

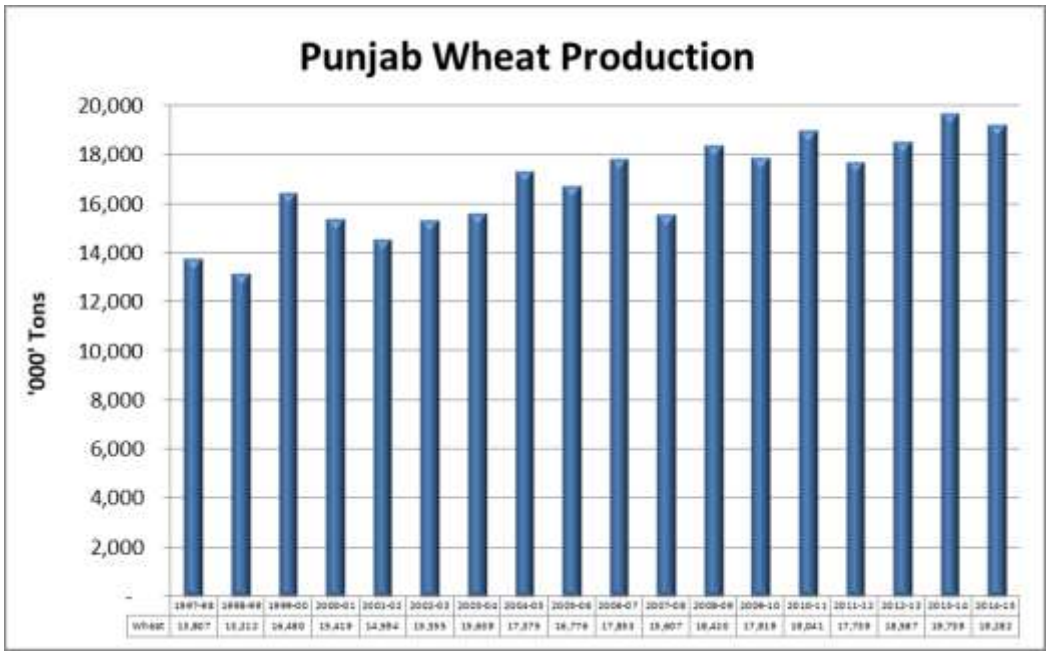


Figure 5 - Punjab's Wheat Production 1998-2015

Punjab is also the largest rice producing province. Rice production in Punjab touched its peak in 2009-10 when the province produced 3.71 million tons. The production increased from 1.95 million tons in 1998 to 3.65 million tons in 2015; which represents an increase of 87%. Compounded annual growth rate during this period was 3.76%. In 2015, Punjab held a share of 52% of the national rice production. Figure 6 shows the 18-year rice production trend of Punjab.

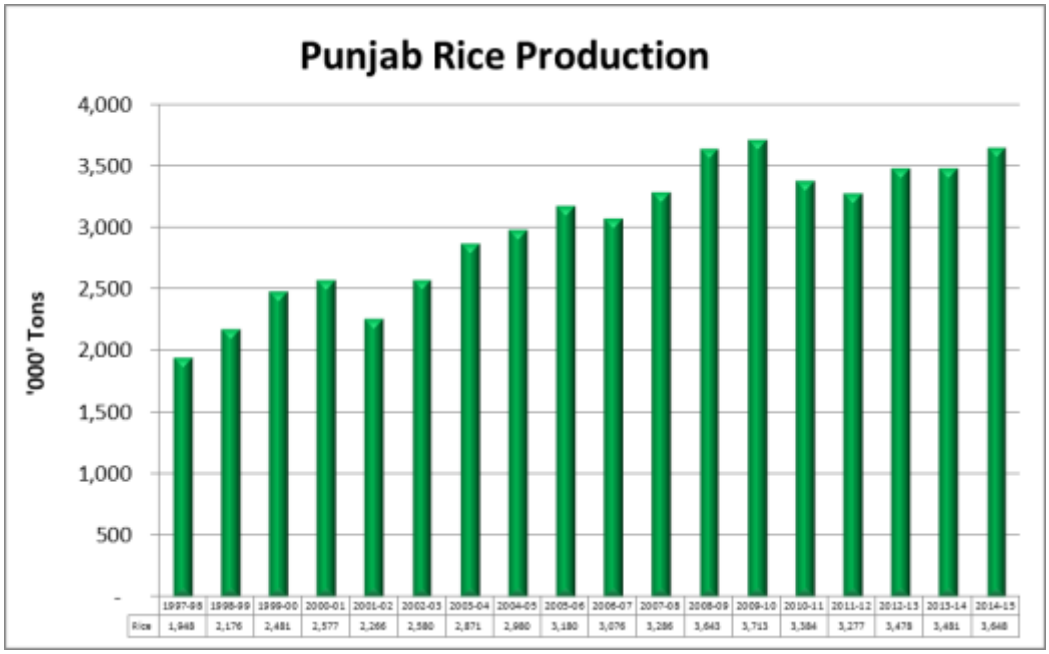


Figure 6 - Punjab's Rice Production 1998-2015

Maize is the third important cereal crop of Punjab. In 2015, the province accounted for 81% of the national maize production. Punjab's maize production grew from 0.69 million tons in 1998 to 4 million tons in 2015; representing an overall growth of 488% and a compounded annual growth rate of 10.9%. Maize production trend of Punjab is shown in Figure 7.

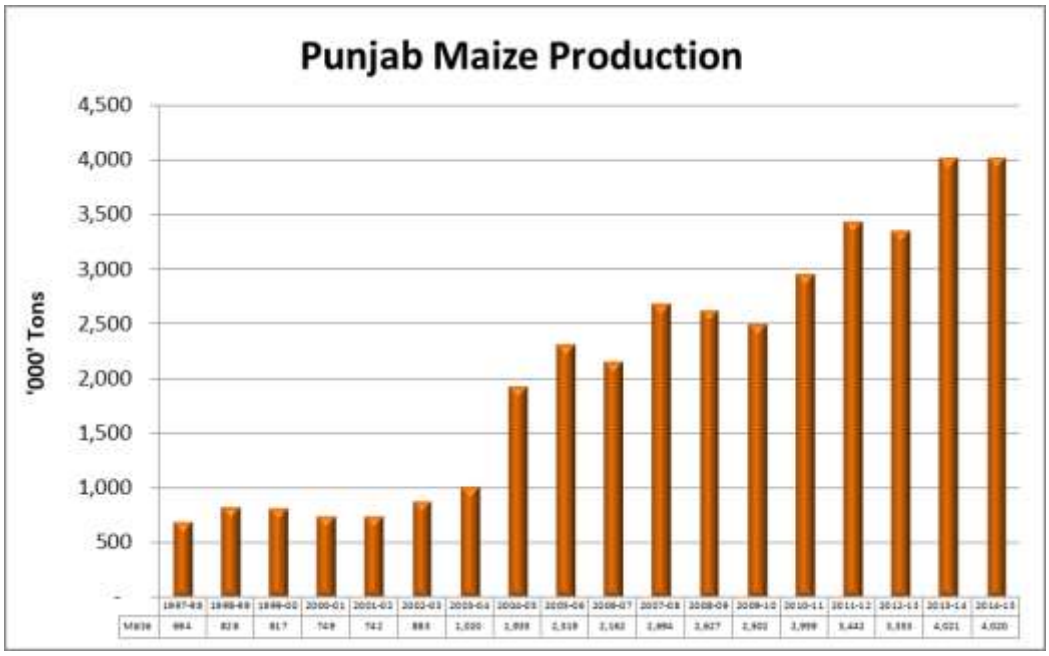


Figure 7 - Punjab's Maize Production 1998-2015

2.3 Objectives of the Study

Punjab is the largest producer of wheat, rice and maize. The current system of storage and marketing of grains operates inefficiently. Lack of proper warehouse and storage places and inability to maintain the required storage conditions lead to causing damage to the grain that result in significant wastages. As per the estimates, 13.8% of the grain production in Punjab is wasted due to losses at different stages.[5] This represents a huge economic loss and saving this loss means providing food to millions of people. In addition, the absence of storage facilities for the farmers at rural level weakens their bargaining position and compels them to sell their produce at lower prices; thereby shrinking their already squeezed profitability. Increased supply in the market in an uncontrolled manner also contributes towards decreasing the grain prices to further reduce farmer's profits. Inability to store his produce also deprives the farmer to take advantage of any possible price hike in the future months. The system also faces the issues of lack of standardization for grains, use of corrupt practices and difficult access to finance for the farmers.

The government plans to address the above-mentioned issues by building storage facilities in the rural areas which may be used by farmers and other value chain actors. One option in this regard is that the government makes this huge investment from its own resources. This proposition however, appears to be a difficult. In addition, the other potential issue in this regard is the inefficiency inherent in government's management systems, which will act as a potential threat to the project's success; thereby risking the wastage of the precious public funds. Keeping these factors in view, it was deemed necessary to consider the engagement of private sector to make the rural warehouses proposal successful. The private sector will likely bring in the required investment and its professional management expertise; that will increase the probability of project's success. The government will keep acting in the roles of facilitator, regulator and monitor.

In order to attract private sector towards this proposition, it is important to fully understand the business model. Private sector invests only if the business proposition can offer the expected returns. There has been efforts in past to attract private sector to invest in storage facilities; however, the response has been modest. It appears that the providing more information on the potential investment opportunity will help private sector better understand the associated cost and benefit and will increase the likelihood of investment.

The current feasibility study is an effort to analyze the business model of a warehouse in the rural areas of Punjab that offers storage facilities on a commercial basis to local farmers and other value chain actors. The option had to be analyzed from two perspectives; the value of storage for the customer (farmers and others); and the financial viability of the business proposition for the investor. The study has endeavored to provide answers from both the perspectives.

2.4 Methodology

The proposed concept of establishing rural grain storage system is new in the province and presently, there is no example of any such warehouse; being operated on commercial basis.

[5] Framework for Warehouse Receipt Financing in Pakistan, State Bank of Pakistan, 2014

Therefore, it was deemed necessary to carry out a market assessment by getting direct input of the potential customers which include grain farmers and traders. Government can also be a potential customer of these warehouses since the current grain storage capacity available with the government is lower than its needs. Wheat storage is a regular activity of provincial and federal governments to ensure food security and to keep the prices stable. Federal government also stores other commodities like rice, pulses, etc.

For gaining insights into the grain markets dynamics and identifying the need for storing grains, visits were made to rural areas to have meetings with grain farmers, traders, processors and other private and public sector stakeholders. The meetings were organized with the help of the Punjab Agriculture Department. Farmers and traders were identified by the department's local staff in Okara and Sheikhupura districts to arrange the meetings. Some of the meetings were held with stakeholder groups while others were held with the individuals. For understanding the markets of all the three types of grains, it was ensured that the sample selected for meetings included producers, traders and processors of wheat, rice and maize.

2.4.1 Stakeholder Consultation

2.4.1.1 Farmers

The prime potential beneficiary of rural warehouses is the farmer of the local areas. It was therefore deemed necessary to know their stance by directly interacting with them in the field. Meetings were conducted to assess the demand for the proposed warehouses and the related issues. The prime objective of these meetings was to assess the propensity of the farmers to store their produce instead of selling it immediately after harvesting. Another key objective was to get an idea of the price the farmer is willing to pay in case he decides to store. The potential benefit to the farmers in terms of increased price of the stored product in the months following the harvesting month and reduction in losses was also assessed during the meetings. Since the responses were expected to vary with the farmer's landholding, effort was made to include farmers of different landholdings in the discussions.

2.4.1.2 Traders

Meetings were conducted with traders in grain markets to know their stance on the idea of establishing rural warehouses. The purpose of these meetings was to know the interest of traders to use the proposed warehouses for storing their agriculture produce. The affordability and traders to pay the storage cost was also assessed. Similarly, the benefit for the traders in terms of price increase of the commodity and reduction in storage losses by storing in proper warehouse were also discussed. Any potential grain storage by farmers tends to reduce the bargaining power and control of the grain traders. Traders' point of view in this regard and any possible resistance to the idea was also assessed during the meetings.

2.4.1.3 Grain Processors

A major buyer of grains is the processing industry; including flour mills, rice mills, maize processors and poultry feed industry. Since storage decision by the farmers may lead to an increase in the raw material cost of these sectors, it was considered important to meet with these stakeholders.

2.4.1.4 Government Departments

Government of Punjab is an important stakeholder in grain marketing. Therefore, meetings were conducted with the relevant departments to understand their stance. Relevant officers from Agriculture Department were met to brief them about the objectives of the study and to understand the department's perspective on the subject.

An important stakeholder in wheat sector is the Punjab Food Department (PFD). Meetings were carried out to understand the wheat procurement process and the situation of availability of storage space for wheat. Food Department is involved in developing modern silos for wheat storage. Discussions were carried out to understand the current situation and future plans of the department in this regard.

2.4.1.5 Silo Suppliers

Meetings were conducted with the local agents of the international silos suppliers who are active in the local market and have sold silos to public sector departments and grain processing industry in the private sector. The storage options available with these suppliers were discussed in detail in the context of providing storage space to the farmers in the rural areas. The cost data was also obtained from the silo suppliers.

2.4.2 Secondary Information

Along with directly collecting information from the field, secondary information was also consulted. Previous reports from local and international sources were reviewed. In addition, available government's statistics were also used to enrich the analysis. Key data in this regards included the past production trends of the three commodities, their historic monthly market prices in different years, storage losses data and the government's grain storage capacities.

3.0 SITUATION ANALYSIS

A thorough situation analysis was carried out by conducting field visits and having meeting with grain farmers, traders, processors in the supply chains of wheat, rice and maize crops. Relevant government's officers were also consulted as part of the process. The objective was to identify and assess the current storage practices and gain an understanding of the viability of the idea of establishing commercial warehouses in the rural areas; with the primary objective of benefiting the local farmers. Commodity-wise supply chain analysis is presented in the following pages.

3.1 Wheat Supply Chain

Wheat is the staple food and the most commonly grown crop in Punjab. It is grown in Rabi season in the month of November and harvested in April. In 2015, Punjab produced 19.28 million tons of wheat that accounted for 73% share of the national production. Wheat carries a high importance with respect to ensuring food security and thus the government ensures stability of wheat prices by engaging itself in wheat procurement and maintaining the necessary strategic stocks. Procurement and stocking is carried out jointly by federal and provincial governments; respectively by Pakistan Agriculture Storage and Services Corporation (PASSCO) Ltd. and the provincial food departments. For the year 2017, the national wheat procurement target was approved as 7.05 million tons. That included Punjab's share of 4.5 million tons and shares of 1.2 million tons, 0.35 million tons and 0.1 million tons respectively each for Sindh, Khyber Pakhtunkhwa and Balochistan. PASSCO was assigned the target of procuring 0.9 million tons from all the four provinces. The targets for each year are set by the government keeping in view the existing stocks of wheat from previous years and the production volumes of the recent year.

Each year, the government announces the minimum guaranteed price of wheat to ensure profitability for the farmers. The support price for the year 2017 was set as Rs 1300 per 40 kilogram. Procurement target for Punjab is managed by the Punjab Food Department. For that purpose, the department is responsible to provide gunny bags[6] to the farmers. The farmers load the wheat grain production from the field and transport it to wheat procurement centers established in all districts of Punjab. In 2017, there were 384 procurement centers which were engaged in buying wheat from the farmers in Punjab. These centers have been made available at Union Council level. Wheat is weighed at the weigh bridges of the procurement centers and procured by the food department. Farmer is issued a receipt on the basis of which he can get his payment through cross cheque; deposited in his bank account. The paid amount includes the payment of the wheat and transportation cost paid back to the farmer at the rate of Rs 9 per 100 kg.

PASSCO also participates in the wheat procurement campaign along with the provincial food departments. PASSCO procurement centers are established all around the country for this purpose. Gunny bags are distributed to the farmers and wheat is procured from them at those centers. PASSCO and the provincial food departments work in close coordination with each other to successfully manage wheat procurement. The support price offered by PAASCO is the same as that by the provincial food departments.

[6] Jute bags known as 'Bardana' in the local language

3.1.1 Wheat Storage Practices

Wheat is harvested and the stalks are stored in the form of bundles in the field. The harvested crop is then threshed to separate grain from the straw. Grain is filled in bags and is temporarily stored in the fields till transported to its next destination. Straw is collected, bundled and stored in the fields as a feed for the livestock. Part of the straw is retained by the farmers for his animals whereas the rest is sold in the market. Wheat grain is stored by different players in the supply chain using different storage techniques.

3.1.1.1 Storage by Farmers

Government does not procure the entire wheat production from the farmers. Only a prescribed number of gunny bags are given to the farmers. For wheat procurement in 2017, farmers were provided ten bags per acre. At 100 kg per bag, total production that the farmers could sell to the government was 1000 kg or 1 ton. The farmers thus sell only a portion of their wheat production to the government. The balance production is sold in the open market.

Farmers do not sell all of their wheat production. They store a certain portion of their production for their own use. Part of this production is consumed to meet the family's yearly food needs and part of it is used as seed for the next crop. Wheat storage as seed is done usually at the rate of around 50 kilograms per acre. This storage is done in specially designed baskets which are placed in farmer's homes. There are not many losses in such storages and the wheat is considered secure.

Apart from the wheat stored for own consumption, there is no practice of wheat storage at farmers' level. One possible option in this regard is to store his wheat by stacking bags in the open areas. However, this is generally not practiced. One reason for this is the lack of space since the available land has to be prepared for the next crop of the Kharif season. Moreover, the wheat stored in open areas requires greater degree of care which is usually difficult for the farmers to ensure. That increases the chances of a greater share of production being wasted. Moreover, the wheat stored in open also remains exposed to threat of thefts. As a result, the farmers prefer to sell their wheat instead of storing.

3.1.1.2 Storage by Punjab Food Department

Punjab Food Department (PFD) ensures food security in the province by procurement of wheat from the farmers at support price and maintaining the recommended stocks. Wheat procurement target for 2017 was set at 4.5 million tons which was around 23% of the total provincial production. Food department stores the wheat in covered as well as open storages. Total covered storage capacity available with PFD is 2.3 million tons. With certain improvisations, the department manages to store up to 2.8 million tons in the available covered storage facilities. These covered storage facilities includes both house-type godowns and the silos. Detail of silos storage capacity available with the PFD is shown in Table 1.

Location	No. of Silos	Capacity per Silo (Tons)	Total Capacity (Tons)
Faisalabad	15	3,300	49,500
Islamabad	16	5,000	80,000

Multan	10	3,800	38,000
Dera Ghazi Khan	8	3,750	30,000
Bahawalpur			30,000
Total			**226,500**
Source: Punjab Food Department (http://food.punjab.gov.pk/high_tech_silos)			

Table 1 – Wheat Storage Capacity Available with Punjab Food Department

Total covered storage existing as silos is 0.226 million tons and the balance is in the form of house-type godowns. It means that covered wheat storage available with PFD comprises of around 10% silo storage and the rest as house type godowns. Considering the figure of 2.8 million tons as covered storage space, it can be said that 62% of the wheat procured by PFD can be stored in covered storage facilities; while the rest has to be stored in open spaces.

Wheat in open spaces is stored by making stacks of wheat bags as per a defined configuration. This arrangement is known as 'Ganji' in the local language. A platform is made at the bottom on which the bags are stored. There are 3,603 wheat bags that are stacked in one 'Gunji' made PFD. The stack of bags is secured from the top from rain and other climatic harshness by covering it by tarpaulins. The food department maintains these open storages all across Punjab in line with the supply and demand of wheat in different areas.

Figure 8 – Wheat Storage in Open Spaces

3.1.1.3 Storage by PASSCO

PASSCO operates at the federal level to store agricultural commodities which include wheat, pulses, paddy, sunflower and other agricultural commodities including perishables. The storage techniques used by PASSCO are quite similar to the ones used by PFD. PASSCO stores commodities in covered as well as in open spaces.

3.1.1.4 Storage by Traders

A significant share of wheat is procured by the traders in the grain markets. These traders usually have smaller informal warehouses where wheat is stored in the form of bags stacked over one another. The traders usually procure wheat from open market and store it to take advantage of any increase in commodity prices in the later months. This change in wheat price is usually not very significant since it is controlled by the government by increasing supplies from its stocks whenever there is a rising price trend in the open market.

3.1.1.5 Storage by Flour Mills

Flour mill sector is a large buyer of wheat. The mills procure wheat from the open market as well as from the government. Wheat is procured by the mills as per their milling capacity and is stored in secure covered places. Small millers store wheat in house type warehouses whereas the larger ones have built silos for this purpose. In some cases, the flour mills may also rent out storage space on some other premises. Some old godowns or sheds available in some closed factories may be used for this purpose. Storage of the wheat procured by flour mills in open spaces is not very common.

3.1.2 Issues in Wheat Procurement

Wheat procurement system by the government has been set up to ensure food security in the country and to ensure guaranteed profitability for the farmers. The government manages to control the prices by supplying what in the market whenever the prices tend to rise. The farmer benefits by getting a guaranteed return on his investment in the crop. Thus the system is mutually beneficial for all the stakeholders. However, the flip side is that the government has to spend billions of rupees each year to achieve these benefits. Moreover, there are many issues and inefficiencies in the system which tend to divert the benefits, originally intended for the farmers, to other players in the wheat supply chain. Some of these issues are discussed in the following paragraphs:

Eligibility as Farmer

Government uses land records of the revenue department to identify farmers and the land owned by them. As per the present policy, gunny bags are provided to the farmers on the basis of their total land at the rate of ten 100-kg bags per acre. In most of the cases, it is the farmer who avails this eligibility for getting the benefit of selling at support price. However, slippages in the system are observed when even some landless people get themselves registered as farmers by using unfair practices. This malpractice is accomplished in collaboration with the government's functionaries. Thus, such non-farming people unfairly get the gunny bags, procure wheat at lower prices from the market which is then loaded in those bags and sold at the government's procurement centers at the support price which is higher than the market price. Some undeserving person gets the benefit of government's support price and some deserving farmers are left out from getting the benefit which was originally targeted at them.

Delayed Provision of Gunny bags

The government buys wheat only up to the set procurement target. Therefore, wheat is accepted for procurement only in the gunny bags provided by the government in specific

numbers in different wheat producing areas. The farmer has to go through a cumbersome process to get the bags. He has to go to procurement centers multiple times and has to wait in long queues to get those bags. The supply of bags is usually not started before the harvesting. The farmers have to wait for the bags before starting the harvesting which delays the procurement process. Sometimes, the harvested wheat stalks or threshed grains remain lying in open waiting for the farmers get their gunny bags. In case of any rain during this period, the produce gets damaged. As per the feedback of the farmers, usually, these delays in issuance of bags and start of procurement are caused intentionally to keep the farmers under constant pressure, weaken their negotiating position and compel them to sell their produce at prices lower than the government's support price to the traders.

Cumbersome Process

The process of selling wheat at the government's procurement centers is long and cumbersome. The farmers transport the loaded trolleys at the center and then have to wait in queues for long durations (many sale transactions may take more than 24 hours). After the wheat is sold, the payment takes another one to two weeks to get processed. Thus, the farmer has to make multiple visits to sell his produce and get his payment. There are instances where some farmers get discouraged by this long process and prefer to sell their produce at lower prices to the middlemen who then sell that at support prices at the government's procurement centers (using the farmers' eligibility and documents). Thus, in such cases also, the benefit of support price intended for the farmer, fails to reach him.

Under-Weighing and Unfair Practices

As per the wheat procurement policy, the wheat that has to be procured by the government can only be weighed at the weigh scales installed within the procurement centers. No private weigh scale is authorized to weigh on behalf of the government. This causes unnecessary delays in the procurement process. In addition, there are complaints of under weighing at government's weigh scales. There are instances where farmers get exploited due to unfair practices by the government's machinery.

Procurement by trader

Small farmer has a weak financial muscle. He wants to sell his produce immediately to meet his cash needs and pay back his debtors and get cash for the next crop. Therefore, some of the farmers do not want to wait for the long process to get completed for getting their payment. So they sell their right as a farmer to the middleman (trader). The trader buys his produce at a price lower than the support price and gives him immediate cash. The produce is then sold at higher price (support price) at government's procurement centers. The trader thus exploits the farmer on his immediate cash needs and the sluggish system facilitates him in this exploitation. The benefit of support price thus gets transferred to the trader instead of the farmer.

3.1.3 International Wheat Market Situation

The year 2017 saw a bumper crop of wheat that led to increasing the already existing surplus of wheat in the country. Government still carries wheat stocks from the last year to which more stocks have been added. There has been an increased supply of wheat in the international market as well that has led to huge decline in export prices. During the past

decade, the wheat price was the highest in March 2008 when it touched USD 404 per ton. In the following years, the export prices followed a declining trend and from December 2016 to June 2017, the international price has been hovering in the range of USD 120-140 per ton.

In such a situation, Pakistan is not competitive in the international wheat export markets. As per the sources of Punjab Food department, the wheat production cost in Pakistan is USD 245 per ton and government is procuring it at around USD 310 per ton. When compared with the international prices, the situation does not allow Pakistan to export its surplus wheat. In case the government still wants to export, it has to pay huge rebates to the exporters to make them competitive. With previous year's surplus stocks being enhanced further by this year's bumper crop, and optimistic projections for wheat production for the next year, the government does not seem to have many options but to take measures to move the local wheat market towards open market system just like the one practiced for other commodities.. Government can take care of its food security concerns by procuring wheat from the open market to maintain its level of strategic stocks.

Within the farmer community, a mixed reaction was observed to the idea of opening up the wheat market just like other commodities. With multiple issues engrained in the current system, many farmers were of the view that opening up the wheat market will not make any difference to the farmers since in the current system as well, the major benefit is taken by the trader and not by the farmer. This group of farmers was of the view that even if farmer has to bear a loss of Rs 30-40 per ton, the government should still open up the wheat market. Doing this will at least save the farmers from the present hassles faced by them. However, the other group of farmers, represented by a sizeable percentage of the farmers, wanted the support price system to continue. Even some of them advocated having support price mechanism for other commodities also.

3.1.4 Post-Storage Situation

Wheat has to be milled into flour before it may be consumed. All the wheat thus directly or indirectly has to go through the milling process which is carried out in flour mills or at small flour grinders (*Chakki*) in towns and cities. Flour mills sector is a large buyer of wheat stored by different actors in the supply chain. Flour mills buy wheat from the open market when new crop lands into market. Traders also sell their stored wheat to the flour mills. Government sells its wheat to flour mills as per their needs. In addition, government also keeps wheat's prices stable by increasing the supply of wheat in the market in case of an increased demand.

3.2 Rice Supply Chain

Rice is the most important crop of Kharif season; cultivated in July and harvested in November. Rice is considered to be the second staple food of the people of Pakistan. In 2015, Punjab produced 3.84 million tons of rice contributing 51% to the national production. In view of its importance with respect to food security, this is also one of the commodities that are stored by PASSCO. However, unlike wheat, no specific targets are set each year for the procurement of rice. Any needed procurement and storage decision is made looking at the specific requirements of the situation. Rice is not stored by the provincial food departments. Rice also carries a high importance with respect to exports by being the second largest export product after textile.

Paddy is sold in the open market with no intervention by the government. Unlike wheat, there is no support price mechanism in place for rice and price is decided by market's demand-supply situation. Rice price in the local market is also affected by the demand-supply situation in the international markets. Rice is sold in grain markets through open auction by the farmers. The other route is where the representatives of the rice mills directly contact the farmers for buying paddy. Just like wheat and other commodities, the trader (Aarthi) plays an important role in the supply chain of rice as well. Important players which store rice after its harvesting include rice mills, local traders, exporters and farmers.

As a general practice, rice is stored in finished form. Only a small share of total production is stored in the form of paddy and that too for smaller periods. The reason is that paddy is more prone to wastages; especially if harvested by harvester machine when it is obtained in wet condition and presence of moisture provides a more favorable environment for insects and bacteria to attack the grain. Thus the paddy has to be dried before it may be stored.

3.2.1 Storage by Rice Mills

Rice mills are the largest buyers with the largest storage capacity for paddy and rice. Crop is harvested and threshed into paddy which is loaded into bags. If harvested by a harvester machine, the paddy is wet and has to be dried before taking to the market. Normal practice adopted by the farmers is drying the paddy in open sun. The dried paddy is loaded into bags and transported to grain market where it is sold through open auction. The agents of rice mills participate in the auction to procure paddy. Payment terms are decided mutually between the buyers and the sellers. Full payment to the farmers may take from one to two months. The paddy procured by the rice mills is transported to their premises where it is dried to remove any excess moisture and stored in the warehouses of the mills. The millers dry paddy in sun as well as by using fuel-powered grain dryers. The miller processes the paddy into rice without much delay since storing paddy is not a recommended practice due to that being more prone to wastage. The finished rice is loaded in cotton or polypropylene bags (65 kg) and stored by the miller till being sold to the next buyer which may be the local wholesaler, retailer or the exporter.

For storing paddy or milled rice, the use of silos is not common and storage in bags is the most commonly used method of storage. The bags are stacked over each other up to a specified number of bags in each stack. The miller ensures appropriate measures to protect the finished rice from climate harshness by properly enclosing the storage areas. When stored for longer periods, fumigation is also carried out to protect from insects and pests.

3.2.2 Storage by the Traders

A sizeable share of rice is also stored by traders. This storage is usually in the form of finished rice which the trader gets after de-husking of his paddy from the local rice mills; after paying the processing charges. Some traders also store paddy; however this is not a commons practice and major share of the production is stored as milled rice. The prime objective of storing is to get the benefit of increase in price of rice in the months to follow. Traders store rice in their own house-type warehouses in the grain market or in the areas close by. These are built in the form of normal covered rooms where rice is stored by stacking the bags on each

other. These are not professionally built warehouses; however, the traders ensure that the grain is kept protected from rain by properly covering the grain. When stored for longer periods, fumigation of the product is also carried out at defined intervals.

One storage option used by some of the traders is that of storing their milled rice in the warehouse of the rice mills where their paddy was processed into rice. Some rice millers offer this service to the traders free of charge for three to four months. The ownership of the product during this period remains with the trader who may sell his product to the same miller after some time at a higher price. Or he may lift the bags from there and sells it in open market. Benefit for the miller in this arrangement is maintaining an ongoing relationship with the trader to motivate him to come to him next year also for de-husking his paddy.

The traders usually do not have their own paddy dryers. In case they receive paddy in wet form from the farmers that has to be dried before it may be stored or sold. It is either dried in open sunlight or the traders get drying services from the millers.

3.2.3 Storage by the Farmers

The practice of rice storage at farmer level does exist, though not very common. Small farmers usually do not engage in this activity since they do not have the financial muscle to delay their cash inflows. Moreover, they have rice in the form of paddy which cannot be stored for long (even when dried). For converting their paddy into rice, they have to interact with the miller for which they do not have the required information and knowhow. Resultantly, they prefer to sell their paddy in the market to get immediate cash and lose the potential high profit margins by selling rice in finished form after waiting for few months.

Farmers in the middle to larger tiers have some tendency to get their paddy de-husked at the rice mills, pay the charges and store the finished rice in their stores. These stores are very informal and usually in the form of a room that has been allocated as the storage space within the houses of these farmers. Naturally, these stores are much smaller than those used by the traders. The practice of farmers storing their milled rice in the storage space within the miller's premises is not common.

3.2.4 Storage by Commercial Exporters

In many cases, the miller is also the exporter. However, there are commercial exporters as well who get orders from international market and source finished rice from the local millers to meet the buyer's demand. Some of these exporters maintain their own warehouses. The duration of storage in these warehouses is usually not long and the product is stored only for the period in which the export order is processed.

3.3 Maize Supply Chain

Maize is an important national crop cultivated twice during a year. The spring crop is cultivated in February and March and harvested in May and June. The autumn crop is cultivated in July and August and harvested in October and November. Around two third of the total annual maize production is obtained from July crop and one third from October crop. In 2015, Punjab produced 4.02 million tons of maize that accounted for 81% of the national

production. Major share of maize is consumed by the local industry and a small share in consumed as corn by the local population in the form of corn flour and roasted corn sold to the local population by the street hawkers.

Maize is sold in open market without any intervention by the government. The farmers harvest maize and may convert it into grain which is transported to the market and sold through open auction. It is important to mention that maize has to be dried in the form of cobs since separation of grain from the cobs is not possible in the form in which it is harvested. Thus, the farmer has the option to either sell it in the form of cobs or dry it before he may separate the grain and sell it. The market price of dried maize is higher by about Rs 100 per maund. Maize drying by the farmers is carried out in open sunlight. The use of fuel-powered dryers is not very common.

There is no support price mechanism in place for maize and the price is decided by market's demand-supply situation. The trader (arthi) plays an important role in the supply chain of maize also. The agents make procurements on behalf of the industrial buyers. The maize may or may not be dried by the farmer before bringing it to the market. Moisture percent in the maize is an important factor in determining the market price of maize. The market price is decided on daily basis and varies to adjust the effects of the incoming supplies by the farmers and the demand by the industrial customers of maize.

Important players which store maize grain include maize processing industry, local traders, and the farmers. Maize does not have an export market. Similarly, there is no major import of maize in the country. Thus the local prices of maize are not affected by price fluctuations in the international markets.

3.3.1 Storage by Industrial Customers

Industry is the biggest buyer of maize. Rafhan Maize Products is the single largest buyer of maize in the country. The company uses the grain for making host of food products including starches, sweeteners and multiple food ingredients and industrial products. The other major buyer of maize is the poultry feed industry where it is a key nutritional component in the feed recipe. Industry buys maize from the farmers through its agents in open auction in the market. Maize brought by the farmers may or may not be dried by the farmers before selling. Industry prefers to buy dried maize and is willing to pay a premium for that. The maize procured by the industrial customers is transported by them to their premises where it is stored after giving necessary treatments like cleaning, drying etc. Majority of the poultry feed mills have built silos to store maize. This helps maintain the quality of the grain, makes handling and processing easy and saves extra loading/unloading costs.

3.3.2 Storage by Traders

The traders of the grain market also store maize for short periods. They have built small to medium storage facilities for this purpose where maize is stored in bags. For this purpose, it is important that the maize is dried before storage; either by exposing it to sunlight or in a fuel-powered dryer. Traders may also store maize on behalf of their buyers or as their own product. In the latter case, the purpose of storage is to gain any expected price hike in the coming days or weeks. Storage by the traders is not done for longer periods since the storage

facilities used by them are informally built house-storages which are unable to maintain the quality of the product. Another storage practice is getting uninhabited and unused buildings on rent and storing grain in those places.

There is a very limited practice of traders having their own grain dryers for maize. There is a price difference of around Rs 100 between the dry and wet maize. This difference is usually decided on the basis of moisture in the wet maize and the weight loss from the product after drying. Moisture in the wet maize is around 17% which is reduced to 13% after drying. There has been an example where grain trader has installed dryers along with silo storage; mainly to store his own produce. The practice of establishing commercial grain drying units of maize or other grains is not very common; though some units do exist which provide such services to the farmers and traders.

3.3.3 Storage by Farmers

Small farmer does not store maize at any stage. The key reason is the lack of financial strength to hold back his produce. He needs immediate cash to pay back his debts and to start preparations for the next crop. Even if in some rare cases, a small farmer does want to store his produce, he does not have any storage facility available for that. There is a very limited practice whereby some farmers store maize for small periods in some vacant rooms in their houses. Usually, it is not grain but the whole maize cobs which are stored after drying in open sunlight. Drying maize cobs is important to prevent the product from being wasted.

The medium and large farmers practice storage of maize; however, that too is done at a limited scale. There are only 5-10% farmers who store their maize in their private sheds. These farmers sell major share of their total production in the market and the balance is stored in their own warehouses. These warehouses are usually in the form of informal storage rooms used for storing old unwanted stuff. Old garages in the houses are also used for storing grain. These places, though covered, cannot be classified as proper warehouses where the grain can be stored in a secure environment. The product thus remains susceptible to attacks by insects and pests. However, since the duration of such storage is usually not long, the extent of these losses is considered bearable by the farmers. Just like traders, some farmers also get some unused buildings on rent to store their grain for short periods.

Figure 9 – Maize Bags Stored in Informal Storages

Some larger farmers also adopt the practice of storing maize in open in the form of a 'Ganji'. For this purpose, two types of arrangements may be followed. In the first type of storage, the entire production is stored in bags and the bags are stacked in the format of a 'Ganji' and duly protected by covers. In the other type, certain portion of the grain is loaded into bags which are stacked on all the four sides to enclose a specified area. Inside that enclosed space, maize is stored in bulk form and properly protected by covers. Maize is sensitive to attacks by fungus and diseases. Therefore, if maize storage is for more than two months, it requires spray to keep its quality intact. Most of the time, this damage starts by absorption of water present in the ground by the lowest bags in the stack. This moisture starts travelling up towards the bags on top and the damage keeps increasing. The maize stored in open is also more exposed to the threat of attacks by pests, insects, squirrels and birds. An average wastage of around 5-10% occurs in such storages; depending on the percentage of moisture in the ground and the precision of protection from the top. The wastage may increase up to 15-20% in case of a rainfall on the stored maize bags.

Thus, the farmer assumes a high risk by storing the maize in open. Depending upon the change in market price of maize, this risk may or may not pay off. Sometimes, the price increase is good enough to generate extra profits; whereas in some other times, the price increase is not enough even to cover the loss occurred due to wastage of the stored grain. Storing maize in a formal warehouse offers a practical solution to keep the product secure and make things more predictable for the farmers.

4.0 DEMAND FOR RURAL WAREHOUSES

4.1 Factors Affecting Demand for Rural Warehouses

Demand for rural warehouses depends upon multiple factors. Along with the market demand-supply situation, the need for rural warehouses will be derived from the benefits for the farmers in terms of reduction in storage losses, an anticipated increase in profitability due to higher selling prices and an increased bargaining position of the farmers. The demand for warehouses will also directly depend upon the storage cost charged by the warehouse operator. It means that the affordability of the farmer will be a critical factor in his decision to store his produce or sell it immediately. Along with the storage cost, another very important factor related to farmer's affordability will be his financial capacity to hold back his produce. This in turn, will depend upon the intensity of his immediate cash needs and the ease of availability of agriculture credit from different formal and informal sources.

4.1.1 Costs and Benefits for the Farmers

Farmer's/Trader's decision to store or sell will depend upon the associated costs and benefits. His cost will mainly include the storage charges to store his product for specified time in the warehouse. Another smaller component of this cost will be the charges of the allied services; such as for grain cleaning and drying. For some farmers, there will also be an added cost of transportation as well. In case of a decision to store, the grain will first be brought to the warehouse and then transported again after specified storage time, to the grain market. In case the farmer finds a buyer who lifts the product directly from the warehouse, this second transportation cost may be avoided if it is borne by the buyer. Another cost that may be considered in this analysis is the cost of capital; the opportunity cost of getting the money at a later point in time versus getting it 'now'. However, for the purpose of the analysis, this cost of capital has not been included.

The monetary benefit for the farmer will be derived mainly from reduction in storage losses and the potential increase in grain's selling prices in the months following the harvesting month. Some added value may also be derived from perceived high quality of the product by being stored in a modern warehouse. In addition to the monetary benefits, another benefit may be accrued by increased access to agriculture finance by developing linkage with the Warehouse Receipt Scheme (WRS); being considered for implementation by the government.

Farmer's/Trader's decision will be 'for' storage if the potential cumulative benefit accrued to him is larger than the cost incurred by him; and the decision will be 'against' storage if the cost is higher than the cumulative benefits. The quantitative cost and benefit analysis from the farmer's perspective is done in later chapter.

4.1.2 Farmers' Capacity to Hold Back

During interaction with the farmers in the field, majority of the farmers were found to appreciate the importance of storage. They also showed their interest to store their produce if some warehouse storage was made available. However, the key concern in that regard was the lack of financial strength to do so. This was especially relevant for small farmers with land holding of up to 20 acres. Government uses the limit of 12.5 acres to define small farmers.

However, based on the input received from the farmers, it can be inferred that even the farmers with land more than 12.5 acres face financial constraints and lack the capacity to hold back their produce. The lack of capacity originates from the fact that the small farmers carry out their farming operations using resources obtained from different sources. Some loans are obtained from formal financial institutions whereas getting credit from informal sources is also a common practice in Punjab's agriculture. Most of the informal credit is obtained from the traders who are also the buyers of the farmers' produce. These loans are obtained for buying agriculture inputs as well as for meeting some personal needs. Thus the small farmers remain in a state of indebtedness which compels them to immediately sell their produce after harvesting to quickly pay back their debts. Moreover, the farmers also need immediate cash to sow their next crop. As a result, such farmers cannot store their produce even if storage space is made available. Making such farmers store their produce is not possible without support by the government. This support may be in the form of soft loans or partial payment of their produce by the government. As per the feedback of the farmers, government should pay up to 70% payment to the farmers for facilitating them to store their produce in the proposed rural warehouses. Alternatively, the government may bear part of the storage charges to be paid by the farmers to the warehouse operator.

However, the situation for middle and large farmers (more than 12.5 acres) is different. These farmers possess the capacity to store their produce after harvesting. The purpose of storage is to increase their negotiating position against the buyers and also reap the potential opportunity of selling at higher prices in the months to follow. As per the feedback obtained from the field, the probable approach by these farmers will be selling part of their produce to get cash for their immediate needs and storing the balance.

4.1.3 Agriculture Credit

30-40% farmers take loans from the banks for carrying out their routine agriculture practices. Majority of these loans are taken for short term needs like buying agriculture inputs. The tenure of such loans is usually from six months to one year. A smaller share of the agriculture credit is used for relatively longer term needs like buying tractors and other agriculture machinery. The tenure of such loans may be up to five years. These loans are given by Zarai Tarraqiati Bank Limited (ZTBL) and other commercial banks. The banks follow their routine lending practices for disbursing these loans. Usually, the farmers have to pledge their land as collateral for getting these loans. In most of the cases, the value of the collateral is much larger than the value of the loan. The interest rate charged by the banks is usually the market rate (unless a loan is available from some special financing scheme under a subsidy). Low literacy and education levels make this process even more difficult for the farmers. Adding to this is the irritant of corruption and unfair practices which further increases the loan processing costs for the farmers.

The net result of all these factors emerges as the fact that the most of the farmers, instead of availing formal credit from financial institutions, prefer to meet their financing needs from traders with whom they share their business interests. They are able to get the money quickly and without any collateral; just on the basis of their personal and/or business relationships. The traders also give them loan for their personal needs along with the business needs. The

trader ensures his return by keeping the farmers under his influence which helps him buy grain at lower prices and increased bargaining terms against the indebted farmers.

4.2 Demand Analysis

Field meetings with the farmers were carried out to assess the demand for rural warehouses. These meetings were held in the form of focus group discussions and one-to-one interviews. Key findings are discussed in the following paragraphs:

- Currently, there is a no significant practice by the farmers to hold back their produce after harvesting because of absence of any rural warehouses. This is true for small, medium and large farmers for all the three types of grains; wheat, rice and maize. Some limited storage is carried out by medium and large farmers; however, the stored quantities are not large enough to create an impact on the market. In case of maize, some medium and large farmers store their produce in the form of a 'Ganji'. Small farmers do not have any option for storage.

- Majority of the farmers showed their interest in holding back part of their produce in case a storage facility was made available. They were found to be well aware of the issues due to lack of storage and loss of the potential benefit of fetching higher prices due to increased bargaining power. As per the findings of the stakeholder consultations, 30-35% farmers may be willing to store their produce if a rural warehouse is made available. These farmers will include medium and large farmers. It will not be possible for the small farmers to opt for storing their produce even if rural warehouses are made available. They do not possess the necessary financial strength for that and thus will require support if the government wants them to benefit from the proposed rural grain storage project.

- Medium and large farmers will also sell major share of their produce and will store only smaller share in the proposed warehouses. As per the feedback from the field, medium and large farmers will be willing to store around 30% of their produce. Thus a farmer with a landholding of 30 acres may sell around 20 acres production and store the balance 10 acres production. A large farmer with 400 acres landholding may sell the production of 250 acres and store the balance production from 150 acres.

- At the start of the project, the rural warehouses may be constructed at district level; however, later, the scope of the project should be increased and such warehouses should be constructed at union council level.

4.2.1 Perceived Benefits of Rural Warehouses

Farmers and traders were directly asked about their perceived benefits of the rural warehouses. The opinions obtained from the field meetings are summarized in the following paragraphs:

4.2.1.1 Increased Bargaining Position

Currently, the farmers do not have any choice but to sell their produce as soon as it is harvested. It is not recommended to store that in the open in uncovered condition due to the

risk of damage due to rainfall or any theft. Provision of rural warehouses will enable the farmers to hold back their produce in a safe place and avail the possibility of higher selling price. This will increase the bargaining position of the farmers against the grain buyers that will increase the probability of farmers fetching higher prices for their produce. However, it is relevant to mention that the probable benefit of improved bargaining position will be limited only to medium and larger farmers since majority of the smaller farmers are already indebted to their prospective buyers and do not have the financial muscle to hold back their produce.

4.2.1.2 Market Price Stability

In the present situation, all the grain harvested in any single day flows into grain market during the same day due to lack of any rural storages. Increased supply in the grain market leads to a drop in grain prices. The buyer knows that the seller (farmer) does not have any option but to sell his produce. The farmers thus have to sell their grain at reduced market prices. Presence of rural warehouses will allow the farmers to control the supply of grain flowing into the market during certain period of time that will help stabilize the market prices.

The issue of price stability is directly relevant for maize and rice since these markets are not directly regulated by the government. Okara is the largest maize producing district of Punjab and as per the sources of the local grain market, it receives as high as sixty to seventy thousand bags of maize per day during the month of July. Increased supply of maize leads to drop in price. As per the information obtained from the market, the rate of maize during July is around Rs 750-850 per maund which increases to Rs 950-1000 in August; when the supply reduces to around fifteen to twenty thousand bags per day.[7] Providing maize farmers the facility of rural warehouses can help them manage the flow of grain into the market to keep the prices stable. Similarly, this argument applies to rice markets in which there is no intervention by the government. In case of wheat, the prices are kept stable by the government by increasing the supply from its stocks whenever there is a rising trend in the market. However, in spite of this, there are variations in wheat price as well which may be capitalized upon by storage if intelligent market information can be made available.

4.2.1.3 Higher Prices Realization

Grain prices are the lowest at the time of harvesting and usually increase in the following months. The rise in prices varies with the type of grain. In the current situation, the farmers are unable to take advantage of this increase in prices due to lack of any storage facility. The result is that this benefit of increased prices is taken up by the traders/stockists who procure grain at lower prices and store in their warehouses.

In case of wheat, although, the market is regulated by offering a support price for the farmers (currently Rs 1300 per maund), there can still be a benefit of rural warehouses for wheat farmers as well. This is due to the situation where the farmers have to sell wheat at prices lower than the support prices to traders to get the benefit of immediate cash and avoid the

[7] These meetings were conducted in May 2017. The price data obtained from the field was found to be different from the statistics of the Government of Punjab (available at www.amis.pk). As per the official market data, the maize average wholesale price in May 2017 was Rs 933 per maund (Rs 2,332 per 100 kg) which reduced to Rs 928 in June and then to Rs 893 in July. The price then increased in the next month to Rs 918 per maund.

hassles of getting involved in government's procedures. The traders store wheat and it is sold at higher prices; Rs 50 to 100 higher than the support price.

In case of maize also, there is an increase in prices in the months following the harvesting. This increase may be as high as Rs 200-300 per maund. As per the market feedback, the maize prices in August may go as high as Rs 1000 per maund.[8] The farmers can take benefit of this price hike if storage facility is made available to them. Along with the issue of lack of space, the other issue in case of maize is that the grain has to be dried before storing it otherwise it catches fungus. Currently, there are not many drying facilities available in the rural areas which may be used by the farmers.

Increase in price over the months is the highest in case of rice. The mills procure paddy from the farmers and store it in their warehouses. They keep processing paddy in the following months to make finished rice. There is an increase in price of rice in the months the benefit of which is taken by the millers and traders.

4.2.1.4 Reduced Grain Wastages

Storage of grain in proper warehouses will reduce the wastages that otherwise have to be borne by the farmer/trader. As per the feedback obtained from the field, the current wastage levels are very high for all the three types of grains. Longer is the duration between the harvesting and selling, more is the percentage of wastages. Insects, pests and animals like squirrels keep consuming the grain stored in open spaces thereby reducing its value. Climatic harshness acts as the other major threat for the grain. The wastages increase manifold in case of a rainfall during the time the harvested crop and/or threshed grain is lying in open in the fields. Though protective coverings are used by the farmers, they do not prove to very useful in case of a heavy and/or sustained rainfall. Moisture in the land also contributes towards increasing the wastages. The result is that the farmers lose a significant share of the value of their produce. As per the feedback of the farmers, there may be a loss of 5-10% of the total value of the produce due to wastages occurring during storage at unprotected locations.

The proposed rural warehouses will protect the grain from insects, pests, animals, birds and climatic harshness and will maintain its quality as per the needs of the buyers. This increase in value will help compensate the owner of the grain for the storage cost he has to pay to the warehouse operator.

4.2.1.5 Protection from Thefts

Though not very significant, the rural farmers do face the issue of theft during the time their produce is stored before being sold. The proposed rural storages will help keep the produce secure from any such threats since the proposed warehouses will be in enclosed areas and properly guarded.

4.2.1.6 Linkage to Warehouse Receipt Schemes

Warehouse Receipt Scheme is being successfully practiced in many countries. The concept is that once a commodity is stored in a warehouse, a warehouse receipt is issued to the depositor

[8] As per the official AMIS data, maize wholesale price in August 2017 in Okara market was Rs 918 per maund.

as evidence that his commodity of stated quality and quantity exists in that location. That receipt may be used as collateral to get a loan from the bank under the guarantee of the warehouse operator to deliver the product against the receipt. This model cannot be implemented currently due to absence of any such warehouses. The proposed rural warehouse facility will thus provide this opportunity to the farmers, farmers groups, traders, etc. to get loans without pledging their land other fixed assets for getting loans.

4.3 Estimating Storage Charges

Currently, there is no practice of storing any type of grain on paid basis in any area of the Punjab. Some limited practice exists at the trader's level but at farmer's level there is no such practice. In the absence of any market information, it is difficult to directly estimate the storage charges that should be considered affordable by the farmers, traders or other customers of the proposed warehouses. The feedback provided by the farmers during field interaction did not generate any clear response in this regard. On an overall basis, the farmers listened to this 'new' proposition of rural warehouses with surprise and exhibited a resistance towards the idea of paying some charges to store their produce for some months. In most of the cases, there was a usual, standard demand from the government to take care of all of their issues.

However, probing deeper and explaining to the farmers the potential benefits of warehouses such as improved bargaining position, reduced grain wastages and the possibility of fetching higher prices, they provided some rough estimates of the storage charges that they will be willing to pay. The affordable storage charges mentioned by the farmers naturally fell in a lower range. For wheat, a price of Rs 10 per maund per month and for rice and maize, a price of Rs 15 per maund per month were considered affordable by the farmers.

From a business perspective, the affordable prices for the customers of the proposed warehouses should be decided keeping in view the potential monetary benefit to them. The customers storing their grain in the warehouses will benefit in terms of increased selling prices and reduction in wastages.

4.3.1 Storage Affordability

In order to have a clearer idea of the situation, it will be useful to have a look at the structure of Punjab's agriculture sector in terms of farm size.

As per the Agriculture Census of 2010, the total number of agriculture farms in Punjab in 2010 was 5.25 million and total farm area was 29.32 million acres. Smaller farms constituted the major share both in terms of number of farms and the farm areas. Small farms (up to 12.35 acres)[9], constituted 90.6% of the total number of farms. In terms of farm area, the share of small farms was 57.9%.

[9] 12.35 acres has been used as the dividing line since the common definition for smaller farms as used by the government is up to 12.5 acres.

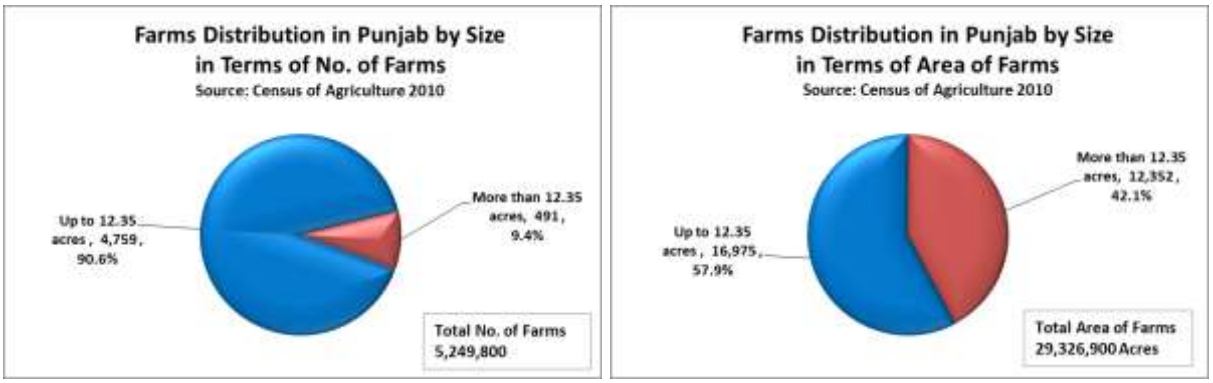


Figure 10 – Farms Distribution by Size in Terms of No. and Area

Table 2 shows the detailed distribution of farms in Punjab in terms of number of farms and their areas; as per the Agriculture Census of 2010.

Farm Size Categories	No. of Farms (000)	Farm Area (000 Acre)	Average Size (Acre)	Share in No.	Share in Area
Under 1.23 acres	1,237.6	816.7	0.66	23.6%	2.8%
1.23 to under 2.47 acres	965.4	1,786.6	1.85	18.4%	6.1%
2.47 to under 4.94 acres	1,144.4	3,908.5	3.42	21.8%	13.3%
4.94 to under 7.41 acres	792.3	4,549.2	5.74	15.1%	15.5%
7.41 to under 12.35 acres	619.0	5,914.0	9.55	11.8%	20.2%
12.35 to under 24.7 acres	360.5	5,823.8	16.15	6.9%	19.9%
24.7 to under 49.4 acres	96.7	2,999.9	31.02	1.8%	10.2%
49.4 to under 98.84 acres	25.1	1,540.9	61.39	0.5%	5.3%
98.84 to under 148.26 acres	4.7	529.3	112.62	0.1%	1.8%
148.26 acres and above	4.1	1,458.2	355.65	0.1%	5.0%
Total	**5,249.8**	**29,326.9**	**5.59**	**100.0%**	**100.0%**
Census of Agriculture 2010 – Agriculture Census Organization (the figures have been converted from Hectares to Acres)					

Table 2 – Number and Areas of Farms in Punjab by Farm Size

23.6% of the total number of farms had an average size of 0.66 acre, 18.4% had an average size of 1.85 acres and 21.8% an average area of 3.42 acres. That means that 63.8% of the total agriculture farms in Punjab had a size of less than 5 acres. In terms of farm area, the share of these farms was only 22.2%. Having such a large number of smaller landholdings makes implementation of development interventions very challenging. There will be an insignificant share of farmers in the category of up to 12.5 acres for whom it will be affordable to store their produce in the proposed warehouses.

It will be useful looking at the volumes of commodities that will be available with farmers of different landholdings. Using average yields and average selling prices, available volumes of grains and the expected revenues for the farmers have been calculated in Table 3 and Table 4.

Wheat			
Average yield (Maund per acre)		30[10]	
Average Selling price (Rs/maund)		1,300	
Farm Size (acre)	**Total Production (maund)**	**No. of Bags**	**Revenues (Rs)**
1	30	12	39,000
2	60	24	78,000
3	90	36	117,000
5	150	60	195,000
8	240	96	312,000
10	300	120	390,000
12	360	144	468,000
15	450	180	585,000
20	600	240	780,000
30	900	360	1,170,000
50	1,500	600	1,950,000
75	2,250	900	2,925,000
100	3,000	1,200	3,900,000
200	6,000	2,400	7,800,000
300	9,000	3,600	11,700,000

Table 3 – Potential Wheat Production Volumes and Revenues from Different Landholdings

A small farmer with a landholding of 1 acre only produces 30 maunds of wheat which he can sell at government's support price to get a small amount of Rs around 39,000. Even if a relatively larger farmer having 10 acres of land is considered, he gets a production of 300 maunds with an expected value of Rs 390,000. Even for farmers with 20 acres of land, the production is 600 maunds which he can sell to get revenues of 780,000. These volumes and revenues do not appear to the large enough to generate the required affordability for the farmers to start considering storing their produce instead of directly selling that.

[10] As per the Agriculture Statistics 2014-15, the average yield of wheat in Punjab was 27.9 maunds per acre. However, this information was seen in the context of the information obtained from the field; and consequently a yield of 30 maunds per acre was used for the calculations.

Maize			
Average yield (Maund per acre)		70[11]	
Average Selling price (Rs/maund)		800	
Farm Size (acre)	**Total Production (maund)**	**No. of Bags**	**Revenues (Rs)**
1	70	28	56,000
2	140	56	112,000
3	210	84	168,000
5	350	140	280,000
8	560	224	448,000
10	700	280	560,000
12	840	336	672,000
15	1,050	420	840,000
20	1,400	560	1,120,000
30	2,100	840	1,680,000
50	3,500	1,400	2,800,000
75	5,250	2,100	4,200,000
100	7,000	2,800	5,600,000
200	14,000	5,600	11,200,000
300	21,000	8,400	16,800,000

Table 4 – Potential Maize Production Volumes and Revenues from Different Landholdings

A similar situation is also seen in case of maize where a farmer with 12 acres of land produces 840 maunds worth Rs 672,000. Similarly a maize farmer sowing 20 acre land produces 1400 maunds of maize worth Rs 1.12 million. Though the earnings are not very large, the situation in case of maize appears to be better than that in wheat.

It is not easy to assess the minimum landholding at which the farmer will consider it affordable to start considering storing part of his produce. However, talking to the farmers in the field and looking at the produce volumes and expected revenues, it can be stated that 20 acres may be seen as the cutoff point beyond which the farmers will start considering the option of storing instead of selling' provided his cost and benefit analysis favors this decision. The cutoff point will be different for different types of grains and more is the per acre revenue, lower will be the landholding at which storage starts becoming affordable for the farmers.

[11] As per the Agriculture Statistics 2014-15, the average yield of maize in Punjab was 60.4 maunds per acre. However, this information was seen in the context of the information obtained from the field; and consequently a yield of 70 maunds per acre was used for the calculations.

5.0 FARMER'S COST AND BENEFIT OF HOLDING BACK

Medium to large farmers store a part of their produce on their own premises to take advantage of increased prices in the later months. Storing in this way entails number of costs that decrease the anticipated profitability of this activity. Important costs in this regard are discussed in the following paragraphs:

5.1 Opportunity Cost of Selling at Higher Prices

The prices of the agricultural commodities are the lowest at the time of harvest due to increased supply. These prices increase in the following months. The farmers can fetch higher prices by storing their produce and selling that in the following months. The value of this opportunity can be estimated by looking at the historical data of monthly wholesale prices of grains under consideration.

The analysis uses wholesale price data from two sources, Pakistan Bureau of Statistics and The Agriculture Management Information system (AMIS) of the Government of Punjab. Pakistan Bureau of Statistics provides price data in two forms. For some commodities, monthly wholesale prices are provided for the past years and the trends of the actual prices can be analyzed. The other presentation of data is in the form of Consumer Price Indices (CPI) for different commodities. The base value of index has been fixed as 100 that is the wholesale price of each commodity in the year 2007-08. Change in index over different months indicates the change in wholesale price of each commodity. The actual price data is for wholesale prices in different cities from all over Pakistan. The CPI data is based on the averages of the prices from all over Pakistan.

The data provided by AMIS is the monthly wholesale prices of different agricultural commodities in different markets of Punjab. The following paragraphs analyze the five-year wholesale price trend of wheat, rice and maize.

5.1.1 Wheat Price Trends Analysis

5.1.1.1 Pakistan Bureau of Statistics Price Data Analysis

The monthly wholesale CPI trend of wheat is shown in Figure 11. The graph shows the data for sixty months; from September 2012 to August 2017. The harvesting month of wheat is April which is shown in the graph by five vertical arrows.

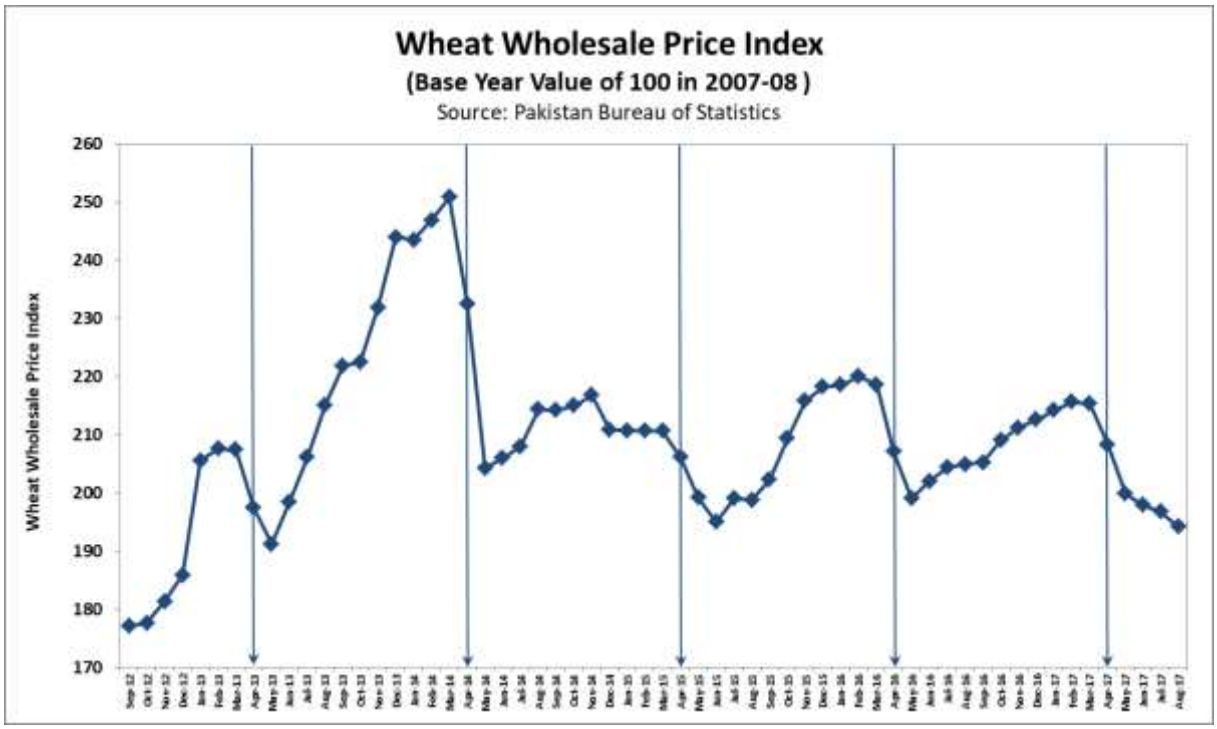


Figure 11 – Wheat Monthly Wholesale Consumer Price Index - Five-Year Trend

The trend shows that wheat prices follow a declining trend in the months immediately after April, the harvesting month. During the five year period under review, the lowest prices during the year were recorded in May for three times and in June for one time. In the most recent year, the prices have been following a continuous declining trend and the price has touched the lowest in the month of August. This can be attributed to the increased supply due to two consecutive bumper crops and an excess inventory in the stores being carried from the previous years. It can be inferred that the normal trend is that following the harvesting month, the wheat prices decline for one to two months after which they start increasing and reach the level of April's prices in the next three to five months. Therefore, storing wheat for two to three months does not appear to be a good proposition for the farmers. Wheat prices rise above than the level of April's prices after six to seven months. This means that in order to attain a price hike, the farmer has to wait for this long and bear the cost of storage during this period.

The price trend was evaluated in quantitative terms by plotting the percent change in price indices with reference to the price index in the harvesting month of April. The results are shown in Figure 12.

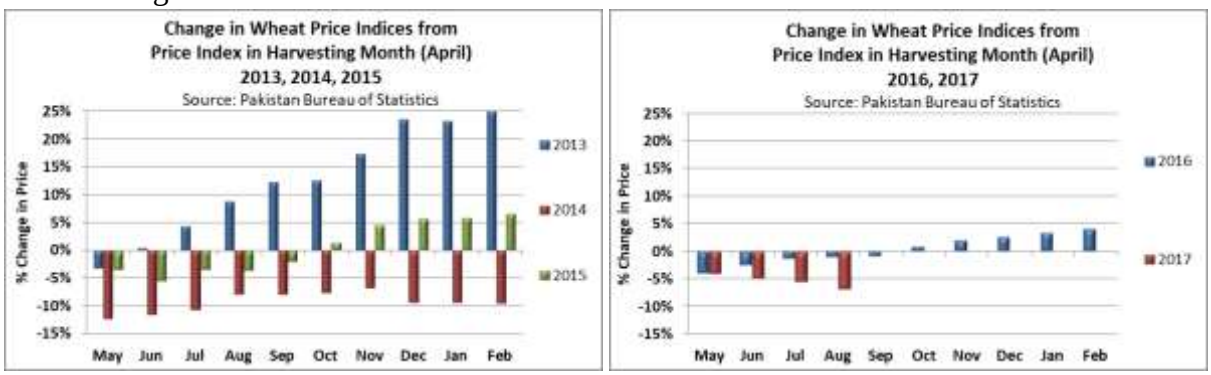


Figure 12 – Change in Wheat price Indices 2013 to 2017 (PBS Data)

The figure shows that the price trends have been different in different years. For example, in the year 2013, the wheat price dropped in May and started increasing from June and continuously increased till December when the overall increase in price index became 23.6% with reference to it value in April. Overall, the price per kilogram increased from Rs 31.61 in April to 39.81 in December; an increase of 25.9%. However, this was the only year that showed this kind of price hike. In other years, the price trend has been different. In 2014, the price in the next ten months following April remained below the price in April. In 2015, the price started increasing in October and increased by 6.7% in February. Similarly, in 2016, the price index rose above the value of that in April in October and the increase went up to 4.1% in February. In the most recent year, the change in price index in the four months after April has been negative. The price decreased from Rs 35.62 per kg (Rs 1,425 per maund) in April to Rs 31.6 per kg (Rs 1,264 per maund) in August.

Treating the year 2013 as an exception, in other years, the highest increase in price index with reference to the price index in harvesting month was 6.7% that was recorded in 2015. This price increase was realized in ten months.

The above-mentioned observation from the price data of PBS indicate that storing wheat in the rural warehouses may not generate attractive benefits for farmers/traders in terms of increase in commodity's price in the following months. There may be possibility of price increase in case there is less supply of wheat due to factors like lesser production, increased exports, etc. However, the likelihood of such events is low since wheat market is controlled by the government and any price increase is avoided by increasing the supply of wheat from government's stocks.

For deciding on the benefit of storing wheat, it will be important to have a look at other benefits of storage such as reduced wastages, etc. before a decision to store may be made by the farmers/traders.

5.1.1.1.1 AMIS Punjab Wheat Price Data Analysis

The data available with AMIS Punjab is richer since it provides monthly price information in different markets of Punjab. Figure 13 through Figure 16 show monthly price trends in four markets of Punjab in terms of percent change in price with reference to the price in the harvesting month of April. Wheat wholesale prices in the four selected markets for six years are provided in Annex I.

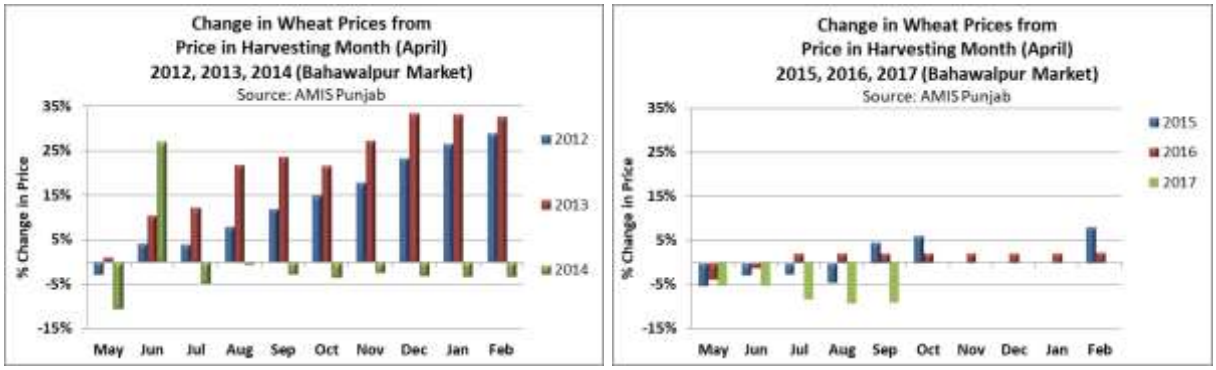


Figure 13 – Change in Wheat Prices w.r.t. Price in April in Bahawalpur Market (2012-2017)

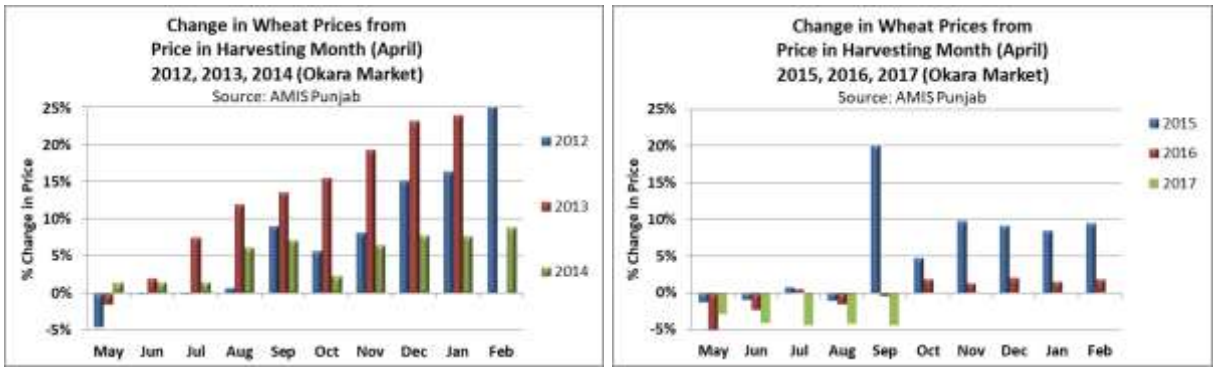


Figure 14 – Change in Wheat Prices w.r.t. Price in April in Okara Market (2012-2017)

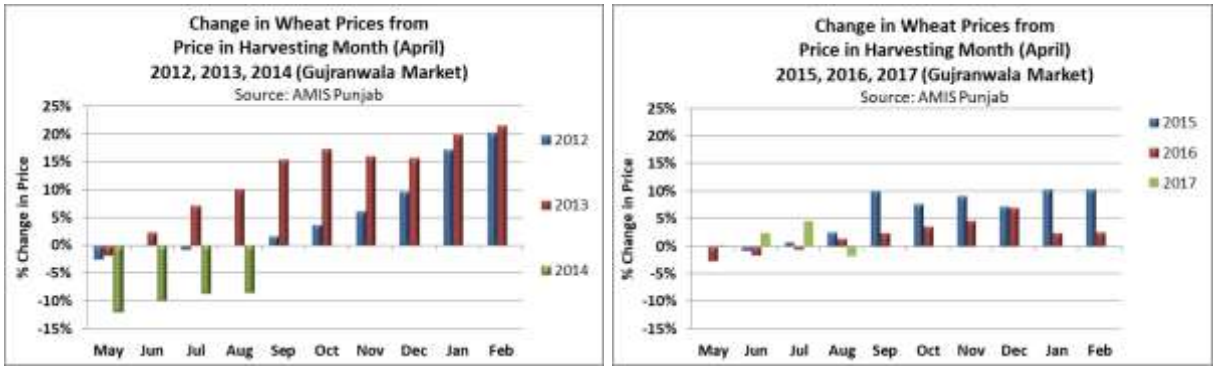


Figure 15 – Change in Wheat Prices w.r.t. Price in April in Gujranwala Market (2012-2017)

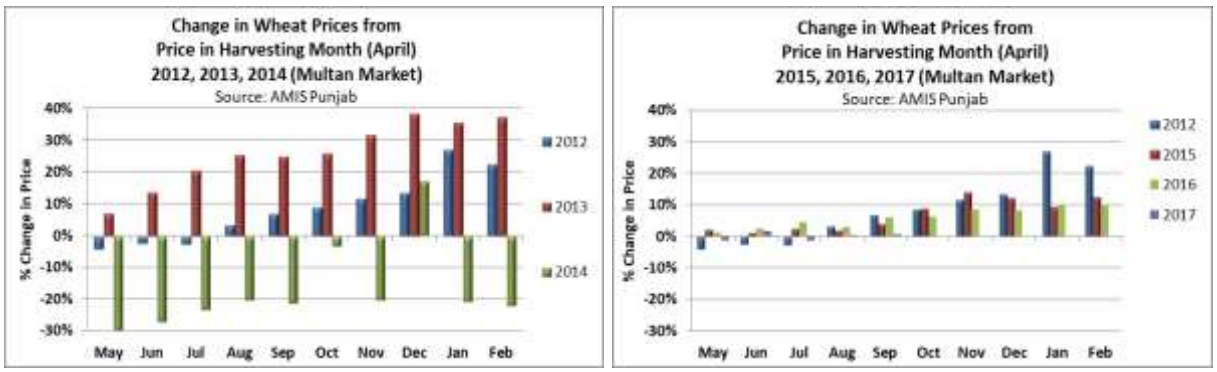


Figure 16 – Change in Wheat Prices w.r.t. Price in April in Multan Market (2012-2017)

Key findings from the above figures are narrated below:

- The monthly changes in wheat prices differed in different markets of Punjab. These differences existed both in terms of direction of change (increase or decrease) and the degree of change. For example, in Gujranwala market in 2014, the price in the months from May to August remained below that of the price in April; however, during the same months, in Okara market, the prices remained above the April prices by around 1%. In Bahawalpur market, during these months, the prices were lower in the months of May, July and August; whereas in June, the price was higher by around 25%.

- The extent of price change in each month varied with the market. For example in 2015, the September's price in Okara was 20% higher than the price in April; whereas in Gujranwala and Bahawalpur markets, this increase was 10% and 5% respectively. Thus

the benefit of price increase after storing wheat for certain number of months will be different in different markets.

- Though as a rule, the wheat prices rose in the months following April, it is not necessary that that the trend remains the same. The trend is inconsistent and the prices are seen to decrease as well as increase in the months following the harvesting month. For example, in 2015, in Okara market, the price in September was 20% higher, which decreased to 4.8% in the next month, again increased to 9.9% in November and then decreased in the next two months to reach 8.5% in January. Similarly, in 2016, in Gujranwala market, the price increase over the price in April was 1.4% in August which increased to reach 6.9% in December and decreased in next two months to reach 2.7% in February. Thus, storing wheat for longer durations does not necessarily lead to increased selling price in the later months. It is affected by the market demand-supply situation; especially in case of wheat where it is controlled by the government.

- In the current year, the prices have been lower in the months after April. In Gujranwala market, the prices were higher by 2.3% and 4.4% in June and July respectively but in the two months were lower by 1.8% and 0.17%y respectively. There is an increased supply of wheat due to good crop in this year. With fixed local consumption and low prospects for exports, the chance of wheat prices rising in the coming months remains slim.

5.1.1.1.2 Estimation of Increase in Wheat Prices

The above-mentioned analysis generates varied views about change in prices over the wheat prices in April in different years. In order to arrive at single figure of increment in price in each month, the highest price change for each month in the four most recent years of 2014, 2015, 2016 and 2017 were selected for each of the four markets. An average of all the four values was calculated to estimate the possible increase in wheat prices. The highest increments for each month from the four years under consideration for the four markets are listed in Table 5.

Market	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Bahawalpur	-3.6%	27.1%	2.0%	2.0%	4.8%	6.1%	2.0%	2.0%	2.0%	2.4%
Okara	1.6%	1.6%	1.6%	6.2%	20.0%	4.8%	9.9%	9.2%	8.5%	9.5%
Gujranwala	0.2%	2.4%	4.5%	2.7%	10.0%	7.7%	9.2%	7.3%	10.4%	10.3%
Multan	2.5%	2.5%	4.5%	3.0%	6.1%	9.1%	9.1%	17.3%	9.8%	12.6%
Average	**0.1%**	**8.4%**	**3.1%**	**3.5%**	**10.2%**	**6.9%**	**7.6%**	**9.0%**	**7.7%**	**8.7%**
Source: Data from AMIS Punjab										

Table 5 – Highest Increment in Price during Four Years from 2014 to 2017

Applying the estimated increments on the current support price of Rs 1,300 per maund and comparing the monetary benefit with the proposed storage charges provides an idea whether the proposition of storing the wheat instead of selling it makes economic sense for the farmer or not. The results are shown in Figure 17.

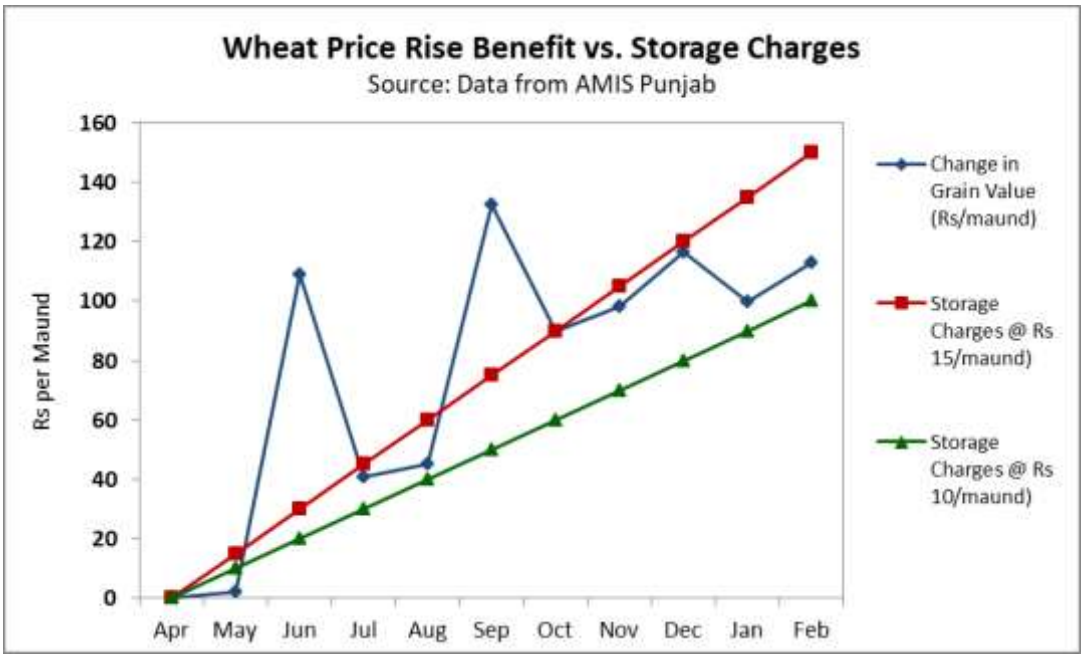


Figure 17 – Wheat Price Rise Benefit vs. Storage Charges

The comparison has been drawn at two value of storage charges; Rs 15 and Rs 10 per month per maund. At Rs 15 per month per maund, the probable increase in value of the grain remains below the storage charges for most of the months during the year. In this scenario, it is only during June and September that the benefit through increased prices was higher than the storage charges.[12] When compared with the storage charges of Rs 10 per month per maund, the benefit to the farmer remains higher than the storage charges for all the months during the year. Thus the storage charges for wheat should preferably be less than Rs 15 per maund per month to make the proposition value-added for the farmers.

However, while doing this analysis, it should be kept under view that the above-mentioned analysis has been based on the averages of the highest percentage increases over the price in April during the last four years. Actual results will be different for different markets and the farmers' decisions to store or not to store, and for how long to store, will be based on the dynamics of the local markets.

5.1.2 Rice Price Trend Analysis

The monthly wholesale CPI trend of Rice is shown in Figure 18. The graph shows the data for sixty months; from September 2012 to August 2017. The harvesting month of rice is November which is shown in the graph by five vertical arrows.

[12] For these months, the two outlier values seem to be responsible for this. An odd increase of 27.1% in Bahawalpur market in June and an unusually high increase of 20% in Okara market in September are causing the two spikes in the graph shown in Figure 17. Taking these outlier values out of the average price change values, for all the months during the year, the benefit appears to be lower than the storage charges at the rate of Rs 15 per maund.

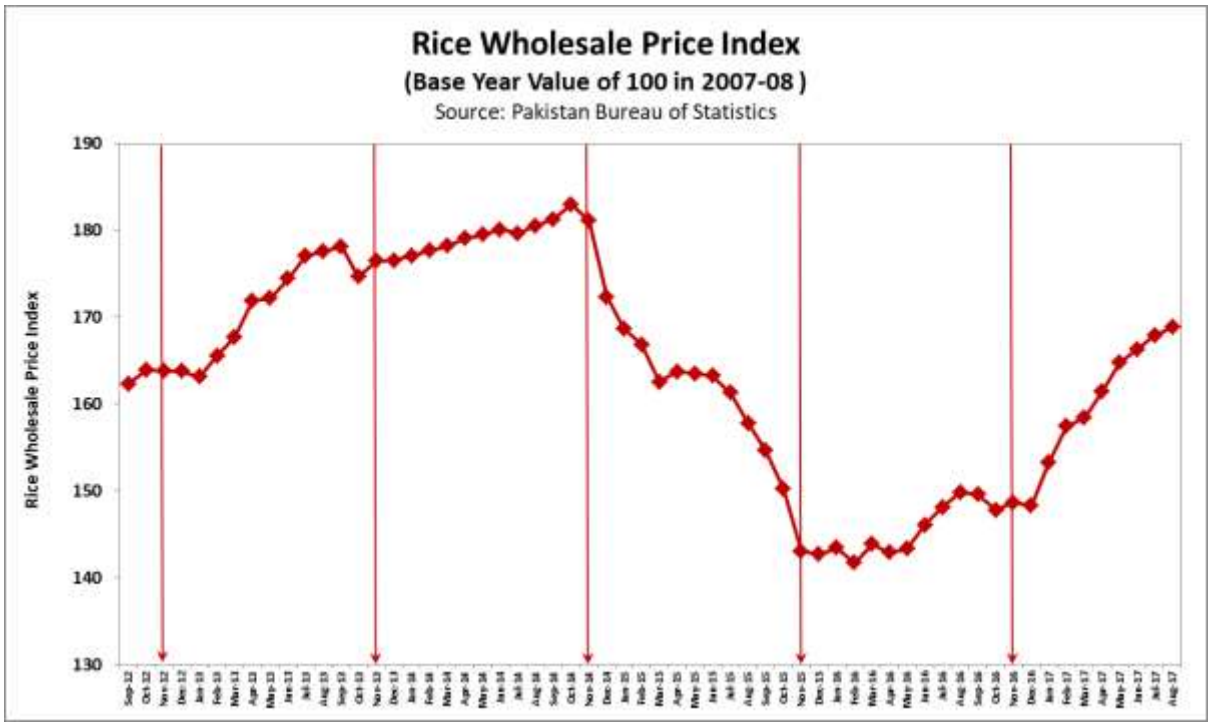


Figure 18 - Rice Monthly Wholesale Consumer Price Index - Five-Year Trend

The trend shows that rice prices have generally followed a rising trend in the months immediately after November, the harvesting month. The only exception during the last five years was the harvesting month of November 2014 when the rice prices continuously decreased over the next twelve months. The per kg price of rice decreased from Rs 79.29 in November 2014 to Rs 54.18 in November 2015; representing an overall decrease of 32%. The decline is attributed to reduced exports of the country and a declining price trend in the international markets.

During the five year period under review, the usual trend was that the rice prices started increasing in the months of January or February and then maintained an increasing trend over the next harvesting period. Storing rice thus appears to offer good storage proposition to the farmers and traders.

The rice price trend was evaluated in quantitative terms by plotting the percent change in price indices with reference to the price index in the harvesting month of April. The results are shown in Figure 19.

Figure 19 – Change in Rice price Indices 2013 to 2017 (PBS Data)

The figures indicate that except for the months following November 2014, there has been an increase in rice prices compared to the prices in November prices for all other years under consideration. The extent of this increase is different in different years. In 2012, the prices started increasing in February and continued to increase till next September. Overall, the per kilogram price increased from Rs 69.8 in November 2012 to Rs 76.79 in September 2013; representing an increase of 11.6%. In terms of maund, overall increase in grain value comes out to be Rs 320; spread over a period of ten months.

Increase in the year 2013 was small and the overall price increase from November 2013 to September 2014 was 2.7%. Similarly, total increase in price from the price of November 2015 was also small. The price increase started in March, the fourth month after the harvest and again decreased in the next month. It started increasing form the next month of June and kept increasing till it became 4.5% higher than the price in November. In 2016, the price increase was fast and just in three months after the harvesting month, the price was already higher than 5%. It increased continuously and the wholesale price of rice was 13.5% higher than that of the price in November.

The key message from the above analysis is that there is an increase in rice price over the months following the harvesting month. However, the increase cannot be projected with accuracy since it is different in different years; since it depends on the demand-supply dynamics of the market. Since rice is also an export commodity, the price is also affected by the demand-supply situation in the international markets.

5.1.2.1.1 AMIS Punjab Rice Price Data Analysis

The data of AMIS Punjab provides monthly price information in different markets of Punjab. Figure 20 through Figure 22 show the monthly rice price trends in three markets of Punjab in terms of percent change in price with reference to the price in the harvesting month of November. Rice wholesale prices in the three selected markets for six years are provided in Annex I.

Figure 20 – Change in Rice Prices w.r.t. Price in November in Gujranwala Market (2012-2016)

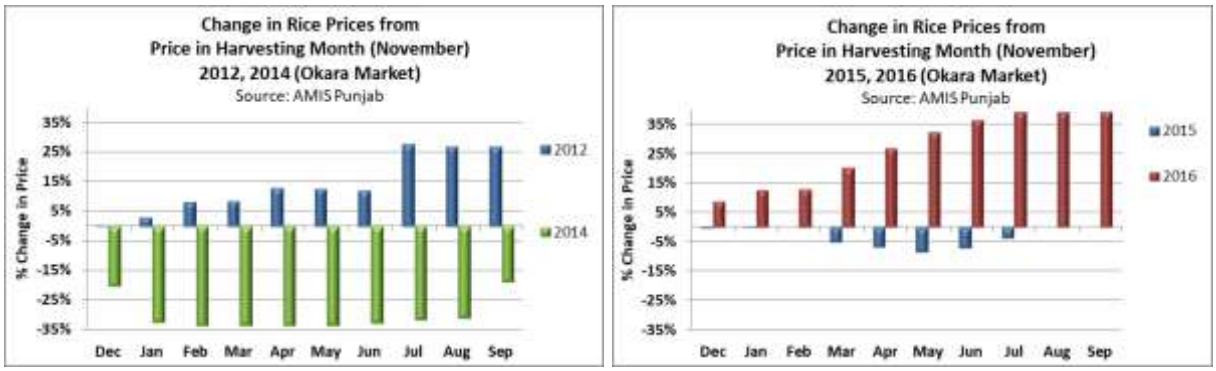


Figure 21 – Change in Rice Prices w.r.t. Price in November in Okara Market (2012-2016)

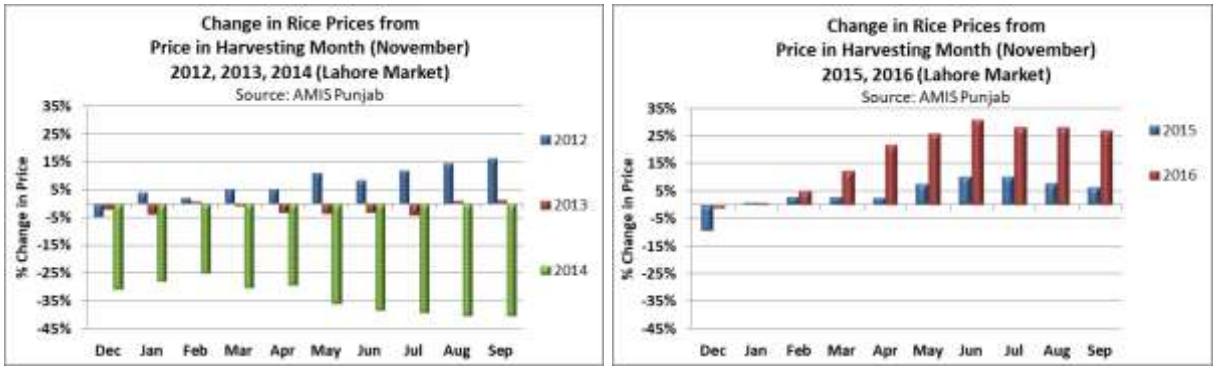


Figure 22 – Change in Rice Prices w.r.t. Price in November in Lahore Market (2012-2016)

Key observations from the listed price trends are discussed below:

- Except for the years 2013-14 and 2014-15, in other three years considered, the wholesale prices of rice have increased in the months following the harvesting month of November. However, the extent of increase has been different in different years. For example, in Gujranwala market, increase in six months, in the month of May in 2012 and 2015 were 7.3% and 7.7% respectively; however, in 2016, the increase in the same month was 26.1%. A similar trend exists for other months also.

- Increase in prices in the same months is different in different markets. For example in the month of June 2017, price increase in Lahore and Okara markets was 30.8%; whereas, in the same month, the price increase in Gujranwala was 36.4%. Along with the difference in prices, the price trends also differ with the markets. For example, in the year 2016-17, the price touched its peak in the month of June in Gujranwala and Lahore markets, and followed a declining trend in the next months. However, in Okara market, the price continued to rise till July and remained stable in the following months; without any decline.

- Usually, the change in different months was gradual and followed a smooth trend. However, there were instances of abrupt changes as well. In Okara market, the price increase in the month of June 2012-13 was 12.2%; which sharply increased to 27.5% in the next month of July and decreased only slightly in the two following months to reach 26.8%.

5.1.2.1.2 Estimation of Increase in Rice Prices

On the basis of the above analysis, it can be inferred that it is difficult to project the increase in rice price since it is affected by multiple factors. For arriving at an acceptable figure of increment in price in each month, the highest price change for each month in the four most recent years of 2014, 2015, 2016 and 2017 were selected for each of the three markets. An average of all the three values was calculated to estimate the possible increase in rice prices. The highest increments for each month from the four years under consideration in the three markets are listed in Table 6.

Market	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Lahore	-1.0%	1.0%	5.3%	12.6%	22.1%	26.1%	30.9%	28.5%	28.3%	27.3%
Okara	9.0%	12.6%	13.1%	20.3%	27.0%	32.3%	36.4%	39.3%	39.3%	39.3%
Gujranwala	-1.0%	1.0%	5.3%	12.6%	12.6%	26.1%	30.9%	28.5%	28.3%	27.3%
Average	2.3%	4.9%	7.9%	15.2%	20.6%	28.2%	32.7%	32.1%	32.0%	31.3%
Source: Data from AMIS Punjab										

Table 6 – Highest Increment in Rice Price during Four Years from 2014 to 2017

In case of rice, there is no support price. Therefore, for calculating the base value of grain, average of the grain prices in Lahore, Okara and Gujranwala markets in the month of November 2016 was considered. Table 7 shows the values.

Market	Price (Rs/100 kg)	Price (Rs/maund)
Lahore	8,250	3,300
Okara	7,360	2,944
Gujranwala	8,250	3,300
Average	**7,953**	**3,181**
Source: Data from AMIS Punjab		

Table 7 – Rice Wholesale Prices in November 2016

Applying the estimated increments on the current support price of Rs 3181 per maund and comparing the monetary benefit with the proposed storage charges provides an idea whether the proposition of storing rice makes economic sense for the owner or not. The results are shown in Figure 23.

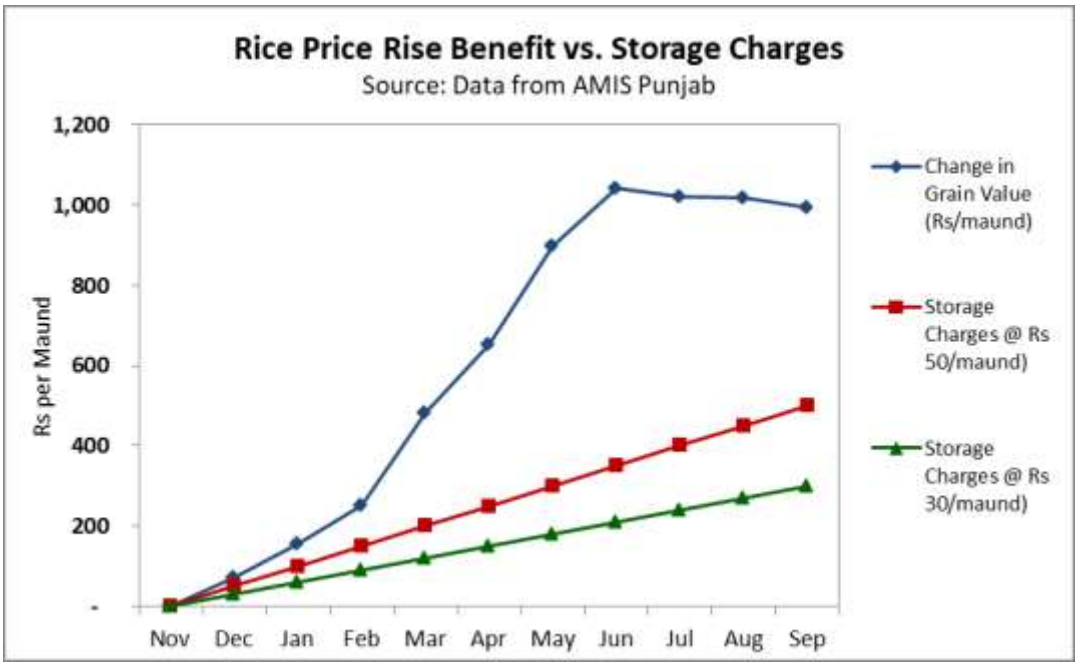


Figure 23 – Rice Price Rise Benefit vs. Storage Charges

The comparison has been drawn at two value of storage charges; Rs 50 and Rs 30 per month per maund. At both the values, the probable increase in value of the rice remains above the storage charges in December and all the following months during the year. Thus it is in the benefit of the farmer to store rice. As per the above data, maximum benefit for the farmer was realized in the month of June when the difference between the storage charges and the price hike was the highest. In the months following June, the benefit reduces; both due to added storage charges and the decreasing price of rice in the later months.

However, while doing this analysis, it is important to remember that the above-mentioned analysis has been based on the averages of the highest percentage increases over the price in November during the last four years. Actual results are ought to be different for different markets and the farmers' decisions to store or to not store, and for how long to store will be based on the then dynamics of the local markets.

5.1.3 Maize Wholesale Price Analysis

5.1.3.1 Pakistan Bureau of Statistics Price Data Analysis

The monthly wholesale CPI trend of maize is shown in Figure 24. The graph shows the data for sixty months; from September 2012 to August 2017. Maize is harvested twice during the year; in May and October. Major production is obtained in May harvest which is shown by solid vertical lines in the figure. Smaller share of maize production is obtained in October harvest which is shown by dotted vertical lines in the figure.

Figure 24 – Maize Monthly Wholesale Consumer Price Index - Five-Year Trend

The maize wholesale price trend has not been consistent in different years. Following the month of May of 2012 and 2013, there was an increase in price; whereas in the next three years, the price showed a declining trend in the months following the harvesting month of May. The price trend of maize is relatively more complex due to two harvesting seasons. The graph shows that the maize price has always decreased after the second harvesting month of October (shown by the dotted vertical lines). In fact, December and January have generally been the months in which the maize price touches its lowest during the whole year. However, it is usually followed by a rise which continues till be next harvesting season of May.

Based on these trends, it can be inferred that maize storage after May in two to three months scenario is not a profitable proposition. The prices trend during the last two years has been downward. Storing maize after the harvesting month of October appears to be a good option is stored for three to four months. In fact, the price trend following October 2016 shows that the price rose above that of October's price after six months; just one month before the next harvesting season. It means that in order to attain a price hike, the farmer has to wait for this long and bear the cost of storage during this period.

The price trend was evaluated in quantitative terms by plotting the percent change in price indices with reference to the price index in the harvesting month of May. The results are shown in Figure 25.

Figure 25 – Change in Maize price Indices 2013 to 2017 w.r.t May Harvest (PBS Data)

The price changes following the harvesting month of May have been negative in most of the years during the five most recent years. Some prices increases can be seen during the years 2013 and 2014. In 2013, the price increased by 3.6% by August and then decreased in the following months. In 2014, the highest increase of 2.9% was achieved in September which again decreased in the following months and became negative by December. The price change in 2015, 2016 and 2017 were negative throughout the years. In this scenario, storing maize after the harvesting month of May does not appear to be an attractive proposition.

The maize price trend was also analyzed with respect to the prices in the autumn harvesting month of October. The price trends during the five years from 2012 to 2016 are depicted in Figure 26.

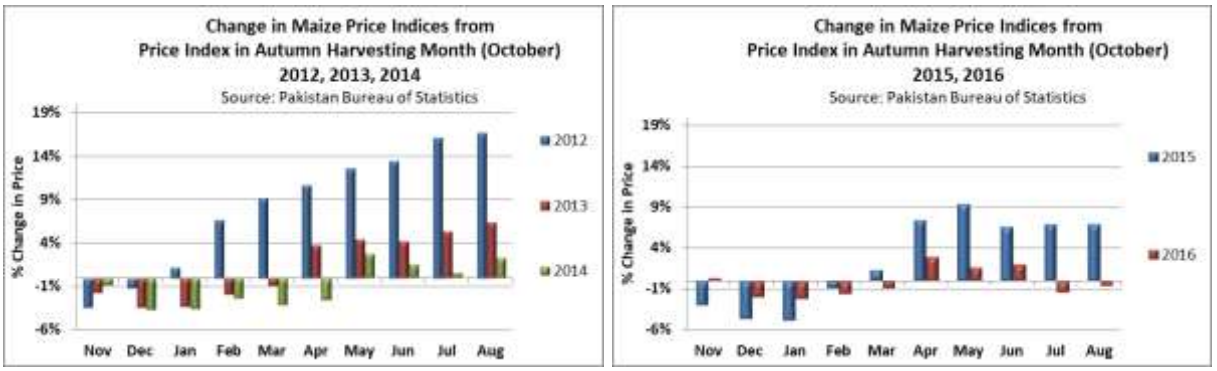


Figure 26 – Change in Maize price Indices 2013 to 2017 w.r.t October Harvest (PBS Data)

The graphs indicate that there are more positive price changes in this case compared to those with that of harvesting month of May. In 2012, the price started increasing in January and increased continuously till August when the price increased by 16.7% compared to that in the month of October. Similarly, in 2013, the price started rising in April and rose up to 5.3% by August. In 2014, there was no increase in maize price compared to the price in October. 2015 also saw a similar trend when the price started increasing in March and touched the highest increase of 9.4% in May. In the most recent October in 2016, a similar trend was seen; however the tune of increase was lower than last year. The price increase touched the peak of 2.9% in April 2017 and decreased in the following months; falling below the October 2016 price in July 2017.

The above analysis indicates that storing maize in the harvesting season of fall can be more profitable for the farmers; compared to storing in the harvesting season of spring.

5.1.3.1.1 Maize Price Data from AMIS Punjab

Figure 27 to Figure 29 show the monthly maize price trends in three markets of Punjab in terms of percent change in price with reference to the price in the harvesting month of May. Maize wholesale prices in the three selected markets for six years are provided in Annex I.

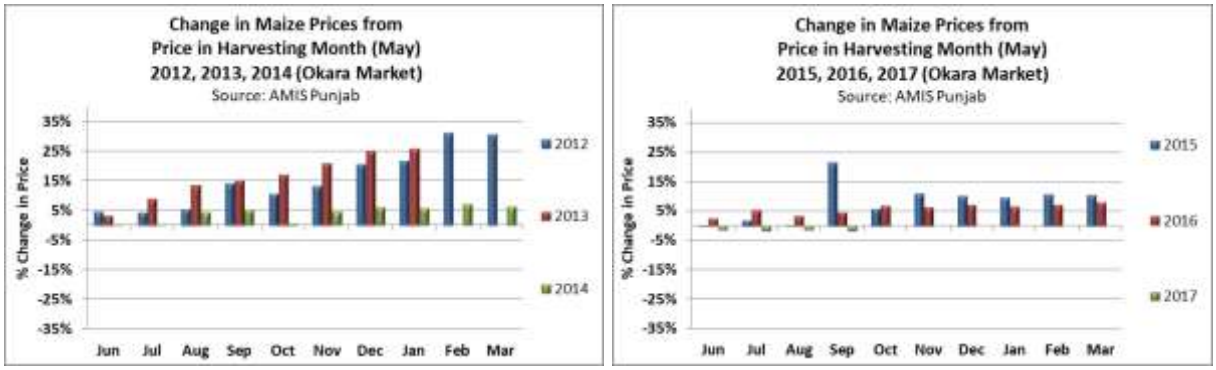


Figure 27 – Change in Maize Prices w.r.t. Price in May in Okara Market (2012-2017)

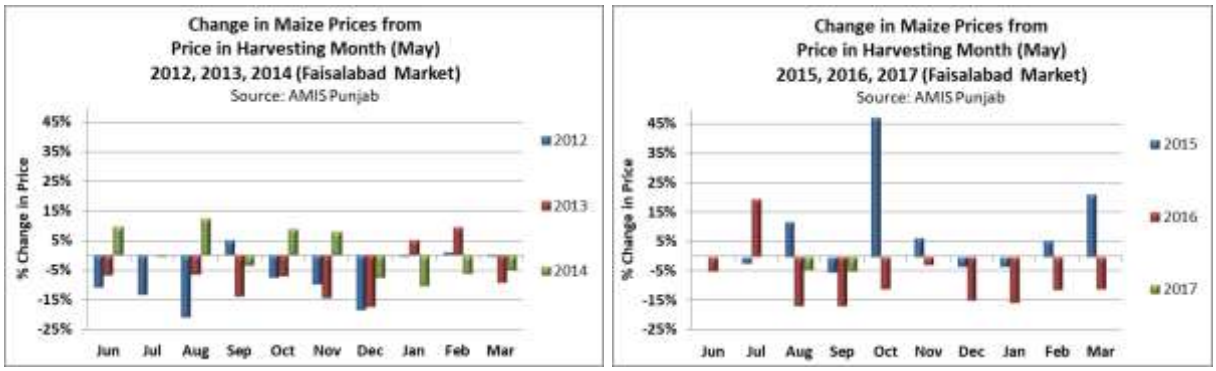


Figure 28 – Change in Maize Prices w.r.t. Price in May in Faisalabad Market (2012-2017)

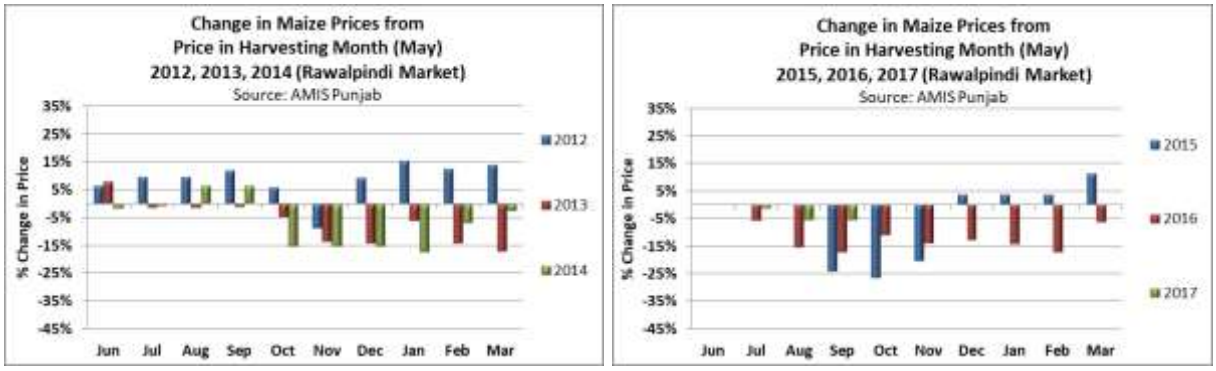


Figure 29 – Change in Maize Prices w.r.t. Price in May in Rawalpindi Market (2012-2017)

Key observations from the above price trends are discussed below:

- There is no consistent trend of change in price in any particular month. The direction and the magnitude of change in any specific month have been different in different years. For example, in Okara market in September, the price increase in 2012 and 2013 was 14.3% and 15.3% respectively; whereas in 2014, it was only 5.5%. In the next year, it was 21.3%

higher but only 4.5% in 2016. In the most recent year, even the direction of change was different and the price in September was lower than that of May by 1.6%. Many similar examples can be seen by comparing the price changes in other months.

- Over the years, the change in price has also been different with respect to different markets. For example, in November 2016, the maize price in Okara market was 6.3% higher than that of the price in May. However, in Faisalabad market, it was 2.8% lower. The situation was further different in Rawalpindi market where the price was 13.8% lower than the price in May.

- Except for Okara market where a gradual and smooth trend was observed, in other markets, the changes mostly appeared to be random. The prices rose above and fell below the base price of May number of times during the year. Moreover, there were instances of abrupt changes as well. In Faisalabad market, in September 2015, the wholesale price of maize was 5.6% lower than that of the price in May. However, in the very next month of October, the price was 47% higher than the price in May; and the change again dropped to 6.5% in the next month.

Looking at such trends, it is difficult to predict price change in any particular month. Other factors impacting the price have to be kept under view to have a better idea of price changes.

AMIS price data was also analyzed with respect to percent change in price with reference to the price in the autumn harvesting month of October. Figure 30 to Figure 32 show the monthly maize price trends in Okara, Faisalabad and Rawalpindi markets in this regard.

Figure 30 – Change in Maize Prices w.r.t. Price in October in Okara Market (2012-2017)

Figure 31 – Change in Maize Prices w.r.t. Price in October in Faisalabad Market (2012-2017)

Figure 32 – Change in Maize Prices w.r.t. Price in October in Rawalpindi Market (2012-2017)

Key observations from the above price trends are discussed below:

- The number of positive changes in maize price appears to be more in the case of October harvest compared to that in case of May harvest. The extent of change is larger in this case. For example in Rawalpindi market, in2015, the maize price in May was 66.7% higher than that of the price in October. While on the other side, in Faisalabad market in December 2015, the price was 34.3% lower than of the price in October. Such drastic changes in prices were not that commonly seen in case of comparison with the price of spring harvest in May.

- The differences in prices in different markets were more pronounced in case of autumn harvest. For example, in 2015, the price in Rawalpindi market remained above (by wide margins) the price of October throughout the year; whereas on the contrary, in Faisalabad market, the price remained below (by wide margins) the price of October. In Okara market, the price was higher in the first half of the year and below in the second half of the year. Similarly, the price trends in 2016 in Okara and Rawalpindi markets were opposite to each other. Similar randomness can be observed in other cases as well.

5.1.3.1.2 Estimation of Increase in Maize Prices

On the basis of the above analysis, it can be inferred that it is difficult to project the increase in maize price since it is affected by multiple factors. For arriving at an acceptable figure of increment in price in each month, the highest price change for each month in the four most recent years of 2014, 2015, 2016 and 2017 were selected for each of the three markets. An average of all the three values was calculated to estimate the possible increase in maize prices. The highest increments for each month from the four years under consideration in the three markets are listed in Table 8.

District	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Okara	2.6%	5.5%	4.5%	21.4%	6.9%	11.1%	10.4%	9.8%	10.7%	10.5%	3.78%
Faisalabad	9.7%	19.4%	12.4%	-3.6%	9.0%	8.2%	-3.4%	-3.5%	5.5%	21.0%	18.96%
Rawalpindi	0.0%	0.0%	6.8%	6.9%	-10.8%	-13.8%	3.8%	3.8%	3.8%	11.4%	15.75%
Average	**4.1%**	**8.3%**	**7.9%**	**8.2%**	**1.7%**	**1.9%**	**3.6%**	**3.4%**	**6.7%**	**14.3%**	**12.8%**

Table 8 – Highest Increment in Maize Price during Four Years from 2014 to 2017

In case of maize, there is no support price and the commodity operates in open market. Therefore, for calculating the base value of grain, average of the grain values in Okara, Faisalabad and Rawalpindi markets in the month of May 2016 was considered. Table 9 shows the values.

Market	Price (Rs/100 kg)	Price (Rs/maund)
Lahore	3,038	1,215
Okara	2,500	1,000
Gujranwala	3,063	1,225
Average	**2,867**	**1,147**
Source: Data from AMIS Punjab		

Table 9 – Maize Wholesale Prices in May 2017

Applying the estimated increments on the current market price of Rs 1,147 per maund and comparing the monetary benefit with the proposed storage charges provides an idea whether the proposition of storing maize makes economic sense for the owner or not. The results are shown in Figure 33.

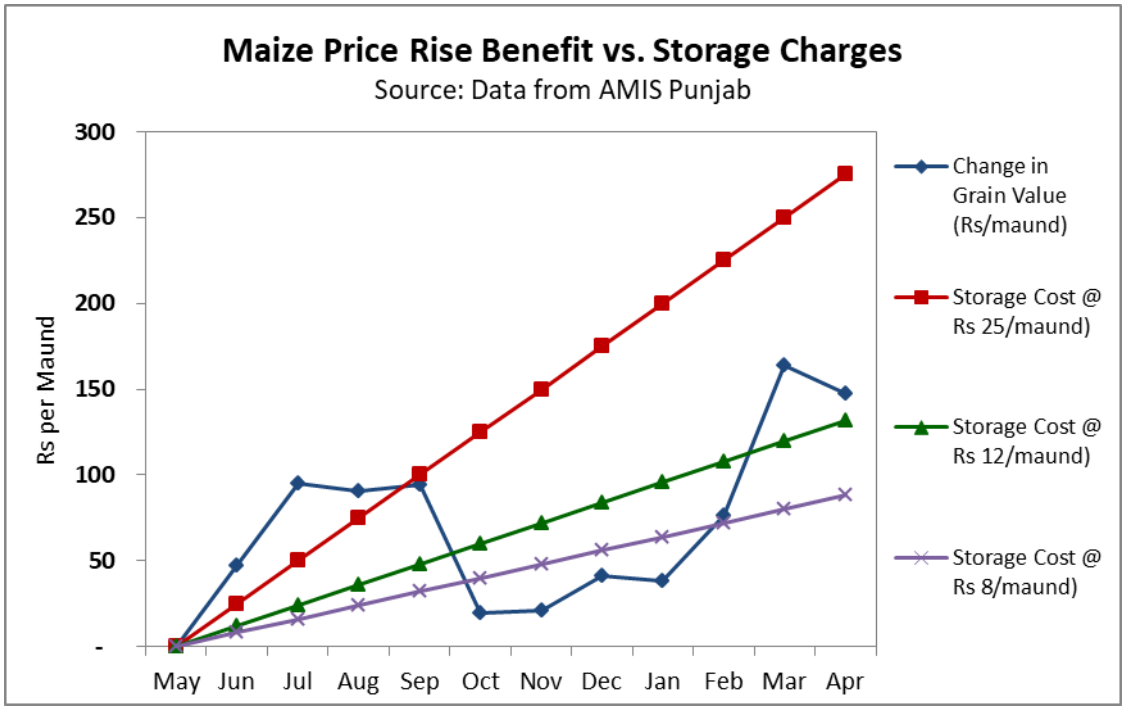


Figure 33 – Maize Price Rise Benefit vs. Storage Charges

The comparison has been drawn at three value of storage charges; Rs 25, Rs 12 and Rs 8 per maund per month. The result is the same in all the three cases; and shows that it is beneficial for the farmer to store maize and sell that by September till when the value added by price increase remains above the storage charges. The price drops in October and starts rising by December. In the month of March, the value added by increased price again increases above the storage charges and decreases in the next month. The storage proposition is economically beneficial for the farmer in the months of March and April at storage charges of Rs 12 per maund per month. At storage charges of Rs 8 per maund per month, it barely becomes viable in the month of February as well. However, from the warehouse operator's point of view, it may not be feasible to offer storage facilities at such a low price.

As per the above analysis, the maximum benefit for the farmer was realized in the months of July and March when the difference between the storage charges and the price hike was the highest. Selling the stored maize in the months from October to February appears to be a loss proposition for the farmer. The decision to store is more difficult in case of maize due to two crops during the year.

However, while doing this analysis, it is important to remember that the above-mentioned analysis has been based on the averages of the highest percentage increases over the price in May during the last four years. Actual results will be different for different markets and the farmers' decisions to store or to not store, and for how long to store will be based on the then dynamics of the local markets.

5.1.4 Conclusion

The analysis comparing the benefit of price increase in storage with that of storage charges for three commodities indicate that the actual benefit has to be seen with reference to the production in any particular year and the demand-supply dynamics of the local markets. Generally, the price trends appear to be random and a deeper analysis is required to more accurately predict the monthly price changes of each commodity. However, it is important to remember that an important reason for the current spurious fluctuations in prices is the lack of grain storage facilities with the producers. Establishment of the proposed rural warehouses will bring in stability in grain markets and make the price trends more predictable for the buyers and sellers.

5.2 Grain Wastage Cost

The other important benefit for the farmer will be in the form of saving the grain losses by storing his grain in a secure warehouse environment. The large farmers may store their produce by forming a 'Ganji' or in informal storage rooms at their homes or farms. For products like maize, there is a requirement of drying the produce also before it may be stored. For drying, the maize is exposed to sunlight by spreading it on the ground. This exposure invites birds, insects and squirrels to attack the maize to decrease its value. Adding to this cost is the wastage that occurs during storage in the informal storage rooms. The grain remains exposed to attack by insects, rodents, pests and moisture which further increases the wastage percentages. Moisture usually attacks from the bottom and becomes a source of fungus growth. It may also leads to causing germination of the grain which makes it unsuitable for human consumption. The grain blackens which reduces its value.

The wastage cost under normal circumstances may range anywhere from 5% to 10%. However, this cost increases manifold if there is rainfall during the storage period. This affects the grain stored in the open in the form of 'Ganji' more compared to that stored in covered spaces. In case of rainfall, if the grain is not protected properly, the wastage may increase to as high as 15-20%. Similarly, in case of a strong wind (aandhi) the extent of wastage in the grain stored in the 'Ganji' increases.

Similarly, wheat and rice are also exposed to different types of threats that may attack the grain and increase the wastage percentages. Unless attacked by some external moisture, wheat

does not have to be dried before storage. With proper storage precautions, the amount of wastage can be controlled. However, the issues of insects, rodents, moisture, fungus attacks remain relevant and may lead to increasing the share of wastage. Wheat, when stored in open, is more prone to wastage compared to when stored in covered spaces. Before storing paddy, it has to be dried to avoid wastage. Rice is also exposed to storage threats just like wheat and the owner has to bear the storage cost.

For understanding the case of storing the grains in a proper warehouse, it will be useful to quantify the wastage occurring in informal storages. The share of wastage depends upon the type of grain, the storage conditions, climatic variations and the overall degree of care ensured by the farmer. In the presence of multiple factors affecting the grain, it is difficult to exactly predict the wastage cost which may range anywhere from 5% to 15%.

The figures of storage losses assumed in the above table have been kept close to figures of storage losses of wheat which are unofficially accepted by the government. Officially, the Government of Pakistan does not recognize any weight loss held in storage; irrespective of the length of storage or handling methods. However, in practice, losses do happen and the 'zero loss tolerance policy' is not fair to market operators. Practically, the losses are usually covered by a 5% weight discount at the time of procurement by the farmers. Millers, when purchasing wheat from the government, have to accept a 5% reduction from the recorded weight of wheat.[13] In line with this, the above-mentioned calculations of loss during storage have been based on 6% per annum; at the rate of 0.5% loss per month for wheat and maize and at 3% per annum at the rate of 0.25% per month for rice.

Various studies done by different international organizations provide information about the storage losses of wheat. The percent of losses is lower in covered storages and higher in open storages and range anywhere from 0.1% to 10%. Such wide variation arises from the differences in the quantity stored, the storage duration, the consumption pattern, the initial condition of the grain, and the pest control methods employed. Estimated wheat losses in covered storages are given in Table 10.

Storage Place	Private Godowns	Government Godowns	Average
Arthis, millers and godown supervisors	2%		
Flour millers	1-2%	3-4%	
Stockists	1%		
Average	**1.5%**	**3-5%**	**2.5%**
Source: (Pakistan) Review of the Wheat Sector and Grain Storage Issues. FAO Investment Center 2013; based on the research carried out by IFC in 2010			

Table 10 – Estimated Wheat Losses in Covered Storages

The share of losses in open storage is higher due to more exposure to risks. As per an IFC study, in a 'Ganji, the bottom layer of wheat bags suffers 50% damage after three months and 100% is damaged after six months. Estimated losses in open storages are given in Table 11.

[13] Pakistan: Review of the Wheat Sector and Grain Storage Issues. FAO Investment Center; prepared under the World Bank/FAO Cooperative Program, 2013

Particulars	No. of Bags in Ganji	No. of Bags Lost in 3-6 Months	No. of Bags Lost in 6-12 Months
Inner Layer	2,337	-	
Outside Layer	1,000	-	
Bottom Layers	266	133	266
Total Bags	**3,603**	**133**	**266**
Percentage	**100**	**3.7**	**7.4**
Source: (Pakistan) Review of the Wheat Sector and Grain Storage Issues. FAO Investment Center 2013; based on the research carried out by IFC in 2010			

Table 11 – Estimated Wheat Losses in Open Storages

5.2.1.1 Estimated Savings of Wastage Losses

Based on the above discussion, an estimate of the savings of wastage cost by storing in the proposed rural warehouses has been made. A conservative approach has been adopted for this purpose. The calculations assume that the wastage cost will grow linearly with the storage duration. Per month wastage has been assumed to be different for different grains. It is assumed that in the current informal storages, the grains losses will occur at the rate of 0.5% per month for wheat and maize and 0.25% per month for rice. It means that on yearly basis, there will be 6% wastage in wheat and maize and 3% wastage in rice. Using the current average selling prices, storage costs have been worked out for the three types of grains. The harvesting month for each grain has been assumed as the first month of storage. The results are shown in Table 12, Table 13 and Table 14.

Wheat Selling Price (Rs/maund)				**1,300**	**Harvesting Month: April**						
Assumed Wastage Cost (% per month)				**0.50%**							
Wheat	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Cumulative Wastage %	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.50%
Cumulative Wastage Cost (Rs)	7	13	20	26	33	39	46	52	59	65	72

Table 12 – Wheat Wastage Costs in Different Months during the Year

Rice Selling Price (Rs/maund)				**3,181**	**Harvesting Month: November**						
Assumed Wastage Cost (% per month)				**0.25%**							
	Dec	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Cumulative Wastage %	0.25%	0.5%	0.75%	1.0%	1.25%	1.5%	1.75%	2.0%	2.25%	2.5%	2.75%
Cumulative Wastage Cost (Rs)	8	16	24	32	40	48	56	64	72	80	87

Table 13 – Rice Wastage Costs in Different Months during the Year

Maize Selling Price (Rs/maund)				**1,147**	**Harvesting Month: May**						
Wastage Cost (% per month)				**0.50%**							
	Jun	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**
Cumulative Wastage %	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.50%
Cumulative Wastage Cost (Rs)	6	11	17	23	29	34	40	46	52	57	63

Table 14 – Maize Wastage Costs in Different Months during the Year

Projected savings in wastage cost for wheat, rice and maize, when stored in proposed rural warehouses are shown in Figure 34.

Figure 34 – Projected Wastage Cost Savings by Storing in Rural Warehouses

The above analysis talks about the share of grain that is wasted completely due to bad storage conditions. In addition to this, the improper storage conditions may also affect the overall quality of the entire grain stock. The grain may remain consumable but its quality may have reduced. In such a case, the owner may get a lower price for that grain.

5.2.1.2 The Grain Quality

In Pakistan, quality testing of grain is usually carried out arbitrarily. Visual inspection is the most commonly used method and formal laboratory testing is very rarely employed. Traditional method of sampling is piercing a bag with a bamboo, taking a random sample and inspecting it visually. Lack of formal laboratory testing and certification system results in having unfair deals between the buyers and the sellers. There remains the need to introduce such a system which may be implemented by a third party commercial agent.

There are no formal grain quality standards implemented in Pakistan. Wheat quality is verified against the 'Fair Average Quality' (FAQ) standards; which specifies quality parameters like foreign matter, broken, shrunken and insect-damaged kernels, etc. These parameters can usually be verified by visual inspection. FAQs also set the limits for moisture content. FAQs for wheat in Punjab are shown in Table 15.

Quality criterion	Tolerance limit	Rejection limit
Moisture	10%	Over 10%
Dust, dirt and other non-edible matter	0.5%	1.0%
Other foodgrains	3.0%	5.0%
Shrivelled/damaged grain	3.0%	5.0%
Weevil-/insect-damaged grain		
New crop until August	Nil	Nil
September and October	0.5%	1.0%
November and December	1.0%	2.0%
January onwards	1.5%	3.0%

Source: Punjab Food Department.

Source: (Pakistan) Review of the Wheat Sector and Grain Storage Issues. FAO Investment Center, 2013

Table 15 – Fair Average Quality Standards for Wheat in Punjab

The FAQ scheme is believed to have no legal status for possible litigation. It is difficult to implement during busy procurement seasons due to availability of limited manpower. The FAQ system will not be effective as the more develops and consumers put more emphasis on quality. FAQ specifications can also not been used for wheat exports since importers provide their own specifications and minimum quality and safety parameters; including test weights, protein content and falling numbers. Wheat quality requirements of UAE and EU markets are provided in Annex II.

5.3 Transportation Cost

Transportation of grain is another important cost for the farmer. For the purpose of this analysis, the transportation cost is relevant for those farmers who store their produce in informal storages before selling it. Such farmers bring the produce from the field to their storage place, store it there for certain period and then sell it in the market. They have to bear the transportation cost twice. Other farmers directly sell their produce in the market and thus have to bear the transportation cost only once. Thus there is an additional transportation cost for the farmers who store their produce. This cost can be saved if they store their produce in the proposed rural warehouses instead of their own places. Transportation cost is more relevant for maize since wheat and paddy are generally not stored by the farmers to be sold at a later stage. Maize has to be stored after drying which entails an additional cost for the farmers. Usually, this drying is carried out in sunlight and the farmer has to bear the cost of security. These farmers also have to bear losses during this drying and storage which further adds to their cost.

As per the data obtained from the field, the average cost of transporting grain on tractor trolley or truck is around Rs 1.5 per bag per kilometer. Assuming an average distance of 10 kilometer from the field to farmer's storage, the transportation cost comes out to be around Rs 8 per maund (assuming 80 kg per bag of maize). Assuming the same distance to market for selling the grain, this transportation cost will be double; i.e. Rs 16 per maund. In case the farmer decides to use the proposed rural warehouses, he will be saving Rs 8 per maund.

5.4 Other Costs

In addition, there are many other costs incurred by the farmer by storing the grain in informal places. These costs will be saved in case the grain is stored in proper warehouse.

5.4.1 Loading/Unloading Cost

Storing grain in the open or in covered spaces requires loading/unloading of bags multiple times which adds to the overall cost of the farmer. The farmer has to first load the grain from the field into the bags which are loaded on trolleys and transported to the place of storage. The bags are unloaded and stored in open or covered areas entailing further cost. In the following months when the grain is to be sold, the cost of loading and unloading has to be incurred once again. As per the information obtained from the field, average cost of loading/unloading of 100-kg bag is Rs 16-17 whereas for 50-kg bag, this cost is Rs 6-7; which comes to around Rs 5-6 per maund. The cost is not dependent on the storage duration. In case the storage time is one month, the cost is Rs 6 per maund per month; and if it three months, the cost reduces to Rs 2 per maund per month.

5.4.2 Shielding Cost

If the grain bags are stored in open in the form of a Ganji that requires protecting it with a tarpaulin which entails a cost. Tarpaulin is exposed to weather harshness which limits its life and requires to be replaced at least every alternate year; if not every year. Similarly, sometimes, there is the requirement to use plastic sheets to protect the grain from moisture attacking from the ground or from the rainwater coming from the top. Likewise, if the farmer is using any building as grain storage, some minimum quality of the building has to be maintained to protect the grain from water, pests, insects, etc. This requirement also translates into added cost for the farmer. Just like the loading/unloading cost, the shielding cost is also not time dependent.

5.4.3 Security Cost

The grain stored by the farmer is exposed to the threat of theft. In not taken care of properly, this may lead to a huge loss for the farmer. Large farmers may have to employ proper workforce to ensure the security of their produce which adds to their overall storage cost. A tentative idea of this cost for storage of 1000 bags of maize is shown in Table 16.

No. of bags stored	**1,000**
Weight per bag (kg)	80
Total weight (kg)	80,000
Total weight (maund)	2,000
No. of guards	2
Cost of a guard (Rs/month)	10,000
Total cost of guards (Rs/month)	20,000
Cost per maund per month (Rs)	**10**

Table 16 – Grain Security Cost Estimation in Open Storage

5.4.4 Insecticides/Fumigation Cost

If stored for longer durations of more than two months, there is the added cost of fumigation or spray of insecticides to protect the quality of the stored grain. In the proposed formal warehouse, this cost will be covered in the storage charges and thus this will also be a saving for the farmer. The tune of this amount, however, will be small and thus will not have a major impact on farmer's/trader's decision to store his grain.

5.5 Net Cost & Benefit of Grain Storage for the Farmer/Trader

Farmer's overall cost and benefit analysis has been carried by comparing the storage cost with the benefits of increase in grain prices and savings of wastage cost by storing in the proposed rural grain warehouses. Other smaller cost savings have not been considered for the purpose of this analysis. Cost and benefit comparison for wheat, rice and maize is respectively shown in Figure 35, Figure 36 and Figure 37.

In case of wheat, with the addition of wastage savings to the price benefit, the proposition became more viable for the farmer. For all the months from June onwards, the benefit for the farmer is expected to be higher than the storage cost at the rate of Rs 15 per maund per month. Previously, when only the price benefit was considered, the storage proposition was not viable if the stored wheat was sold in the months of July, August, November, December, January or February. Thus, the proposition of storing wheat appears to be viable for the farmer if the storage charges remain up to around Rs 15 per maund per month. The analysis also provides an idea of the price that the warehouse owner may charge from the farmer.

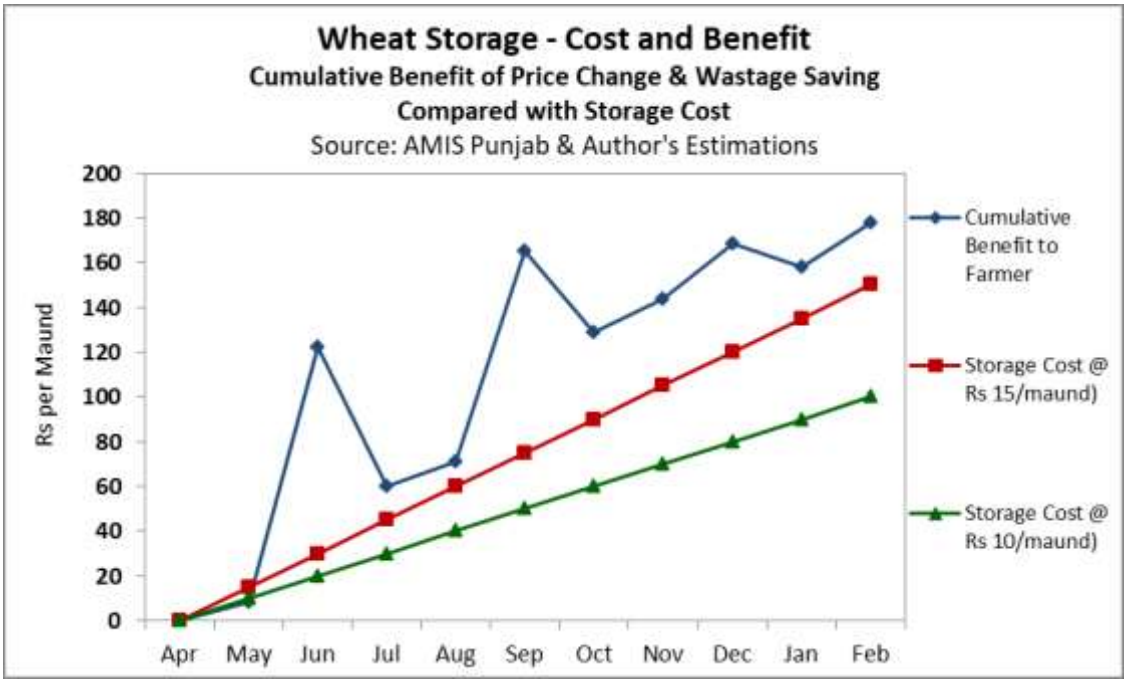


Figure 35 – Wheat Storage – Cost and Benefit for the Farmer

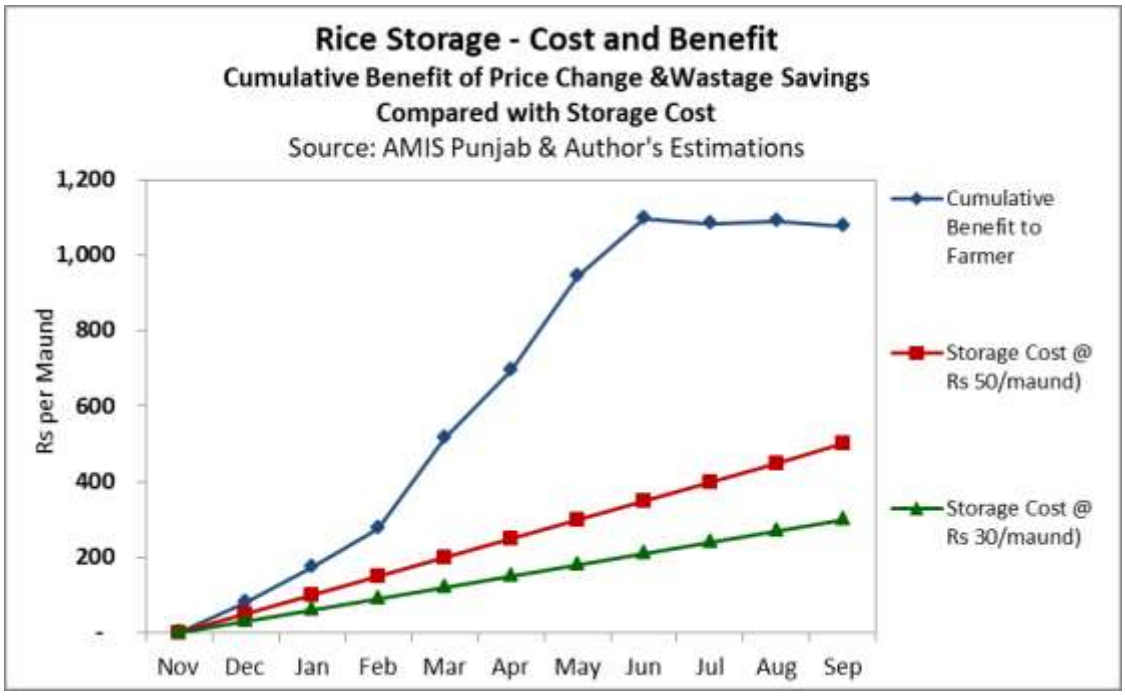


Figure 36 – Rice Storage – Cost and Benefit for the Farmer

The addition of wastage savings to the overall benefit of the farmer in case of storing rice was seen to increase his overall profitability. The benefit curve of farmer, even only with the expected price increase, was already above the storage cost. Therefore, the option of rice storage appears to be viable for the farmer in all the months following the harvesting month of November.

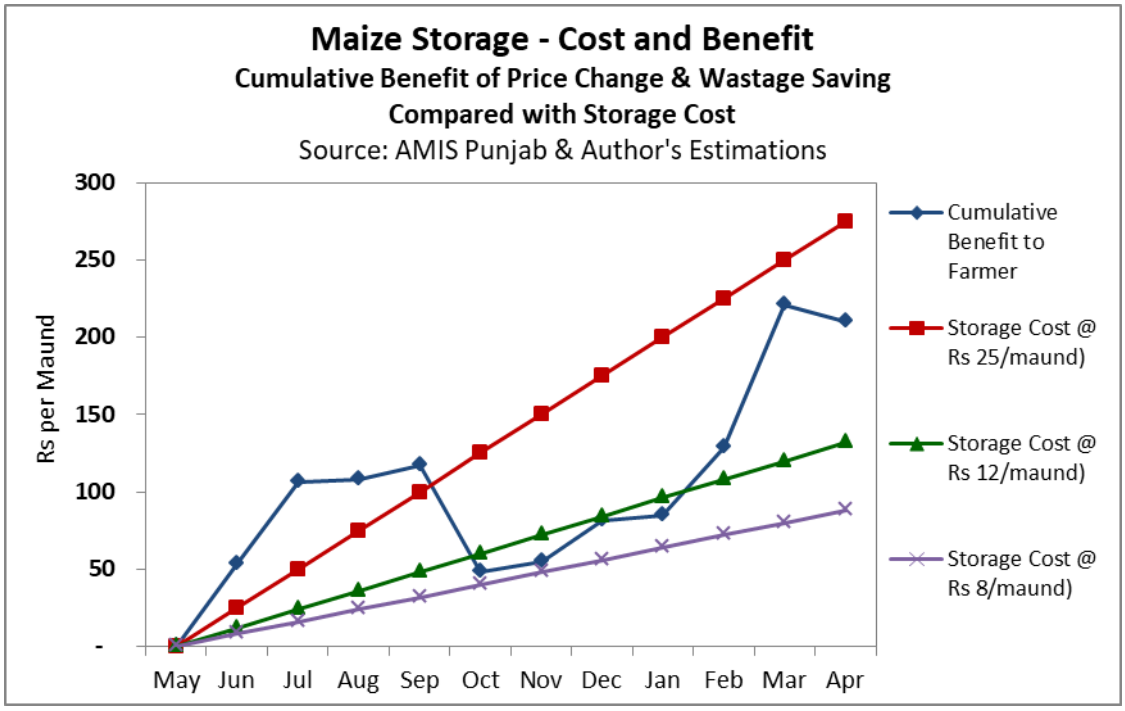


Figure 37 – Maize Storage – Cost and Benefit for the Farmer

The viability of maize storage increases with the addition of wastage savings to the benefit due to price increase. The number of months during which the storage proposition is beneficial for the farmer increases. Previously, with only the price benefit considered, at a

storage cost of Rs 12 per maund per month, the storage benefit was lower than the benefit in February which surpassed the cost in that month when the wastage savings were added. At a storage cost of Rs 8 per maund per month, the storage proposition appears to become viable for the farmer during all the months of the year. However, it may not be possible for the warehouse operator to offer storage facilities at such a low price.

6.0 GRAIN STORAGE OPTIONS

Grain storage may be done in traditional manner or using modern methods. Traditional storages comprise of covered warehouses where the grain is stored in bags; whereas, the modern storage methods usually store grain in bulk form. Silos represent an important modern option which is used all over the world for storing grain.

6.1 Warehouse Storage

Warehouses are used for storage and physical protection of goods. In case of grain, the stored goods primarily refers to grain bags. Bags are stored in the warehouse by stacking on each other. Usually, there is a platform at the floor to protect seepage of moisture from the floor into the bottom bags. As per the general practice, the grain bags are stacked on top of each other without any use of racks. This is permissible in case of grain since it is not damaged due to pressing by the weight of the bags on top.

Figure 38 – Warehouse Grain Storage

All kinds of warehouses consist of a floor, walls, a roof, and one or more entrances. Depending upon the design, other components may include ventilators, windows, artificial lighting, etc. The prime consideration in making a warehouse is that the quality of the commodity to be stored is adequately protected from the effect of physical factors such as moisture and heat. The warehouse design should also protect the stored goods from attack by insects, pests, birds, etc. This is especially very relevant for grain warehouses where the stored product is the attractive food for all these damaging organisms.

Traditional warehouse storage is simpler to construct and the knowhow for that is easily available. However, most of the warehouses in Punjab, being used for grain storage, are informal in their design. They are simple sheds where grain bags are stacked without much consideration to their arrangement. The requirements of a modern warehouse do not exist in these structures. The result is that the quality of the grain stored therein is not protected properly and the share of losses due to grain wastages remains high. A modern grain storage warehouse needs to have certain minimum standards to adequately preserve the quality of the

product. The building has to be built as per defined standards. Moreover, the warehouse operations should be managed by professionally trained staff using modern inventory management software. Key requirements of a professionally built grain warehouse are provided in Annex III.

6.2 Silos Storage

Silos are the bins, commonly used for bulk storage of grains. There are different types of silos that may be used for this purpose; such as concrete silos, tower silos, bunker silos, bag silos, silo bins, etc. Tower silo is used more commonly for grain storage. It is in the form of a cylindrical structure which can be made from different materials. Steel is the most commonly used material for making large silos.

Figure 39 – Steel Silos

Figure 40 – Concrete Silos

Figure 41 – Bunker Silos

Figure 42 – Bag Silos

6.2.1 Advantages of Silos

Silo storage offers number of advantages over the traditional bags storage in house type storages.

Preservation of Grain Quality

Silo storage offers the provision of maintaining optimal storage conditions for the grain by controlling the temperature and humidity. It also protects the stored product from insects, pests, molds, birds which can damage the grain quality. High quality grain can be sold at higher price which increases the profitability of the farmers/traders.

Lower Wastages

Maintenance of optimal storage conditions prevents wastage of grain and thus reduces the possibility of economic loss and increased profitability for the owner of the grain.

Easier Handing and Saving of Bags Cost

The silos store grain in bulk form without any bags. Grain is directly loaded into vehicles and transported in bulk form which makes its handling easier. Bags constitute a significant cost in grain trading which is saved in case the grain has to be stored in silos.

Reduction in Loading/Unloading Cost

Since there is no involvement of bags, the loading/unloading cost of bags is also not relevant in case of bulk storage in silos. Grain is usually loaded into transporting vehicles using machines. These factors directly contribute towards improving profitability of the grain owners.

Lesser Land Requirement

Silo storages are built in the form of long cylindrical towers which require lesser space to store a certain quantity of grain; compared to the land requirements for a standard house type store where grain is stored in bags. However, this benefit is relevant only for the large silos which are used by government or large industrial units; with the storage capacity ranging from 4,000 to 6,000 tons per silo. When using smaller silos for storing smaller volumes available with the farmers, the advantage of lower space requirement does not remain relevant.

6.2.2 Disadvantages of Silos

High Capital Cost

Grain storage silos are not manufactured locally and are imported by the agents of the large international companies. Establishing silo project thus entails a high capital cost which at times becomes prohibitive for the investors.

6.2.3 Utility of Silos for Different Types of Grains

A rural warehouse may have both the warehouse and silo storage. Silo storage will be especially more relevant for maize. It is due to the reason that traditional bags storage for maize leads to causing grain wastage. The quality of the maize can be best maintained in silos. As per the feedback of the farmers, the preferred capacity of small silos for the rural farmers for storing maize should be around 5 to 10 tons (125 to 250 maunds).

Wheat can also be stored in silos and the large flour mills use this type of storage to store their wheat. However, the quality of the wheat can be protected even in bags. The storage cost of silos is usually considered higher than that of the traditional house type storage and there is not much price increase in case of wheat, it may be difficult for the wheat to bear that high cost.

In case of paddy, the use of silos is usually not preferred since silos are installed in open spaces where they are directly exposed to sun. Exposure to high temperatures over extended periods may lead to making the paddy brittle and increase the share of broken rice in the final product; thereby decreasing the overall value of the final product. Thus as per general perception, for rice, traditional house type storage is considered a better option. However, a warehouse has been established by NRSP in district Hafizabad in Punjab which is being used for storing paddy in silos. The warehouse has three large silos; each with a storage capacity of 1100 tons.

6.2.4 Suitable Size of Silo Storage for Rural Warehouses

Silo storage is now not a new concept in Punjab and it has been in use by the government as well as by the industrial consumers of grain over the past decades. The use of these silos is generally for storing wheat or maize. Use of silos for storing paddy or rice is not practiced.

The silos that currently exist in the province are of large capacities; ranging from 4,000 to 6,000 tons storage capacity per silo. The silos of such large capacities are economical with respect to their capital and operational costs.

However, for providing grain storage space to the farmers in rural areas, these large silos will not be useful. As per the business model of a commercial warehouse, the farmers/traders will bring in their grain to the warehouse where it will be stored for certain number of weeks/months; as per the need of the owner of the grain. At the time when he comes to take his grain back, it is important that he gets the same grain that was stored by him. Providing him this comfort that he is getting back 'his own grain' will be an important factor in building the required confidence level between the farmer/trader and the warehouse operator. In case the storage facility has large silos where the produce of different farmers/traders is stored in bulk in a mixed form, it will create issues since nobody will be sure if he is getting the same grain that was originally stored by him. Therefore, in case silos are to be used in a commercial grain warehouse, it is important to have silos of smaller capacities that correspond to the average weight of grain brought for storage by small to medium farmer.

Figure 43 – Silos Storage (Large)

6.2.4.1 Silo Capacity Assessment

Suitable capacity of silo for small to medium farmer can be assessed by looking at the volumes that he may hold.

6.2.4.1.1 Silo Capacity Calculations with respect to Availability of Wheat

At an average production of 30 maunds per acre and assuming that the farmer will sell three fourth and store one fourth (25%) of his total production, the volumes available for storage at different landholdings are shown in Table 17.

Farm Size (acre)	Total Production (maunds)	Production available for storage (maunds)	Production available for storage (tons)
2	60	15	0.6
5	150	37.5	1.5
10	300	75	3
15	450	112.5	4.5
20	600	150	6
30	900	225	9
40	1,200	300	12

Table 17 – Silo Capacity Calculations for Wheat

6.2.4.1.2 Silo Capacity Calculations with respect to Availability of Maize

At an average production of 70 maunds per acre and assuming that the farmer will sell three fourth and store one fourth (25%) of his total production, the volumes available for storage at different landholdings are shown in Table 18.

Farm Size (acre)	Total Production (maunds)	Production available for storage (maunds)	Production available for storage (tons)
2	140	35	1.4
5	350	87.5	3.5
10	700	175	7
15	1,050	262.5	10.5
20	1,400	350	14
30	2,100	525	21
40	2,800	700	28

Table 18 – Silo Capacity Calculations for Maize

6.2.4.1.3 Recommended Capacity of Small Silo

Based on the calculations for wheat and maize, it can be said that suitable capacity of the small silo may range from 5 to 10 tons (125 to 250 maunds). On the basis of the above calculations, the expected volumes of wheat available from any single farmer may go as high as 12 tons. In case of maize, the average volumes available for storage may range from 10 tons for 10 acre farmer to up to 28 tons for 40 acre farmer. Thus, having silos with capacity ranging from 5 to 10 tons can meet the requirements of the farmers. For farmers bringing in volumes larger than the silo capacity can be accommodated in multiple silos.

Since the average production volumes available for storage are higher in case of maize, the warehouses established in maize growing areas should have silos of larger capacities compared to that in rice growing areas since silo storage will not be very commonly used for storing paddy. Wheat, being the Rabi crop, will be the common for both the areas.

The above-mentioned calculation also indicates that silo storage will not be suitable for smaller farmers. It is due to the reason that the warehouse operator will allocate any individual silo to individual farmers to avoid mixing of produce of any two farmers. Thus the

farmer will be charged for the whole silo. Storing grain less than the total capacity of the single silo will increase the unit storage cost for the farmers and make it less affordable for them. For example, the wheat available with a farmer with farm size of up to 15 acre will be less than the available capacity of a single silo. In case of maize, this limit appears to be up to 10 acres. Thus, such smaller farmers will be in a position to use silo storage only if they make more than 25% of their produce available for storage which is very unlikely due to the financial constraints of these farmers. Moreover, the cost of storing in silos will be higher than that of doing that in house type storage and thus will be less affordable for smaller farmers.

Figure 44 - Small Silo (Kikapu) (6 Tons)

One available option for small silo was the one offered by 'Kepler Weber' which has capacity of 6 tons. This is known as 'Kikapu Silo' and it has been used successfully in African countries as the field storage option for the farmers..Kikapu silo is shown in Figure 44. Detailed technical specifications of Kikapu silo are presented in Annex IV. During the project's implementation phase, small silo options available from other suppliers should also be explored.

6.3 Commodities for Storage in Different Zones

Since wheat, rice and maize is produced all across Punjab, the rural warehouses will be established in all the areas of the province. In the first phase, these warehouses may be established at district level. However, in the next phase, the reach of these warehouses should be increased and they should be established at union council (UC) level. Depending upon the

success of the project and the market need, the concept may even be extended even to the village level. For the initial phase of the project, there is a need to conduct a survey to assess the potential demand for these warehouses in selected districts.

The location of the warehouses should correspond to the production centers of different grains in the province. Wheat is cultivated in all districts in Rabi season; whereas the crops grown in Kharif season vary with different agro-climatic zones in the province. Therefore, the types of products stored in the proposed rural warehouses will vary with the location. Although, these warehouses are being proposed as grain warehouses, but some other agricultural products which are not grains may also be stored in these warehouses to increase the number of days of occupied storage space and increase the commercial viability of the project. An important product in this regard is cotton. Cotton, after being picked in the fields may be stored in these warehouses; or alternately, cotton bales may be stored to take advantage of higher prices in the following months.

In order to have an idea of the kind of products that may be stored in these warehouses in different zones, the production centers of the four major crops, wheat, rice, maize and cotton are shown in Figure 45 and Figure 46.

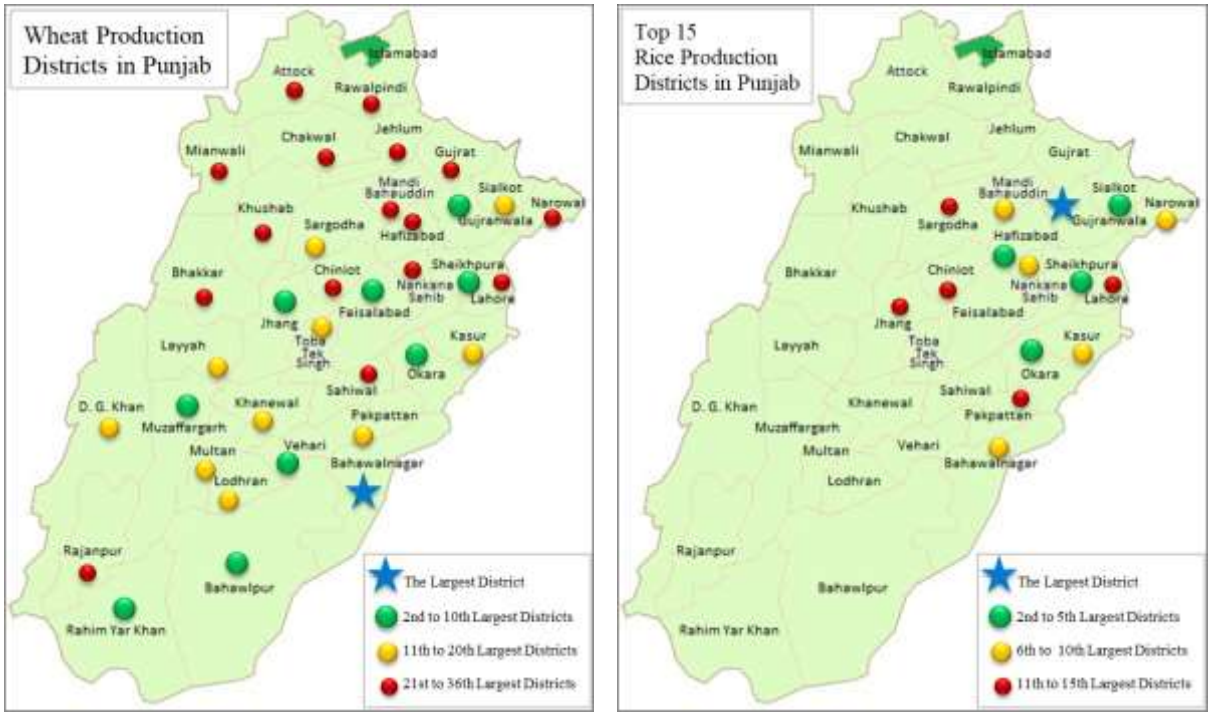


Figure 45 – Wheat and Rice Producing Districts in Punjab

Wheat is produced in all the districts of Punjab. It main production centers are located in central and southern Punjab. The districts in northern Punjab have smaller wheat production volumes. Compared to Kharif crops, wheat production is relatively more uniformly distributed. This is also indicated by the fact that the top fifteen wheat producing districts

accounted for 61% of the total production in 2013-14[14]. 42% of the number of districts accounted for 61% of the total production.

As the proposed rural warehouses are established in different parts of the province, wheat will be an important storage commodity in all the districts. However, the situation will be different for the commodities produced in Kharif season.

In case of rice, the major production clusters are present in the eastern Punjab in a belt extending from north to center of the province. Gujranwala is the largest rice producing district; followed by Sheikhupura, Okara, Hazifabad and Sialkot. Thus the rural warehouses established in these districts will receive paddy or rice as the second important commodity for storage in those facilities. Rice production is quite concentrated compared to wheat production; indicated by the fact that the top fifteen districts accounted for 84% of the total rice production in 2013-14.

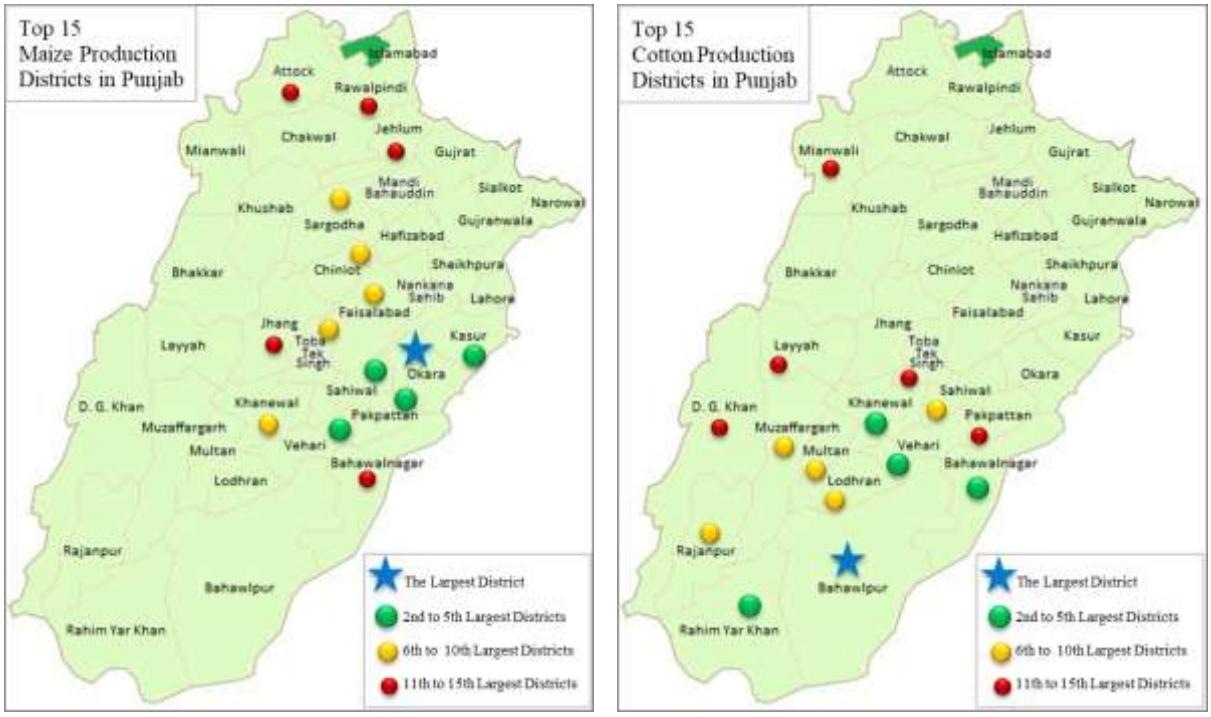


Figure 46 – Maize and Cotton Producing Districts in Punjab

In case of maize, Okara is the largest district. Pakpattan, Sahiwal, Kasur and Vehari are the next largest maize producing districts. Maize production is clustered in the central Punjab; extending into southern Punjab; along the eastern border. Thus, in these districts, maize will be a key product that will be coming for storage in the proposed rural warehouses. Maize production in Punjab is very concentrated since top fifteen districts accounted for 96% of the total provincial maize production. It means that practically, maize will be a potential storage commodity only in these fifteen or may be lesser number of districts.

[14] The latest available district-wise crop production is that of 2013-14. There are no quick changes in crop production patterns in different areas. Therefore, the ranking of districts with respect to production of different commodities can be considered the same in the current year.

Cotton is the fourth crop that has been included in this analysis; to increase the commercial viability of the proposed warehouses. Cotton production is concentrated in Southern Punjab; with Bahawalpur being the largest district. It is followed by Bahawalnagar, Khanewal, Vehari and Rahim Yar Khan. The top fifteen districts accounted for 95% of the total provincial production of cotton in 2013-14. Thus, the warehouses established in these districts may also receive cotton as one of the commodities for storage. The benefits of storage of cotton will be the same as those of the three grains; to store in a secure environment to reduce wastage, to take benefit of the higher future prices and to increase the bargaining power of the seller.

6.3.1 District-wise Storage Capacity

The storage capacity of the rural warehouses will depend upon the availability of the volumes for storage which in turn will depend upon the production of those agricultural products in those areas. Therefore, different areas will have warehouses of different capacities. A demand survey in each area should preferably be carried out before establishing a warehouse.

In this context, it is important to highlight that the districts with smaller volumes of the four agricultural commodities should have warehouses of smaller capacities. Lesser availability of storage volumes in such districts may require intervention by the government to ensure financial viability of these projects; since the grain volumes available for storage may be lesser than the breakeven capacity of the warehouses.

7.0 THE PROPOSED BUSINESS

7.1 Purpose of the Business

The proposed business focuses on establishing a warehouse for grain storage in the rural areas to be used by farmers, traders and other prospective customers for storing grain. The project will primarily derive its revenues from service charges for the storage facility provided to the grain owners. The project will help the local farmers and traders to protect their grain by storing that in secure storage environment; thereby reducing grain wastages. The facility will also enable the farmers and traders to hold back their produce during the high supply times and sell it at potentially higher prices in the later months. The warehouse network will also help stabilize grain market prices that will also contribute towards strengthening farmer's negotiating position and increase his profitability.

The proposed storage facility will also have allied equipment for storing the product in best possible manner which ensures its quality. This will include grain cleaning and grain drying equipment. Farmers/traders will be responsible for bringing their grain in bags or in bulk form to be stored in the warehouse (in bags). Service charges from these allied services will be the other source of revenue for the project. Silo storage has not been included in the feasibility calculations due to its higher capital cost.

7.2 Product Line

The products for storage in the proposed warehouse facility will include the following three major grains produced in Punjab:

1. Wheat
2. Maize
3. Rice

The three products have been selected since these three constitute the major share of total grain production of Punjab. These three crops can thus provide the required storage volumes to the proposed warehouse facility. One major benefit for the farmers/traders to store will be through increased prices of the stored grains in the following months. With this perspective, maize and rice appear as the more prospective commodities for storage compared to wheat; since wheat's price is controlled by the government and there is very little increase in price that may be realized in case of wheat. In fact, in the current scenario, where there is surplus wheat stocks are available from the previous years, and there has been a bumper crop this year, any increase in wheat price is improbable.

The share of storage used by these three commodities will vary with the location of the facility. For example, rice and maize are the two major Kharif crops with defined major centers of production in different districts of Punjab. Consequently, the warehouses established in maize areas will receive more maize for storage and the warehouses established in rice areas will receive more rice for storage. Wheat is the major Rabi crop cultivated all across Punjab and thus will be available for storage in the warehouses in all districts of the province.

The project's feasibility calculations have been based on three types of grains; wheat, maize and rice. However, practically, the proposed warehouses may also be storing other commodities; such as cotton, pulses and grains like barley, etc. The possibility of using the available storage facilities for agriculture inputs like fertilizers may also be considered. The option of storing pesticides, however, should be exercised with care since storing them in the same place as that of grains may cause contamination of grains to make those unfit for human consumption. If pesticides have to be stored, there has to be a separate space for that purpose.

7.3 Proposed Location

For the purpose of this feasibility study, district Okara has been proposed to house this warehouse facility since the district produces sizeable volumes of all the three commodities. Okara is the largest maize producing district with production of 770,200 tons in 2014; accounting for 19.2% of the total production of Punjab. During the same year, the district produced 319,000 tons of rice and 814,500 tons of wheat; respectively accounting for 9.2% and 4.1% shares of the province's total productions.

Figure 47 – Proposed Location for Rural Warehouse Facility

7.3.1 Factors for Site Selection of Grain Warehouse[15]

Along with the factor of being close to crop production areas, there are certain technical factors that should be kept in view while selecting the site for establishing grain warehouses.

Level Ground

The warehouse should be erected on level ground, ideally slightly raised above the surrounding area. The selected area should be well drained and protected from chance of any

[15] Adapted from FAO's publication, Grain Storage Techniques – Evolution and Trends in Developing Countries

flooding. It is important to avoid low locations. In case a level area cannot be found, then the least a sloping area should be selected.

Load Bearing Capacity of the Soil
The selected site should have good load-bearing capacity a high resistance to compaction, and good drainage characteristics. The warehouse should be protected from running water by an effective drainage system.

Proximity to Main Road
To facilitate access and movement of stocks, the warehouse should be established close to a main road. Moreover, the approaches to the warehouse should permit easy movement and maneuvering of vehicles around it. This implies that in addition to the warehouse area, there should be usable space available around it. To allow for future expansion, it will be good to have sufficient vacant space around the warehouse. Location at the main road is also important with respect to provision of adequate parking space; to avoid clogging of traffic due to queuing/parking of vehicles bringing in grain to the warehouse.

Not Very Close to Population Centers
Another consideration arises from the fact that the grain in the warehouse may have to be fumigated with gas which is not friendly to human beings. Therefore, the selected site should be a safe distance from houses, shopping centers and other working areas.

Site Alignment
The site selection should also consider the fact that it is preferable to construct warehouse building with its long axes oriented East-West as nearly as possible. By doing this, the side walls are least exposed to the sun and the temperature variations inside the store are minimized. Another factor in this regard is considering the fact that the alignment of the warehouse site and the constructed building should facilitate circulation of the prevailing wind. In this manner, the interior can be effectively cooled by opening all doors and windows at appropriate times.

7.4 Warehouse Capacity

The capacity of the warehouse will vary according to the location; driven by the production of the three types of grains in that area. There may be more than one warehouse in an area driven by the market demand. For the purpose of this feasibility study, a storage capacity of 5,000 tons has been assumed; which is considered to be an average capacity as per the industry norms. All the available capacity is has been assumed to be as the traditional warehouse for storing grain bags. Silo storage has not been considered in the feasibility calculations.

7.5 Project Cost

The project has a total cost of Rs 97.070 million. The summary of different cost components is shown in Table 19. Details are discussed in the following pages.

Project Head	Cost (Rs)
Land	15,000,000
Building & Civil Works	58,886,538
	-
Grain Handling Equipment	8,000,000
Warehouse Management Equipment	1,500,000
Office Equipment & Furniture	1,265,000
Vehicles	800,000
Pre-operating expenses	8,429,327
Capital Investment	93,880,865
Working Capital	3,189,238
Total Project Cost	**97,070,103**

Table 19 - Project Cost Details

7.5.1 Land and Building

Total land requirement for the project has been estimated to be 3 acres. Land cost will vary with the location. For the purpose of this feasibility study, based on the information obtained from the field, land cost has been assumed to be Rs 5.0 million per acre. The land will be used for three main areas; warehouse storage, space for allied equipment and space for ancillary buildings. Open spaces will be used for solar drying of grains. Space requirement and the associated civil construction cost are discussed in the following paragraphs:

7.5.1.1 Space Requirement for Warehouse Storage

The project assumes a warehouse storage capacity of 5,000 tons of grain. For calculating the space it is important to take into account the volume of the grain. Different grains have different specific volumes (volumes per unit mass). Maize has a higher specific volume of 1.8 cubic meter per ton which is lower than that of 1.6 for wheat or rice.[16] The space requirement calculations have been based on the specific volume of maize. This ensures that the space required for storing certain weight of maize will be able to easily accommodate the same weight of wheat or rice; but the vice versa will not be true. The space requirement calculations are shown in Table 20.

[16] It is important to mention that this is the specific volume of bagged maize. Specific volume of maize stored in bulk is lower which means that the space requirement for bulk storage of grains is lower compared to that of grains stored in bags. As per the information provided by the silo suppliers, the specific weight of maize is 0.75 tons per cubic meter which translates into a specific volume of 1.33 cubic meter per ton.

Total Weight of Maize Stored (tons)	**5,000**
Specific Volume of Maize (cubic meter per ton)	1.8
Cubic ft/Cubic Meter	35.3
Specific Volume (cubic feet/ton)	63.54
Volume Required for Storage (cubic ft)	317,700
Warehouse height (ft)	20
Area Required (sq ft)	15,885
Space Utilization %	52%
Total Area Required (sq ft)	30,548

Table 20 – Warehouse Space Calculation

The calculations assume a warehouse height of 20 feet which means a stack height of around eighteen bags.[17] The space utilization of 52% has been based on the information provided in an FAO document on grain storage.[18]

7.5.1.2 Space Requirement for Other Areas

Space for the allied equipment has been assumed to be 2,400 square feet that will house the grain cleaners, grain dryers and boiler. The space for ancillary buildings include office building, quality control lab and the store for keeping tools, consumables, such as bags for storage, fumigation chemicals, etc. Total space for ancillary buildings has been assumed to be 1,200 square feet.

7.5.1.3 Total Land Requirement for the Project

. Total space requirement was calculated to be 30,548 square feet that was increased by 50% to make it 51,222 square feet or 1.18 acre. Around 2 acres of land was assumed to be used for grain drying. Thus the total land requirement was assumed to be 3 acres. Table 21 shows the summary of land requirement calculations.

Space Requirement Head	Space Requirement (sq ft)
Warehouse Storage	30,548
Allied Equipment Space	2,400
Ancillary Buildings Space	1,200
Total Requirement	**34,148**
Open Space @ 25%	17,074
Total Space Requirement (sq.ft.)	**51,222**
Total Land Requirement (acre)	1.18
Land Requirement solar for drying (acre)	1.82
Land Requirement after Rounding Off (acre)	**3.0**

Table 21 – Project's Land Requirement Summary

[17] Field data
[18] Grain Storage Techniques – Evolution and Trends in Developing Countries, FAO

Land cost has been assumed to be Rs 5.0 million per acre. This is based on the information collected from the field. Since land cost varies widely with the location, the sensitivity of project's viability with the increase in land cost has also been included at the end.

7.5.2 Buildings and Storage Infrastructure

7.5.2.1 Building & Civil Works

The building and civil construction will be required for the warehouse storage, allied equipment installation, ancillary buildings and boundary wall. Summary of cost calculations is shown in Table 22.

Building	Total covered area (sq. ft.)	Unit construction Cost (Rs per sq. ft.)	Construction Cost (PKR)
Warehouse Storage	30,548	1,800	54,986,538
Allied Equipment (sq.ft.)	-	1,600	-
Ancillary Buildings (sq.ft.)	1,200	2,000	2,400,000
Boundary Wall (r.ft.)	1,500	800	1,200,000
Main Gate (no.)	1	300,000	300,000
Total Cost (PKR)			**58,886,538**

Table 22 – Buildings & Civil Works Calculations

7.5.3 Warehouse Machinery & Equipment

Along with the storage space, the proposed rural grain warehouse will also require machinery and equipment to provide services to farmers. This has been classified as the warehouse management equipment and the grain management equipment. In addition, there will be utility equipment as well. The cost summary is shown in Table 23.

Machinery & Equipment Category	Cost (Rs)
Warehouse Management System	1,500,000
Grain Handling Equipment	8,000,000
Utility Equipment	5,000,000
Total Machinery & Equipment	**14,500,000**

Table 23 – Machinery & Equipment Cost Summary

7.5.3.1 Warehouse Management Equipment

Details of warehouse management equipment are provided in Table 24.

Warehouse Management Equipment	No.	Unit Cost	Total Cost
Quality Control Lab	1	500,000	500,000
Racks	-	5,000,000	-
Warehouse Management Software	1	500,000	500,000
CCTV Security System	1	500,000	500,000
Total	**4**		**1,500,000**

Table 24 – Warehouse Management Equipment Cost Details

Warehouse Management Software

The warehouse operations will be managed using modern software. The materials flowing and out of the store and the overall inventory management will be carried out using that software. Use of this software is also important for linking the proposed rural warehouse projects with the upcoming Warehouse Receipt Scheme. Currently, the grain warehouses in public and private sector are being operated informally, without the use of information technology. Therefore, this software will have to be developed to meet the specific requirements of the project. The software should at least be equipped with the following features:

- A complete record of all the incoming and outgoing grain loads in terms of grain type, quantity, quality, ownership and entry/exit dates
- A real time status of the warehouse space utilization
- Location of the grain loads of different owners stored at different places in the warehouse and availability of vacant space
- Calculation of storage charges with respect to grain type, storage type and the total duration for which it was stored
- Information on warehouse environment control (temperature, humidity)
- Documentation for grain movement into and out of the warehouse

CCTV Security System

For ensuring the security of the facility and protection of the people's stocks stored in the warehouse, a CCTC system will be installed in the building.

Standby Generator

In the wake of current electricity shortage, it is important that the project should have a standby generator to maintain the warehouse operations streamlined. One generator has thus been proposed for the project.

Racks

The option of using racks for storing grain bags was considered but was not found to be practical. As per the current storage practices, grain bags in the informal warehouses are stacked over one another without the use of any racks. The project has adopted the same practice since the option of racks was expensive and the benefit of using them was not very clearly defined. Avoiding this has led to cutting the project's total capital investment and increasing the project's viability.

7.5.3.2 Grain Handling Equipment

The proposed rural warehouses should be established in line with the international best practices for such warehouses and should be equipped with all the allied facilities that are required for effective quality assurance of the stored grains. Providing modern facilities will increase the confidence of the farmers/traders and will help then fetch better value for the stored products. Details of grain handling machinery included in the project are provided in Table 25.

Grain Handling Equipment	No.	Unit Cost	Total Cost
Weigh Bridge	1	800,000	800,000

Grain Cleaners	2	600,000	1,200,000
Grain Dryers	2	3,000,000	6,000,000
Total	5		8,000,000

Table 25 – Grain Handling Equipment Cost Details

The allied equipment required for the warehouse facilities is discussed in the following paragraphs:

Weigh Bridge
The grain coming for storage has to be weighed before it may be stored in the warehouse. For generating mutual confidence between the grain owner and the warehouse operator, it is important that grain is weighed on project's own weigh bridge. The proposed weight bridge will have the capacity to weigh the loaded vehicles of up to 15 tons of weight.

Grain Cleaner
The grains received by the warehouse will be cleaned to remove dust and foreign matter like straw, leaves and any other impurities. This operation will be carried out using grain cleaning machine which is available from local suppliers. In order to easily manage the flow of grain coming for storage, two grain cleaners have been included in the project.

Grain Dryer
Grain dryer will be used depending upon the type of grain received for storage. For wheat, there is no requirement of drying. However, maize has to be dried before storing it since excess moisture makes it prone to fungus and disease attack. Similarly, in case of paddy as well, there is a need for drying before it may be stored. This requirement is especially more relevant when paddy is harvested by harvesting machine.

Grain Grader
Grain Grader may also be included in a rural warehouse project to categorize the grain into different grades. This is also important from the point of view of the Warehouse Receipt Scheme which will be linked to these warehouses. However, in the current feasibility, grain grader has not been included due to its current limited use and availability.

7.5.3.3 Utility Equipment

Utility equipment comprises of boiler to generate steam and a generator to be used as standby source of electricity. Details of the utility equipment are provided in Table 26.

Utility Equipment	No.	Unit Cost	Total Cost
Boiler	1	3,000,000	3,000,000
Standby Generator	1	2,000,000	2,000,000
Fork Lifter	-	2,000,000	-
Total	**2**		**5,000,000**

Table 26 – Utility Equipment Cost Details

Fork Lifter

The option of having a fork lifter in the project was also considered; however, it was decided not to include that in the project; to lower the project's cost. Fork lifter is expensive equipment and helps to manage the operations more easily. However, the benefit of the equipment appeared not to be justifying its cost. Therefore, it was assumed that the loading/unloading and transport of bags within the warehouse and from and to the transport vehicles will be done by manual labor.

7.5.4 Office Equipment and Furniture

Office equipment and furniture is required for administrative and production staff. It includes furniture, interior decoration and IT equipment. Details are presented in Table 27.

Item	No.	Cost	Total Cost (Rs)
Office Interior	1	300,000	300,000
Office Furniture	1	400,000	400,000
Laptop Computers	1	70,000	70,000
Desktop Computers	3	35,000	105,000
Printers	2	20,000	40,000
Telephone Exchange	1	40,000	40,000
Telephone sets	10	2,000	20,000
Air Conditioners	4	60,000	240,000
Fans	10	5,000	50,000
Total			**1,265,000**

Table 27 - Office Equipment and Furniture Cost

7.5.5 Pre-Operating Expenses

Pre-operating expenses include the cost of utility connections, installation, registration and licenses, salaries of the personnel that will be hired before the plant operations start and the operational expenses, such as travelling, office expenses, etc. Summary of pre-operating expenses is provided in Table 28.

Cost Head	Cost (Rs)
Registration, licenses, etc.	500,000
Consultancies for civil works, etc.	2,944,327
Utility Connections	2,325,000
Machinery Installation	2,000,000
Salaries	240,000
Promotional Cost	225,000
Admin. Expenses	195,000
Total (PKR)	**8,429,327**

Table 28 - Pre-Operating Costs

7.5.6 Working Capital

The proposed project is based on a new idea which has to first create awareness, then ensure trial and finally run on sustainable basis on the projected repeat business. Project's operations are thus expected to pass through a period where it may be running below its projected revenues. In order to account for this factor, the working capital has been calculated on the basis of three months costs. Working capital calculation is shown in Table 29.

Cost Item	Cost (Rs)
Electricity Bill	555,863
Fuel & Maintenance Cost	120,000
Office Maintenance Cost	228,375
Marketing Cost	140,000
Salaries	1,500,000
Spares	145,000
Starting Cash Balance	500,000
Total Working Capital (Rs)	**3,189,238**

Table 29 – Working Capital Calculation

For all the operating costs, including electricity, fuel & maintenance, office administration, marketing and human resource, a cushion of three months expenses has been included in the working capital. Spares cost has been assumed to be equal to 1% of the cost of machinery and equipment. In addition, a starting cash balance of Rs 0.5 million has also been included in the project's working capital.

7.6 Project's Operations

7.6.1 Project's Revenues

The project will earn revenues by charging money for storage of grains and for providing value added services of grain cleaning and drying. There are three target grains with varying availability during different months of the year. Therefore, the available storage space will be utilized differently in different months. In line with the harvest calendars of wheat, rice and maize, a storage calendar has been proposed which shows the percentage of available storage being used for the three types of grains during twelve months of the year.

7.6.1.1 Storage Calendar for Traditional Storage Facility (Bags)

Figure 48 shows the suggested storage utilization plan for the bags storage capacity. Capacity allocation in terms of tons and maunds during each of the twelve months are respectively shown in Table 30 and Table 31.

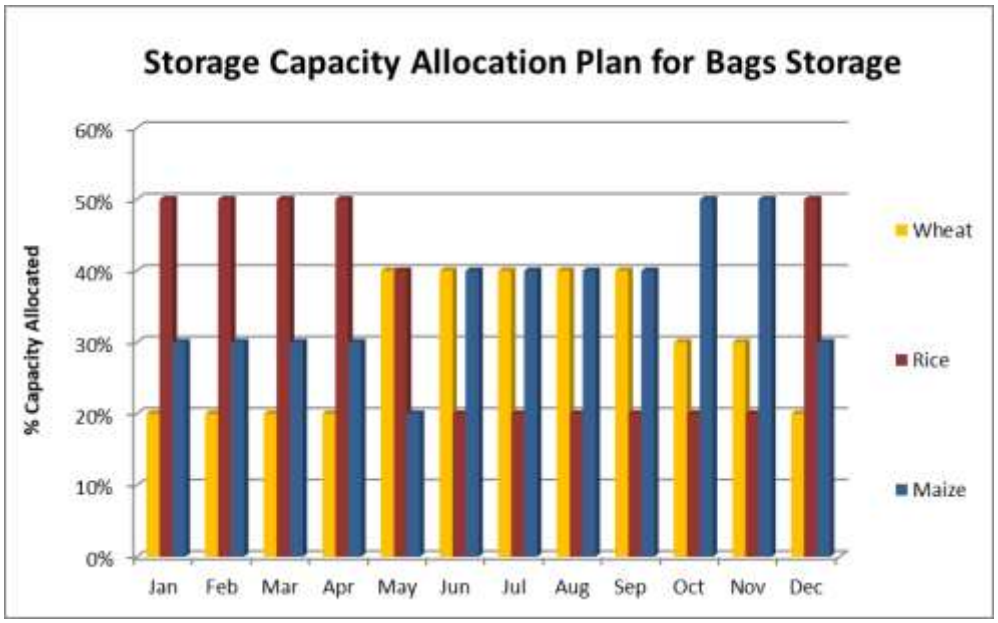


Figure 48 –Storage Capacity Allocation Plan for Bags Storage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000	2,000	1,500	1,500	1,000	18,000
Rice	2,500	2,500	2,500	2,500	2,000	1,000	1,000	1,000	1,000	1,000	1,000	2,500	20,500
Maize	1,500	1,500	1,500	1,500	1,000	2,000	2,000	2,000	2,000	2,500	2,500	1,500	21,500
Total	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**60,000**

Table 30 – Storage Capacity Allocation of Available Bags Storage in Terms of Tons

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat	25,000	25,000	25,000	25,000	50,000	50,000	50,000	50,000	50,000	37,500	37,500	25,000	450,000
Rice	62,500	62,500	62,500	62,500	50,000	25,000	25,000	25,000	25,000	25,000	25,000	62,500	512,500
Maize	37,500	37,500	37,500	37,500	25,000	50,000	50,000	50,000	50,000	62,500	62,500	37,500	537,500
Total	**125,000**	**125,000**	**125,000**	**125,000**	**125,000**	**125,000**	**125,000**	**125,000**	**125,000**	**125,000**	**125,000**	**125,000**	**1,500,000**

Table 31 – Storage Capacity Allocation of Available Bags Storage in Terms of Maunds

The highest capacity allocation for wheat has been assumed for the five months from May to September. During these months, wheat gets 40% of the total available bags storage capacity. Maize gets 50% capacity in the months of October and November during the autumn harvesting season. During June, July and August, maize has been given 40% capacity allocation; equal to that of wheat during the same months. This is because the spring harvesting season of maize coincides with that of wheat. Rice gets the highest 50% capacity allocation during five months from December to April. In the five months following April, the capacity allocation for rice reduces to 20% and increases to 50% in December, following the harvesting month of November.

Total available bags storage capacity in terms of ton-months is 60,000 (the product of 5,000 tons and 12 months). The suggested capacity allocation plan leads to distributing 36% available capacity each to maize and rice and 28% capacity to wheat. Capacity distribution is shown in Figure 49. Changing the distribution of capacity between the three commodities will

lead to change in project's revenues since the proposed storage charges are different for different commodities.

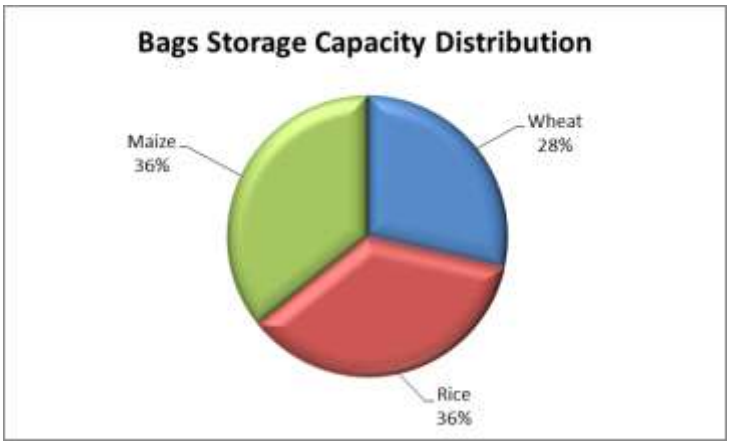


Figure 49 – Bags Storage Capacity Distribution

7.6.1.2 Suggested 'Sale' Prices

7.6.1.2.1 Storage Charges

Storage charges for the three commodities have been fixed keeping in view the information obtained from the field and the analysis carried out in the previous section where the benefit of storage for the farmer/trader was analyzed. The approach has been to keep the prices within the range in which the proposition makes sense for the customer since otherwise the project will not be getting many customers. The proposed storage charges, which have been used for calculating the project's revenues, are listed in Table 32.

Stored Product	Storage Charges (Rs per maund per month)
Wheat	15
Rice	50
Maize	30

Table 32 – Proposed Storage Charges

Rice storage charges have been kept higher since its storage offers the highest value addition to the farmer/trader.

7.6.1.2.2 Allied Services Charges

The project will charge from the farmers/traders for providing the services of grain cleaning and drying. The suggested charges are listed in Table 33.

Service	Service Charges (Rs per maund)
Grain Cleaning Charges	10
Grain Drying Charges	20

Table 33 – Proposed Allied Services Charges

7.6.1.3 Capacity Utilization Schedule

The project is a new concept and thus is not expected to run at full capacity during the first few years. The capacity utilization for the first year of operations has been assumed to be 60%, which will increase to 80% in the next year and from third year onwards, the project is assumed to run at full capacity. Suggested capacity utilization schedule is shown in Table 34.

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
60%	80%	100%	100%	100%	100%	100%	100%	100%	100%

Table 34 - Capacity Utilization Schedule

7.6.1.4 Revenues

Based on the above storage plan, storage prices and the capacity utilization plan, the revenues during the first year of the project's operations were calculated to be Rs 26.39 million (at 60% capacity utilization).

Revenue Source	Revenues (Rs)	Share
Storage Charges	29,100,000	91.9%
Allied Services	2,550,000	8.1%
Total Revenues (Rs)	**31,650,000**	**100.0%**

Table 35 – Revenues Summary

7.6.1.4.1 Service Charges Growth

Keeping in view that the project is based on a new concept, a conservative approach has been taken on the growth of service charges in the years to follow. A modest price growth rate of 5% per annum has been assumed for the second year which is increased to 6% in the third and 7% in the fourth year. From seventh year onwards, the service charges have been assumed to grow at the same rate of 10% per annum. Service charges growth schedule is presented in Table 36.

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Growth Rate	5%	6%	7%	8%	9%	10%	10%	10%	10%

Table 36 – Sale Price (Service Charges) Growth Schedule

Detailed revenue calculations are presented in Annex V.

7.6.2 Costs Assumptions

7.6.2.1 Electricity Cost

Electricity cost has been calculated on the basis of overall load of 200 KVA as per the capacity utilization assumptions during each year. A2 General Commercial supply tariff has been applied to calculate the monthly bill. An annual increase of 8% in electricity cost has been assumed.

7.6.3 Depreciation/Amortization

Straight line depreciation method has been used to calculate the associated cost. Different rates applied to different types of assets are shown in Table 37.

Asset	Depreciation Rate
Land	0%
Building and Civil Works	10%
Grain Handling/Allied Equipment	10%
Office Equipment	20%
Vehicles	20%

Table 37 - Depreciation Rates

The pre-operating expenses, included in the project cost, have been amortized over a period of five years. Depreciation and amortization costs and the year-end values of the assets during ten years are presented in Annex VI.

7.6.4 Human Resource Plan

The project will require human resources in all important functions. Overall management will be carried out by a Warehouse Manager who will be assisted by storekeeping, administration and accounts teams. Total HR needs of the enterprise has been calculated to be 21 persons. Human Resource cost details are presented in Table 38.

Designation	No.	Salary (Rs/month)	Total (Rs/month)	Salary per annum
Warehouse Manager	1	50,000	50,000	600,000
Admin/Accounts Officer	1	30,000	30,000	360,000
Storekeeper	1	30,000	30,000	360,000
IT/Store Assistant	1	20,000	20,000	240,000
Boiler Operator	1	30,000	30,000	360,000
Grain Equipment Operators	2	20,000	40,000	480,000
Weigh Bridge Operator	1	20,000	20,000	240,000
Lab Operators	2	25,000	50,000	600,000
Loading/Unloading Labor	5	15,000	75,000	900,000
Security Supervisor	1	25,000	25,000	300,000
Security Guards Permanent	3	15,000	45,000	540,000
Security Guards for Operations	3	15,000	45,000	540,000
Driver	1	25,000	25,000	300,000
Office Boy	1	15,000	15,000	180,000
Total	**24**		**500,000**	**6,000,000**

Table 38 - Human Resource Cost

Security cost constitutes a major component of the total HR cost. This is important to ensure the safety of the grains stocks of the farmers/traders. The security staff will manage the CCTV system that will be installed for safety and security of the facility.

The HR cost was divided into two types, the staff which will be retained whether the warehouse is operational or not and staff which will be retained only when the warehouse is operational. The second type of cost has been included as direct payroll cost and the first type of cost is considered as the fixed cost. The positions directly related to warehouse operations include Admin/Accounts Officer, Storekeeper, IT Assistant, weigh bridge operator, grain equipment operators, loading/unloading labor, Security Supervisor and three security guards. The staff that will be treated as permanent include the Warehouse Manager, Driver, Office Boy and the other three security guards. With this distribution, the split between the direct and indirect payroll costs is shown in Table 39.

Type of Cost	Annual Cost (Rs)	% Share
Payroll Production	4,380,000	73%
Payroll Admin	1,620,000	27%
Total	**6,000,000**	**100%**

Table 39 – HR Cost Distribution between Variable and Fixed Costs

7.6.5 Office Administration Cost

Office maintenance cost includes the costs of stationery, correspondence, telephone, internet, travelling and refreshment. During the first year of operations, total office administration cost was calculated as Rs 781,500. The split of the total cost between different types is shown in Figure 50. The assumptions and the calculations of office administration costs are shown in Annex VI.

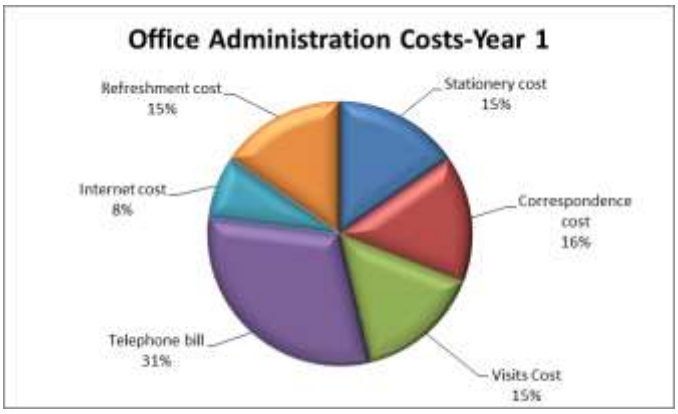


Figure 50 – Office Administration Costs

7.6.6 Marketing Cost

Targeted marketing holds a central position in making the project of rural warehouses successful. Three types of marketing activities have been proposed; awareness brochures, direct marketing by meeting with the farmers/traders and awareness/marketing seminars. Marketing cost will be high during the initial years and will decrease in the later years. Annual marketing cost during the first year of operations has been calculated as Rs 560,000. 56% of this cost is spent on meetings, 37% on seminars and the balance on introductory brochures. Marketing cost calculations and the underlying assumptions are provided in Annex VI.

7.7 Financial Feasibility Analysis

7.7.1 Key Financial Assumptions

No. of Projection Years	10
Discount Rate used for NPV [19]	20%

7.7.2 Financial Feasibility

The project of rural grain warehouses is found to be financially feasible. The calculations indicated a positive NPV of Rs 16.22 million, an IRR of 24.31% and payback period of 4.61 years. Financial feasibility results are provided in Table 40.

IRR	24.31%
NPV (Rs)	16,216,586
Payback Period (years)	4.61

Table 40 - Financial Feasibility Results

7.8 Breakeven Analysis

Breakeven analysis was carried out to know the storage capacity utilization that recovers the project's fixed costs. For calculating the unit contribution margin, maund-month was considered as the unit. Variable and fixed costs were identified to carry out the analysis.

7.8.1 Variable Costs

Three types of costs were identified as the variable costs. These were the costs which were directly related with the project's operations; meaning that with nothing being stored in the warehouse, these costs would not have existed. These included the direct payroll, direct electricity and the equipment maintenance cost. Direct payroll included the salaries of the persons who were retained only in case the warehouse was getting business. These included Admin/Accounts Officer, Storekeeper, IT Assistant, weight bridge operator, grain equipment operators, loading/unloading labor, Security Supervisor and half (3) of the total number of security guards. Variable part of the electricity bill was the one which was used in the storage areas of the building and the one used for running machinery and equipment for carrying out grain handling activities. Maintenance cost was the cost of maintaining the grain handling equipment and routine maintenance of warehouse storage, storage silos, etc.

[19] Determination of an appropriate discount rate is a key component in any NPV analysis. The use of a discount rate takes account of the declining value of money over time. It recognizes that Rs 1 collected in one year will be worth less than the same Rs 1 collected today due to opportunity cost and the risk. Discount rates for private projects are based on opportunity costs, using short to midterm investment rates that the organization would have earned from the investment opportunities available in the market for the period under analysis and at risk levels the organization is willing to undertake. Generally, for private companies which are following a stable growth, a discount rate of around 15% is used. Whereas, for new companies which have not reached scale and predictable growth, a discount rate of around 20% is considered okay.

7.8.2 Fixed Costs

Fixed costs are the ones which do not depend on project's operations and are bound to be incurred even in case of zero sales (storage volumes in this case). These costs included indirect payroll cost, fixed part of the electricity bill, depreciation, amortization, office administration, marketing, licensing/regulatory fees, audit and other legal/professional fees and vehicle fuel and maintenance costs. The fixed payroll included the salaries of the Warehouse Manager, driver, office boy and half of the total number of security guards. Fixed electricity refers to that part of electricity bill which is used in office building, illumination outside the building, etc.

7.8.3 Unit Contribution Margin

The basic unit of 'sales' in the case of warehouse is the product of basic storage unit and the unit of time since the storage services being offered are time-based and storage service charges are also charged on monthly basis. Therefore, the basic storage unit has been considered as 'maund' and the unit of time has been considered as 'month'. With this definition, the total annual capacity of the proposed warehouse facility comes out to be 1,501,200 maund-months (product of 125,100 maunds and 12 months). Breakeven analysis based on the costs of the first year of operations is shown in Table 41.

	Year 1
Revenues (Rs)	31,650,000
Direct Costs (Rs)	5,596,000
Gross Profit (Rs)	26,054,000
No. of Units 'sold' (maund-month storage)	900,000
Unit Revenue (Rs/maund-month)	35.17
Unit Variable Cost (Rs/maund-month)	6.22
Unit Contribution Margin (Rs/maund-month)	28.95
Fixed Costs (Rs)	13,816,469
Breakeven Capacity (maund-month)	477,271
Total Available Capacity (maund-months)	1,500,000
Breakeven Capacity %	31.8%
Breakeven Capacity in terms of maunds (maund-month/12)	39,773
Breakeven Capacity in terms of tons	**1,657**

Table 41 – Breakeven Capacity in the First Year of Operations

The analysis shows that during the first year, the project 'sold' 900,000 units of storage capacity; on the assumed 60% capacity utilization. Unit revenue of Rs 35.17 was found by dividing the total annual revenues by the number of sold units. Similarly, unit variable cost of Rs 6.22 was found by dividing the total annual direct costs by the same number. Unit Contribution margin (UCM) of Rs 28.95/maund-month was found by subtracting the unit cost from the unit revenue.

Fixed costs for the first year were Rs 13.82 million. Dividing the fixed costs by the UCM, the breakeven capacity was found to be 477,271 maund-months. This was 31.8% of the total available capacity of 1,500,000 maund-months. This value is based on the annual capacity. Dividing this by 12, the breakeven capacity in terms of weight of grain stored comes out to be 39,773 maunds or 1,657 tons. Therefore, in order for the project to fully recover its fixed costs, the warehouse has to hold at least 1,657 tons of grain during the entire twelve months of the year. Breakeven analysis for the ten years of project's operations is shown in Annex VII.

7.9 Sensitivity Analysis

The project's financial feasibility is quite close to edge and thus a sensitivity analysis deems necessary to understand the impact of different factors on project's viability. The analysis views the change in NPV and Net Profit Margin with the change in the following factors:

- Sale price (storage charges)
- Land price
- Share of debt

7.9.1 Sensitivity to Sale Price (Storage Charges)

There is no availability of the market prices since the proposed commercial warehouse project is the first of its kind. The sale prices used in the calculations have been based on the market feedback and the expected benefits of storing for the farmers/traders. It was therefore deemed necessary to carry out sensitivity with respect to drop in sale prices so as to identify the prices beyond which the project does not remain financially viable. The sensitivity of project's NPV and the net profit margin to change in sale prices is shown in Figure 51.

Figure 51 – Project's Sensitivity to Sale Price

Decrease in sale price was measured in terms of percentage. The storage charges for all the three commodities were decreased. The project remained viable up to a decrease of around 12.2%. This shows that project has a medium sensitivity to decrease in sale price. In case the assumed prices are higher than the customer's expectations, they may have to be decreased thereby making the project financially unviable. The graph also shows that the project's net profit margin decreases from 18.0% at the assumed prices to 12% at 12.2% decrease in sale prices.

7.9.2 Sensitivity to Land Price

Land is an important cost component and the price varies widely with the location. Therefore, it was deemed necessary to conduct project's sensitivity with the land price. The sensitivity trend is shown in Figure 52.

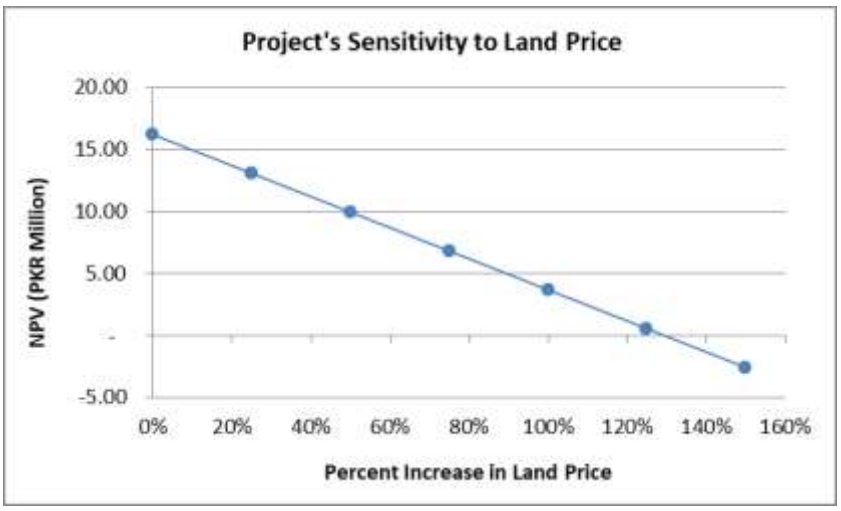


Figure 52 – Project's Sensitivity to Land Price

The project's viability does not appear to be very sensitive to land price. The land price assumed in the feasibility calculations is Rs 5 million per acre. The sensitivity trend shows that the project remains financially viable even if the land price is doubled. The NPV enters into the negative range when the land price is increased by around 126%.

7.9.3 Capacity to Absorb Debt

The feasibility calculations have assumed that the project is financed with 100% equity. However, it is important to know the impact of adding debt to the capital structure of the project. The impact of adding debt share on project's NPV is shown in Figure 53.

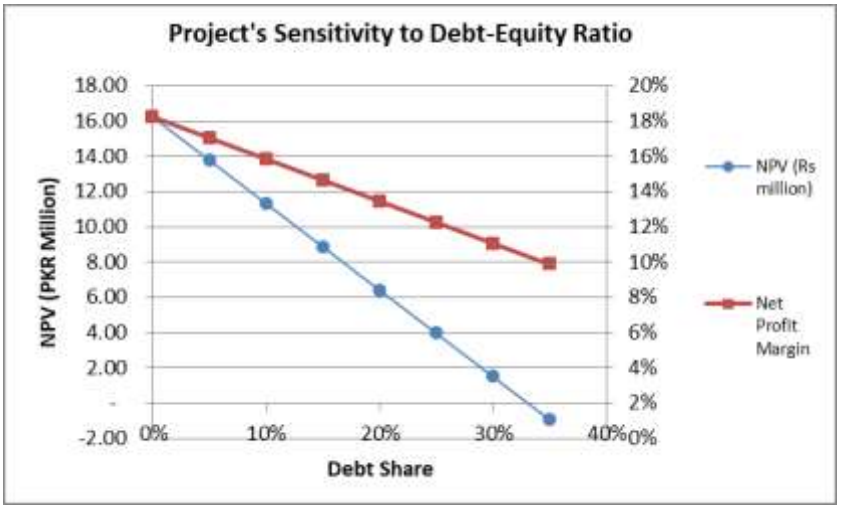


Figure 53 – Project's Sensitivity to Share of Debt

For doing this calculation a debt of ten years tenure at an interest rate of 12% was assumed. The result shows that the project has a lower capacity to absorb the debt cost. The project becomes financially unviable at a debt share of around 33%.

7.10 Summary of Assumptions

7.10.1 Project Cost Assumptions

Land Cost (Rs/acre)	5,000,000
Warehouse space utilization	55%
Unit Construction Costs	
Warehouse Storage	1,800 Rs/sq ft
Allied Equipment	1,600 Rs/sq ft
Ancillary Buildings	2,000 Rs/sq ft
Boundary Wall	800 Rs/R. ft.
Main Gate (no.)	Rs 300,000

Table 42 – Assumptions for Land & Building

7.10.2 Pre-operating Costs Assumptions

Personnel cost	2 months salaries each of Warehouse Manager, 2 security guards and 1 driver and 1 month salary of Admin Officer
Promotional cost	Rs 25,000 for promotional brochures and Rs 200,000 for marketing visits
Utility connections	Rs 2,000,000 for electricity connection and Rs 300,000 for water tube well
Admin Expenses	Travelling expenses of Rs 40,000 and office expenses of Rs 25,000 for 3 months
Registration/Licenses Cost	Rs 500,000
Consultancy for civil works	5% of civil construction cost

Table 43 - Assumptions for Pre-operating Costs

7.10.3 Working Capital Assumptions

Cost Item	Basis
Electricity Bill	3 month electricity bill
Fuel & Maintenance Cost	3 months maintenance expenses
Office Administration Cost	3 months office expenses
Marketing Cost	3 months marketing expenses
Salaries	3 months salaries
Spares	1% of machinery cost
Starting Cash Balance	Rs 500,000

Table 44 – Assumptions for Working Capital

7.10.4 Revenue Assumptions

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
60%	80%	100%	100%	100%	100%	100%	100%	100%	100%

Table 45 – Assumptions for Storage Capacity Utilization

7.10.4.1 Price Assumptions

Product for Storage	Storage Charges (Rs/maund/month
Wheat	15
Rice	50
Maize	30

Table 46 – Assumptions for Sale Prices (Storage Charges)

Service	Price (Rs/maund)
Grain Cleaning	10
Grain Drying	20

Table 47 – Assumptions for Allied Service Charges

7.10.4.2 Price Growth Rate Assumptions

Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
5%	6%	7%	8%	9%	10%	10%	10%	10%

Table 48 – Assumptions for Annual Sale Price Growth

7.10.5 Cost Assumptions

Machine maintenance (% of machine cost)	**1%**
Machine maintenance increase per year	0.10%

Table 49 – Assumptions for Machines Maintenance Costs

Payroll growth rate	**8%**
Electricity Cost growth	8%

Table 50 – Assumptions for Payroll and Electricity Cost Growth Rates

Vehicle oil change frequency (km)	**4,000**
Kilometers per month	4,000
Cost per oil change (Rs)	5,000
Fuel cost per kilometer (Rs)	6
No. of Vehicles	1

Table 51 – Assumptions for Vehicle Fuel and Maintenance Costs

Depreciation Method	Straight line
Amortization Rate	Straight line
Asset Type	**Depreciation Rate**
Land	0%
Building and Civil Works	10%

Grain Handling/Allied Equipment	10%
Office Equipment	20%
Vehicles	20%
Asset Type	**Amortization Rate**
Pre-operating Expenses	20%

Table 52 – Assumptions for Depreciation and Amortization

7.10.6 Marketing Cost Assumptions

Advertising brochure cost (Rs)	**15**
Growth in brochure cost	5%
Cost per mail letter (Rs)	10
Growth in mail cost	5%
Cost per marketing trip	5,000
Growth rate of travel cost	10%
Cost per seminar	100,000
Growth rate in seminar cost	10%

Table 53 – Assumptions for Marketing Costs

7.10.7 Office Administration Cost Assumptions

Stationery cost per month	**10,000**
Stationery cost growth rate	10%
Mail cost per month	5,000
Telephone bill per month	20,000
Telephone bill growth rate	8%
Internet cost per month	5,000
Internet cost growth rate	8%
Refreshment cost per month	10,000
Refreshment cost growth rate	10%

Table 54 – Assumptions for Office Administration Costs

7.10.8 Legal/Regulatory Costs Assumptions

Regulatory fee (Rs/annum)	**100,000**
Growth rate of regulatory fee per annum	5%
Audit fee (Rs/annum)	100,000
Growth rate of audit fee per annum	5%
Legal/Professional fee (Rs/annum)	50,000
Growth rate of legal fee per annum	5%

Table 55 – Assumptions for Legal/Regulatory Costs

7.10.9 Financial Assumptions

Accounts Receivables months	**3**

Accounts Payables months	1
Spare parts inventory (% of machinery)	1%
Increase in spares inventory per annum	5%

Table 56 – Assumptions for Cash Flow Calculations

Financing Source	**Share**
Equity	100%
Debt	0%

Table 57 – Assumptions for Financing Plan

Discount Factor for NPV	**20%**
Tax Rate	35%
Debt Tenure (for sensitivity)	10 years
Interest Rate (for sensitivity)	12% p.a.

Table 58 – Assumptions for Financial Calculations

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
0%	5%	10%	20%	30%	40%	40%	40%	40%	40%

Table 59 – Assumptions for Dividend Payout Ratio

7.11 Financial Statements

7.11.1 Projected Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Operating Revenues	31,650,000	44,890,000	59,475,000	63,475,000	68,525,000	75,075,000	82,437,500	90,850,000	100,225,000	110,775,000
Direct Costs										
Direct Payroll	4,380,000	4,730,400	5,108,832	5,517,539	5,958,942	6,435,657	6,950,510	7,506,550	8,107,074	8,755,640
Direct Electricity	1,168,000	1,681,920	2,270,592	2,452,239	2,648,419	2,860,292	3,089,115	3,336,245	3,603,144	3,891,396
Boiler Fuel Cost	3,360,000	3,528,000	3,704,400	3,889,620	4,084,101	4,288,306	4,502,721	4,727,857	4,964,250	5,212,463
Machine Maintenance	48,000	52,800	57,600	62,400	67,200	72,000	76,800	81,600	86,400	91,200
Total Direct Cost	**8,956,000**	**9,993,120**	**11,141,424**	**11,921,798**	**12,758,661**	**13,656,255**	**14,619,146**	**15,652,252**	**16,760,869**	**17,950,699**
Gross Profit	**22,694,000**	**34,896,880**	**48,333,576**	**51,553,202**	**55,766,339**	**61,418,745**	**67,818,354**	**75,197,748**	**83,464,131**	**92,824,301**
Operating Costs										
Payroll Admin	1,620,000	1,749,600	1,889,568	2,040,733	2,203,992	2,380,311	2,570,736	2,776,395	2,998,507	3,238,387
Fixed Electricity	1,055,450	1,172,400	1,301,334	1,405,105	1,517,177	1,638,215	1,768,936	1,910,115	2,062,589	2,227,260
Depreciation	7,251,654	7,251,654	7,251,654	7,251,654	7,251,654	6,838,654	6,838,654	6,838,654	6,838,654	6,838,654
Amortization	1,685,865	1,685,865	1,685,865	1,685,865	1,685,865	-	-	-	-	-
Marketing Cost	560,000	437,000	371,875	177,084	106,079	67,460	73,248	79,568	86,469	94,008
Office maintenance Cost	913,500	1,065,900	1,126,599	1,191,994	1,292,054	1,400,674	1,518,598	1,646,635	1,785,668	1,936,657
Licensing/Regulatory Fee	100,000	105,000	110,250	115,763	121,551	127,628	134,010	140,710	147,746	155,133
Audit fee	100,000	105,000	110,250	115,763	121,551	127,628	134,010	140,710	147,746	155,133
Legal/Professional Fee	50,000	52,500	55,125	57,881	60,775	63,814	67,005	70,355	73,873	77,566
Vehicle fuel & maintenance	480,000	528,000	580,800	638,880	702,768	773,045	850,349	935,384	1,028,923	1,131,815
Total Operating Costs	**13,816,469**	**14,152,919**	**14,483,321**	**14,680,722**	**15,063,466**	**13,417,430**	**13,955,546**	**14,538,527**	**15,170,174**	**15,854,613**
Earnings before interest and taxes	**8,877,531**	**20,743,961**	**33,850,255**	**36,872,480**	**40,702,873**	**48,001,315**	**53,862,808**	**60,659,220**	**68,293,957**	**76,969,688**
Interest	-	-	-	-	-	-	-	-	-	-
Earnings before taxes	**8,877,531**	**20,743,961**	**33,850,255**	**36,872,480**	**40,702,873**	**48,001,315**	**53,862,808**	**60,659,220**	**68,293,957**	**76,969,688**
Tax	3,107,136	7,260,386	11,847,589	12,905,368	14,246,005	16,800,460	18,851,983	21,230,727	23,902,885	26,939,391
Net Operating Income	**5,770,395**	**13,483,575**	**22,002,666**	**23,967,112**	**26,456,867**	**31,200,855**	**35,010,825**	**39,428,493**	**44,391,072**	**50,030,297**
Balance brought forward	-	5,770,395	18,291,271	36,264,543	48,185,324	52,249,534	50,070,233	51,048,635	54,286,277	59,206,410
Total profit available for appropriation	5,770,395	19,253,970	40,293,937	60,231,655	74,642,192	83,450,389	85,081,058	90,477,128	98,677,349	109,236,707
Dividend	-	962,698	4,029,394	12,046,331	22,392,657	33,380,156	34,032,423	36,190,851	39,470,940	43,694,683
Balance carried forward	**5,770,395**	**18,291,271**	**36,264,543**	**48,185,324**	**52,249,534**	**50,070,233**	**51,048,635**	**54,286,277**	**59,206,410**	**65,542,024**

7.11.2 Projected Balance Sheet

ASSETS											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Current Assets											
Cash	3,044,238	10,517,689	28,751,044	52,110,593	72,030,942	83,837,434	86,932,197	92,987,647	101,046,450	110,554,276	121,191,577
Short term securities		-	-	-	-	-	-	-	-	-	-
Accounts Receivables		7,912,500	11,222,500	14,868,750	15,868,750	17,131,250	18,768,750	20,609,375	22,712,500	25,056,250	27,693,750
Spare Parts inventory	145,000	152,250	159,863	167,856	176,248	185,061	194,314	204,030	214,231	224,943	236,190
Total Current Assets	**3,189,238**	**18,582,439**	**40,133,407**	**67,147,199**	**88,075,940**	**101,153,745**	**105,895,261**	**113,801,051**	**123,973,181**	**135,835,468**	**149,121,517**
Fixed Assets											
Land	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
Building & Civil Works	58,886,538	52,997,885	47,109,231	41,220,577	35,331,923	29,443,269	23,554,615	17,665,962	11,777,308	5,888,654	- 0
Small Silos	-	-	-	-	-	-	-	-	-	-	-
Grain Handling/Allied Equipment	9,500,000	8,550,000	7,600,000	6,650,000	5,700,000	4,750,000	3,800,000	2,850,000	1,900,000	950,000	-
Office Equipment & Furniture	1,265,000	1,012,000	759,000	506,000	253,000	-	-	-	-	-	-
Vehicles	800,000	640,000	480,000	320,000	160,000	-	-	-	-	-	-
Net Fixed Assets	**85,451,538**	**78,199,885**	**70,948,231**	**63,696,577**	**56,444,923**	**49,193,269**	**42,354,615**	**35,515,962**	**28,677,308**	**21,838,654**	**15,000,000**
Other Assets											
Pre-operating Expenses	8,429,327	6,743,462	5,057,596	3,371,731	1,685,865	-	-	-	-	-	-
Contingencies											
Total Other Assets	**8,429,327**	**6,743,462**	**5,057,596**	**3,371,731**	**1,685,865**	**-**	**-**	**-**	**-**	**-**	**-**
TOTAL ASSETS	**97,070,103**	**103,525,785**	**116,139,234**	**134,215,507**	**146,206,729**	**150,347,014**	**148,249,876**	**149,317,013**	**152,650,489**	**157,674,122**	**164,121,517**

LIABILITIES											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Current Liabilities											
Accounts Payables		685,288	777,860	880,861	951,301	1,027,377	1,109,540	1,198,275	1,294,109	1,397,610	1,509,390
Short term loan											
Other Current Liabilities											
Total Current Liabilities	**-**	**685,288**	**777,860**	**880,861**	**951,301**	**1,027,377**	**1,109,540**	**1,198,275**	**1,294,109**	**1,397,610**	**1,509,390**
Long Term Liabilities											
Lease payable											
Long term debt	-	-	-	-	-	-	-	-	-	-	-
Long term debt	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Equity											
Paid up Capital	97,070,103	97,070,103	97,070,103	97,070,103	97,070,103	97,070,103	97,070,103	97,070,103	97,070,103	97,070,103	97,070,103
Retained Earnings		5,770,395	18,291,271	36,264,543	48,185,324	52,249,534	50,070,233	51,048,635	54,286,277	59,206,410	65,542,024
Total Equity	**97,070,103**	**102,840,498**	**115,361,374**	**133,334,646**	**145,255,427**	**149,319,637**	**147,140,336**	**148,118,738**	**151,356,380**	**156,276,513**	**162,612,127**
TOTAL LIABILITIES	**97,070,103**	**103,525,785**	**116,139,234**	**134,215,507**	**146,206,729**	**150,347,014**	**148,249,876**	**149,317,013**	**152,650,489**	**157,674,122**	**164,121,517**

7.11.3 Projected Cash Flow Statement

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Operating Activities											
Net Income		**5,770,395**	**13,483,575**	**22,002,666**	**23,967,112**	**26,456,867**	**31,200,855**	**35,010,825**	**39,428,493**	**44,391,072**	**50,030,297**
Depreciation		7,251,654	7,251,654	7,251,654	7,251,654	7,251,654	6,838,654	6,838,654	6,838,654	6,838,654	6,838,654
Amortization		1,685,865	1,685,865	1,685,865	1,685,865	1,685,865	-	-	-	-	-
Change in spares inventory	(145,000)	(7,250)	(7,613)	(7,993)	(8,393)	(8,812)	(9,253)	(9,716)	(10,201)	(10,712)	(11,247)
Change in Accounts Receivables		(7,912,500)	(3,310,000)	(3,646,250)	(1,000,000)	(1,262,500)	(1,637,500)	(1,840,625)	(2,103,125)	(2,343,750)	(2,637,500)
Change in Accounts Payables		685,288	92,573	103,001	70,441	76,076	82,162	88,735	95,834	103,501	111,781
Cash from operations	**(145,000)**	**7,473,452**	**19,196,054**	**27,388,943**	**31,966,679**	**34,199,150**	**36,474,918**	**40,087,873**	**44,249,655**	**48,978,765**	**54,331,985**
Financing Activities											
Short term debt principle repayment											
Long term debt principle repayment		-	-	-	-	-	-	-	-	-	-
Addition to short term debt											
Additions to long term debt	-										
Issuance of shares	97,070,103										
Net cash from financing activities	**97,070,103**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Investing Activities											
Capital Expenditure	(93,880,865)										
Cash from investing activities	**(93,880,865)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Net Cash	3,044,238	7,473,452	19,196,054	27,388,943	31,966,679	34,199,150	36,474,918	40,087,873	44,249,655	48,978,765	54,331,985
Cash balance brought forward	-	3,044,238	10,517,689	28,751,044	52,110,593	72,030,942	83,837,434	86,932,197	92,987,647	101,046,450	110,554,276
Cash investment in securities		-	-	-	-	-	-	-	-	-	-
Cash available for appropriation	3,044,238	10,517,689	29,713,743	56,139,987	84,077,273	106,230,092	120,312,352	127,020,070	137,237,301	150,025,215	164,886,260
Dividend	-	-	962,698	4,029,394	12,046,331	22,392,657	33,380,156	34,032,423	36,190,851	39,470,940	43,694,683
Cash carried forward	**3,044,238**	**10,517,689**	**28,751,044**	**52,110,593**	**72,030,942**	**83,837,434**	**86,932,197**	**92,987,647**	**101,046,450**	**110,554,276**	**121,191,577**

7.11.4 NPV and IRR Calculations

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Net Cash Flow (Rs)	3,044,238	7,473,452	19,196,054	27,388,943	31,966,679	34,199,150	36,474,918	40,087,873	44,249,655	48,978,765	54,331,985
Total Investor Cash outflow (Rs)	(97,070,103)										
Net Cash flows (Rs)	(97,070,103)	7,473,452	19,196,054	27,388,943	31,966,679	34,199,150	36,474,918	40,087,873	44,249,655	48,978,765	54,331,985
Accumulated Cash flows (Rs)		(89,596,651)	(70,400,597)	(43,011,655)	(11,044,975)	23,154,175	59,629,093	99,716,966	143,966,621	192,945,386	247,277,371
Payback period (years)		1.00	1.00	1.00	1.00	0.61	-	-	-	-	-
IRR	**24.31%**										
NPV (Rs)	**16,216,586**										
Payback (years)	**4.61**										

8.0 PROJECT IMPLEMENTATION

8.1 SWOT Analysis

The proposed warehouse project is a new concept which is currently not being practiced in Punjab. It will be useful to clearly understand project's strengths, weaknesses, opportunity and strengths to increase the probability of success of project's implementation. The following paragraphs provides a brief analysis of the project's strengths, weaknesses, opportunities and threats (SWOT).

8.1.1 Strengths

Modern Warehouse

The proposed rural warehouse is a modern grain storage facility which currently does not exist in the province of Punjab. The facility includes traditional bag storage to meet the demand for storage of grains by the farmers and traders in rural areas of Punjab.

Provision of Allied Services

Along with the storage facility, the project also offers allied services required for maintaining the quality of the stored produce. These include facilities for grain weighing, cleaning and drying. This becomes a major strength of the project in view of the fact that the current availability of such services on commercial basis for the local farmers is very limited.

High Quality Product

The proposed modern warehouse will ensure that the quality of the stored grains is maintained as per the defined standards. The farmers/traders will thus be able to get a higher price for their stored products. Similarly, availability of high quality produce will attract the prospective customers to assign a preference to the product stored in such warehouses.

Farmer-Focused Intervention

The rural warehouse project directly focuses to meet the storage needs of the farmers and will this contribute towards increasing their profitability by improving their bargaining power, reducing wastages and fetching a higher price in the later months.

8.1.2 Weaknesses

A New Concept - No Demonstration

Establishing warehouses for farmers in the rural areas on commercial basis is a new concept the success of which has not yet been demonstrated in the country. There has been no formal survey to ascertain the demand for such facilities. In addition to the market demand, there is very little availability of technical information on modern warehouses. Unavailability of such data thus acts as a weakness that deters the investors to venture into this area. It will be important to support the project in the beginning for ensuring successful demonstration of commercial viability of the idea.

8.1.3 Opportunities

Investment Opportunity

The proposed rural warehouse project offers an attractive investment opportunity to earn decent profits. Initial assessment indicates the existence of an unmet demand from the farmers and traders of the rural areas. The project is financially viable based on the assumptions used in the feasibility calculations.

Economic Benefits

Investment mobilization in rural warehouses will lead to reduction in grain wastages and an improved profitability for the farmers. One of the key opportunities emerging out of the proposal of rural warehouses is the reduction in grain wastages. This translates into savings of billions of rupees for the producers, traders and consumers of the grain. It will also result in improving the quality of the grain for the final consumers. The project will also be a source of creating new employment opportunities for the rural population.

Government's Interest

Grain storage has always been a key area of concern for the government and the government is keenly interested in any such project that targets to address this grave issue. Therefore, for making the project even more attractive for the investors, the government will be willing to provide incentives. Along with incentives, an important step will be undertaking a formal demand survey to quantity the existing demand. This will increase investors' confidence to venture in this area.

Availability of Subsidized Finance (SBP scheme)

Government offers subsidized financing for establishing warehouses to enhance storage capacity in the country. As per a scheme of State Bank of Pakistan, financing for this purpose is available at an interest rate of 6% p.a.

Storage Space for the Government

Government is a major buyer of wheat and other grains. Punjab Food department procures and stores wheat. PASSCO also stores wheat and many other grains. The current storage capacity available with the government is less than its needs which leads to losses due to grain wastages. The storage facility offered by the proposed rural warehouses can also be used by the government to store their produce. The government will pay the storage charges in lieu of the current storage charges being borne by it.

Linkage to Warehouse Receipt Scheme

The proposed project will be an important step towards implementation of Warehouse Receipt Scheme to facilitate provision of agriculture credit for the farmers. The produce stored in the modern warehouses will act as the collateral for the financial institutions. For this purpose, there will be licensed warehouses that will be included as part of the program.

8.1.4 Threats

Grains Prices Fluctuations

One of the key drivers for farmers/traders to store grain is the potential increase in grain prices in the months following the harvesting months. The historical price data shows that the

prices do not necessarily increase in those months. Such trends and any losses incurred by the grain owners due to drop of prices of the stored grains may become a major threat to the acceptability of the proposed warehouse project.

Resistance from the Traders

Increased bargaining power for the farmers through availability of secure storage space will tend to decrease the bargaining power of grain traders and the trader will find it difficult to impose his terms and conditions on the farmers. Thus, the project may face a resistance from the traders. However, the other side of the argument is that traders may also store their produce in the proposed warehouses. In this way, the project can also directly benefit traders that may reduce this potential opposition.

Resistance from the Industry

Provision of storage facility will lead to farmers getting higher prices for their grains. This means a higher price of raw materials for the industrial consumers of the grains. It may or may not be possible for the industry to increase the prices of its products to compensate for the increased raw material prices. This potential reduction in profitability may lead to industrial consumers of maize, rice and wheat opposing the idea of rural warehouses.

Political Implications

Potential increase in grain prices may lead to increased prices of consumer products by the industrial producers. The price of wheat is controlled by the government, so there will be little impact on its price. However, increase in maize prices may lead to increased prices of maize products; including poultry feed that may lead to increase in the prices of eggs and poultry meat, the two important food items of daily use. This may trigger some political implications as well which the implementers of the project will have to keep under consideration.

Low Response of Potential Customers

Since the project will be the first of its kind, it may not be able to generate enough interest of the farmers and traders, the prospective customers of the rural warehouses. This may lead to the project running below its breakeven storage volumes and making it difficult for the investors to continue. The project may therefore need some support from the government during its initial year of operations.

8.2 Regulatory Environment for Warehouse Establishment

The proposed warehouse establishment will be subject to different types of laws. Project's implementation requires good understanding of the applicable laws and regulations regarding warehouses and agriculture produce marketing. Key applicable laws and their requirements are discussed in the following paragraphs:

8.2.1 The Food Grains [Licensing Control] Order, 1957

The Food Grains Order 1957 ensures that the purchase, sale or storage of food grains[20] is done under a license issued by the Licensing Authority under this order. Key highlights of the Order are narrated in the following paragraphs:

- As per the Order, no person, other than a producer, shall engage on this own or on behalf of any other person, as a commission agent, in the purchase, sale or storage for sale of the food grains, except under and in accordance with a license issued by Licensing Authority under this Order.

- The Order defines different players in the grain value chain. Producer is defined as a person who grows food grains by the labor of his own hand or the labor of others. Wholesale dealer is the person who sells any food grains in any one transaction in an aggregate quantity exceeding twenty five maunds. Retail dealer is a person who sells any food grains in any one transaction in an aggregate quantity not exceeding twenty five maunds.

- The Order defines the quantities for household consumption or as seed by the consumers. Any person who stores food grains in excess of the defined normal quantities is deemed to store those for sale. The person with a license to sell cannot withhold food grains except under certain conditions. The relevant section (clause 4) reads as follows:

  > 'No person to whom a license has been issued shall withhold from sale the Food grains stocked by him except:
  > a) in accordance with or under any law for the time being in force.
  > b) on the ground that the food grains are meant for his bona fide private consumption or for supply to the Government of Pakistan or the Provincial Government under a duly executed authority or contract.'

- No person can acquire or possess more than the normal quantity of food grains with proper authorization. The persons holding stocks of food grains exceeding the normal quantity have to regularly send to the Licensing Authority a fortnightly statement of stocks. In case of any noncompliance, the Licensing Authority may seize the stocks or ask the holder to dispose those in accordance with its directions.

[20] Includes wheat, rice, broken rice and paddy

- A License granted under the Order shall, unless suspended, withdrawn or cancelled continue to be in force up to the end of calendar year in which it is issued and renewable for a period not exceeding three years, by the Licensing Authority.

- If any person contravenes any provisions of this Order, he shall be punishable with imprisonment for a term which may extend to 3 years or with fine or with both

8.2.1.1 Comments

The scope of Food Grains [Licensing Control] Order 1957 covers only wheat and rice crops. The law does not talk about maize which is another important grain being considered under this feasibility study. It will be important to clarify any licensing requirement for maize during the implementation of this project.

The Order mentions that it is not allowed to withhold food grains from being sold except under two conditions; the first being that it is meant for the owner's self-consumption or for supply to the government; and secondly, it is being withheld in accordance with or under any law for the time being in force. The proposed warehouse project's concept is based on withholding of agriculture produce by the farmers by storing that in the proposed rural warehouses. It is important to clarify this clause to avoid any confusion in this regard so that the private investors are not turned off by any such limitation.

8.2.2 The Punjab Registration of Godowns Act 2014

The Punjab Registration of Godowns Act 2014 makes it mandatory to register godowns to provide for a comprehensive system regarding stable supply and availability of essential articles and the related ancillary matters.[21] Key highlights of the Act are discussed in the following paragraphs:

- As per the Act, the owner cannot store or stock an essential article in the godown unless the godown is registered under this Act. Registration is done by the Registration Authority on the basis of application by the godown owner. The owner, whose godown is registered, is required to comply with the provisions of this Act, the rules and the directions issued by the Registering Authority.

- The owner of the registered godown is required to comply with the provisions of the Act and the directions issued by the Registering Authority. The owner is also required to maintain and produce for inspection, to the Registering Authority, the books, accounts and records relating to essential articles stored in or removed from the godown.

- The Registering Authority may enter and search a godown and seize any essential article if any provisions of the Act are violated, the owner furnished incorrect information or any direction of the Registering Authority is not followed.

- If a person contravenes any provision of this Act, he may be punished with an imprisonment or with fine or both.

[21] Essential article is an article that is declared essential by the government through a notification.

8.2.3 The [Punjab] Foodstuffs Control Act 1958

The Punjab Foodstuffs Control Act 1958 is meant to control the supply, distribution and movement of, and trade and commerce of food stuffs in the Punjab. Key highlights of the Act are discussed in the following paragraphs:

- The Act mentions wheat, rice, paddy and sugar and any other commodity or class of commodities declared by the government as foodstuff.

- The purpose of this act is to maintain supplies of any foodstuff for securing its equitable distribution and availability at fair prices for regulating or prohibiting the storage, movement, transport, supply distribution, disposal, acquisition, use of consumption and trade and commerce.

- The powers conferred under this Act include regulating by licenses, permits, the manufacture of food from foodstuffs, controlling the prices, regulating by licenses, permits the storage, transport, distribution, disposal and acquisition, prohibiting the withholding from sale of any foodstuff, requiring any person holding stock to sell the whole or part, regulating or prohibiting any commercial or financial transactions which may be detrimental to public interest, maintaining and producing for inspection the books, accounts and records.

- If a person contravenes ay provision of this Act, he may be punished with an imprisonment or with fine or both.

8.2.4 The Punjab Agricultural Produce Markets Ordinance 1978

The Punjab Agricultural Produce Markets Ordinance 1978 is meant to provide for the better regulation of purchase and sale of agricultural produce and for that purpose to establish markets and make rules for their proper administration. The Ordinance becomes relevant in the context that the proposed warehouses may also be used as a trading place for the stored agricultural produce. Key highlights of the Ordinance, relevant to the proposed warehouse project, are narrated below:

- The agriculture produce mentioned under this Ordinance covers a wide variety of products including wheat, rice, paddy, maize grain, maize cob, cotton ginned (lint) and cotton unginned (phutti). These are the commodities which are specifically being considered as the potential products for storage in the proposed rural warehouses.

- The Government may, by notification and in any other manner that may be prescribed, notify market area for the purposes of this Ordinance and the agricultural produce over which control is to be exercised.

- After issuance of notification and establishment of market committee, no person for himself or on behalf of another person can, within the notified market area, set up, establish or use any place for the purchase or sale of the agricultural produce or purchase sell, store or process such agricultural produce except under and in accordance with the

terms and conditions of a license granted under the provisions of this Ordinance. A license is not required by a grower who either himself or through a bona fide agent sells his own agricultural produce or the produce of his tenant or by a person who purchases any agricultural produce for his private or domestic use.

- Within the market, no person can store, purchase, sell or in any other manner deal in any commodity which is not declared as agricultural produce.

- The market committee concerned is the Authority to issue license to a dealer under this Ordinance and to renew such a license. The market committee may also cancel or suspend the license in case of breach of any conditions.

- The market committee enforces the provisions of this Ordinance and the rules and bye-laws made thereunder in the notified market area and establishes a market therein providing such facilities for persons visiting it in connection with the purchase, sale, storage, weighing, pressing and processing of agricultural produce.

- A market committee may levy fees, not exceeding the maximum rates prescribed, on the agricultural produce bought or sold by or through a dealer in the notified market area. All moneys received by a market committee are deposited into a fund known as the market committee fund.

- The market committee fund is used for bearing expenses and for developmental activities which also includes construction of cold storages, warehouses and godowns for the benefit of growers.

8.3 Financing Facility for Storage of Agriculture Produce by SBP

In order to develop the agricultural produce marketing and enhance storage capacity State Bank of Pakistan (SBP), in June 2010, floated a Scheme for "Financing Facility for Storage of Agricultural Produce (FFSAP)" to encourage Private Sector to establish silos, warehouses and cold storages. Key features of FFSAP are discussed in the following paragraphs:

- The Scheme provides long term financing for establishment, expansion and balancing, modernization & replacement (BMR) of steel/metal/concrete silos, warehouses & cold storage facilities for storing agricultural produce.

- The Scheme provides financing facilities for:
    - Purchase of new imported & locally manufactured plant & machinery, equipment and accessories thereof, to be used in steel/metal/concrete silos, warehouses and cold storages
    - Purchase of new generators: The capacity of generator cannot be in excess of in-house energy requirements of the silos/warehouses/cold storages.
    - Up to 65% cost of entire civil works.

- Financing is available for a maximum period of seven years including a maximum grace period of six months. Maximum financing of banks/DFIs to a single project cannot exceed Rs 500 million under the Scheme. However, banks/DFIs may provide financing facilities over and above the said maximum limit from their own sources.

- The rate of service charges at which SBP will provide refinance to the banks is determined on the basis of average of weighted average yields of last two auctions of 3, 5 and 7 years PIBs, subject to the following:
    - The service charges are adjusted on six monthly basis
    - The rates once fixed shall remain locked-in for the entire duration of the loan, provided the borrowers continue to repay on due dates as per repayment schedule.

    - The interest rates for end users as fixed in 2009-10 are shown in Table 60.

Loan Tenure	**End User's Rate**
Up to 3 years	8.00% p.a.
Over 3 years and up to 5 years	9.00% p.a.
Over 5 years and up to 7 years	10.00% p.a.

Table 60 – Interest Rates for SBP Financing Scheme for Silos/Warehouses (2009-10)

- All commercial banks and Development Finance Institutions (DFIs) are eligible for providing financing under the Scheme. Yearly limits are allocated to individual banks/DFIs under the Scheme.

- Principal amount of loans are repayable in equal quarterly/half yearly installments after prescribed grace period. The refinance granted by SBP offices to the Banks/DFIs is recovered on the due dates as reported in the original repayment schedule from the account of the banks/DFIs maintained with the respective office of the SBP. In case the

borrower(s) fails to make repayment of the amount of installment as per the original repayment schedule, the bank/DFI is entitled to charge normal rate of mark up on such overdue principal amount besides taking other actions to recover the same as are incidental to such defaults.

- Mark-up is paid on quarterly basis.

8.3.1 Current Status of FFSAP

FFSAP Scheme is currently functional and most of the design parameters of the Scheme are still the same as were defined in the original design of the Scheme in 2010. However, the interest rate has been lowered since the time the Scheme was floated. The current interest rate on the loans obtained under FFSAP Scheme is 6% p.a. The current promotional brochure showing the key highlights of the Scheme is shown in Annex VIII.

Since the inception of FFSAP Scheme in 2010, loans have been granted to establish silos, warehouses and cold storages. Outstanding finance under the Scheme in December 2015 and 2016 is shown in Table 61.

Outstanding Financing under SBP FFSAP Scheme	
December 2015	December 2016
Rs 1,766 million	Rs 1,757 million
Source: SME Finance Annual Review 2016, State Bank of Pakistan	

Table 61 – Outstanding Financing under SBP FFSAP Scheme

8.4 Implementation Strategy

The concept of establishing rural warehouses in Punjab is new and therefore its implementation requires adopting a careful approach. While the project's calculations show that the project has a market and is financially viable, it still leaves the room to further authenticate in quantitative terms, the existence of demand and the prospective response of the potential customers. The following paragraphs suggest the route for a phased implementation of the proposed rural warehouse project.

8.4.1 Implementation Phase I – Pilot Testing

8.4.1.1 Establishing Warehouses

In Phase I, the government should conduct pilot testing of the idea of establishing rural grain warehouses; that will be operated on commercial basis. In the beginning, it will be difficult to attract private sector to invest in this new business idea. It is therefore important that the government should itself take the first initiative and establish such warehouses through its own investment. The number of these warehouses to be established all across the province should be from four to six. The purpose will be to get a flavor of the demand and better understand the impact of different variables affecting the project's feasibility. The pilot phase should be implemented with the following considerations:

- The warehouses should be established at different locations in Punjab; and should necessarily cover the southern, central and northern parts of the province. This will help understand the appetite of the potential farmers/traders in different areas to use the developed storage facilities.

- Establishing these warehouses at different locations will also help cover the diversity of agricultural commodities grown in different areas. The pilot-phase warehouses should cover the areas growing wheat, rice, maize and cotton. The response of farmers/traders for each of these commodities may vary due to their different storage requirements, price fluctuations, etc.

- The sites to establish these warehouses should be at some central locations, close to the main roads and safe from the danger of natural calamities like floods, etc. The other important consideration for selecting the sites is the proximity to major grain production clusters.

- The warehouses should also be equipped with the necessary allied facilities including weigh bridge, grain cleaner, grain dryer, etc. This will be the added value of the project that will help attract the potential customers.

8.4.1.2 Operating Warehouses

Government cannot run ventures like commercial warehouses due to its limited business expertise and the system's inherent issues of malpractices. Involving private sector is thus the key towards making this venture successful. The established warehouses should be handed over to private sector investors who should manage the operations. This will ensure that the

facilities are managed effectively and efficiently with a commercial approach. However, while doing that, it should be ensured that the original purpose of benefiting the small farmers is not overlooked. The perceived roles of public and private sectors in the management of these warehouses are listed below:

Private Sector

- Investing working capital for managing the warehouse operations
- Hiring and managing the team for running operations
- Marketing the project in a cost-sharing arrangement with the government
- Managing the routine operations of the warehouse and bearing all the necessary costs
- Claiming the major share of the profits

Public Sector

- Facilitating the project through incentives
- Supervising the warehouse management operations to improve its understanding about the project and know the pitfalls
- Sharing the marketing cost of the project with the private sector operator
- Claiming the minor share of the profits

8.4.1.3 Proposed Incentives during Pilot Phase

In order to make this pilot testing successful, government should provide incentives to the projects. Following are the important steps in this regard:

8.4.1.3.1 Option of Storing Government's Grain Stocks

Government should contribute towards improving the viability of the new businesses by providing them guaranteed business of storing the government's grain stocks. Punjab Food department should be involved in the process to store their stocks in the new warehouses. This will be a win-win situation since the government will get a secure place to store its stocks and the warehouse operator will get business that will help him operate above his breakeven point.

8.4.1.3.2 Marketing Campaign on Cost Sharing Basis

Government should launch marketing campaign to create awareness about the newly established rural warehouses and their benefits for the farmers. Key activities in this regard may include holding meetings and awareness seminars in rural areas, door-to-door awareness campaigns and advertisements in print and electronic media. The key objective of this campaign will be to generate business for the new ventures to help them demonstrate the commercial viability of this new concept. The cost of this campaign should be shared by the government and the private sector warehouse operators.

8.4.1.3.3 Financial Support to Small Farmers

Small farmers should be provided support by the government to enable them to store their produce in the warehouses. This will not only contribute towards increasing the viability of the warehouse operator but also help small farmers realize the potential benefits of storing their produce. The support to farmers may be in the form of paying a share of their storage costs. Or alternatively, they may be part of the potential payment of their produce.

8.4.2 Exploratory Research

It is also important to further fine tune the idea of establishing rural warehouses. For that purpose, the government should conduct exploratory research. Two areas should at least be covered by this research:

8.4.2.1 Demand Assessment Survey

A formal survey should be conducted to accurately assess the quantitative and qualitative dimensions of the demand for rural warehouses. The results of the survey will be useful in improving the project design and making it more useful for the stakeholders. The survey will also strengthen the implementation process in the next phase of the project. Formal quantitative validation of demand will also build the confidence of private investors to invest in the project. This will help expedite the implementation progress.

8.4.2.2 Silo Technology Indigenization

Government should initiate an R&D program to indigenize the manufacturing of silos for grain storage. This research should validate the benefits of silos for grain storage with reference to the local conditions. This should be done for different types of grains grown locally and the storage conditions; including temperatures, humidity levels and other climatic variations during different seasons during the year. The research should also study the impact of storing grains in different sizes of silos. This will be important in view of the fact that currently, in Pakistan, there is no use of small farm level silo. All the silos in the country being used either by public or private sector are of large size.

The other facet of this R&D should be to develop the technology of manufacturing silos at local level. An important area in this regard is the availability of specialized material for making silos. The technology used for making silos does not appear to be difficult and the local light engineering sector should be able to easily handle that. For small silos, a more practical approach could be importing some small farm level silos and developing those through reverse engineering using the local vendors. Successful R&D activity will lead to reducing the cost of silos to make it more affordable for the farmers.

8.4.3 Implementation Phase II – Launch of Warehouse Scheme

Once a successful demonstration of the commercial viability of the pilot phase is achieved, the second phase of the project should be initiated. This should include the launching a scheme inviting the private sector to invest in commercial grain warehouses in rural areas. For making the investment proposition more attractive, government should offer incentives to the potential investors.

8.4.3.1 Proposed Incentives for Rural Warehouse Scheme

8.4.3.1.1 Land at Subsidized Rates

Government may provide land for establishing warehouses at subsidized rates. The sites should be selected by the government keeping in view the location of the production clusters. Provision of the land should be linked to the condition that it will be used only for establishing warehouses and not for any other purpose.

8.4.3.1.2 Subsidized Credit

The scheme should include availability of credit at subsidized interest rates. The existing scheme of SBP (FFSAP) should be analyzed with respect to its utilization and impact since its inception. If deemed necessary, the scheme may be modified to make it even more attractive for the investors. Alternatively, a new scheme may be launched by the Government of Punjab keeping in view the findings of this study. The provision of subsidized credit should be linked to establishing the warehouses as per the international standards. Moreover, at least a certain share of the total storage space in the warehouse should be in the form of silos.

8.4.3.1.3 Facilitative Import Duty Structure

For promoting the use of silos in the proposed rural warehouses, the import duty structure should be kept facilitative. The duty on import of silos should either be waived off completely or reduced to facilitate imports. As per Pakistan Customs Tariff 2016-17, the current duty on silos is 20%[22] which needs to be reduced for making this scheme successful. The reduction in customs duty may be done for all types of silos; however, the importance of this intervention is higher for small silos even more since the users of small farm level silos will be the small farmers who have limited financial resources.

8.4.3.1.4 Support of Local Agricultural Machinery Industry

The local agricultural machinery industry should be patronized and facilitated for making silos and the allied equipment for the warehouses; such as grain cleaners, grain dryers, etc. Exemptions should be provided on import of raw materials for manufacturing silos and on modern technology used in allied equipment. Modern grain cleaners and dryers should be imported by the government and provided to the local industry for effecting indigenization through reverse engineering. The scope of subsidized credit may also be extended to the engineering units manufacturing this machinery and equipment.

8.4.3.1.5 Financial Support to Small Farmers

The incentive of providing financial support to small farmers, to make the storage option affordable for them, should be continued in the implementation phase II as well. This support may be in the form of government paying the partial or total storage charges of the grain stored by small farmers. This will improve the profitability of the small farmers and will provide guaranteed business to warehouse owner to help him move above his breakeven point. The allocation of funds for this purpose should be on the basis of farm size. The usual definition of 12.5 acres should preferably not be used to define small farmer since around 90% of the total farmers will qualify for this support under this definition. The farm size for getting this support should be smaller and should be decided after discussion with the farming community and the decision makers of the Agriculture Department, Government of Punjab.

94.06		**Prefabricated buildings.**	
9406.0010		- - - Green houses	20
9406.0020		- - - Dairy, live stock and poultry sheds	20
9406.0030		- - - Silos	20
9406.0040		- - - For cold storage	20
9406.0090		- - - Other	20

[22]

8.4.3.1.6 Operational Subsidy for First Year of Warehouse Operations

In case the market response for storage in the new warehouses turns out to be below the breakeven point, the government may consider providing operational subsidy to warehouse owners. This subsidy should only be available for one year after which the warehouse businesses should be able to run the business on sustainable basis.

8.4.3.1.7 Government as the Customer

Storing government's grains stocks in the newly established warehouses was proposed for the Phase I of implementation. This incentive should be included in Phase II as well since this will also meet a crucial need of provincial food departments and PASSCO and help improve the viability of the businesses.

8.4.3.1.8 Marketing Campaign

Government should keep supporting the marketing of rural warehouses in the implementation Phase II as well. The marketing cost should be shared both by the government and the warehouse owner. Government should provide this support only for one to two years; following which the warehouse enterprise should be in a position to attract customers through its own resources.

8.5 Other Implementation Options

8.5.1 Farmers Ownership

As one of the implementation routes, the farmers can join hands to establish rural warehouses for their community. Part of the project funds can be pooled by the participating farmers and part can be contributed by the government; as a subsidy or as a soft loan to contribute towards the capital and operating costs of the project. The partner farmers can use the warehouse to store their own produce and/or rent out the facilities to other farmers/traders to run the project on a commercially viable basis.

8.6 Key Challenges

8.6.1 Attracting Business for Warehouses

The concept of rural warehouses is new in the province. Since currently there are no rural warehouses and consequently no practice of farmers holding back their produce, it will be difficult in the beginning to convince the farmers about the benefits of this activity. The project has to pass through the three standard phases that any new project has to pass. The first phase will be that of creating awareness about the project and its benefits for the potential customers. The next challenging phase will be convincing the farmers for a trial where they will be sacrificing their immediate cash flows in anticipation of increased cash flows in the future. Once the business passes through a successful trail phase, and the customers start realizing the promised benefits, the next phase will the one where these warehouses will be able to get sustained business. Sustaining the initial period, where the business may have to operate below the breakeven point, will be challenging.

8.6.2 Resistance from the Industrial Customers of Grains

The proposed rural warehouses will build a holding capacity for the farmers that will increase their bargaining power against the buyers. The buyers will have to face an increase weight of the farmers while negotiating price and other business terms. An increase in average selling price will potentially increase profit margins for the farmers. Increase cost of raw materials for the industry will create a situation where their profits may decrease. To compensate for that, they may have to increase the selling prices of their products which may or may not be possible due to market constraints. It can therefore be expected that the proposed warehouse project will face a resistance from the industrial customers of grains that include flour mills, rice mills and maize processing units.

8.6.3 Perception of Hoarding

One of the questions raised during field interaction with the farmers was if storing grain for maximizing the profits was ethical or not. The concern was based on the apprehension that storing grain in warehouses (and not selling that) may fall under the definition of hoarding and the practice may not be ethical. Some of the participants even labeled this idea as being against the religious teachings. While implementing the project, it will be important to address this apprehension and develop a narrative to explain to the rural population the usefulness of the concept and that it does not conflict with any ethical values.

9.0 ANNEXES

9.1 Annex I - Monthly Wholesale Prices

9.1.1 Annex I-A - Wheat Wholesale Prices in Different Markets

Wheat Wholesale Price (Rs/100 kg) - Multan Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	2,464	2,568	2,589	2,551	2,448	2,489	2,482	2,636	2,730	2,777	2,851	2,897
2013	3,238	3,123	3,087	2,770	2,973	3,149	3,339	3,470	3,458	3,486	3,646	3,829
2014	3,751	3,800	3,900	4,204	2,971	3,067	3,218	3,351	3,311	4,058	3,350	4,932
2015	3,326	3,272	3,240	2,981	3,054	3,019	3,059	3,041	3,107	3,252	3,397	3,345
2016	3,265	3,356	3,336	3,039	3,073	3,108	3,175	3,130	3,223	3,229	3,296	3,293
2017	3,336	3,345	3,363	3,007	2,967	3,014	2,969	2,971	2,988	-	-	-
Source: AMIS Punjab												

Wheat Wholesale Price (Rs/100 kg) - Okara Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	2,512	2,557	2,522	2,540	2,424	2,540	2,537	2,559	2,772	2,686	2,750	2,929
2013	2,957	3,184	3,172	2,952	2,909	3,014	3,178	3,307	3,356	3,414	3,523	3,638
2014	3,663	NA	NA	3,003	3,050	3,050	3,050	3,188	3,218	3,076	3,199	3,236
2015	3,235	3,270	3,244	3,106	3,071	3,081	3,134	3,077	3,727	3,256	3,413	3,392
2016	3,370	3,401	3,394	3,163	3,014	3,092	3,180	3,115	3,150	3,221	3,205	3,228
2017	3,213	3,223	3,254	3,128	3,038	2,998	2,991	2,995	2,990	-	-	-
Source: AMIS Punjab												

Wheat Wholesale Price (Rs/100 kg) - Gujranwala Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	2,606	2,639	2,595	2,604	2,542	2,607	2,585	NA	2,649	2,703	2,765	2,855
2013	3,050	3,131	3,217	3,032	2,983	3,107	3,253	3,340	3,501	3,558	3,520	3,510
2014	3,635	3,687	3,723	3,480	3,067	3,135	3,181	3,184	NA	NA	NA	NA
2015	NA	NA	NA	NA	3,145	NA	3,125	3,175	3,229	3,459	3,387	3,435
2016	3,375	3,472	3,468	3,183	3,098	3,132	3,163	3,229	3,261	3,299	3,332	3,404
2017	3,261	3,268	3,307	3,055	3,061	3,127	3,192	2,999	3,050	-	-	-
Source: AMIS Punjab												

Wheat Wholesale Price (Rs/100 kg) - Bahawalpur Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	NA	NA	NA	2,377	2,308	2,475	2,472	2,566	2,661	2,732	2,800	2,930
2013	3,009	3,063	3,063	2,850	2,884	3,150	3,200	3,471	3,523	3,467	3,624	3,800
2014	3,798	3,782	3,720	3,403	3,040	4,327	3,232	3,381	3,308	3,280	3,321	3,295
2015	3,288	3,288	3,236	2,981	3,124	2,963	3,038	3,045	2,986	3,273	3,313	NA
2016	NA	NA	3,379	3,124	3,010	3,088	3,188	3,188	3,188	3,188	3,188	3,188
2017	3,188	3,199	3,188	3,166	3,000	2,996	2,900	2,869	2,875	-	-	-
Source: AMIS Punjab												

9.1.2 Annex I-B - Rice Wholesale Prices in Different Markets

Rice Wholesale Price (Rs/100 kg) - Okara Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	NA	6,750	7,245	7,417	8,268	8,654	8,767	NA	9,250	NA	9,100	9,122
2013	9,382	9,861	9,882	10,286	10,252	10,214	11,602	11,527	11,542	11,550	NA	NA
2014	NA	11,750	11,750	11,750	11,676	11,548	11,880	11,900	11,857	11,776	11,254	8,982
2015	7,612	7,493	7,490	7,492	7,476	7,569	7,700	7,748	9,136	7,250	7,250	7,210
2016	7,242	7,250	6,865	6,744	6,630	6,725	6,975	7,250	7,250	7,250	7,360	8,020
2017	8,290	8,327	8,852	9,346	9,740	10,042	10,250	10,250	10,250	-	-	-
Source: AMIS Punjab												

Rice Wholesale Price (Rs/100 kg) - Gujranwala Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	6,510	6,691	6,843	7,740	8,458	8,542	8,982	NA	9,625	9,913	9,621	9,233
2013	9,713	9,904	9,683	10,221	10,329	10,721	10,650	11,094	11,563	11,844	12,121	11,807
2014	11,230	11,775	11,565	11,285	11,257	11,286	11,200	11,820	11,844	12,041	11,909	8,250
2015	8,590	8,920	8,330	8,404	7,634	7,350	7,259	7,100	7,100	7,100	7,035	6,386
2016	7,106	7,250	7,250	7,221	7,567	7,750	7,750	7,602	7,500	8,152	8,250	8,163
2017	8,327	8,688	9,292	10,070	10,404	10,795	10,598	10,587	10,500	-	-	-
Source: AMIS Punjab												

Rice Wholesale Price (Rs/100 kg) - Lahore Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	6,846	6,750	7,190	8,417	8,896	9,482	9,656	9,963	10,583	10,587	9,894	9,438
2013	10,333	10,139	10,447	10,444	11,024	10,750	11,096	11,350	11,540	11,500	11,657	11,440
2014	11,230	11,775	11,565	11,285	11,257	11,286	11,200	11,820	11,844	12,041	11,909	8,250
2015	8,590	8,920	8,330	8,404	7,634	7,350	7,259	7,100	7,100	7,100	7,035	6,386
2016	7,106	7,250	7,250	7,221	7,567	7,750	7,750	7,602	7,500	8,152	8,250	8,163
2017	8,327	8,688	9,292	10,070	10,404	10,795	10,598	10,587	10,500	-	-	-
Source: AMIS Punjab												

9.1.3 Annex I-C - Maize Wholesale Prices in Different Markets

Maize Wholesale Price (Rs/100 kg) - Okara Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	2,512	2,557	2,522	2,540	2,424	2,540	2,537	2,559	2,772	2,686	2,750	2,929
2013	2,957	3,184	3,172	2,952	2,909	3,014	3,178	3,307	3,356	3,414	3,523	3,638
2014	3,663	NA	NA	3,003	3,050	3,050	3,050	3,188	3,218	3,076	3,199	3,236
2015	3,235	3,270	3,244	3,106	3,071	3,081	3,134	3,077	3,727	3,256	3,413	3,392
2016	3,370	3,401	3,394	3,163	3,014	3,092	3,180	3,115	3,150	3,221	3,205	3,228
2017	3,213	3,223	3,254	3,128	3,038	2,998	2,991	2,995	2,990	-	-	-
Source: AMIS Punjab												

Maize Wholesale Price (Rs/100 kg) - Rawalpindi Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	2,258	2,201	2,340	2,388	2,389	2,547	2,625	2,624	2,681	2,537	2,184	2,618
2013	2,762	2,693	2,729	2,768	2,787	3,017	2,750	2,750	2,754	2,651	2,411	2,395
2014	2,625	2,394	2,313	2,313	2,872	2,825	2,850	3,068	3,070	2,438	2,438	2,433
2015	2,375	2,677	2,800	2,783	2,650	2,650	2,650	2,650	2,011	1,950	2,117	2,750
2016	2,750	2,750	2,952	3,067	3,250	3,250	3,068	2,750	2,698	2,900	2,802	2,840
2017	2,788	2,700	3,048	3,063	3,063	3,063	3,024	2,894	2,900	-	-	-
Source: AMIS Punjab												

Maize Wholesale Price (Rs/100 kg) - Faisalabad Market												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2012	2,138	2,240	2,598	3,024	2,638	2,352	2,289	2,086	2,770	2,435	2,381	2,155
2013	2,625	2,667	2,625	2,509	2,822	2,630	2,831	2,640	2,431	2,627	2,418	2,335
2014	2,967	3,086	2,566	2,551	2,563	2,812	2,551	2,882	2,470	2,794	2,773	2,370
2015	2,297	2,405	2,433	2,369	2,375	2,375	2,318	2,656	2,250	3,493	2,530	2,293
2016	2,293	2,506	2,874	2,825	2,813	2,674	3,358	2,344	2,344	2,506	2,733	2,394
2017	2,376	2,494	2,500	2,500	2,500	2,500	2,500	2,386	2,375	-	-	-
Source: AMIS Punjab												

9.2 Annex II - Wheat Specifications

Criterion	United Arab Emirates	ISO/EU
Moisture	Max. 12%	Max. 14%
Test weight	Min. 76 kg/hl	Min. 75 kg/hl
Foreign matter (non-edible)	Max. 2%	Max. 2%
Foreign matter (edible)	Max. 3%	Max. 5%
Shrivelled and broken grain	Max. 3%	Max. 4.5%
Bug- and heat-damaged grain	Max. 3%	Max. 2%
Gluten (wet)	Min. 26%	Min. 21%
Protein on dry-matter basis (N x 5.7 DMB)	Min. 12.%	
Hagberg falling number	Min. 250 sec	
W		160
Live insects	Nil	Nil

Sources: Grain trading companies in Pakistan.

Source: (Pakistan) Review of the Wheat Sector and Grain Storage Issues. FAO Investment Center, 2013

Table 62 - Sample Import Specification Requirements for Wheat in UAE market

	Durum wheat	Common wheat
A. Maximum moisture content	14.5%	14.5%
B. Maximum percentage of matter that is not basic cereal of unimpaired quality	12%	12%
1. Broken grains	6%	5%
2. Grain impurities	8.5%	7%
2.1. Impurities other than mottled grains	5%	7%
(a) shrivelled grains	X	X
(b) other cereals	3%	X
(c) grains damaged by pests	X	X
(d) grains with discoloured germ	X	X
(e) grains overheated during drying	0.50%	0.50%
2.2. Mottled grains	3.5%	n.a.
3. Sprouted grains	4%	4%
4. Miscellaneous impurities of which:	4.5% (*)	3%
(a) extraneous seeds:		
— noxious	0.10%	0.10%
— other	X	X
(b) damaged grains		
— from spontaneous heating or excessive heating during drying	0.05%	0.05%
— affected with fusariosis	1.5%	X
— other	X	X
(c) extraneous matter	X	X
(d) husks (cob fragments in the case of maize)	X	X
(e) ergot	0.05%	0.05%
(f) decayed grains	X	X
(g) impurities of animal origin	X	X
C. Maximum percentage of wholly or partially mitadiné grains	27%	n.a.
D. Maximum tannin content (**)	n.a.	n.a.
E. Minimum specific weight (kg/hl)	78	73
F. Minimum protein content (**)	11.5%	10.5%
G. Hagberg falling number (seconds)	220	220
H. Minimum Zeleny index (ml)	n.a.	22

X = no specific limit but content to be taken into account for maximum limits set in points 2 and 4.
n.a. = not applicable/not requiring analysis.
* = of which a maximum of 3 percent of impurities other than grains affected by fusariosis.
** = As percentage of dry matter.
Source: European Commission Regulation No. 742/2010 of 17 August 2010.

Source: (Pakistan) Review of the Wheat Sector and Grain Storage Issues. FAO Investment Center, 2013

Table 63 – Minimum EU Quality Requirements for Wheat

9.3 Annex III - Warehouse Technical Considerations[23]

Foundations and Floor

- Unstable clay soils and areas which have been filled in should be avoided because they involve the risk of subsidence. In all cases, it is necessary to dig down to a point where the soil-bearing pressure is 150 kN per square meter or better.

- The floor must be able to bear the weight of the grain which will be stacked upon it, and it must also be impermeable to ground water. For these reasons, the floor should consist of a slab of reinforced concrete laid upon well compacted hard core, with a moisture barrier sandwiched between the two. This moisture barrier should consist of a layer of bitumen or asphalt, bitumen felt, or a polyethylene film.

- The reinforced concrete slab must be made with expansion joints, to prevent cracking (which makes storage hygiene difficult). It should be covered with a cement cap a few centimeters thick, which is rendered smooth and hardened (to prevent powdering). Ideally, the concrete slab should be laid after the roof has been completed: to prevent direct sunshine drying it too rapidly, and possibly causing it to crack.

- The floor level must be sufficiently above ground level to ensure that water will not enter the warehouse, even after the heaviest rainfall that can be expected. Consideration could be given to erecting the warehouse on a plinth raised about 1.2 meters above ground level, to facilitate loading and unloading of vehicles; but this alternative is expensive and can add 40% to the cost of construction.

Walls

- Most modern warehouses are constructed with a framework, usually of reinforced concrete. The supporting pillars are linked together by lower tie-bars, which are themselves secured to the floor slab, and by upper tie-bars, which hold the frame firmly together. It is essential that all joints are secure and accurate, and that the reinforcing rods are well covered with concrete. The walls of the warehouse are built between the supporting pillars.

- If the supporting posts are thicker than the walls, it is important that the extra thickness is on the outside of the building so that the internal surfaces of the walls are smooth and free from projections. This facilitates cleaning of the store, and avoids interference with other operations as well.

- The walls may be made of stabilized earth bricks and should be rendered smooth on both sides. They should be painted white, on the inside to facilitate the detection of insect pests, and on the outside to help keep the warehouse as cool as possible. Alternatively, the walls may be made of a lightweight material such as fibro-cement, galvanized metal sheet, or aluminum sheeting. However, walls of this kind are easily damaged, have poor insulating properties, and are sometimes prone to erosion.

[23] Adapted from FAO's publication, Grain Storage Techniques – Evolution and Trends in Developing Countries

- A vapor-proof barrier should be incorporated into the base of the walls, to prevent damp rising and causing damage to the warehouse structure and its contents. Also, a concrete strip about 1 meter wide should be laid around the outside of the warehouse, to prevent rain from eroding the base of the walls below the damp course.

Roof

- Internal pillars supporting roof frames should be avoided because, as previously stated, they can interfere with pest control and other stock management procedures. Instead, roof frames should be designed so that they transfer the weight of the roof to the supporting columns or to the walls if the warehouse is small.

- Modern engineering techniques allow very wide 'free-span' roofs (i.e. roofs without internal supporting pillars) to be constructed. However, such roofs are very expensive and rarely used in warehouse construction. A steel portal frame should be used if the span is to be greater than 15 meters. Warehouses less than this width may have reinforced concrete roof frames.
- Roof cladding may be of galvanized steel or aluminum sheeting, or asbestos cement; the latter being more fragile but having better insulating properties. Tiles are not recommended, especially for large warehouses.

- The roof should overhang the gables by 0.7 to 1.0 meters, and the eaves by at least 1 meter. This ensures that rainwater is shed well clear of the walls; and obviates the need for guttering and drainpipes, which may become blocked or assist rodents entering the warehouse. The overhang also helps to keep walls cool and protects ventilation openings from rain.

Ventilation

- Ventilation openings are necessary for allowing the renewal of air and reducing the temperature in the warehouse, they also allow some light to enter it. If such openings are located too low down they can be the source of numerous problems: entry of water, rodents, thieves, etc. These problems are avoided when ventilators are placed under the eaves. They should be fitted on the outside with anti-bird grills (20 mm mesh) and on the inside (10 cm behind the grills) with 1 mm mesh screens (removable for cleaning) which will deter most insects.

Doors

- The number of doors will vary according to the size of the warehouse. If possible there should be at least two doors, so as to be able to rotate stocks on a 'first in, first out' basis. However, this may not be possible or practical in a very small warehouse.

- Double sliding doors are recommended. Preferably made of steel, or at least reinforced along their lower edges with metal plate as protection against rodents, they should be sufficiently large (at least 2.5 x 2.5 m) and close fitting. If swing doors are fitted they should open outwards in order not to reduce the storage capacity of the warehouse. It is recommended that the doors be protected from rain by an extension of the roof or a separate cover.

Illumination

- Adequate light in a warehouse is an important factor as far as the safety of workers inside it is concerned. However, there can be problems in providing sufficient natural light while satisfying other technical aspects at the same time.

- Many warehouses are fitted with translucent sheets in the roof. However this is considered inadvisable, because it may involve the risk of spot heating of produce in the top layers of stacks underneath. Other warehouses are reasonably well lit by daylight filtering through ventilation gaps left along the tops of side walls. This source of illumination is impaired by the installation of bird-proofing. Non-opening windows set high up in walls may solve this problem; although their sills could harbor pest-infested grain residues, unless they are specially sloped to prevent this happening.

- Leaving several doors wide open during the hours of intense sunlight in tropical countries provides adequate illumination of the interior. This is probably the most practical solution when all open doorways are in active use. Otherwise, it does invite the risk of theft, or furtive access by rodents. Artificial lighting is justified only in warehouses which are regularly worked in during hours of darkness.

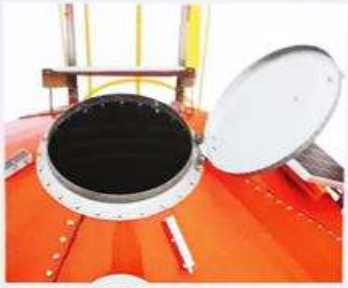
9.4 Annex IV - Technical Details of Kikapu Silo

TECHNICAL DETAILS

ROOF

The roof is designed on a self-supported structure and the reinforced rims developed on the sheets allow high mechanical resistance.

The sheets are coated with aluminum, zinc and silicon. The finishing is made by using orange paint, ensures superior durability against corrosion.



CENTRAL LID

The silo has a central lid with a handle to facilitate its opening and the loading. The lid supports locks, ensuring safe and secure storage.

SILO BODY

The side sheets by Kepler Weber are made with high strength galvanized steel in a corrugated design, giving lower friction coefficient between the grain mass and the silo wall and higher resistance to the assembled equipment.

SEALING

Exclusive sealing system on the silo's body, guaranteeing a stronger barrier against water penetration, better aeration efficiency (lower energy consumption) and optimization of the fumigation process. This sealing process is applied on the horizontal and vertical joints.

SUPPORT COLUMNS

The columns are manufactured with high resistance steel, on top hat profile and with reinforced rims, which gives them high resistance to compression.

Kepler Weber columns are totally effective on its section, giving them, this way, more lightness and heavier structural rigidity.

SQUARE VALVE

MANUAL VALVE

Valve with manual operation, ensuring easy outflow of the product, and with the possibility of putting a lock for more security of the stored product.

SOLAR PANEL

Made up of photovoltaic, the solar panel convert the energy of the sunlight into electrical energy.

This system start the motor which is used on the aeration of the silo, getting, this way, a clean and costless energy, adding environmental responsibility to the product and making its installation viable in any region.

AERATION

The aeration consists in making ambient air pass through the grain mass, through insufflation, ensuring good conservation of the grains for a longer period of time, under particular storage and operation conditions.

The main benefit is to keep the ideal conditions of temperature and moisture of the stored mass of grains, avoiding production losses due to humidity and mycotoxins development.

ACCESS LADDERS

For higher safety during the loading process, maintenance and other necessary activities, the silo has an access ladder to the central lid with protection in one side.

The equipment has also a side ladder. This ladder has tubular rungs and safety cage, which ensure higher operational safety and follow the safety standards.

ARTICULATED ARM

This articulated arm considerably reduces the necessary effort to take the product to the roof, because it works with a pulley. It also speeds the loading process and ensures greater operational safety.

TECHNICAL SPECIFICATIONS

MODEL	Ø NOMINAL	SHEETS PER RING	QUANTITY OF STIFFENERS	HEIGHT B	HEIGHT C
1823 (Big)	1,818.9	02	04	914.4	634.4

The dimensions below are specified on mm.

MODEL	RINGS	THICKNESS OF SIDE SHEETS	
		#20	#18
		0.95 mm	1.25 mm
1823 (Big)	03	02	01

MODEL	RINGS	VOLUME (m^3)	CAPACITY (bushel)	CAPACITY (tonnes)	STRUCTURE HEIGHT (mm) D	BODY HEIGHT (mm)	TOTAL HEIGHT (mm) A
1821 (Small)	01	3.44	98	2.58	1,474	868.5	2,976.9
1823 (Big)	03	8.16	232	6.12	1,474	2,697.3	4,805.7

Note: Capacity without compaction factor, with maize on specific weight of 0.75 t/m^3.

9.5 Annex V – Revenue Calculations

9.5.1 Annex V-A - Sale Price (Service Charges) Growth in Ten Years

Warehouse Storage Prices (Rs/maund/month)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Wheat Storage Price	15	16	17	18	19	21	23	25	28	31
Rice Storage Price	50	53	56	60	65	71	78	86	95	105
Maize Storage Price	30	32	34	36	39	43	47	52	57	63

Allied Services Prices

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Grain Cleaning Services	10	11	12	13	14	15	17	19	21	23
Grain Drying Service	20	21	22	24	26	28	31	34	37	41

9.5.2 Annex V-B - Revenues from Storage Services (Rupees)

Revenues (Rs) Year 1
Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	225,000	225,000	225,000	225,000	450,000	450,000	450,000	450,000	450,000	337,500	337,500	225,000	**4,050,000**
Rice Storage	1,875,000	1,875,000	1,875,000	1,875,000	1,500,000	750,000	750,000	750,000	750,000	750,000	750,000	1,875,000	**15,375,000**
Maize Storage	675,000	675,000	675,000	675,000	450,000	900,000	900,000	900,000	900,000	1,125,000	1,125,000	675,000	**9,675,000**
Total	**2,775,000**	**2,775,000**	**2,775,000**	**2,775,000**	**2,400,000**	**2,100,000**	**2,100,000**	**2,100,000**	**2,100,000**	**2,212,500**	**2,212,500**	**2,775,000**	**29,100,000**

Revenues (Rs) Year 2
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	320,000	320,000	320,000	320,000	640,000	640,000	640,000	640,000	640,000	480,000	480,000	320,000	**5,760,000**
Rice Storage	2,650,000	2,650,000	2,650,000	2,650,000	2,120,000	1,060,000	1,060,000	1,060,000	1,060,000	1,060,000	1,060,000	2,650,000	**21,730,000**
Maize Storage	960,000	960,000	960,000	960,000	640,000	1,280,000	1,280,000	1,280,000	1,280,000	1,600,000	1,600,000	960,000	**13,760,000**
Total	**3,930,000**	**3,930,000**	**3,930,000**	**3,930,000**	**3,400,000**	**2,980,000**	**2,980,000**	**2,980,000**	**2,980,000**	**3,140,000**	**3,140,000**	**3,930,000**	**41,250,000**

Revenues (Rs) Year 3
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	425,000	425,000	425,000	425,000	850,000	850,000	850,000	850,000	850,000	637,500	637,500	425,000	**7,650,000**
Rice Storage	3,500,000	3,500,000	3,500,000	3,500,000	2,800,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	3,500,000	**28,700,000**
Maize Storage	1,275,000	1,275,000	1,275,000	1,275,000	850,000	1,700,000	1,700,000	1,700,000	1,700,000	2,125,000	2,125,000	1,275,000	**18,275,000**
Total	**5,200,000**	**5,200,000**	**5,200,000**	**5,200,000**	**4,500,000**	**3,950,000**	**3,950,000**	**3,950,000**	**3,950,000**	**4,162,500**	**4,162,500**	**5,200,000**	**54,625,000**

Revenues (Rs) Year 4
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	450,000	450,000	450,000	450,000	900,000	900,000	900,000	900,000	900,000	675,000	675,000	450,000	**8,100,000**
Rice Storage	3,750,000	3,750,000	3,750,000	3,750,000	3,000,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	3,750,000	**30,750,000**
Maize Storage	1,350,000	1,350,000	1,350,000	1,350,000	900,000	1,800,000	1,800,000	1,800,000	1,800,000	2,250,000	2,250,000	1,350,000	**19,350,000**
Total	**5,550,000**	**5,550,000**	**5,550,000**	**5,550,000**	**4,800,000**	**4,200,000**	**4,200,000**	**4,200,000**	**4,200,000**	**4,425,000**	**4,425,000**	**5,550,000**	**58,200,000**

Revenues (Rs) Year 5
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	475,000	475,000	475,000	475,000	950,000	950,000	950,000	950,000	950,000	712,500	712,500	475,000	**-**
Rice Storage	4,062,500	4,062,500	4,062,500	4,062,500	3,250,000	1,625,000	1,625,000	1,625,000	1,625,000	1,625,000	1,625,000	4,062,500	**-**
Maize Storage	1,462,500	1,462,500	1,462,500	1,462,500	975,000	1,950,000	1,950,000	1,950,000	1,950,000	2,437,500	2,437,500	1,462,500	**-**
Total	**6,000,000**	**6,000,000**	**6,000,000**	**6,000,000**	**5,175,000**	**4,525,000**	**4,525,000**	**4,525,000**	**4,525,000**	**4,775,000**	**4,775,000**	**6,000,000**	**62,825,000**

Revenues (Rs) Year 6
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	525,000	525,000	525,000	525,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	787,500	787,500	525,000	**9,450,000**
Rice Storage	4,437,500	4,437,500	4,437,500	4,437,500	3,550,000	1,775,000	1,775,000	1,775,000	1,775,000	1,775,000	1,775,000	4,437,500	**36,387,500**
Maize Storage	1,612,500	1,612,500	1,612,500	1,612,500	1,075,000	2,150,000	2,150,000	2,150,000	2,150,000	2,687,500	2,687,500	1,612,500	**23,112,500**
Total	**6,575,000**	**6,575,000**	**6,575,000**	**6,575,000**	**5,675,000**	**4,975,000**	**4,975,000**	**4,975,000**	**4,975,000**	**5,250,000**	**5,250,000**	**6,575,000**	**68,950,000**

Revenues (Rs) Year 7
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	575,000	575,000	575,000	575,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	862,500	862,500	575,000	**10,350,000**
Rice Storage	4,875,000	4,875,000	4,875,000	4,875,000	3,900,000	1,950,000	1,950,000	1,950,000	1,950,000	1,950,000	1,950,000	4,875,000	**39,975,000**
Maize Storage	1,762,500	1,762,500	1,762,500	1,762,500	1,175,000	2,350,000	2,350,000	2,350,000	2,350,000	2,937,500	2,937,500	1,762,500	**25,262,500**
Total	**7,212,500**	**7,212,500**	**7,212,500**	**7,212,500**	**6,225,000**	**5,450,000**	**5,450,000**	**5,450,000**	**5,450,000**	**5,750,000**	**5,750,000**	**7,212,500**	**75,587,500**

Revenues (Rs) Year 8
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	625,000	625,000	625,000	625,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	937,500	937,500	625,000	**11,250,000**
Rice Storage	5,375,000	5,375,000	5,375,000	5,375,000	4,300,000	2,150,000	2,150,000	2,150,000	2,150,000	2,150,000	2,150,000	5,375,000	**44,075,000**
Maize Storage	1,950,000	1,950,000	1,950,000	1,950,000	1,300,000	2,600,000	2,600,000	2,600,000	2,600,000	3,250,000	3,250,000	1,950,000	**27,950,000**
Total	**7,950,000**	**7,950,000**	**7,950,000**	**7,950,000**	**6,850,000**	**6,000,000**	**6,000,000**	**6,000,000**	**6,000,000**	**6,337,500**	**6,337,500**	**7,950,000**	**83,275,000**

Revenues (Rs) Year 9
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	700,000	700,000	700,000	700,000	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000	1,050,000	1,050,000	700,000	**12,600,000**
Rice Storage	5,937,500	5,937,500	5,937,500	5,937,500	4,750,000	2,375,000	2,375,000	2,375,000	2,375,000	2,375,000	2,375,000	5,937,500	**48,687,500**
Maize Storage	2,137,500	2,137,500	2,137,500	2,137,500	1,425,000	2,850,000	2,850,000	2,850,000	2,850,000	3,562,500	3,562,500	2,137,500	**30,637,500**
Total	**8,775,000**	**8,775,000**	**8,775,000**	**8,775,000**	**7,575,000**	**6,625,000**	**6,625,000**	**6,625,000**	**6,625,000**	**6,987,500**	**6,987,500**	**8,775,000**	**91,925,000**

Revenues (Rs) Year 10
Traditional Warehouse Storage (bags)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat Storage	775,000	775,000	775,000	775,000	1,550,000	1,550,000	1,550,000	1,550,000	1,550,000	1,162,500	1,162,500	775,000	**13,950,000**
Rice Storage	6,562,500	6,562,500	6,562,500	6,562,500	5,250,000	2,625,000	2,625,000	2,625,000	2,625,000	2,625,000	2,625,000	6,562,500	**53,812,500**
Maize Storage	2,362,500	2,362,500	2,362,500	2,362,500	1,575,000	3,150,000	3,150,000	3,150,000	3,150,000	3,937,500	3,937,500	2,362,500	**33,862,500**
Total	**9,700,000**	**9,700,000**	**9,700,000**	**9,700,000**	**8,375,000**	**7,325,000**	**7,325,000**	**7,325,000**	**7,325,000**	**7,725,000**	**7,725,000**	**9,700,000**	**101,625,000**

9.5.3 Annex V-C - Revenues from Allied Services

Rate (Rs/maund)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cleaning		10	11	12	13	14	15	17	19	21	23
Drying		20	21	22	24	26	28	31	34	37	41

Storage Volumes (maund)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Wheat	30,000	40,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Rice	37,500	50,000	62,500	62,500	62,500	62,500	62,500	62,500	62,500	62,500
Maize	37,500	50,000	62,500	62,500	62,500	62,500	62,500	62,500	62,500	62,500

Wheat	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cleaning	300,000	440,000	600,000	650,000	700,000	750,000	850,000	950,000	1,050,000	1,150,000
Drying	-	-	-	-	-	-	-	-	-	-
Total revenue from Wheat	**300,000**	**440,000**	**600,000**	**650,000**	**700,000**	**750,000**	**850,000**	**950,000**	**1,050,000**	**1,150,000**

Rice	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cleaning	375,000	550,000	750,000	812,500	875,000	937,500	1,062,500	1,187,500	1,312,500	1,437,500
Drying	750,000	1,050,000	1,375,000	1,500,000	1,625,000	1,750,000	1,937,500	2,125,000	2,312,500	2,562,500
Total revenue from Rice	**1,125,000**	**1,600,000**	**2,125,000**	**2,312,500**	**2,500,000**	**2,687,500**	**3,000,000**	**3,312,500**	**3,625,000**	**4,000,000**

Maize	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cleaning	375,000	550,000	750,000	812,500	875,000	937,500	1,062,500	1,187,500	1,312,500	1,437,500
Drying	750,000	1,050,000	1,375,000	1,500,000	1,625,000	1,750,000	1,937,500	2,125,000	2,312,500	2,562,500
Total revenue from Maize	**1,125,000**	**1,600,000**	**2,125,000**	**2,312,500**	**2,500,000**	**2,687,500**	**3,000,000**	**3,312,500**	**3,625,000**	**4,000,000**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Total Revenues from Allied Services	**2,550,000**	**3,640,000**	**4,850,000**	**5,275,000**	**5,700,000**	**6,125,000**	**6,850,000**	**7,575,000**	**8,300,000**	**9,150,000**

9.6 Annex VI - Operating Costs Calcualtions

9.6.1 Annex VI-A - Depreciation & Amortization Schedule

Depreciation Schedule

(Values in Rs)		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	Rate	Opening Balanc	Depreciation	Depreciation	Depreciation	Depreciation	Depreciation	Depreciation	Depreciation	Depreciation	Depreciation	Depreciation
Land	0%	15,000,000	-	-	-	-	-	-	-	-	-	-
Building and Civil Works	10%	58,886,538	5,888,654	5,888,654	5,888,654	5,888,654	5,888,654	5,888,654	5,888,654	5,888,654	5,888,654	5,888,654
Storage Silos	10%	-	-	-	-	-	-	-	-	-	-	-
Grain Handling/Allied Equipment	10%	9,500,000	950,000	950,000	950,000	950,000	950,000	950,000	950,000	950,000	950,000	950,000
Office Equipment	20%	1,265,000	253,000	253,000	253,000	253,000	253,000	-	-	-	-	-
Vehicles	20%	800,000	160,000	160,000	160,000	160,000	160,000	-	-	-	-	-
Total		**85,451,538**	**7,251,654**	**7,251,654**	**7,251,654**	**7,251,654**	**7,251,654**	**6,838,654**	**6,838,654**	**6,838,654**	**6,838,654**	**6,838,654**

Year End Value

(Values in Rs)		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Land		15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
Building and Civil Works		58,886,538	52,997,885	47,109,231	41,220,577	35,331,923	29,443,269	23,554,615	17,665,962	11,777,308	5,888,654	- 0
Storage Silos		-	-	-	-	-	-	-	-	-	-	-
Grain Handling/Allied Equipment		9,500,000	8,550,000	7,600,000	6,650,000	5,700,000	4,750,000	3,800,000	2,850,000	1,900,000	950,000	-
Office Equipment		1,265,000	1,012,000	759,000	506,000	253,000	-	-	-	-	-	-
Vehicles		800,000	640,000	480,000	320,000	160,000	-	-	-	-	-	-
Total		**85,451,538**	**78,199,885**	**70,948,231**	**63,696,577**	**56,444,923**	**49,193,269**	**42,354,615**	**35,515,962**	**28,677,308**	**21,838,654**	**15,000,000**

Amortization Schedule

(Values in Rs)	Rate	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Pre-operating Expenses	20%	8,429,327	1,685,865	1,685,865	1,685,865	1,685,865	1,685,865	-	-	-	-	-
Accumulated Amortization cost			1,685,865	3,371,731	5,057,596	6,743,462	8,429,327	8,429,327	8,429,327	8,429,327	8,429,327	8,429,327
Year end value		8,429,327	6,743,462	5,057,596	3,371,731	1,685,865	-	-	-	-	-	-

9.6.2 Annex VI-B - Office Administration Cost Calculations

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Stationery per month	10,000	11,000	12,100	13,310	14,641	16,105	17,716	19,487	21,436	23,579
Stationery cost per year	**120,000**	**132,000**	**145,200**	**159,720**	**175,692**	**193,261**	**212,587**	**233,846**	**257,231**	**282,954**
Correspondence cost										
Routine mail per month	50	40	30	20	20	20	20	20	20	20
Routine mail per year	600	480	360	240	240	240	240	240	240	240
Routine mail unit cost (Rs)	30	32	33	35	36	38	40	42	44	47
Total routine mail cost	1,500	1,260	992	695	729	766	804	844	886	931
Courier mail per month	50	40	30	20	20	20	20	20	20	20
Courier mail per year	600	480	360	240	240	240	240	240	240	240
Courier unit cost (Rs)	200	210	221	232	243	255	268	281	295	310
Total courier mail cost (Rs)	120,000	100,800	79,380	55,566	58,344	61,262	64,325	67,541	70,918	74,464
Correspondence cost per year	**121,500**	**102,060**	**80,372**	**56,261**	**59,074**	**62,027**	**65,129**	**68,385**	**71,804**	**75,395**
Travelling Expenses										
No. of visits per month	2	3	3	3	3	3	3	3	3	3
No. of visits per year	24	36	36	36	36	36	36	36	36	36
Cost per visit (Rs)	8,000	8,640	9,331	10,078	10,884	11,755	12,695	13,711	14,807	15,992
Total cost of visits (Rs)	**192,000**	**311,040**	**335,923**	**362,797**	**391,821**	**423,166**	**457,020**	**493,581**	**533,068**	**575,713**
Telephone cost										
Telephone bill per month	25,000	27,000	29,160	31,493	34,012	36,733	39,672	42,846	46,273	49,975
Telephone bill per year	**300,000**	**324,000**	**349,920**	**377,914**	**408,147**	**440,798**	**476,062**	**514,147**	**555,279**	**599,701**
Internet Cost										
Internet cost per month	5,000	5,400	5,832	6,299	6,802	7,347	7,934	8,569	9,255	9,995
Internet cost per year	**60,000**	**64,800**	**69,984**	**75,583**	**81,629**	**88,160**	**95,212**	**102,829**	**111,056**	**119,940**
Refreshment Cost (office tea, etc.)										
Refreshment cost per month	10,000	11,000	12,100	13,310	14,641	16,105	17,716	19,487	21,436	23,579
Refreshment cost per year	**120,000**	**132,000**	**145,200**	**159,720**	**175,692**	**193,261**	**212,587**	**233,846**	**257,231**	**282,954**
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Total Office Administration Cost	**913,500**	**1,065,900**	**1,126,599**	**1,191,994**	**1,292,054**	**1,400,674**	**1,518,598**	**1,646,635**	**1,785,668**	**1,936,657**

9.6.3 Annex VI-C - Marketing Cost Calculations

Introductory Brochures	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
General Brochures										
No. of general brochures per month	200	200	100	50	50	50	50	50	50	50
No. of general brochures per year	2,400	2,400	1,200	600	600	600	600	600	600	600
Cost per brochure (Rs)	25.00	26.25	27.56	28.94	30.39	31.91	33.50	35.18	36.94	38.78
Cost of general brochures per month (Rs)	5,000	5,250	2,756	1,447	1,519	1,595	1,675	1,759	1,847	1,939
Cost of general brochures per year (Rs)	60,000	63,000	33,075	17,364	18,233	19,144	20,101	21,107	22,162	23,270

Meetings	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Farmers/Associations										
No. of meetings per month	5	4	3	2	1	0.5	0.5	0.5	0.5	0.5
No. of meetings per year	60	48	36	24	12	6	6	6	6	6
Cost per meeting	5,000	5,500	6,050	6,655	7,321	8,053	8,858	9,744	10,718	11,790
Cost per month (Rs)	25,000	22,000	18,150	13,310	7,321	4,026	4,429	4,872	5,359	5,895
Meetings Cost per year (Rs)	**300,000**	**264,000**	**217,800**	**159,720**	**87,846**	**48,315**	**53,147**	**58,462**	**64,308**	**70,738**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Seminars										
Awareness Seminars										
No. of seminars per year	2	1	1	0	0	0	0	0	0	0
Cost per seminar	100,000	110,000	121,000	133,100	146,410	161,051	177,156	194,872	214,359	235,795
Cost of Awareness Seminars (Rs)	**200,000**	**110,000**	**121,000**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
TOTAL COST OF MARKETING (Rs)	**560,000**	**437,000**	**371,875**	**177,084**	**106,079**	**67,460**	**73,248**	**79,568**	**86,469**	**94,008**

9.7 Annex VII - Breakeven Analysis

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenues (Rs)	31,650,000	44,890,000	59,475,000	63,475,000	68,525,000	75,075,000	82,437,500	90,850,000	100,225,000	110,775,000
Direct Costs (Rs)	5,596,000	6,465,120	7,437,024	8,032,178	8,674,560	9,367,949	10,116,425	10,924,395	11,796,618	12,738,236
Gross Profit (Rs)	26,054,000	38,424,880	52,037,976	55,442,822	59,850,440	65,707,051	72,321,075	79,925,605	88,428,382	98,036,764
No. of Units 'sold' (maund-months storage)	900,000	1,200,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Unit Revenue (Rs/maund-month)	35.17	37.41	39.65	42.32	45.68	50.05	54.96	60.57	66.82	73.85
Unit Variable Cost (Rs/maund-month)	6.22	5.39	4.96	5.35	5.78	6.25	6.74	7.28	7.86	8.49
Unit Contribution Margin (Rs/maund-month)	28.95	32.02	34.69	36.96	39.90	43.80	48.21	53.28	58.95	65.36
Fixed Costs (Rs)	13,816,469	14,152,919	14,483,321	14,680,722	15,063,466	13,417,430	13,955,546	14,538,527	15,170,174	15,854,613
Breakeven Capacity (maund-months)	477,271	441,992	417,483	397,185	377,528	306,301	289,450	272,851	257,330	242,582
Total Available Capacity (maund-months)	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Breakeven Capacity %	31.8%	29.5%	27.8%	26.5%	25.2%	20.4%	19.3%	18.2%	17.2%	16.2%
Breakeven Capacity in terms of maunds (maund-months/12)	39,773	36,833	34,790	33,099	31,461	25,525	24,121	22,738	21,444	20,215
Breakeven Capacity in terms of tons	**1,657**	**1,535**	**1,450**	**1,379**	**1,311**	**1,064**	**1,005**	**947**	**894**	**842**

9.8 Annex VIII – FFSAP Brochure

زرعی پیداوار کی ذخیرہ کاری کے لیے قرضوں کی سہولت

تعارف :

- اسٹیٹ بینک آف پاکستان نے زرعی پیداواری ذخیرہ کاری میں اضافہ نیز مارکیٹنگ کے فروغ کے لیے جدید گوداموں، ویئر ہاؤسز اور کولڈ اسٹوریج کی تعمیر اور اپ گریڈیشن کی ویئر ہاؤسنگ کے شعبے میں نجی شعبے کی حوصلہ افزائی کے لیے یہ اسکیم متعارف کرائی ہے۔

نمایاں خصوصیات:

- اس اسکیم کے ذریعہ قرضوں کی سہولت زرعی پیداوار کی ذخیرہ کاری کے لیے گوداموں، ویئر ہاؤسز اور کولڈ اسٹوریج کی تعمیر/توسیع کے سلسلے میں دستیاب ہے۔
- قرضے گوداموں، ویئر ہاؤسز اور کولڈ اسٹوریج میں استعمال ہونے والے نئے پلانٹ اور مشینری اور جنریٹرز کی مقامی خریداری اور درآمد کے لیے دستیاب ہیں، علاوہ ازیں اسکیم کے تحت قرض کی سہولت تعمیراتی کاموں کی لاگت کا 65% تک دستیاب ہے۔
- قرضے پلانٹ اور مشینری اور جنریٹرز وغیرہ کی مالیت کے مساوی دستیاب ہیں۔
- قرضے کی سہولت تمام بینکوں اور ترقیاتی مالیاتی اداروں (DFIs) کے ذریعے دستیاب ہے۔
- قرضوں کی اصل رقم مقررہ رعایتی مدت (اگر کوئی ہو تو) گزرنے کے بعد سہ ماہی / ششماہی مساوی اقساط میں قابل ادائیگی ہے۔ مارک اپ سہ ماہی بنیاد پر قابل ادائیگی ہے

For further information /assistance kindly contact:-
I.H. & SME Finance Department
021-3245-5502 / 3568 / 3525
I.I. Chundrigar Road, Karachi.

Printed at the State Bank of Pakistan, SBP BSC, Printing Press, Karachi.

FINANCING FACILITY FOR STORAGE OF AGRICULTURAL PRODUCE (FFSAP)

زرعی پیداوار کی ذخیرہ کاری کے لیے قرضوں کی سہولت

STATE BANK OF PAKISTAN
I.H. & SME Finance Department
www.sbp.org.pk

Financing Facility for Storage of Agricultural Produce (FFSAP)

The Scheme

- SBP has introduced the Scheme to encourage Private Sector to establish Silos, Warehouses & Cold Storages in order to enhance storage capacity and develop agricultural produce marketing.

Salient Features

- Financing is available for establishment / expansion / BMR of Silos, Warehouses & Cold Storages facilities for storing **agricultural produce**.
- Financing is available for local purchase/import of new plant & machinery / new generators used in Silos/Warehouses/Cold Storages. Further, up to 65% cost of civil works is also eligible under the Scheme.
- Financing is available to the extent of C&F Value/ ex-factory/ showroom price of plant, machinery, generators etc.
- Financing facilities are available through all commercial banks and DFIs.
- Maximum financing to a single project is Rs. 500 million under the Scheme.
- Principal amount of loans is repayable in quarterly / half yearly installments after prescribed grace period, if any. Markup is payable on quarterly basis.

Tenor of Financing

- The facility is available for a maximum period of seven years including a maximum grace period of six months.

Mark up Rates

- Financing is available at mark-up rate of 6 percent per annum.

The interested borrowers may contact their bank / DFI branches for information and completion of formalities.

Further, details of the scheme are available at following links of SBP website:
اسکیم کی تفصیلات مندرجہ ذیل لنکس پر دیکھی جاسکتی ہیں:

http://www.sbp.org.pk/smefd/circulars/2010/C8.htm
http://www.sbp.org.pk/smefd/circulars/2014/CL2.htm
http://www.sbp.org.pk/smefd/circulars/2015/C13.htm

مزید معلومات کے لیے مندرجہ ذیل پر رابطہ کیا جاسکتا ہے:
آئی ایچ اینڈ ایس ایم ای فنانس ڈیپارٹمنٹ، ایس بی پی، کراچی۔
021-3245-5502 / 3568 / 3525

- اسکیم کے تحت ایک پروجیکٹ کے لیے زیادہ سے زیادہ قرضے کی سہولت 500 ملین روپے تک دستیاب ہے۔

قرضوں کی مدت:

- قرضوں کی زیادہ سے زیادہ مدت بشمول چھ ماہ کی رعایتی مدت سات (7) سال ہے۔

مارک اپ ریٹ:

- قرضے مارک اپ کی شرح 6 فیصد سالانہ پر دستیاب ہے۔
- قرض کے حصول میں دلچسپی رکھنے والے قرضے/معلومات کے حصول کے لیے کمرشل بینکوں/ترقیاتی مالیاتی اداروں (DFIs) کی شاخوں سے رابطہ قائم کرسکتے ہیں

Chief Managers SBP BSC Field Offices
ایس بی پی بی ایس سی کے چیف منیجرز کے دفاتر:

Karachi	021-99212435	کراچی
Lahore	042-99210452	لاہور
Peshawar	091-9211975	پشاور
Quetta	081-9202786	کوئٹہ
Faisalabad	041-9200444	فیصل آباد
Sialkot	052-9250362	سیالکوٹ
Bahawalpur	062-9255035	بہاولپور
Islamabad	051-9201715	اسلام آباد
Hyderabad	022-9200605	حیدرآباد
Rawalpindi	051-9272751	راولپنڈی
Sukkur	071-9310261	سکھر
Multan	061-9200592	ملتان
Gujranwala	055-9200310	گوجرانوالہ
D.I.Khan	0966-9280043	ڈی آئی خان
Muzaffarabad	05822-921672	مظفرآباد