USAID Small and Medium Enterprise Activity

Private Silo Warehousing for Pakistan's Grains

A feasibility study for rice paddy, maize, and wheat

December 29, 2020

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ABSTRACT

Pakistan needs modern drying and storage facilities to preserve its leading grains from post-harvest losses and to achieve food security. This feasibility study of stand-alone drying and storage facilities presents the rationale for these investments for the wheat, rice paddy, and maize crops. Based on detailed value chain mapping of these crops and comprehensive financial modelling, the study lays out the technology choices, the investment needs, and the legal and regulatory requirements for such facilities. It clearly identifies the policy action and public support that can mobilize private investment to move Pakistan's agriculture sector and its farmers to the next level.

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ACRONYMS

AOAC	Association of Official Analytical Chemists
CDC	Central Depository Company
CMC	Collateral Management Company
EMC	Equilibrium Moisture Content
EWR	Electronic Warehouse Receipt
FCF	Free Cash Flow
GoP	Government of Pakistan
GoS	Government of Sindh
GRN	Goods Received Note
ICT	Information Communication & Technology
IoT	Internet of Things
IRR	Internal Rate of Return
IT	Information Technology
KIBOR	Karachi Inter-Bank Offered Rate (Pakistan's reference lending rate)
KP	Khyber Pakhtunkhwa province
MCC	Main Control Center (MCC) of silo facility
NCMCL	Naymat Collateral Management Company Limited
NRSP	National Rural Support Programme
PAC	Pakistan Agricultural Coalition
PAMRA	Punjab Agricultural Marketing Regulatory Authority
PLC	Programmable Logistic Control of silo facility
PMEX	Pakistan Mercantile Exchange
SBP	State Bank of Pakistan
SECP	Securities and Exchange Commission of Pakistan
SME	Small and Medium Enterprise
SMEA	Small and Medium Enterprise Activity (SMEA)
SOP	Standard Operating Procedures
WACC	Weighted Average Cost of Capital
USAID	United States Agency for International Development

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Exchange Rate

1 USD = 165 PKR

EXECUTIVE SUMMARY

The coronavirus crisis has highlighted long-standing shortcomings of Pakistan's agricultural value chains. The scarcity of modern storage for agricultural commodities and the lack of information about availability of stocks have also led to bouts of volatile commodity prices and insecurity of supply raising concerns about Pakistan's food security.

Significant investment in modern agri-storage is critical for addressing this situation. But nearly all modern drying and silo storage for Pakistan's leading grains—wheat, rice paddy, and maize—exists inside large-scale mill facilities and is not accessible for farmers, traders, and medium-to-small-sized millers. Between these three crops, Pakistan's post-harvest losses are estimated at nearly US$ 343 million per annum in quantity and quality due to lack of proper drying and storage.

Farmers are the real losers in these crop value chains even though they bear the most risk among all stakeholders in the agricultural sector. The loss of quality is mainly due to the primitive practice of sun drying which farmers as well as traders depend on since they do not have access to mechanical drying facilities. Farmers are not able to hold their rice paddy or maize since they require drying after harvest and most often have to make a 'distress sale' of their harvest as the prices at harvest time are the lowest of the year.

Beyond these physical losses, the lack of reliable storage with grading of commodity means that the markets for these commodities are often constrained to local buyers. In Pakistan's rural landscape, commodity testing labs are not found in the wholesale markets but only on the premises of the larger mills. This leads to lack of standardization which has far-reaching consequences: this is the major hurdle in the way of nation-wide electronic trading of agri-commodities. Real price discovery is difficult in this collection of markets.

The advent of the electronic warehouse receipts regime in Pakistan in 2020 brings a strong prospect for addressing these major gaps in the Pakistan's leading crop value chains. Under this regime, an accreditation entity called Naymat Collateral has been licensed by Pakistan's corporate regulator, the Securities and Exchange Commission of Pakistan (SECP). Under a clear contractual framework defined by the CMC Regulations 2019 notified by SECP, Naymat Collateral will accredit warehouses and warehouse operators and run a software system in which warehouse operators will be able to issue electronic warehouse receipts (EWRs) against stock which pass regime-wide testing criteria for each crop and enter storage at the accredited warehouse. These EWRs are transferrable and can be traded on the Pakistan Mercantile Exchange. This is the kernel of a nation-wide agri-commodity market with the same testing and grading criteria applied for a crop at all accredited warehouses. For banks, a system of pledging (blocking of pledged EWRs) based on the successful 'CDC model' of securitization has been incorporated into this regime. Warehouse operators have a clear obligation to give back the quantity and quality they take in. And this is intended to bring confidence to not only the depositor but also to the bank lending against the EWR as well as any traders on the commodity exchange that a warehouse operator will make them whole for the stock underlying any EWR issue by that warehouse operator. A number of risk mitigation mechanisms are built into the architecture of the regime to address risks to the fulfilment of this promise.

This feasibility study has been conducted to develop commercially viable drying and storage facilities which can become the pillars of the EWR regime. The exploration of the target value chains conducted through a detailed literature review, extensive interviews with experts, and field

visits to the relevant regions of Punjab, Sindh, and KP provinces shows that the rice-wheat belt of northeastern Punjab, the maize-wheat belt of eastern Punjab (which also has maize-maize), and the rice-wheat belt of upper Sindh are the most suitable geographies for the proposed storage business. The crop rotations in these areas can maximize the utilization of the storage facilities through the year and also use the drying facilities for at least one crop.

A comprehensive value chain mapping for each map for this study reveals that farmers can make appreciable gains by getting their rice paddy and maize dried mechanically and stored in a silo facility. This value chain mapping uses prices for the main services of the proposed facility—drying and storage—which have been paid by real customers of these services in the multiple pilots conducted by Pakistan Agricultural Coalition and Engro Fertilizers for the EWR model.

Using this value chain mapping as a reference, detailed financial modeling was conducted for this study. At first, the financial modelling focused on a 10,000-ton facility with three US-origin silos of 3,300 tons each (equivalent to rice paddy). Even at higher prices for storage and drying than were charged in the pilots, this capacity level was found to show an equity IRR of 10.9 percent and a simple payback of 9.9 years but with significantly constrained liquidity during the tenor of debt contracted at the beginning of the project. Additional analysis of public support through exemption of the sales tax on services lifts the equity IRR and addresses the liquidity constraints of the business. But these results were at higher prices than were charges in the pilots. Therefore, further analysis was conducted.

The results indicate that a 15,000-ton facility would be a more commercially viable unit than a 10,000-ton facility at the prices for drying and storage paid by customers during the pilots conducted. The option of a 20,000-ton facility may require too much grain volume to be aggregated at one spot given the low yields and relatively small farm sizes in Pakistan. The financial projections take into account all costs associated with imported silos and testing equipment with locally produced units for receiving, pre-cleaning, drying, and outloading.

The proposed 15,000-ton storage facility comprises six 2,500-ton silos to facilitate storage of different grades of commodity. It has a drying unit constituted by three trains of 10 tons per hour each to allow flexibility in accommodating lots of different moisture levels. The investment outlay for this facility is estimated at Rs. 283 million with Turkish-origin silos.

The model was used to conduct sensitivity analysis and it was found that changes in the following variables has the highest impact on the internal rate of return to the equity investor: storage charge, drying charge, storage utilization, capitalization ratio, and loan tenor. A base case was created using some of the prices paid during the pilots: storage rental of Rs. 18 per maund per month for maize and rice paddy and Rs. 15 for wheat; and drying cost of Rs. 70 per maund). With these assumptions and the storage utilization rising from 70 percent in year 1 to 100 percent in year 3 onwards, the internal rate of return to the equity investor for the paddy-wheat play in Punjab comes to 16.6 percent with a payback of 8.1 years.

The profitability varies by geography and grain combination. Compared to rice paddy, maize has 1.33 times the bulk density and wheat has 1.45 times the bulk density (i.e., weight per unit of volume). Therefore, maize and wheat allow for not only a higher storage of grain with the same configuration, but a significantly higher drying volume as well. This results in improved profits being generated (owing primarily to increased volume instead of differences in price) using the same initial investment.

Table 1. Financial Results by Geography & Grain Combination					
	15,000-ton silo facility with 30 tons per hour drying capacity	**Punjab** (base case)	**Upper Sindh**	**Punjab**	**Punjab**
		Paddy-Wheat	**Paddy-Wheat**	**Maize-Wheat**	**Maize-Maize**
1	IRR to Equity	16.6%	17.2%	22.6%	30.9%
2	Payback Period (years)	8.1	8.0	6.8	5.7
3	NPV (million PKR)	64.8	70.1	124.9	205.4
4	Project IRR	5.8%	6.1%	9.6%	14.3%
5	Project IRR with no sales tax	12.7%	13.1%	17.9%	24.5%

The proposed business is a low-margin, high-volume business with a lumpy capex profile. Rapid market adoption of its services and full utilization of its machinery are key to its sustainability. The financial analysis shows that sufficiency of liquidity is critical while the business is paying off its debt. Therefore, it is recommended that

- ➔ The sales tax on services applicable to warehousing services must be set near zero for a ten-year period to allow this business to get established.

The strategic priority for building the proposed business is to develop trust and credibility among its relevant agriculture stakeholders. This will require active operational management of each facility's machinery and equipment as well as its human resources. The warehouse operator's mandate to give back the quantity and quality of the commodity that it took in must be executed by actively managing the risks of operational negligence, fraud, etc.

Maize and rice paddy are niches of the agriculture sector which have lighter regulation and policy action. But for wheat, the country largest crop and mainstay in the winter, the value chain has government influence or direct control right from the farmer to the flour miller. Therefore, it is recommended that:

- ➔ The wheat purchase and storage operations of the provincial governments must be coordinated with the electronic warehouse receipts regime to allow the proposed business to get guaranteed business while it provides cooperation in information sharing on stocks.

The legal and regulatory review conducted for this study found that the EWR regime rests of a legal basis that has existed for long. This includes civil laws that govern the sale and purchase of produce and the storage of produce; civil laws that recognize electronic documents/transactions; and civil laws that govern food items. One law that has recently been promulgated in Punjab, the Punjab Agricultural Marketing Regulatory Authority (PAMRA) Act, will have bearing on the EWR regime since it involves, inter alia, collection of information about location and size of commodity stocks as well as a fee for trading of agricultural commodities. But the PAMRA Act's implementation rules and regulations are yet to be notified. It is recommended that

- ➔ The linkages between Punjab's PAMRA Act and the EWR regime must be clarified expeditiously.

Pakistan's EWR regime is preparing for launch. Its benefits to farmers will depend heavily on the establishment of stand-alone drying-and-storage facilities near farms. An estimated US$ 225 million will need to be invested in about 130 such facilities to preserve a quarter of the target commodities from physical deterioration and loss of value. Pakistan's leading business groups, financial houses as well as key stakeholders in the agriculture landscape have shown interest in the grain warehousing investment opportunity.

There is a strong case for public support to these investments under the EWR regime, as has been done in countries like Turkey, Ukraine and the USA. Given the findings of this feasibility study, a serious effort is required to realize the benefits for farmers through:

a) Road shows for attracting investment in drying and storage facilities based on this feasibility study
b) Top up of the State Bank's Financing Facility for Storage of Agricultural Produce (FFSAP)
c) Capitalizing the proposed Risk Mitigation Fund for the EWR regime
d) Setting the provincial sales tax on services near zero for agricultural warehousing services and drying services
e) Removing the withholding tax on trades involving physical settlement on PMEX
f) Removing the 28% duty on silo imports

1. INDUSTRY CONTEXT

1.1. PAKISTAN'S LEADING GRAIN VALUE CHAINS

Pakistan is one of the world's largest producers of wheat, rice paddy[1], and maize (corn)—the grains that are the focus of this study. Over the past decade, Pakistan's annual rice output rose at a compound growth rate of 5.1 percent from 4.8 million tons in 2011 to 7.2 million tons[2]. This growth was mainly on the back of growth in domestic demand since exports have grown at only 1.4 percent per annum in this period reaching 4 million tons in 2019[3] with a value of US$ 1.8 billion. The value of the underlying rice paddy from which this rice was produced is estimated at US$ 2.7 billion. Pakistan's maize output has shown a higher growth of 7.9 percent per annum as it rose from 3.7 million tons in 2011 to 7.2 million tons in 2019[4]. This is mainly driven by the growth of the poultry demand. The value of the Pakistan's 2019 maize output is estimated at US$ 1 billion at harvest. Meanwhile, Pakistan's wheat output has remained stagnant during this period hovering at an annual average of 25 million tons[5] with the 2019 wheat crop valued at US$ 5.3 billion at harvest. Therefore, these three crops represented a value of US$ 9.1 billion in 2019.

Rice paddy is part of a globally connected rice value chain. Pakistan exports rice to some 100 countries. The aromatic Basmati varieties have traditionally been grown in the northeastern part of Punjab (see figure 1) while the IRRI and the smaller but growing volumes of hybrid varieties are typically cultivated in Sindh. This cultivation is mainly in upper Sindh with a smaller volume in lower Sindh. However, the interviews conducted with industry stakeholders for this study revealed that some 20-25 percent of the acreage under rice paddy in upper Sindh is now Basmati as well. Pakistan's rice production is significantly larger than its domestic consumption needs. Basmati is the favorite among domestic consumers. So, the majority of the Basmati output is consumed within the country with exports shy of a million tons per annum. By contrast, the vast majority of the IRRI and hybrid grain is exported. Overall, there is hardly any government intervention in the rice value chain.

Yields are often closer to the international average for hybrid varieties but are typically below competing countries for Basmati and IRRI varieties (which presents a prospect for growth in output). Basmati yields have not climbed far from about 30 maunds[6] per acre (3 tons per hectare) in a number of years[7]. Pakistani farmers are still cultivating the older IRRI varieties (IRRI-6 and IRRI-9) and their yields continue to hover around 45 maunds per acre (4.4 tons per hectare). Imported hybrid seed is only found to yield about 60 maunds per acre (nearly 6 tons per hectare) as a national average but mechanization is now beginning to raise these yields. The advent of mechanized sowing (currently at five percent of total rice cultivation)

[1] Rice paddy is the grain that grows on farms. Rice mills de-husk, mill, and polish the paddy to produce rice which is marketed to consumers.
[2] Government of Pakistan, *Economic Survey of Pakistan* (various issues)
[3] Source: Rice Exporters Association of Pakistan.
[4] Government of Pakistan, *Economic Survey of Pakistan* (various issues)
[5] Government of Pakistan, *Economic Survey of Pakistan* (various issues)
[6] A maund equals 40 kilograms.
[7] Rice yield estimates are from the Rice Exporters Association of Pakistan.

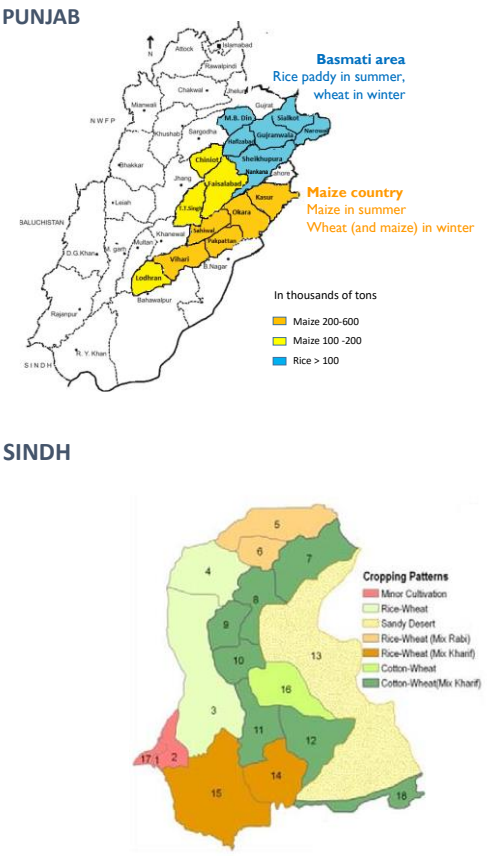
presents the prospect of increase in Pakistan's rice output in the coming years. For all varieties, the preservation of quality through timely modern drying and storage is a priority.

Maize Pakistan's maize (corn) output has grown rapidly on the back of robust poultry sector growth of about seven percent year-on-year over the past eight years (disturbed badly by the corona crisis in 2020). Maize is a critical ingredient of poultry feed and quality is a priority for poultry feed millers because compromised quality can lead to chicken mortality on poultry farms. According to industry sources, poultry feed mills purchase about 65 percent of Pakistan's maize. Rafhan, Pakistan's leading maize processor purchases about 20-25 percent of the maize crop to produce industrial products, particularly starch, as well as edible oil and other food ingredients. Some 8-10 percent of Pakistan's maize is purchased by the silage industry for consumption as cattle feed. The remaining maize is for human consumption. The government generally does not intervene in the maize value chain but there are duties on import of maize.

Punjab accounts for the vast majority of maize production with some production in KP and small volume cultivated in Sindh. Maize farmers typically use imported hybrid seed and are able to secure an average of 100 maunds per acre (close to 10 tons per hectare) from the maize summer harvest and 65 maunds per acre (6.4 tons per hectare) from the maize winter harvest. Since feed millers and other leading processors take quality seriously, preservation of quality through proper drying and storage is of great concern to the maize value chain.

Wheat is Pakistan's staple food and is grown on some 80 percent of farms through the winter to produce an average of 25 million tons per annum. Yields are significantly below international levels and have remained in the range of 30 maunds per acre (3 tons per hectare). Roughly a third of Pakistan's wheat output is kept by farmers for family consumption over the year, about a third is purchased by traders for onwards supply to flour millers, and an average of 7 million tons is purchased from farmers by the federal and provincial governments.

Fig. 1. Suitable areas for warehousing of wheat, maize and rice paddy



Sindh: Cropping zones 4, 5, and 6 touch districts Larkana, Naushehro Feroz, Qambar Shahdadkot, Jacobabad, Shikarpur, Kashmor, and Ghotki
Sources: Government of Punjab, Pakistan Agriculture Research Council

Government intervention in the wheat value chain is heavy with the provincial governments conducting commodity operations that purchases wheat at harvest time at a government purchase price, stores the wheat for a few months, and sells the wheat to flour mills to secure supply of wheat flour, the staple food. The Punjab Food department, the leading government

purchaser of wheat[8], borrows heavily for purchasing the wheat it stores and carries a rising stock of bank debt linked to this commodity operation. This debt stock has risen steadily from Rs. 166 billion in 2010-11 to Rs. 495 million in 2019-20 while the mark-up paid by the Government of Punjab was Rs. 26 billion in 2010-11 and Rs. 41.5 billion in 2019-20[9] compared to the Government of Punjab's annual development expenditure of Rs. 255 billion[10] in the same year. Punjab Food department starts releasing its wheat to flour millers from mid-September. A flour miller's typical practice is to purchase directly from farmers during the harvest to feed the milling operation as well as to store for the rest of the year. From September to December, the miller runs the milling operation mainly using wheat released under official allocation from the Food Department. For the rest of the year, the wheat stored by the mill or purchases from the market of wheat, if available, usually support the milling operation. In addition to wheat flour, Pakistan's flour mills also produce suji, maida, etc. Wheat losses during storage in godowns in Pakistan are estimated at 1.5 percent in the private sector (at facilities of middlemen/aarhti's, flour millers, stockists) and 3.5 percent in government godowns[11].

Wheat stocks held back by farmers are typically small and held in traditional home-based storages. Changes to the commodity operations of the provincial food departments are long overdue. The commodity operations of the provincial governments and the milling operations of flour millers present opportunities for a wheat storage service.

1.2. TARGET GEOGRAPHIC AREAS

For maximum viability, the grain storage business requires maximum utilization of its storage units throughout the year. Wheat, rice paddy and maize are three of Pakistan's leading grains. The areas where wheat is cultivated half the year and rice paddy, or maize are cultivated in the rest of the year are most suitable for the proposed grain warehousing business.

The vast majority of Pakistan's farmers cultivate wheat in the winter season: roughly November to May in most parts of Punjab and October to April in most parts of Sindh. In Punjab, rice paddy cultivation is concentrated in (i) northeastern Punjab (the seven districts of the Basmati area[12]) with sowing in June and harvest in November, and (ii) upper Sindh with sowing in April and harvesting mainly in September-October. There is rice paddy cultivation in lower Sindh as well, but the crop rotation is mostly vegetables and some sunflower rather than wheat.

[8] The federal and provincial governments purchase about 7 million tons of wheat each year. During the 2011-2019 seasons, Punjab Food Department purchased 3.5 million tons of wheat in 2011, 2012, and 2014 and 4 million tons in all other years. In 2020, it purchased 4.5 million tons. Source: Rana, Ahsan (2020). *Public Intervention in Wheat Market: A Case Study of Punjab,* a report for The World Bank's SMART Agriculture program, (July 2020).
[9] Rana, Ahsan (2020). *Public Intervention in Wheat Market: A Case Study of Punjab,* a report for The World Bank's SMART Agriculture program, table 5 (July 2020).
[10] Government of Punjab (2020). *Estimates of Expenditure,* Annual Budget Statement for 2020-21, Revised estimates 2019-20, Page 25.
[11] IFC (2010). *Technical Due Diligence Report: Pakistan Silos Project*. Washington DC, USA, quoted in FAO (2013). *Review of the wheat sector and grain storage issues*. Table 14, page 37 (Rome, Italy).
[12] These seven districts constitute what was 'Gujranwala Division': Gujranwala, Sheikhupura, Nankana Sahib, Hafizabad, Sialkot, Mandi Bahauddin, and Narowal. They are traditionally known as the Kalar ('kaalar') Tract.

The majority of Pakistan's maize cultivation takes place in the districts southwest of Lahore city where some farmers even take two crops of maize through the year (see figure 1). The summer-harvested maize crop is generally sown around February-March and harvested in June-July while the winter-harvested crop is sown around July-August and harvested in the November-December timeframe. KP has a maize belt in districts Mardan and Swabi but the rotation crops are mostly tobacco and potatoes. KP is a wheat deficit province which significantly dents the possibility of a maize-wheat rotation large enough to support a sizable silo storage facility.

Table 2. Crop combinations, areas, and volumes matter

Millions of tons	Summer crop	Winter crop
PUNJAB: 6.5 million tons		
Punjab: 7 districts of Basmati area	Rice paddy 3.5	Wheat 3.0
Punjab: 9 districts of 'maize country'	Maize 3.5	Wheat: 5 Maize: 1.2
SINDH: 1.4 million tons		
Sindh: 7 rice districts of upper Sindh^	Rice paddy 2.1 (0.4 Basmati)	Wheat 1.4

*FY15-FY19 average; CRS Government of Punjab ^FY18 estimate GoS

Therefore, the ideal geographic areas for the grain storage business are:

(i) rice paddy and wheat in Punjab's Kalar tract and upper Sindh,
(ii) maize and wheat in the districts southwest of Lahore, and
(iii) maize and maize in the districts southwest of Lahore.

The seven districts of the Kalar tract cultivated some two million tons of rice paddy and about three million tons of wheat in 2019. The districts of upper Sindh represent some 2.1 million tons of paddy and 1.4 million tons of wheat production.

1.3. THE PRIMITIVE INFRASTRUCTURE FOR PRESERVATION OF GRAIN QUALITY

The post-harvest preservation of the rice paddy and maize crops is currently in a primitive state, except after the commodity enters a major processor's facility. With a high proportion of rice intended for export markets, the preservation of quality is a priority in the rice value chain. Rice paddy needs to be dried within 24 to 48 hours of harvest to avoid the development of aflatoxins, a cancer-causing fungus. Moisture levels in harvested rice paddy can be up to 30 percent and sun-drying is able to bring it closer to 20 percent (typically required by millers). After harvest, the paddy is threshed—the process of separating all the non-grain components from the rice grain—the grain is still inside its husk after threshing. This reduction in moisture from an average of about 24 percent moisture to the range of 20 percent moisture is achieved by sun-drying not only outside mill facilities but in many cases inside mill facilities as well, given the large volumes to be dried in a short period of time after harvest and the low cost of sun-drying. The cost is basically of rental plus labour to rake the paddy and cover it overnight and is in the range of Rs. 20 per maund. Once inside rice mills, the paddy's moisture is typically reduced from about 20 percent to 14 percent which is a suitable level for milling and also for storage.

Sun drying of rice paddy is typically conducted at drying pits which are prepared for this purpose at each harvest (see figure 2). In north-eastern Punjab, the phenomena of fog, smog, and possible winter rains reduce the contact of the paddy with sunlight for drying. This makes it a period of uncertainty and loss for farmers, traders, and other stakeholders in the rice value chain. Since sun drying is not a year-round business and basically requires land, the acreage of drying pits is scarce compared to what is required for the harvested paddy. In some areas, farmers and traders may be stuck for up to two weeks in queue for their paddy to be dried which can bring further deterioration in paddy quality. Finally, the sun drying method introduces extraneous matter, particularly soil, into the paddy adding half a percent to its weight as estimated by industry sources. It also introduces cracks in the grain which means the proportion of broken grains during milling is higher. The estimated reduction in the value of paddy is 2.5 percent based on the deductions typically applied to incoming paddy after testing at mills, a good part of it attributed to sun drying by millers.

Given the summer temperatures at the time of wheat harvest in most parts of Pakistan, wheat does not require drying before storage. But the maize crop requires drying at two levels. An initial round of drying is done while the corn is still on the cob to reduce its moisture to a level acceptable to the simple threshing machines used in Pakistan[13]. This is achieved by laying out the maize for sun drying on any hard surface, including village roads, road shoulders, etc. Some portion of the crop is stored in bags for sale in the future by large farmers and traders at this stage with the corn still on the cob. The rest is threshed and sun-dried a little further before sale to processors. Maize industry sources estimate that sun drying adds to the weight

Fig. 2. The ancient practice of sun-drying is widespread

Sun-drying of paddy (Hafizabad)

Photo credit: Hassam Hussain

Sun-drying of maize I (Okara)

Photo credit: Dr. Imran Hassan

Sun-drying of maize II (Okara)

Photo credit: Dr. Imran Hassan

of the maize by 0.2 percent as extraneous matter, particularly soil enters it. Winter-harvested maize also faces the issues of fog, smog, and winter rains which reduce its contact with sunlight for drying and can cause significant loss of quality and therefore crop value. The estimated reduction in the value of maize is 2.5 percent based on the deductions typically applied to incoming maize after testing at mills, a good part of it attributed to sun drying by millers. In Punjab, the moisture level of winter-harvested maize is reduced from about 24 percent to 18 percent. For summer-harvested maize, the high ambient temperatures in June and part of July can reduce moisture levels to the range of 12-14 percent which become acceptable to millers but with any untimely pre-monsoon rains in June and the prospect of the monsoon in July brings great uncertainty and loss to maize farmers.

[13] This presents a major opportunity for modern harvesting machinery for maize in Pakistan.

Fig. 3. Elements of a storage facility

Figure. 3.1. Weighbridge

Photo credit: Kazim Saeed

Figure 3.2. Mechanical dryer

Photo credit: Kazim Saeed

The rice paddy and maize crops suffer significant post-harvest losses which can be reduced through modern mechanical drying that is available to farmers in developed and advanced developing countries. Pakistan has a vibrant industry producing steam-drying equipment and associated infrastructure for mechanical drying of paddy and maize. It is mostly located in northeastern Punjab but its market is currently limited to drying facilities inside Pakistan's mills. A stand-alone facility with only mechanical drying for a few weeks a year is not a viable investment. The world over, drying and storage facilities with mechanical drying and silo storage are established at near-farm locations to ensure that the quality of the crop does not deteriorate in the post-harvest period.

1.4. THE MODERN DRYING AND SILO FACILITY

The international experience with grain warehousing facilities for rice paddy, wheat, and maize commonly indicates medium- to large-sized silo storage facilties as the norm (see experience of the USA, India, Turkey, and Ukraine in Annex 2). These facilities have grain quality testing capability, efficient grain cleaning equipment, and highly efficient mechanical drying capacity as an integral part of the storage facility. Drying of wheat is conducted where the climatic conditions require it—in the wheat growing areas of Turkey and parts of the USA, wheat does not require mechanical drying. Finally, metal silos emerge as the technology choice for new investment in grain storage.

In the Pakistani context, modern drying and storage facilities are typically found inside mill facilities are have five key components: a testing lab, a weighbridge, a pre-cleaning system, a mechanical drying unit, and silo storage. The testing lab is critical to a silo storage facility because it allows grading of each incoming lot by on standard parameters. This way, each silo can hold grain of a specific quality grade. This standardization has far-reaching consequences since it opens the door to reliable collateral-based lending and electronic trading of the agri-commodity placed in the storage facility. The lab requires relevant testing equipment suited for each crop. Such labs are non-existent in Pakistan's rural landscape outside mill facilities and this is a major hurdle to the creation of a modern nation-wide market for agri-commodities.

A weighbridge is typically a metal platform mounted permanently on a concrete foundation with load cells installed (figure 3). A loaded vehicle is driven onto the platform for a reading by the weighing scales. Subsequently, the unloaded vehicle is driven onto the platform to capture

the weight of the vehicle. This weight and the estimated weight of the bags is reduced from the first reading to secure the grain weight. Pakistan has a large number of weighbridges installed across the rural landscape. Inside mill facilities, weighbridges have the electronic scales which can provide a reading directly to the software system of the mill to reduce human intervention in the process of weighment.

Before drying and storage, the pre-cleaning system removes extraneous matter from the grain such as trash, dirt, inert materials (TDI), metal pieces, string, non-grain portions from the harvest, etc. The pre-cleaning system in such facilities typically has a separator for metal particles, a dust control and aspiration system which removes dust, drum pre-cleaners for removing coarse particles and impurities from corn and wheat, and vibrating screens for removing coarse particles and impurities from rice paddy. Of the grain arriving at the mill gate, the proportion of extraneous matter can be 4 to 6 percent for paddy and about 2 percent for maize according to industry experts in Pakistan. The pre-cleaning system can reduce these proportions to an acceptable range of within 1 percent for both crops.

For mechanical drying of rice paddy and maize, passing them through dryers which use steam generated by a boiler is more suitable than direct heat application to these grains. Such mechanical dryers are produced in Pakistan and have an appreciable history of performance with silo facilities. These dryers compete suitably on performance with the significantly more expensive imported dryers and therefore dryers installed in Pakistan are typically of local manufacture. For both rice paddy and maize, mechanical dryers are able to bring moisture down from above 25 percent to the range of 13-14 percent in more than one pass with a tempering period in between passes.

Outside of Pakistan's modern mill facilities, grains are stored in bags not only in flat warehouses but also as pre-modern pyramids of bags on a plinth covered by tarpaulin ('cover and plinth', see figure 4). Modern silo storage offers a significant improvement over existing storage methods because it offers much more control of the grain under storage (see Annex 2 for comparison of cap and plinth/ganji storage, flat warehousing, and vertical silo storage). Compared to movement of air through a flat warehouse using simple ventilation or exhaust fans, silos conduct aeration of the stored grain, i.e., passing air through the grain using the centrifugal fans installed under each silo with vents in the canopy of the silo for this air to escape. This is intended to avoid the development of 'heat traps' in portions of the stored grain, prevent moisture from transferring, and generally maintain grain safety. With their fully mechanized and automated handling, silos significantly reduce dependence on labour. While flat warehousing can be flexible for storing small volumes and monitoring their quality, silo facilities make bulk handling and storage easy with firm quality monitoring of very large grain volumes with minimal spillage and significantly lower loading and unloading costs. With their vertical storage, silos allow very large grain volumes to be stored on much smaller pieces of land compared to flat warehousing.

Figure 4. Grain storage options

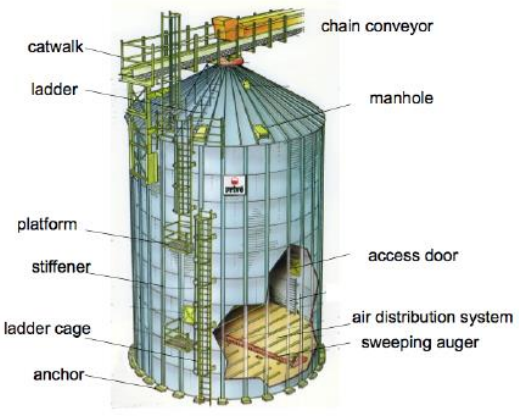
Fig 4.1. Pre-modern Cap & Plinth (Ganji) storage

Photo credit: Kazim Saeed

Figure 4.2. Bag storage in flat warehouse

Photo credit: Hassam Hussain

Figure 4.3. Silo storage



Source: Schmidt-Seeger

Most often, dozens of mini-sensors are installed on cables dropping from the top of the silo into the stored grain to give information about temperature and humidity levels in various sections of the silo. This data can be analyzed from the control role or remotely, with suitable software. Entry of grain into the silo is from a chain conveyor at its top and exit of grain is through conveyor elevators installed in its foundation. The mechanical entry and exit of grain from the silo mean no human contact with the grain. Silo facilities are common in Pakistan with industry sources providing an estimate of five million tons of silo storage installed in Pakistan. Pakistan's feed milling industry has been storing maize in silos for nearly forty years. Yet, there is no manufacture of silo facilities in Pakistan with silos imported from the United States, Turkey, China, and other origins.

Use of the silo storage technology also allows easy connectivity with bulk transportation and handling that is not only economical but also efficient in terms of time and labor. The traditional storage methods are based on

transportation, handling and storage in bags. This practice is not only laborious, time inefficient and uneconomical but also contributes to deterioration of the quality of stored commodity.

Silo operation requires a level of skill and experience, particularly, for managing the balance between the temperature and moisture inside the silo with the ambient temperature and humidity. The moisture level of the grain at entry is a critical determinant of its safe storage with preservation of quality. Silos provide much stronger protection from rodents compared to flat storage in bags but they have about the same level of protection of pests. Fumigation of grain in silos is generally easy but, in Pakistan, the fumigation practice with silos is found to vary from facility to facility often resulting in some pest resistance. Hence, strict pest control at entry and during storage requires keen attention.

1.5. IMPACT OF MISSING NEAR-FARM STORAGE

The lack of modern testing, cleaning, drying, and storage for grain quality preservation has significant impacts on the stakeholders of the rice paddy, wheat, and maize value chains, particularly, Pakistan's farmers. Taking a minimum estimate of 2.5 percent of value lost due to quality deterioration and about the same for loss of quantity, at least 5 percent of the value of the rice paddy and maize crops is lost due to sun-drying and inadequate storage in bags in flat warehouses or even out in the open. The value of this loss for rice paddy is estimated at Rs. 23 billion (US$ 137 million) and for maize at Rs. 9 billion (US$ 55 million). Wheat does not require drying given Pakistan's weather conditions around the wheat harvest but it is by far the biggest crop cultivated in Pakistan and the estimated loss in quantity of 2.5 percent means Rs. 22 billion (US$ 133 million) lost per annum. Among these three crops, sub-optimal drying and inadequate storage are causing Pakistan a loss of US$ 324 million per annum.

Since rice paddy and maize have to be dried properly (paddy within a day or two after harvest) and only large farmers have land to dry their grain, most farmers have to part ways with their crop right after harvest. This inability of the farmer to hold the crop forces a 'distress sale' since prices are generally lowest at the time of harvest. According to the last Agricultural Census of Pakistan (2010), eighty-eight percent of Pakistan's 82 million farms are less than 12.5 acres (5 hectares) although these farms only account for about half of the acreage under cultivation.

The 'distress sale' is usually made to traders/middlemen whose business model is often to commingle lower quality grain with high quality grain or even low-price varieties with high-price varieties to make a blend that may be sold at a higher price in the wholesale markets (mandi's) or to processors of the grain. This is possible because there is no testing or formal standardization of grain in the markets or where farmers are selling their produce to traders/middlemen. This also means that farmers who produce higher quality grain are mostly unable to gain a premium for it which is a major disincentive to farmer investment to achieve a higher quality crop.

Traders have little access to modern drying and storage with proper grain management. They usually rely on sun-drying and store volumes in bags. They often pay farmers late as they secure deals in the wholesale market or with processors. In the absence of a nation-wide agri-commodity market, traders are often constrained to make local deals. Therefore, farmers are short on cash even as they are part ways with their harvest.

The traders/middlemen to whom farmers sell their produce are usually also the ones supplying agricultural inputs in the area—or linked to them. Most farmers do not have easy access to the formal banking sector and are dependent on middlemen to advance them agricultural inputs for the next crop, usually on deferred payment. This deferred payment, basically caused by constrained access to credit, means that farmers are usually charged more than 10 percent extra on the cost of the inputs—an implicit interest rate north of 40 percent on an annualized basis.

The lack of grain quality preservation also means that millers/exporters suffer losses in their milling operations. The variability in (untested) grain quality arriving at the mill-gate means that mills often have to conduct significant salvage operations inside the mill facilities. Mills are most often a conduit for bank finance to flow into the agriculture sector transmitted as commodity payments onwards to traders who are then able to pay farmers, the real producers in agricultural value chains. But the volume of this financing is constrained by the balance sheet of each mills that acts as an intermediary in this way. Rice exporters often face the constraint that they cannot capture bank finance in November to secure grain required to service an export order with delivery intended a few months after harvest.

The absence of modern quality testing, drying and storage near farms or at the wholesale agricultural markets also means that a real, nation-wide market for agricultural commodities is still not a reality in Pakistan. Trading of agricultural commodities primarily remains a local activity with many additional steps to secure the assurance that the quality that is being quoted is the quality that will be delivered. A corollary of this situation is that real price discovery—which can reward the farmer's produce at its real value—cannot take place. Another constraint that emerges from the patchwork of storages is the lack of transparency about what stocks are available where—a pillar of liquid markets and a requirement for public policy regarding price stability and anti-hoarding measures.

Banks are a critical stakeholder in the agriculture sector but their exposure to the farming community is constrained by the main mode of lending to farmers: hypothecation of the farmer's future crop backed by the farmer's land as collateral. The future crop carries significant risk with the limited crop insurance regime in Pakistan and the farmer's land is difficult to liquidate. For commodity-based lending, banks have a relatively unstable mechanism which does not extend to farmers.

For selected agricultural commodities, the bank appoints an agent or muqaddam as custodian at a storage facility inside the location of their borrower, most often millers not farmers. This mode has a framework endorsed by the central bank but it has seen some major compromises. Since the muqaddam is the agent of the bank, the muqaddam compromise appears as the bank's liability. As a result, the practice of banks is often to make it an extension of balance sheet lending rather than strictly collateral-based lending. Experts in collateral-based lending take the view that this mode of collateral-based lending has been abused in Pakistan for a structural reason as well. In developed agricultural markets, this mode is used only for blue chip clients while another mode is often used for collateral-based lending to all others: warehouse receipts.

1.6. THE EWR BUSINESS MODEL

Pakistan is launching its Electronic Warehouse Receipts (EWRs) regime. Under a warehouse receipts-based financing regime, any owner of an eligible commodity can get it tested for entry

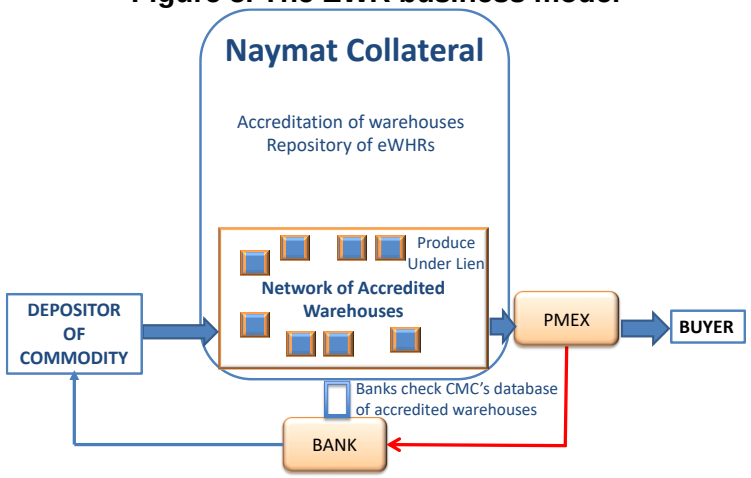
into an accredited warehouse/silo where it can be collateralized to secure bank financing. The electronic warehouse receipt is the collateral. Commodities eligible for EWR-based financing are usually non-perishable and have a highly liquid market. In Pakistan, these commodities are: wheat, maize, rice paddy, rice, sugar, oilseeds, etc. As banks as well as holders of commodity are looking for an alternative to using land as collateral for agri-financing. The agent or muqaddam mechanism has also experienced grave compromises. The prospect of receiving bank financing creates a strong incentive for all stakeholders to preserve the agri-commodity's quality so it can pass the testing requirements for proper storage. This will reduce Pakistan's high post-harvest losses.

Since most modern storage is within mill premises in Pakistan, a framework is needed to make stand-alone agri-warehousing a feasible business. Towards this goal, the EWR regime is being launched in Pakistan's agriculture sector. The first private warehouse accreditation and EWR repository company to be launched under this regime, Naymat Collateral, has been incorporated and given a license by the Securities and Exchange Commission of Pakistan (SECP) under the Collateral Management Companies (CMC) Regulations 2019. The list of Naymat Collateral's equity sponsors includes blue chip companies: HBL, MCB, Faysal bank, CDC, National Foods, K&N's, Jaffer Brothers, Atlas group, Saif group, Transhold, Pakistan Agricultural Coalition and Agrivo. The State Bank of Pakistan adjusted its prudential regulations to allow EWRs to be used as collateral by banks. The full documentation of the EWR regime has been developed (outlined in section 3.4 of this report with the warehousing guidelines and SOPs summarized in the Annex 8) with the support of the global warehouse receipts program of the International Finance Corporate (IFC, a member of the World Bank Group).

As figure 5 shows, the CMC Naymat Collateral will accredit a network of warehouses based on standardized warehousing and commercial guidelines. Anyone with an agricultural commodity eligible under this regime (mostly grains at the start) can store their produce in an accredited warehouse if their stock passes the notified quality parameters through testing at entry. Against deposits of grain, the warehouses will issue an Electronic Warehouse Receipts (EWR) in the software system operated by the CMC Naymat Collateral. Banks will provide finance by collateralizing the commodity stored in the warehouse using the same software system. The EWR's can be traded on the Pakistan Mercantile Exchange which is electronically connected with the CMC Naymat Collateral which means that the transactions can be settled seamlessly through electronic means.

The EWR regime has a long history in Pakistan. In 2010, the State Bank invited ACE Global of Switzerland to work on EWRs in Pakistan. Subsequently, pilots were conducted under State Bank of Pakistan leadership to familiarize banks with the concept of warehouse receipts-based financing. The regime could not be not launched for scale-up. The feedback from banks was that a framework was needed for allocation of roles and risks among the regime's stakeholders.

Figure 5. The EWR business model



Source: Pakistan Agricultural Coalition

To address this gap, the SECP developed the CMC Regulations and secured their initial notification by the federal cabinet in May 2017. The National Rural Support Program (NRSP), a major Pakistani non-profit focused on poverty alleviation, developed a dedicated drying and silo storage facility in District Hafizabad with SBP support and successfully piloted the participation of small farmers in collateralized lending through its microfinance lending arm. Small farmers brought in up to 25 tons of rice paddy or wheat to either sell or collateralize it for a loan. In parallel, Pakistan Agricultural Coalition (PAC), a non-profit focused on developing new models for growth in agriculture, has guided pilots with wheat, rice paddy, and maize with commercial banks, logistics companies, millers, traders, farmers, and small processors under the supervision of the SECP and SBP.

The objective of the three pilots conducted by Pakistan Agricultural Coalition was not to attain high storage volumes but to develop a commercial and scalable business model. The basic model was tested in the first pilot in 2017. The lender was HBL, Pakistan's largest bank, with the wheat crop in the Muridke area of District Sheikhupura and Agility, Pakistan's leading logistics company, was the operator of the flat warehouse provided by Long Grain Rice company. Three farmers brought 243 tons of wheat and secured lending of Rs. 4.8 million against it.

This was followed by a rice paddy pilot in late 2017 at Engro Rice Mills with a leading Islamic bank, Bank Islami, in the same area. This pilot developed the Islamic banking product for this regime. Three farmers placed a total of 30 tons of paddy in the Engro silos and one of them secured lending of Rs. 0.56 million.

The third pilot developed a microfinance lending product, conventional and Islamic insurance products, and tested the collateral management software for transaction facilitation. Nevertheless, the EWR pilots greatly benefited farmers by not only preventing 'distress sale' at harvest time and providing them much-needed access to formal credit at harvest but also fetching much higher prices after storage at the warehouse.

USAID supported Pakistan Agricultural Coalition's third pilot at Okara in 2018 through its Financial Markets Development (FMD) project. USAID supported an international expert to advise on the design of the business model, help optimize the process flow, and bring in a software package dedicated for supporting the warehouse receipts process flow. Farmers placed maize in the designated silos of the 'warehouse operator', Islamabad Feeds (a leading feed mill at Okara), after testing. Agility Pakistan, Pakistan's leading logistics company, played the role of 'collateral manager' on behalf of the participating banks and oversaw testing, handling, and storage at the Islamabad Feeds facility on behalf of the banks.

As the warehouse operator, Islamabad Feeds was responsible for the physical integrity of the commodity as well as its security and insurance. Adamjee Insurance, Pakistan's leading insurer, tailored its conventional and Islamic ('takaful') insurance policies for this regime. The warehouse operator, Islamabad Feeds, took out this insurance with each participating bank clearly identified as a co-loss payee. The participating banks developed lending products tailored for the EWR regime: MCB Bank for conventional, Bank Islami for Islamic, and FINCA Microfinance Bank for microfinance. The banks would only get re-paid when the commodity under lien gets sold, therefore, Islamabad Feeds also gave an off-take guarantee to each bank which means it would purchase any farmer's maize under lien if the farmer is not able to find a buyer for it at loan maturity. Such guarantees have been in each pilot but never needed to be called. The pilot was overseen by State Bank of Pakistan which conducted a major farmer awareness event in Okara for this pilot.

A total of about 486 tons of maize worth Rs. 7.7 million was collaterized during the pilot. Three farmers/sellers (Mr. Saqib Yaqoob, Mr. Muhammad Asif, and Mr. Zeeshan Sarwar) participated in the pilot and each brought total volumes of 312 tons, 102 tons and 1.4 tons respectively. The pilot greatly benefited the participants by providing them aggregate gains of 16%, 13% and 17% respectively after the storage period. Annex 4 shows the calculation of gains for one of the lots of farmer Muhammad Asif.

Overall, there was a positive response from all participants in these pilots with no depositors losing money on their play and no bank seeing a default. The pilots adequately demonstrated that the EWR regime can provide access to timely bank credit and bring better returns. Depositors gains would have been higher without the delays caused by late approval of the EWR-related products at the participating banks and also by processing of applications at the rural branches. The charges involved in these pilots were so readily accepted by depositors that higher charges were applied in a subsequent series of pilots conducted in 2019 and 2020 by Engro Fertilizers, the leading fertilizer company, where Rs. 18 per maund per month was paid by participants in the final pilot for paddy and for maize with Rs. 70 per maund paid for drying of each of paddy and Rs. 40 per maund for drying of maize.

Banks charged a rate (mark-up) of about 370-400 basis points above KIBOR, the benchmark lending rate, in these pilots. This was considered high by the farmers. Based on the experience in this pilot, Bank Islami reduced its rate to 250 basis points above KIBOR in one subsequent pilot and Bank of Punjab set a rate of 100 basis points above KIBOR in another subsequent pilot.

All pilots illustrated the need for active marketing of EWRs not only by the warehouse operator but also by the participating banks to attract more participation. The first pilot's main lesson was that the location of storage must be at existing points of aggregation (either at mandi or processor's site) so that participants do not have to pay for an additional transport hop and the labor charges associated with loading and unloading of their lots. Another lesson was that more than sun drying of maize is needed to pass the moisture threshold of 12 percent before storage in summer. A large amount of prospective business was lost in the maize pilot because some 2,107 tons was brought in by 22 additional farmers to participate in the pilot but was rejected due to high moisture or fungus development (which is also related to moisture level). Finally, the participation of the State Bank of Pakistan, the central bank, was a major endorsement for the EWR business model and encouraged the banks to participate.

Beyond these lessons, bankers were also collected at a meeting hosted by the central bank to secure their input regarding the results of the EWR pilots and the proposed CMC regime. Their key recommendations were:

Regulatory endorsements are needed: EWR should be approved as collateral by SBP and Okra licensing of CMC must be completed by the SECP,

To get the regime off the ground, some secure off-takers would be needed at the beginning and government support may be requested to reduce some costs,

EWRs need to be marketed better to farmer and processors/millers,

The EWR regime will soon need new testing/warehousing capacity to accredit (in addition to the excess capacity of millers which was used to conduct the pilots).

Both elements of the first input have been implemented. Government engagement with various aspects of the regime is ongoing. Better marketing of the regime must be implemented by all participating entities. Finally, this feasibility study is one of the key measures for addressing the fourth recommendation.

2. THE DRYING AND STORAGE BUSINESS

2.1. STRATEGY

The proposed business will offer reliable silo storage services with grading for maize and wheat or rice paddy and wheat or maize and maize depending on the geographic area selected. Service businesses in this space in comparator countries[14] are found to offer the following services:

i) Storage & Warehouse Receipt/collateral services (round the year)
ii) Grain Quality testing (round the year/storage period)
iii) Cleaning (peak during harvesting period)
iv) Drying (peak during harvesting season)
v) Inputs supply: seeds, machineries, chemicals, etc. (round the year)
vi) Financial services: credit, insurance, trade finance, etc. (round the year)
vii) Organized marketplace for grain (round the year)

The strategic direction of the proposed business must be to establish credibility and trust for the first four core business lines and subsequently leverage these to build the last three business lines. This is the international experience where the initial revenue growth is from provision of the core services and revenue growth in subsequent years is from the associated services particularly the arrangement of financial services for which the warehouse operator begins to apply charges to the financial institutions. To remain conservative, the financial modeling conducted in this effort only includes revenue from the core services. The focus in the initial years must be on maximizing silo capacity and utilization, increasing the efficiency of pre-cleaning and drying, increasing the utilization of quality testing lab, and minimizing operational costs to develop trust and a reputation for the high quality for services provided.

For scaling up such a business, the recommended strategy is to build up a portfolio of warehousing facilities with a couple of facilities to start with and gradual additions as the mastery of grain management and local conditions improves. This feasibility study focuses on one such facility but the commercial considerations, design choices, and revenue model outlined in this document can be replicated for many facilities.

In the short- to medium-term, two strategic pull factors must be relied upon to fill the silo storage (which drives most of the other services):

- The dire need for drying of rice paddy and maize after harvest makes the drying and storage business highly attractive for farmers, traders, and second-tier processors who do not have access to mechanical drying.
- The need for bank financing for agri stakeholders means that, under with accreditation under the electronic warehouse receipts regime, the drying and storage business has a strong pull for agri stakeholders. The service must coordinate the banks to aim for

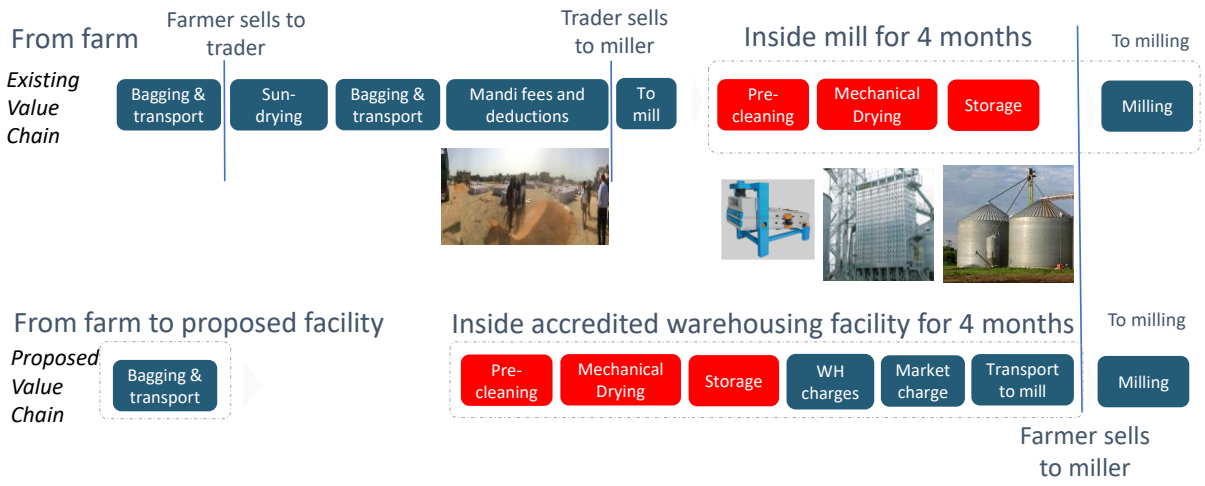
[14] StarAgri has over 800 warehouses (mostly flat) across 16 states of India and over 1.5 million tons of warehousing capacity. It has about US$ 1 billion worth of commodity under collateral management. National Bulk Handling Corporation (Pvt) Limited has over 1,300 warehouses (mostly flat) across 19 states of India and over 75 million metric tons of agri-commodities under management. NBHC has managed over US$ 3 billion worth of collateral for 54 banks.

disbursement of loans with crop as collateral as rapidly as loans against gold as collateral are disbursed (within 7 days in parts of the country).

The electronic warehouse receipts regime makes this collateralized bank financing possible. The warehouse and its operator are at the center of this regime. Warehouse operators have a clear obligation to give back the quantity and quality they take in.

To place the proposed business in the context of the existing value chains, a simple comparison can be made with a scenario that is commonly observed in Pakistan's agriculture sector. Millers and traders regularly purchase grain at harvest and place it in storage for a few months for profit-taking on the back of the gradual price increase. Gradual increase in price subsequent to harvest is a regular feature of grain value chains. The lowest price of the year

Figure 6. Comparison of existing value chain with proposed model



is typically observed at harvest time since the entire supply of a grain becomes available during the few weeks of harvest and the demand for the grain is distributed over the entire year. This play is best implemented by millers who have drying and silo storage capacity which means that at the time of sale a few months later, they can offer pristine quality grain in a market where quality grain is a highly scarce commodity so far away from the harvest. This play is not the core business of millers, but it offers the closest comparison of the proposed business model with what is happening in the market today. Figure 6 tracks the movement of the grain through the entire value chain for this play to set up a comparison with the proposed business.

2.2. BUSINESS LINES AND PRICING

At its core, the proposed drying and storage business is intended to be an operation that conducts:

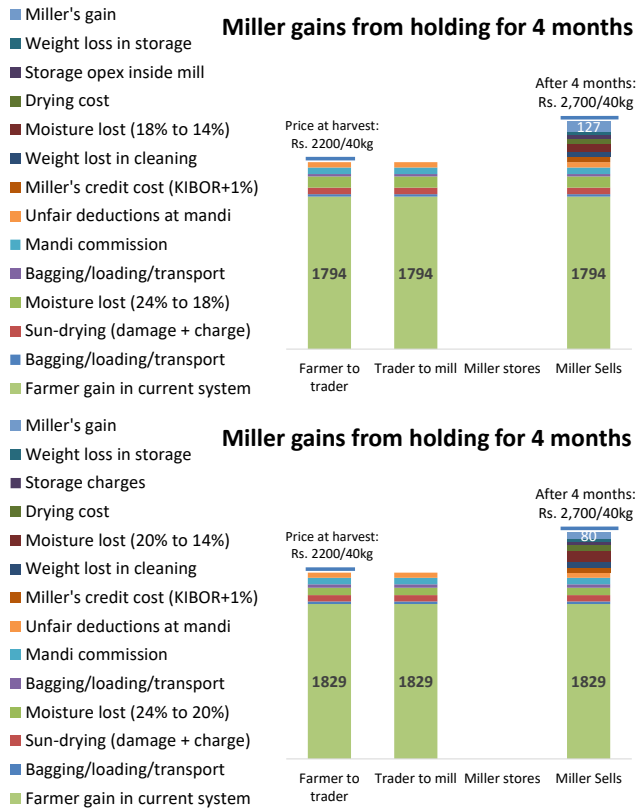
i) testing (to decide whether to accept an incoming commodity and also to grade it),
ii) pre-cleaning,
iii) drying of maize and rice paddy for the volumes to be placed in storage,
iv) drying of maize and rice paddy as a service based on availability of dryers, and
v) silo storage of commodity

For rice paddy and wheat, these offerings will be packaged primarily as

- a storage service (as testing, pre-cleaning, and drying are essential for silo storage),
- a drying service offered if the drying unit is available after drying for storage,
- a testing service offered if the testing unit is available after testing for stored volumes.

Value chain mapping of the rice paddy, maize, and wheat value chains was conducted for the purpose of exploring the range for pricing of these products. The analysis is presented here with the as an illustration. Annex A5 shows the detailed calculations and comparator graphics for all three commodities.

Figure 7. Comparison for rice paddy



At harvest time, the average farmer makes a 'distress sale' to a trader/aggregator after which the harvest is bagged and transported to the trader's location for sun-drying. Paddy is dried at drying pits and then bagged and transported to the mandi in most cases. Maize is typically first dried by farmers while the grain is still on the cob and then threshed for drying of the separated grain at drying pits generally by traders. For paddy, this sun drying typically brings the moisture from an average of 24 percent to about 18-20 percent. For winter maize, sun drying typically brings the moisture level from an average of 24 percent to about 18 percent.

The mandi has a transaction fee set by the provincial government—currently 3.5 percent in Punjab—but the price farmers get at the mandi has a number of standard unfair deductions—estimated at 2.7 percent for this report—which are found across Pakistan. Traders also charge a commission at about 1 percent of the value of the grain.

Testing at the mill facility is a rarity in the rural landscape and multiple pilots by Pakistan Agricultural Coalition have demonstrated that farmers are willing to pay for a testing service. In one of the pilots, a charge of Rs. 500 per test was applied to each incoming lot and was paid by farmers. Once the grain is tested at the mill, it passes through the pre-cleaning unit and the dryer before being placed in storage. Pre-cleaning reduces the weight of rice paddy to about 1 percent by removing about 4 percent of extraneous matter and of maize and wheat by about 1 percent by removing about 1 percent of extraneous matter. The drying step reduces the moisture level from the 18 percent mentioned above to the range of 13-14 percent which is suitable for milling as well as storage. Wheat does not require drying in Pakistan. This removal of extraneous matter and moisture means loss in the commodity's weight.

The mill bears a cost of drying for which an estimate is available from the pilots conducted by Pakistan Agricultural Coalition and Engro Fertilizers: Rs. 62 per maund for rice paddy and Rs. 40 per maund for maize. These prices were paid by real commercial participants in the pilots. But the financial modeling done for this report showed that Rs. 62 per maund is closer to the actual drying cost, without much margin, while Rs. 40 per maund only represents the operational cost of drying. In this exercise, Rs. 62 per maund was used.

Table 3. Gains from 4 months' price appreciation

Rs per 40kg	Price appreciation	Current: Gains to miller	Proposed: new gains to farmer
Rice paddy	500	127	298
Winter maize	400	174	256
Summer maize	300	119	182
Wheat	115	15	80

See Annex 5 for detailed calculations

The six pilots conducted for warehouse receipts—three by Pakistan Agricultural Coalition and three by Engro Fertilizers—indicate that the cost of silo storage is in the range of Rs. 10 per maund per month including insurance. A lower level was charged in one of the pilots since the host warehouse operator offered their facility at a rate discounted down from their actual cost of Rs. 10 per maund per month. The modelling conducted for this exercise under the electronic warehouse receipts regime indicates a cost of a little over Rs. 12 per maund per month since it includes the charges of the CMC as well as the sales tax on services. Of course, the price charged to depositors in the later pilots was higher with Rs 18 per month being paid in the last pilot. The comparison in figure 7 uses Rs. 10 per maund per month as the internal cost of the miller in the current scenario and Rs. 18 per maund per month as the price for the depositor in the proposed scenario. Over a four-month period of storage, the reduction in grain weight due to moisture loss is taken at 1.5 percent for rice paddy and maize. Meanwhile, there is typically a moisture gain of 0.5 percent in wheat over such a period.

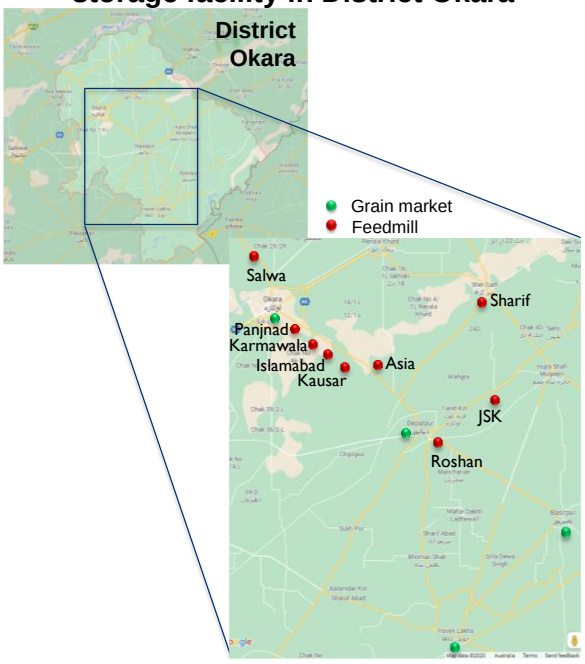
Finally, the miller's cost of funds is taken at KIBOR plus one hundred basis points (KIBOR+1%) while the farmer's cost of credit is taken as KIBOR plus four hundred basis points (KIBOR+4%). These calculations confirm what millers typically say about their gains from holding on to rice paddy after the harvest: that they are able to make over a hundred rupees per maund on it.

The same analysis was applied to winter maize, summer maize, and wheat. Annex 5 presents the detailed calculations and illustrative graphics but table GP summarizes their results. It is clear that each value chain would allow farmers to capture a portion of the gains from price appreciation after harvest if they can bring their crop to the proposed facility for drying and storage. One reason for this gain is the avoidance of the sun-drying step—this was one of the reasons for the major rejections of lots brought by farmers to the pilot facility. Another reason for this gain is the avoidance of unfair deductions applied at the wholesale market to the price eventually available to the farmer. Further, in Punjab, the new Punjab Agricultural Marketing Regulatory Authority (PAMRA) Act which applies a much lower transaction fee on agricultural trades outside wholesale market yards. This analysis identifies the pricing that can be applied to the services of the proposed business and also demonstrates that there is room for slightly higher prices to be charged as the reliability of the proposed services and credibility of the business model are established.

As an illustration, Annex 6 shows the financial needs of a maize farmer for cultivating the summer maize crop. When a maize farmer harvests the winter maize crop and place it in the silos of the proposed facility after drying, the crop's 65 maunds per acre priced at Rs. 1,200

per maund at winter harvest would have a value of Rs. 78,000 per acre. The bank would lend 70 percent of this value to the farmer which is Rs. 54,600. This can address the farmer's need for next crop. Since only about 50 percent of the total expenditure on a crop is disbursed at the beginning of the season, the farmers can collateralize only half of the winter crop to get the cultivation of the summer crop started. Beyond this, the price appreciation of collateralized winter crop can give (65 maunds per acre x Rs. 256 per maund from Annex 5 table A5.2 =) Rs. 16,640 per acre. So, this mode allows the farmer to gain from the price appreciation while resolving the issue of cash to buy inputs for the next crop. As noted earlier, the farmer who does not have ready cash to pay for inputs ends up paying about 13 percent higher prices for formal sector inputs (fertilizer, pesticide, weedicide, etc.) purchased 'on due' or deferred payment. From Table A6, this saving can be estimated as Rs.2,691. Therefore, the farmer stands to gain (Rs. 16,640 + 2,691=) Rs. 19,331 more per acre for using the proposed services under the electronic warehouse receipts regime. *This is about a 20 percent increase on the Rs. 98,500 per acre the farmer is estimated to see as revenue from the summer maize crop.*

Figure 8. Case study: Siting a drying and storage facility in District Okara



2.3. LOCATION, LOCATION, LOCATION

The majority of the revenue of the proposed business is from a rental service: storage. Hence, the choice of the facility's location can be a make-or-break decision. The operations required to provide the proposed services mean that the location must have good access to

- Farms, wholesale market(s), and mills,
- Road and transport infrastructure,
- Grid electricity and other energy sources, particularly biomass which can be a renewable energy resource, and
- Water & drainage

To allow for future expansion, a slightly larger piece of land than what is strictly required has been proposed in the financial modelling (see chapter 4). The siting recommendation is to secure a piece of land that is just off a main road to keep the vehicular traffic associated with the proposed operation off the main road.

A key choice regarding the location is the proximity of the proposed facility to existing silo storage capacity at mill facilities. It would be counter-productive to site the facility too close to the mills and interfere in their catchment area. Siting should complement the existing storage capacity of mills rather than competing with them.

To illustrate this choice, Figure 8 shows the feed mills in District Okara. These mills have an estimated aggregate storage capacity of 420,000 tons[15]. By comparison, the summer maize output of District Okara is 780,000 tons[16]. This indicates that about half of the maize output of District Okara could conceivably be serviced with modern silo storage facilities with drying capability. Such processing plants (feed mills, rice mills and flour mills) are present in the target areas of maize, paddy and wheat which have been identified in section 1.2 above. All these areas of Punjab and Sindh have suitable climatic conditions for silo storage with some differences of grain management during storage from one area to the other.

2.4. DESIGN CHOICES

One of the most important design choices for the proposed business is the total storage capacity of a given facility. Given the low crop yields and small farm sizes in the target areas, large volumes are not aggregated at one location. This factor and inputs from industry players indicate a choice of either a 10,000-ton storage unit or a 15,000-ton storage unit with sufficient space to expand as business builds up. Starting with storage capacities or 20,000 tons or more would be suitable in situation where business can be guaranteed for a stand-alone facility of this size.

Beyond the capacity of the entire facility, the choice of the unit size of the silos that comprise the facility is important as well. The most common choices are silos of 2,500-tons each which are typically of 60-foot diameter and silos of 3,300 tons each which are typically of 72-foot diameter. Since the electronic warehouse receipts regime has declared at least three grades for each eligible crop, it would be ideal to have multiple silos which can house sizable volumes of each grade. This points in the direction of the 2,500-ton silo unit.

Storage by grades means that stocks of different depositors which fall into the same grade will be commingled. It is important to note that these tonnage numbers are specific to rice paddy. Wheat and maize have higher bulk densities (weight per volume) than rice paddy and therefore will pack a greater weight in the same volume of the silos. This will allow greater revenues.

2.5. THE PROPOSED FACILITY

The proposed facility requires additional space to accommodate the capacity that will be installed first, an area to accommodate providers of associated services (banks, input suppliers, etc.), space for flat warehousing if required, and possible expansion in future. The preparation of this land involves levelling. More importantly, for planning civil works and a bill of quantities for the grain station, geological/soil testing of the land is required to check the condition of the earth that is going to bear heavy loads of grain in a vertical silo structure.

As figure 9 shows, the construction of office space and accommodation for staff, a parking shed for 10 vehicles and roads for vehicle mobility are also proposed. A 100-ton truck weighing scale is suitable for this facility since the typical truck carries 20-40 tons of grain and modern dumper trucks may carry heavier loads. To remove human intervention in weighment,

[15] Team estimates
[16] Source: Crop Reporting Services, Agriculture Department, Government of Punjab

the weighbridge will have direct electronic connectivity with the enterprise resource planning system of the facility.

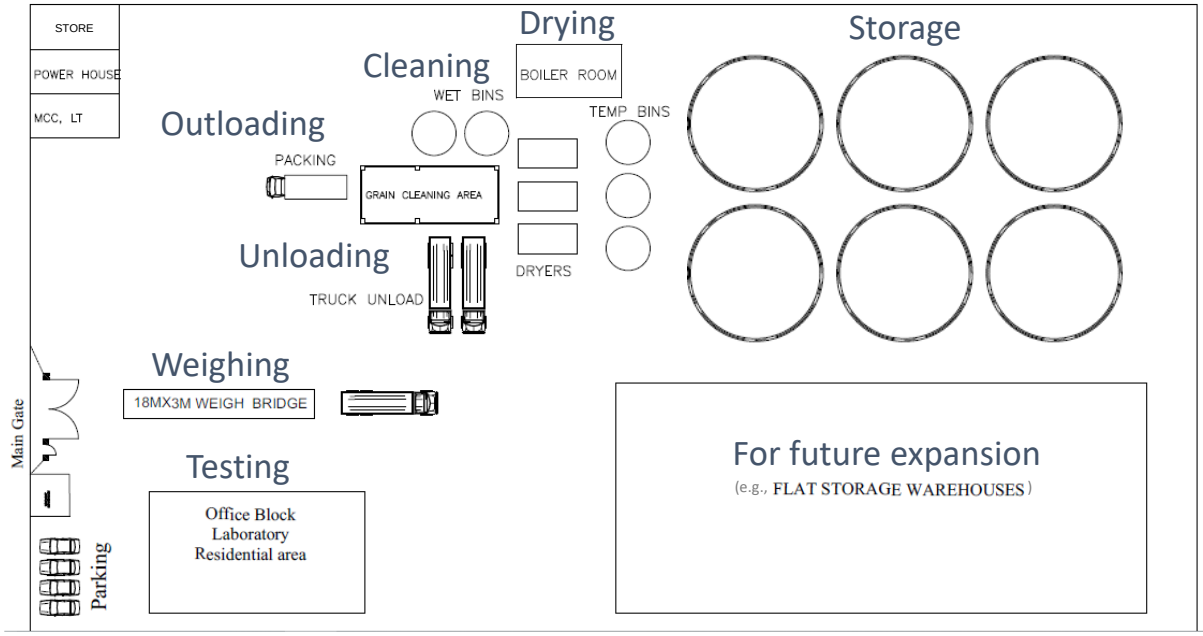
To facilitate speed of grain delivery at the facility, the grain receiving set-up includes dumping units for two vehicles to unload simultaneously. Grain dust filters will be present to collect dust during unloading. Gravitational force utilization is the principal that governs the loading and unloading of silos.

Grain unloaded in dumping hoppers will be transported horizontally by motorized conveyer to motorized bucket elevator for vertical transportation of grain to start the pre-cleaning process.

This will be done by passing the grain through

i) a magnetic separator (for separation of metal impurities),
ii) a motorized drum cleaner (for separation of coarse impurities that are larger in size than the grain, and
iii) a motorized sifter (for separation of tiny impurities that are smaller in size than the grain) and motorized aspirator (for separation of light weight impurities).

Figure 9. Sample site lay out (not to scale)



Completion of pre cleaning results in a grain that has less impurities and is ready to store if it is in dry condition (<13% moisture for more than one-year storage). By passing through the precleaning system through gravitational force, this precleaned grain is then moved through vertical transportation through bucket elevator either to a motorized conveyer for a silo destination or the buffer bins of the dryer that are placed to hold the pre-cleaned wet grain for drying. Two buffer bins can support the three-dryer set-up for almost 24 hours.

Three column type dryers equipped with motorized bucket elevators are proposed to circulate the grain in column and high velocity fans for intake of ambient air passing through heating coils to raise its temperature and reduce the relative humidity. The moist air that has taken some moisture from grain to dry the present grain can be let out. It is supported by a steam

line from a 1000 heating surface boiler using biomass as a fuel. When the grain batch has received its targeted moisture, it will be shifted to one of three tempering bins to cool down. Each tempering bin will be designated for a dryer to facilitate the whole operation. In this state, this cool grain can be transported by motorized bucket elevator to a motorized conveyer for its silo storage destination.

The grain will rest for the rest of its storage life in steel silos which are a cylinder shape space with galvanized, corrugated walls, supported by stiffeners and wind pipes. Silos have a steel roof with vents and one exhaust fan for each silo to facilitate the grain and head space temperature differences. Two centrifugal fans for each silo with air flow rate of 0.1-0.2 cfm/bushel (depending upon grain type: wheat requires more than corn) will pull the air from the environment and push it through the grain through air ducts in the bottom of silo structure. Efficient use of this aeration system will reduce quality and quantity losses during storage.

The silos will be equipped with 3D inventory sensors and ICT/IoT based temperature and moisture sensors that will keep the silo operators/warehouse operators updated regarding the storage conditions.

For unloading and packing of stored grain, discharge gates in the bottom of silos will release the grain by gravitational force and will be transported horizontally by motorized conveyer to delivery point where grain will be elevated by motorized bucket elevator to a hopper with options of bagging and bulk transportation. Pneumatic system with a compressor is in place to operate all gates/valves in loading, unloading.

All electrical supplies will be from the main control center (MCC) and programmable logistic control (PLC) with interlocking of all receiving, precleaning, drying, loading and unloading systems to save energy and time.

2.6. PROPOSED PROCESS FLOW

The process flow for silo operations is laid out in detail in the warehousing guidelines that are a key component of the EWR regime's documentation. The details of those guidelines will be followed by the proposed facility to comply with the requirements of accreditation and therefore need not be reproduced here. This section provides specifics on a key part of that process flow: what will happen when a new lot is received and how the quality will be checked as a new lot reaches the facility.

The entry of materials in the vehicle's bill of lading (e.g., quantity, supplier, number of bags, etc.) will be made in the bill of lading receiving register/system kept by gate keeper at the facility's main gate. Then, the token number for this lot will be issued by the gate keeper and security staff will direct the vehicle to its specified parking area. Then, the bill of lading will be collected by the laboratory sampling staff from the main gate with his signature on the bill of lading receiving register. Sampling is the process of collecting small quantities from various portions of the lot which produces a random and scientifically representative sample of the lot for testing. Once the unloading slip for the vehicle is issued, sampling will be done by the laboratory's sampling staff. This is an important step since the grade (and therefore the value) of the incoming lot is determined based on the testing of this sample.

Entry of all incoming raw materials will be made in the lab register/system as per the bill of lading and physical sample verification. Inside the lab, the moisture of the sample will be

determined with a moisture meter and physical quality of the sample will be checked for any damaged or fungal particles. Calibration of the moisture meter and other testing equipment will be done for the specific grain under review according to the approved protocols or patent procedures recommended by the Association of Official Analytical Chemists (AOAC). The field moisture meters will be re-calibrated before the review of every new lot while the fluorometer will be calibrated once a year. The moisture level of the sample will also be determined using a hot air oven by adopting the standard procedures.

Once the testing is complete and the lot is considered acceptable to the facility, the vehicle(s), will be declared to have passed by the manager of the facility's quality control team by signing off on both the bill of lading and the unloading slip. The signed bill of lading and the unloading slip of the passed vehicle(s) will be handed over to the weighbridge scale operator by the lab sampler for weighment. First weighment of the loaded vehicle(s) will be made by the scale operator after verifying signature on the bill of lading and the slip. Vehicle will be led to parking in the unloading area by security staff. Then according to the token number, unloading of material will be made in the presence of a sampler.

The sampling staff and the silo operation team will determine the destination (dryer intake position number/silo number) of the commodity as per the lab's test declaration. The sampling staff, equipped with a field moisture meter will continue doing spot checks as the unloading progresses. If any change is observed during unloading in the quality parameters, unloading will be stopped and reported to the quality control manager onsite for further directions.

Once the unloading has taken place, the weighment of the empty vehicle as per store keeper and lab report and system generated note will be issued by the scale operator duly signed and verified by the store officer. If any stock is partially rejected, then the scale operator will issue a rejected material slip which will be duly signed by the quality control manager. The gate pass for the rejected material/bags will be issued by the laboratory staff after signature of the quality control manager onsite. Then the vehicle will be allowed to leave from the main gate after verification of all the above-mentioned documents by the gate keeper/security staff.

As per the accreditation requirements, selected staff notified to the CMC will be allowed to issue a new electronic warehouse receipt (EWR) in the CMC's software system against the lot received. The standard Warehouse Storage Agreement which is part of the EWR regime's documentation will be signed with the Depositor of the lot in whose name the EWR is issued.

In the EWR documentation, exit from storage of the lot underlying an EWR is called 'delivery'. Delivery will start with the presentation of the documents listed in the EWR warehousing guidelines by the current Holder of the EWR. Vehicles to withdraw the commodities will be moved to destination of delivery point either through bulk loading or in bagged form. Each delivery will be checked for quality before dispatch with a corresponding signature of the Holder of the EWR.

2.7. SURVEILLANCE

Most often in Pakistan, silo operators use manual operations for monitoring stock quality and quantity. For the proposed facility, it is recommended to shift the monitoring of the quality and quantity of the stock inside the silo to an Enterprise Resource Planning (ERP) system with the relevant Management Information System (MIS) using information & communications

technology and the Internet of Things (IoT) where applicable. This will not only provide support to the warehouse operator but also to the CMC, participating banks and insurance companies.

Temperature, moisture and carbon dioxide concentrations are the major parameters of the quality of grain stored in a silo. These are the key indicators of the development of any 'hot spot' in the grain, insect activity, and fungal growth. According to the current practice in Pakistan, temperature cables are installed in silos from which temperature data of the stored grain is collected manually as required by the silo operator. This manual operation is laborious and time-consuming. It is recommended that the silos are equipped with ICT-based hardware to not only secure the real-time quality monitoring data but also generate email/sms alerts regarding the quality of the stored grains. Furthermore, temperature cables have a high depreciation rate and a repair option is generally not available. Finally, although grain temperature is a good indicator of stored grain quality, it does not provide advance information about moisture migration. Alerts about expected moisture migration play a key role in maintaining stored grain quality and in securing the silo steel structure itself. These quality issues may lead to the following safety issues: the silo may catch fire, the silo may dislocate with structural damage, a silo worker may be entrapped in the grain when addressing this type of issue by entering the silo, etc.

The use of IT and ERP for inventory management and surveillance is also being used with good results to uncover frauds at many facilities in Pakistan. It is recommended that the grain storage facility's MIS use a software that is linked with the weighbridge scale with no rights of editing by staff—simply the auto weight saving option. Many storage stations may be linked in this way to reduce the incidence of fraud at the weighbridge which has been witnessed in Pakistan.

The use of ICT-based monitoring of commodities in storage has begun to spread in Pakistan and good results have been achieved. Therefore, it is recommended that the silos at the proposed facility are equipped with 3D/contactless radars that can measure even a quarter-inch change in the quantity level of the stored inventory.

Fumigation and Aeration are the vital areas during storage. Fumigation is the use of chemicals to save grains from insects. Most commonly, Aluminum Phosphide 56 percent tablets are used in Pakistan. Fumigation is somewhat difficult and needs special attention with care to safeguard grain which can save lives of fumigators and other nearby residents.

Aeration helps the grain to maintain its quality. Efficient utilization of the ambient environment with the knowledge of Equilibrium Moisture Content (EMC) of each grain helps the silo operator to safeguard grain quality in the silo. A combination of aeration and fumigation is recommended to save the grain from infestation.

2.8. HUMAN RESOURCES

The proposed facility will run well-understood and time-tested technologies. But their operation requires robust technical expertise in a complement of human resources that have the relevant experience with these technologies. Annex 7 lists a staff count of thirty personnel broadly divided into teams for management, administration, marketing, silo storage, testing lab, drying, security, boiler room, security, and HSE. Some double-hatting is possible within this count of thirty. The financial modelling conducted for this study indicates that a

management overhead with a CEO, CFO, and other executive can be supported by a portfolio of 8 to 10 facilities of 15,000 tons proposed in this report.

The highest priority is to source professionals with the relevant expertise, experience, and integrity for this operation. Since silos have been in operation in Pakistan's poultry feed industry for nearly forty years and have been in active use in the country's wheat and rice value chains for a couple of decades, there is a good number of professionals in the various areas of expertise required for the proposed facility.

2.9. INSTALLATION AND COMMISSIONING

The proposed grain storage facility may be commissioned in close to 30 weeks after financial close has been achieved. This requires a combination of the following tasks conducted in parallel. Steel silos for bulk storage are not manufactured locally. Irrespective of country of origin, metal silos can be expected to take about 25 weeks to arrive at the site. The other imported items are the testing equipment which can take a much shorter period to import. The other key machinery is all local: the receiving system, pre-cleaning unit, drying unit and packing systems. For this machinery, about 20 weeks is a reasonable time. The civil works can be expected to take about 25 weeks just in time for the arrival of the metal silos. With the above tasks completed in coordination, the installation and commissioning can take 1 to 4 weeks after the silos arrive and the civil works have been completed. This takes the expected duration from financial close to commissioning at nearly 30 weeks.

2.10. RISKS AND THEIR MITIGATION

The key risks to the bottom line and reputation of the proposed business mainly emanate from the sampling and testing activity, the reasons that can result in weight shortage, risks during storage, risks from improper silo operation, fraud and theft. The minimum insurance requirements of the EWR regime are listed in Annex 8 which include fire and allied perils insurance which provides cover for physical risks to the silo and its contents as well as insurance for fraud/infidelity which takes place with malintent by the warehouse operator's staff and for professional indemnity to cover for the results of negligence by the staff. This section discusses the operational and other risks that the warehouse operator will need to manage. Regulatory risks are discussed in Section 3.

Sampling and testing risks A key risk at the time of receipt of commodity at the warehouse is the incorrect assessment of its quality and grade. This risk can be addressed by ensuring that scientific random sampling is implemented by the sampling team and rigorous testing is conducted by the analysis team. Further, active multi-level supervision of the sampling and testing activity with frequent sampling can reduce mistakes and attempts at fraud. Another risk at this stage is the possibility of excessive mixing of the incoming product with lower grades. This risk can be addressed through appropriate testing on calibrated equipment and regular/surprise audits to verify the quality of stocks held at the warehouse, including through reputable third-party inspection and testing companies.

Weight shortage risks There are a handful of risks that can cause weight shortage which can bring serious liability to the operation. If the weighing scale is not calibrated properly, the accuracy of weight measurement gets compromised. To eliminate this possibility, fit-for-purpose weighing equipment/scales must be used with suitably frequent calibration. As

required by the EWR regime, valid calibration certificate must be obtained to support accuracy of measurement. Next, improper handling of commodity can result in spillage and loss of stock. This may be addressed through periodic cross-checks with the facility's own dead weights as well as other scales and weighbridges in the vicinity. Shortage of quantity can also be addressed through simple steps of due diligence such as counting of bags at unloading.

Storage risks The deterioration of commodity during storage is a serious risk for the proposed business. This can be addressed through strict quality testing at entry, regulator monitoring of stocks during unloading, proper pre-cleaning, adequate drying, regular monitoring of stocks during storage with proper aeration and fumigation.

Another source of risk during storage is weight reduction due to moisture loss. The key to mitigating this risk is to reject incoming lots with moisture levels above acceptable limits. These acceptable limits can be set by the facility's management with reference to the maximum moisture levels acceptable under the EWR regime as notified by the Pakistan Mercantile Exchange (PMEX). Of course, it is common practice to apply a cushion for limiting this liability. For example, a 3 percent cushion was applied for rice paddy in the pilots conducted for the EWR regime and this was accepted by farmers since they understand that such a weight loss occurs. This can be implemented by stating in the warehouse storage agreement signed with the depositor that moisture loss of up to a certain percentage during storage will be acceptable at the time of withdrawal. But any weight loss higher than such a limit would be a liability for the warehouse operator. Wheat may actually experience a gain of up to 0.5 percent during storage of a few months due to moisture gain.

Another key risk during storage is infestation by insects. The main measure to deal with this risk is a strict testing protocol that rejects any incoming stocks that have a live infestation. Further, fumigation of stocks during storage is another measure to deal with this risk.

Silo operation risks Some in-storage risks are associated with improper operation of the silo equipment. For example, broken grains may be produced if the conveying and elevating system is not working properly. Periodic maintenance is the solution. As listed in the EWR regime's warehousing guidelines, re-circulation during silo storage should be avoided.

Fungal growth may start if grain batches with high moisture are included during silo loading. Samplers and management must ensure that only adequately dried grain is loaded into the silo.

Infested grains are produced when aeration and fumigation are not up to standards and requirements. Further, silo fire incidents can happen when improper fumigation practice is performed. Closed loop fumigation is one of the best solutions. High moisture grain in storage may also cause this type of risk that may be avoided by continuous monitoring and proper use of aeration system and ensuring that adequately dried grain is loaded into the silo.

Grains can heat up if aeration of silos is not done properly. Moisture migration not only shrinks the grain but also produces rust on silo walls. The solution is to match all aeration operations to weather conditions.

Grain quality can also be compromised through contamination with other grains which were stored earlier in the same silo. The solution is to clean and empty all process lines before changing the grain type during arrivals and deliveries.

Negligence in loading silos can cause live insects to enter and may also create a major risk. The sampler and the silo operator must be skilled to manage this risk and must be supervised regularly.

Silo collapse incidents happen when unloading of a silo is not taken by central discharge of silo. The solution is proper checks and balances on the silo discharge gates. Re-circulation of stored grain should be discouraged in general. During re-circulation, if the central discharge gate is not operated (usually by mistake), such an incident may take place.

Fraud by the warehouse operator's staff is a critical risk for all stakeholders of the EWR regime. Fraud by warehouse staff by diverting goods can lead to serious liability for the warehouse operator. This can be addressed through strong procedural controls such as, multi-layer checks, separation of maker of each document from its checker, electronic link of weighbridge scale to ERP, inventory management, and routine surprised audits by the warehouse operator's management, etc. The fraud/infidelity insurance cover is part of the EWR requirement, but operational vigilance must be the first line of defence against fraud. The weighbridge is always a vulnerable component. A suitable ERP system with suitable MIS as well as a skilled weighbridge operator can eliminate the risk. Scale operator rotations are also a management tool that can mitigate this risk.

Theft risk can be addressed by ensuring that the boundary wall of the facility is secured with barbed wire, by achieving physical security through private security guards, and monitoring the facility through CCTV cameras, etc. The appropriate insurance cover to be obtained under the EWR regime's warehousing guidelines is an important mitigation tool as well.

Market risk the proposed facility will be developed under the EWR regime which is new and has not been marketed widely yet. Therefore, the market risk consists in low uptake of the new services to be offered under this regime. However, as indicated by the need for drying and bank credit in Pakistan's rural areas, there is a case to be made for rapid uptake of the proposed services. But the benefits of these services will be to be actively marketed and the cost-benefit analysis of these services (as illustrated in Annex 6) will need to be explained to each customer category.

3. LEGAL AND REGULATORY FRAMEWORK

At its core, Pakistan's electronic warehouse receipts (EWR) regime includes accredited warehousing of agricultural commodities against which EWRs are issued and then collateralized by banks to lend to the owner of the agricultural commodity / holder of the receipt. These activities also involve the buying and selling of the EWR whether through simple transfer from one holder to another or their trading on the Pakistan Mercantile Exchange (PMEX). These activities entail oversight by the government regarding information about the location and technical, managerial, and financial status of licensed warehouses and the quantity of agri-commodity stocks held there, market monitoring and possible action for ensuring supply and affordability of essential food items, and accessibility of effective finance to various agricultural market players. This section outlines the legal and regulatory framework for the conduct of agri-warehousing services and activities for the benefit of potential investors.

3.1. LEGAL STRUCTURE AND INVESTOR PROTECTIONS

For purposes of the discussion which follows, it would be appropriate to set out certain basic principles of the Pakistani legal system at the outset. Pakistan is a constitutional federal republic. The Constitution provides for legislative powers to be divided, subject-wise and territorially, between the Centre and the various Provinces. Although Pakistan is a common law country, almost all of its laws are codified. The statutory laws are largely based on English Law. It is also important to note that the Constitution of Pakistan recognizes fundamental rights. Article 24 of the Constitution of Pakistan recognizes the fundamental right of all persons (not merely citizens, but also foreign investors) to be protected from compulsory deprivation of property except in accordance with law, and Article 10A recognizes the fundamental right of all persons to due process, inter alia, in respect of the determination of their civil rights and obligations.

In addition to the above, the Company Law of Pakistan permits foreign ownership of companies as well as foreign directorship of companies, subject to subsequent vetting and approval by the Ministry of Interior. Moreover, the Foreign Exchange Manual of the State Bank of Pakistan permits the remittance abroad of a company's dividends subject to certain conditions. Recently, the State Bank of Pakistan has also enacted a simplified procedure for the repatriation of disinvestment proceeds (F.E. Circular No. 05/2020). Finally, the Protection of Economic Reforms Act, 1992 further supplements the protections named above insofar as foreign investors are concerned.

3.2. LEGAL FRAMEWORK OF WAREHOUSING BUSINESS

A warehousing arrangement is legally categorized as a contract of bailment and the law in respect of bailment is comprehensively set out in Chapter IX of the Contract Act, 1872. A bailment is defined under Section 148 of the Contract Act as 'the delivery of goods by one person to another for some purpose, upon a contract that they shall, when the purpose is accomplished, be returned or otherwise disposed of according to the directions of the person delivering them.' Under Section 151 of the law, the bailee (i.e., warehouse keeper) 'is bound to take as much care of the goods bailed to him as a man of ordinary prudence would, under similar circumstances, take of his own goods'. Section 166 and 167 deal with the rights of third-party claimants to the goods and it excludes liability for the bailor (i.e., warehouse keeper) where he acted 'in good faith'.

Furthermore, the sale of goods (including agricultural produce) is dealt with under the Sale of Goods Act, 1930. Section 2(4) of the Sale of Goods Act explicitly recognizes as a 'document of title to goods,' a 'warehouse-keeper's certificate… warrant or order for the delivery of goods, and any other document used in ordinary course of business as proof of the possession or control of goods, or authorizing… the possessor of the document to transfer or receive goods thereby represented'. In addition, under Section 33 of the Sale of Goods Act, goods may be 'delivered' pursuant to a sale by 'doing anything which the parties agree shall be treated as delivery or which has the effect of putting the goods in the possession of the buyer or of any person authorized to hold them on his behalf'. The Sale of Goods Act recognizes, therefore, the sale of agricultural produce through the delivery of a warehouse receipt.

Insofar as electronic warehouse receipts (EWR) are concerned, the Electronic Transactions Ordinance 2002 provides, in Section 3 thereof that 'no document, record, communication, or transaction shall be denied legal recognition, admissibility, effect, validity, proof or enforceability of the ground that it is in electronic form…' And Section 4 of the said Ordinance provides that 'The requirement under any law for any document record, information, communication or transaction to be in written form shall be deemed satisfied where the document, record, information, communication or transaction is in electronic form…'

On the subject of collateralization for the purpose of loans, Section 172 to 179 of the Contract Act are especially relevant, and they provide legal recognition to contracts of pledge as a sub-set of contracts of bailment. Under Section 176, 'in case of a default in payment of a debt', the pawnee (i.e., also known as a pledgee) may 'bring a suit against the pawnor upon the debt or promise, and retain the goods pledged as a collateral security; or he may sell the thing pledged on giving the pawnor reasonable notice of the sale'.

Reading the above laws together, it is clear that the underlying legal framework necessary to enable an agri-warehousing and Electronic Warehouse Receipt ('EWR') regime is already in place in Pakistan: the Contract Act sets out specific rules relating to warehousing (i.e. bailment), setting up a clear and transparent relationship between the depositor and the warehouse owner (as well as possible liability to third-party claimants); the Sale of Goods Act, coupled with the Electronic Transactions Ordinance, recognizes and provides a mechanism for the trading of EWRs; and the Contract Act permits the collateralization of loans by financial institutions through a pledge over stored goods.

3.3. PROVINCIAL AGRI-WAREHOUSING LAWS

As was mentioned above, Pakistan is a constitutional federal republic and the Constitution provides for legislative powers to be divided, subject-wise and territorially, between the Centre and the various Provinces. The Provinces have legislative authority to enact laws in respect of food and agriculture, and many such laws are presently in force and are being administered by the respective Provincial Agriculture Departments.

The Sindh Registration of Godowns Act, 1995, and the Punjab Registration of Godowns Act, 2014, require the compulsory annual registration of all warehouses holding 'essential articles', and the respective Provincial Governments are empowered to notify what goods and produce would fall within the scope of this term for purposes of these acts. Neither of the two laws prescribe specific pre-conditions for registration. They simply state that the Registering Authority shall 'make such inquiry and require the owner to furnish such information as… necessary'. Under these two laws, the warehouse owner must 'maintain and produce for inspection of such books, accounts and record relating to the essential articles stored in or removed from the godown'. In Sindh, the Registering Authority is the Director General of the Bureau of Supply & Price. Under the attendant rules, the annual registration fee is Rs.1,000/- and a stock register must be maintained in the prescribed format and submitted to the Authority fortnightly. In the case of Punjab, the Registering Authority is the Director (Agriculture Economics and Marketing). The attendant rules, if they have been framed, have not been publicised. In the case of Sindh and Punjab, the enforcement of the registration law is inconsistent. The main focus of the two laws is monitoring and information gathering, for purposes of aiding in enforcement of the food control and anti-hoarding laws which are discussed in more detail below.

The West Pakistan Foodstuffs (Control) Act, 1958 (as subsequently amended and adopted by each of the respective Provinces) is important to note. For the purposes of this law, 'foodstuffs' includes wheat, rice, paddy, and such other commodities as each respective Provincial Government may choose to regulate at its discretion. Section 3 of the law confers broad power on the Provincial Government to pass an order 'so far as it appears to be necessary or expedient for maintaining supplies of any foodstuff or for securing its equitable distribution and availability at fair prices'. An order 'may provide for regulating or prohibiting the keeping, storage, movement, transport, supply distribution, disposal, acquisition, use, or consumption thereof and trade and commerce therein.' And without prejudice to the generality of the foregoing, the law further provides powers for 'regulating by permit or license', 'controlling prices', 'regulating storage', 'prohibiting the withholding from sale', 'requiring any person holding stock... to sell the whole or specified part to such persons or class of persons… as may be ordered', 'regulating or prohibiting any class of commercial or financial transactions', 'requiring persons engaged in foodstuffs business to maintain and produce for inspection books of account', and 'search and seizure'.

In addition to the above, Sindh and Punjab have also enacted laws in respect of anti-profiteering and hoarding of 'essential commodities' and 'essential articles', namely, the Sindh Essential Commodities Price Control and Prevention of Profiteering and Hoarding Act of 2005 and the Punjab Essential Articles (Control) Act of 1973 as well as the Punjab Prevention of Hoarding Act 2020. These laws essentially regulate the hoarding of and profiteering in 'essential commodities' and 'essential articles'. The Sindh Act mentions wheat flour, and rice, but not wheat or paddy. Meanwhile, the 2020 Punjab Act mentions paddy and wheat flour.

Under these laws the respective Provincial Governments are empowered to regulate price of notified commodities, and to ensure the availability for sale of produce.

In addition to the above, it is important to note that there was a system in place which earlier regulated the sale of agricultural commodities outside notified market areas overseen and regulated by market committees, i.e., through the Agricultural Produce Markets Act, 1939. However, subsequent legislative amendments in Punjab and Sindh have done away with these requirements, although it still remains in force in Khyber-Pakhtunkhwa.

Under the Sindh Wholesale Agricultural Produce Markets (Development and Regulation) Act, 2010, the earlier law has been repealed in its application to Sindh, and private and direct sales and purchases of wholesale produce outside the territory of a market committee are now permitted. The implementation of the new laws remains inconsistent, however, and earlier market practices are reported to continue in some cases.

Insofar as Punjab is concerned, the current law in effect on the subject is the Punjab Agricultural Market Regulatory Authority Act, 2018 ('the PAMRA Act'). Under this law, the Regulatory Authority ('PAMRA') consists of the Special Secretary for Agriculture Marketing at the Punjab Agriculture Department, the Director-General Punjab Food Authority, the Director-General Punjab Food and Drug Authority, three Provincial lawmakers nominated by the Government, the Vice-Chancellor of an agri-university to be nominated by the Government; four persons from the private sector, and the Authority's Director General. PAMRA is now the primary regulator for agriculture produce markets in Punjab. Under Section 11 of this law, a warehouse is defined as a 'key service provider' and it needs to be registered with PAMRA. PAMRA is also authorized to collect an 'annual fee' and to regulate the business of warehousing on a Provincial level. Since PAMRA has not yet framed its own rules and regulations, the precise scope of its interaction with the business of agri-warehousing is somewhat uncertain at the time of writing this report.

As can be seen from the above discussion, the Provincial Laws introduce significant uncertainty and regulatory risks into the agri-warehousing business. Insofar as the Foodstuffs Control and Anti-Profiteering and Anti-Hoarding laws are concerned, it can only be hoped that the respective Provincial Governments will be encouraging towards corporate-run businesses by reputable owners since all their operations will be transparently run, as opposed to the informal sector which has traditionally dominated this sector, and therefore less likely to be misused for purposes of food hoarding. This will, however, require industry outreach to the Provincial Government so as to be able to highlight their concerns and reservations. Secondly, insofar as the PAMRA Act in Punjab is concerned, it introduces a statutory body which has the power to specify operational and regulatory requirements on warehouses which potentially may run in parallel to (and possibly even in conflict with) the EWR Regime regulated by the Securities and Exchange Commission of Pakistan (the 'SECP'), which is discussed in more detail in the following section. To avoid this, it is important that the SECP and its licensed CMCs should, through an interactive process, arrive at a result which is mutually acceptable to both governments. And it is quite critical that this process should be carried out before any potentially inconsistent regulations are issued by PAMRA.

3.4. DESCRIPTION OF THE EWR REGIME

The Securities and Exchange Commission of Pakistan (the 'SECP') is the statutory regulator for companies under the Companies Act 2017 and the Securities Act 2015. Section 457 of Companies Act has empowered the SECP to regulate 'agriculture promotion companies' and 'collateral management companies' which may 'manage produce as collateral', 'carry out warehousing', 'issue warehouse receipts for agricultural commodity financing' and 'stock audit and verification services'. Pursuant to the powers conferred under this and other provisions, the SECP has framed the Collateral Management Companies Regulations, 2019 (the 'CMC Regulations'), which form the basis for the EWR Regime. In October 2020, these Regulations were further amended on the advice of the International Finance Corporation (the 'IFC'), a member of the World Bank Group, to bring them more closely in line with international practices.

Under the CMC Regulations, the SECP will register a CMC to carry out two essential functions which are central to the EWR regime: to accredit warehouses and to maintain an electronic system to act as a repository of EWRs. The purpose behind the CMC Regulations is to facilitate the banking industry's lending to the agriculture sector and for this purpose, significant powers have been conferred on CMC.

CMC's fundamental responsibility is to accredit warehouses which meet certain notified criteria. These criteria are discussed in more detail hereunder, in the section on 'Accreditation Criteria for Warehouses'. In order to grant and maintain certification, the CMC carries out periodic (as well as unscheduled) inspections of accredited warehouses and their operations based on its standard operating procedures (SOPs) regarding commercial aspects of the warehousing operation and its Warehousing Guidelines regarding physical and procedural aspects of the warehouse (both are outlined in Annex 8. It also frames basic criteria which must be met for accreditation as well as fit and proper criteria for key warehouse officers.

Under the CMC Regulations, all warehouse receipts must be issued electronically by the warehouse operator on the EWR software system of the CMC. Physical Goods Receiving Notes (GRN) may be issued on a short-term basis but they are not capable of being transferred or pledged, and they must be replaced with an EWR within a few days. The CMC is empowered to operate an electronic system (i.e., the 'EWR System') which serves as a repository for EWRs issued by accredited warehouses.

To recognise lending against EWRs, the State Bank of Pakistan (which is the central bank and the statutory regulator for commercial banks) has amended its prudential regulations for Corporate/Commercial Banking through BPRD Circular No. 21/2019 so as to include loans against 'pledged' EWRs as a form of 'secured' lending.

The CMC frames Standard Operating Procedures ('SOPs') and Warehousing Guidelines which set out the operational requirements to be complied with by accredited warehouses in order to maintain their accreditation. These are accompanied by standard templates of the following contracts: (i) Accreditation Agreement; (ii) Storage Agreement; (iii) Electronic Warehouse Receipt ('EWR') and Goods Receiving Note ('GRN'); (iv) Participation Agreement/System Usage Agreement.

The CMC Regulations envisage that eventually, the electronic repository maintained by CMC will be interlinked with the Pakistan Mercantile Exchange ('PMEX') so as to support trading of deliverable futures contracts through PMEX's centralized marketplace. By way of background, the PMEX is licensed under the Futures Markets Act 2016, under the regulatory supervision of the SECP. The PMEX is licensed to trade in standardised futures contracts which are

approved in advance by the Commission, in consultation with relevant government agencies and departments. The SECP's intention is that trading in respect of EWRs will primarily be carried out through listing on the PMEX.

At present, one company has been registered as a CMC by the SECP, Naymat Collateral Management Company Limited. Its sponsors include the Central Depository Company Pakistan, several of Pakistan's largest commercial banks (Habib Bank, MCB Bank, and Faysal Bank), key agri and logistics industry players (Jaffer Brothers, K&Ns, National Foods, Saif Group, Atlas Group, Transhold, and Agrivo), as well as the non-profit Pakistan Agricultural Coalition.

3.5. COMPARATIVE ANALYSIS OF THE EWR REGIME

3.5.1. Comparison with Existing System

When compared to the existing informal system, the CMC Regulations contain significant advantages (discussed in section 1.6 of this report) which mitigate the risks for various stakeholders, but also additional reporting and regulatory responsibilities for accredited warehouses:

Accreditation Criteria for Warehouses: - Under the existing informal system there is no private or public system for accreditation of warehouses. In contrast, Regulation 11 of the CMC Regulations sets out detailed criteria for accreditation. While that is too detailed to spell out in its entirety, some notable requirements are as follows: (i) the Warehouse Operator must be approved by the CMC, it must be financially capable and it must have adequate trained staff with necessary expertise; (ii) the warehouse must be suitable with respect to the produce which is being stored, and it must be equipped with necessary equipment as stipulated, including (without limitation) for sampling, testing, grading, weighing, loading and unloading, segregation, pest management, drying, handling, etc.; (iii) it should have adequate facilities to maintain sufficient level of security; (iv) it should be comprehensively insured as prescribed in the SOPs; (v) financial securities in the form of bank guarantees covering a certain portion of risk must be provided to the CMC for the coverage of third-parties; (vi) it should be electronically connected with the CMC at all times. One disadvantage to warehouse operators under the accreditation requirements is that licensing is for one year and it then needs to be renewed. A longer licensing period would potentially give greater confidence to the investor. Another disadvantage is the significant paperwork and disclosures required to be made for purposes of obtaining accreditation.

Warehouse Staff: - Under the existing informal system there is no independent scrutiny of the warehouse staff employed at warehouses. In contrast, Regulation 6(j) of the CMC Regulations requires that the CMC should before accrediting a warehouse (and, as a condition of accreditation) ensure that its key officers meet the Fit and Proper Criteria set out in the Standard Operating Procedures. Moreover, under Regulation 4(p) the CMC is also required to 'specify the qualifications, code of conduct and practical training for Warehouse Operators, inspectors and Warehouse specialized staff'. The draft Standard Operating Procedures by NCML (which are presently under scrutiny by SECP) anticipate that four key officers should be subject to the fit and proper criteria: - the CEO, the CFO, the Head of Operations / Warehousing, and the Head of Quality Control / Testing. Notably, 'Weighbridge Operators' are not included in the list of officers required to be subjected to

the fit and proper criteria. The notified officers are required to provide police clearance certificates and character certificates from local notables (e.g., village headman, revenue official, police officer, etc.) In addition, the fit and proper criteria require that they should not have availed any loan write-off and there should be no bank default, they should not have been convicted by any court of law, nor should they have entered into a plea bargain with the National Accountability Bureau. From the perspective of an investor, the fit and proper criteria may be somewhat cumbersome to satisfy in rural areas where the warehouses are intended to be set up, but it is important from the perspective of depositors.

Electronic Safeguards: The existing informal system is completely paper-based and, as a consequence, fraud is rampant in the form of forgery, false documents, and duplication of receipts/transfer documents. Under the proposed EWR System, all warehouse receipts must be issued through the electronic system. Furthermore, the draft contracts proposed by NCML as part of the SOPs provide that a transaction in respect of goods stored at an accredited warehouse is only valid if registered on the electronic system. As a consequence, the possibility of third-party claimants to the goods relying on duplicated, forged, or false documents is significantly lessened. The only physical document issued to depositors is either an information copy of the EWR, which evidences the holder/pledge status of the document at the time of issue, or a Goods Receiving Note ('GRN') a temporary, and non-assignable, non-transferable document which may be issued for a time-bound period only in case the electronic system is inaccessible. This reduces the risk for the accredited warehouse operator since there is less likelihood of legal claims being raised on the basis of forged or false documents, and the electronic system is presumed to be authoritative as to title to any given EWR.

CMC Oversight: - The CMC is an independent third-party registered by SECP, the corporate regulator. Its sponsors and directors are subject to strict pre-qualification scrutiny, and must meet the fit and proper criteria specified by the SECP. It is subject to the Code of Corporate Governance applicable to listed companies. A CMC cannot own its own warehouses except by SECP permission and subject to such conditions as SECP may specify. It must have adequate capitalization. Under the Regulations, the CMC exercises active oversight over the affairs of the warehouse. In particular, Regulation 12 gives the CMC powers to ensure that the SOPs and Warehousing Guidelines (along with the Regulations as a whole) are being complied with by cancelling or suspending accreditation: -

'If the CMC becomes aware of information on the basis of which it is reasonable to conclude that the Warehouse Operator, or the Warehouse itself, have materially breached, or are not in compliance with, the requirements of applicable law, these Regulations, or the Standard Operating Procedures or the Warehousing Guidelines, or the material written undertakings given by the Warehouse Operator to the CMC, the CMC may suspend or cancel the Warehouse's accreditation through a detailed written order, after giving the Warehouse Operator an opportunity of being heard.'

In addition, under Regulation 12A, the CMC may issue instructions to a warehouse where it becomes necessary to take action to protect the interests of other participants (i.e. financial institutions and/or depositors), including in respect of the release (or withholding of release) of produce to any person, the suspension, cancellation, or imposition of terms in respect of any EWR issued by the accredited warehouse, the imposition of restrictions on any aspect of the warehouse operations, to carry out an audit, or to arrange additional

insurance coverage, or to incur capital expenditure in respect of the warehouse's maintenance, refurbishment, renovation or redesign. From the perspective of the Warehouse Operator, the broad powers given to the CMC and the fact that CMC also controls whether the Operator will continue to remain accredited in the future are a significant risk. Notwithstanding the same, it is important to note that the CMC is itself a regulated entity (i.e., by SECP), and also a private corporate entity, which is likely to effectively limit overreach of these powers.

Claim Management: - In the existing informal system, in the event of a dispute the parties are forced to rely on the Pakistani legal system, which is ill-suited to this purpose for two reasons: - (i) The practice of issuing ex parte (i.e., without notice) injunctions in civil matters on the first date of hearing is common; and (ii) it often takes years to resolve the issue, by which time the goods stored at the warehouse may no longer be marketable. The SOPs drafted and proposed by NCML offer an alternative claim management system whereby a person raising a dispute may take it directly to CMC for resolution. Given its quasi-regulatory power over warehouses (including the power to suspend or cancel accreditation, and to carry out inspections, etc.), CMC may be able to use this claim management system to resolve a significant proportion of disputes which may arise by relying on the financial securities and insurance policies arranged by the accredited warehouse, or by proposing a mutually agreeable private settlement. There are some advantages to this approach, most importantly, savings with respect to time and legal costs. In many instances, the time required to resolve a claim in a civil court in Pakistan is simply unpracticable for most business people. The disadvantage however is that CMC, given its mandate, is likely to give a determination which takes into account commercial factors and not merely legal ones. It is also worth keeping in mind that the claim management procedure does not (and legally, cannot) preclude legal proceedings in case either party is simply unsatisfied with the final decision.

Insurance & Financial Securities: In the existing informal sector warehouses are generally uninsured. In fact, no insurance products were available for warehouses in respect of fraud and fidelity insurance and these have only very recently been developed and marketed, specifically for the purpose of the EWR Regime. Under the SOPs proposed by NCML, insurance coverage is required to be arranged by a warehouse for the entire value of goods proposed to be stored at the warehouse in respect of 'Fire and Allied Perils' which includes 'Holder, or Operator. This includes Fire & Lightning, Riot & Strike Damage, Malicious Damage, Earthquake (Fire & Shock), Explosion, Atmospheric Disturbance, Aircraft Damage, Impact Damage & Burglary and Housebreaking)'. In addition, through a combination of insurance and bank guarantees, the warehouse is required to ensure up to 30% of the value of goods proposed to be stored at the warehouse in respect of fraud & fidelity coverage. In addition, the Warehouse Operator also provides a personal indemnity bond covering all loss 'in respect of any loss or damage suffered as a consequence of its failure to maintain the quantity, grade, weight and quality of Produce and/or to maintain adequate insurance coverage as required under the CMC Regulations and SOPs'. (It should be noted that while the indemnity bond is not immediately encashable, it amounts to an acknowledgement of liability on the basis of which a claim can then be brought in a civil court).

Securitization: The existing informal system of agri-warehousing severely limits the potential of financial institutions to extend loans to farmers, especially small-scale farmers. Under the existing system, produce is 'pledged' to banks through the appointment of an agent of the bank known as a muqaddam who physically takes safekeeping of the produce

by going to where the produce is stored (typically at the borrower's location) and taking them into his custody. Banks may rely on their own full-time officers to act as muqaddams, or occasionally hire third-party contractors to take on this role. The muqaddam is intended to control the produce by making sure it is not misappropriated. In actual practice, collusion with borrowers by the muqaddams is a common problem faced by banks. To make matters worse, in the event of a default banks have to rely on court proceedings to acquire transferable title to the produce. Although the Financial Institutions (Recovery of Finances) Ordinance, 2001 provides for summary foreclosure and sale however the statutory provision in question is presently under litigation and the Supreme Court is expected to decide on its legality in the coming years.

The proposed SOPs by NCML attempt to confront this problem by incorporating a securitization mechanism which has proven highly effective in Pakistan over the last decade, which is the mechanism for enforcing a pledge over securities held by the central depository. Under the electronic central depository system, securities are pledged by placing a 'block' on their transfer or sale by the bank. Upon default, the securities are transferred into the account of the bank at the click of a button, and then may be disposed at the bank's discretion. Notable courts are, by statute, prevented from issuing injunctions in respect of securities. At best, they may grant certain financial coverage of damages. The EWR System being developed by NCML incorporates a similar mechanism which significantly reduces the risk for banks. A third-party claimant who is not registered as the 'holder' of the EWR in the EWR System is entitled only to seek damages, not an injunction, and the warehouse (as well as third-parties dealing with an EWR) are contractually obliged to deal with the holder of the EWR as registered in the electronic system.

3.5.2. International Comparison of Pakistan's EWR regime

The EWR Regime proposed to be set up in Pakistan is broadly similar to systems in comparator countries although there are some key differences. Some important comparative features to be noted are presented in Annex 10.

So, according to various international experiences, the WHR regime has got, at least, 3 (three) main areas of application:

- Physical trade operations to effectively transfer the ownership (title) on agricultural produce (grain) without moving it out from the accredited warehouse.
- Using WHR as a collateral in obtaining finance (credits) at the financial institutions (banks).
- Supporting the physical delivery procedure at the commodity derivatives exchange.

There are only few countries where all three areas of WHR application exist (like, for instance, USA, Canada, Holland, etc.) In some countries (like, Bulgaria, Kazakhstan, Ukraine), the application of the EWR regime is mainly focused on the usage of the receipts as a collateral in various financing schemes, mainly to ease an access to additional funds / finance for agricultural producers / farmers and processors.

Some other countries (like, Hungary, Turkey, South Africa), are mostly focused on the usage of the WHRs as an effective tool of physical commodity delivery at the existing commodity exchanges. This area of EWR application significantly helps to develop

organized (central) marketplaces (commodity exchanges) in these countries and makes their agricultural / grain markets more transparent, liquid, and trustable.

In this regard, Pakistan has got a unique opportunity to positively absorb all the advantages provided by other countries' experiences in order to develop its own EWR regime on a highly-integrated basis not only to increase efficiency of the current grain trade operations (both, in spot and organized markets), but also to develop a viable EWR financing, mainly for farmers and processors.

As in many other countries, it will require the establishment of the well-developed network of accredited warehouses in the main grain-producing regions / provinces, and effective management structure of the EWR regime. Such a regime in the other countries is mainly regulated and supervised by the state organizations. But the Pakistan approach differs a bit as it relies on the supervision of a private, licensed Collateral Management Company (CMC), which could be more flexible and efficient, rather than bureaucratic, from the implementation point of view.

Finally, to compare with many other countries, there is a lack of one very important element of the current EWR regime in Pakistan: the availability of well-functioning grain quality system which is supervised by the government. Ideally, an accredited warehouse should have a well-equipped grain laboratory or station that is supervised not only by the CMC, but also by the central (national) grain laboratory. The development of the national grain quality system (based on the central grain laboratory's standards & testing procedures) should be considered as a strategic task of the Government of Pakistan.

Any potential investor needs attentively to follow up all the above-mentioned EWR regime peculiarities and to accept them accordingly. One needs to realize that the grain warehousing business could be rather profitable if a warehouse is accredited and included into the EWR regime. The existing EWR regulation is encouraging enough, and the Government of Pakistan is enthusiastic to further stimulate its successful implementation in the country.

3.6. FUTURE DEVELOPMENT OF THE EWR REGIME

Following the enactment of the CMC Regulations and the licensing of a CMC has accelerated the development of the EWR Regime in Pakistan, there are still several avenues for further development.

Notably, significant legislative work would be ideal so as to achieve two objectives. Firstly, it is necessary to streamline governmental and regulatory oversight. As discussed above, there are too many overlapping statutes, as well as regulatory and reporting requirements. All this is further complicated by the fact that these parallel laws are administered by the Federal and Provincial Governments, respectively. Secondly, and equally importantly, it is necessary to provide a statutory framework which complements the legal system under development by way of Regulations and private contracts. A law supplementing the securitization mechanisms proposed by NCML (which mirrors the benefits extended to banks under the Central Depositories Act, insofar as securities are concerned) would greatly enhance the strength of the EWR regime.

Furthermore, the development of a central standards and grain quality testing organization would greatly enhance the capacity of warehousing business and enable third-parties dealing with receipts to do so with greater confidence. A dedicated central agri-laboratory with knowledge of the local and international standards and agri-market, which has the technical capacity and the legal authority to set and enforce standards, could be extremely beneficial.

3.7. NOTABLE INCIDENCE OF TAX & OTHER LEVIES

Income Tax: - Under the Income Tax Ordinance 2001, as at present the Rate of Tax for Companies is 35%, but for this particular year (i.e., 2019-2020) it has been revised downward to 29%. In case of an individual or association of persons (i.e., a partnership or firm), the rate of tax is 35% for income above Rs. 3,000,000/- per annum. At present, there is also a 3% withholding rate on payments made in respect of warehousing services, which serves as a 'minimum tax.'

Depreciation Allowance: - Taxpayers are allowed a deduction in respect of depreciation at the rate of 15% for all plant and machinery (including prefabricated silos). In addition, an initial first-year allowance of 25% is permitted in respect of plant and machinery.

Workers Welfare Fund and Workers Profit Participation Fund: - Establishments are liable to pay 2% of their annual income to the Workers Welfare Fund maintained by the Federal Government. In addition, every company is liable to transfer 5% of its annual profits to a statutorily mandated corporate fund maintained for the benefit of its labourers known as the Workers Profit Participation Fund.

Punjab Sales Tax on Services: In the Province of Punjab, income from 'services provided by warehouses or depots for storage including cold storage' is taxed at a rate of 16%. Income from mechanical drying services offered by a warehouse may be taxed as a 'service in relation to supply of tangible goods including machinery, equipment and applicable for use, without transferring right of possession' at a rate of 16%.

Sindh Sales Tax on Services: - In the Province of Sindh, income from 'warehouses or depots for storage or cold storages' is taxed at a rate of 13%.

Federal Sales Tax on Goods: - Under the Sixth Schedule, there is a sales tax exemption for Pakistani agricultural produce, which has not been subjected to any further manufacturing process.

PAMRA: - The Punjab Agricultural Marketing Regulatory Authority has the power to levy annual fees on warehouses and other fees. The rate of such fees has not yet been stipulated since PAMRA has only recently been formed.

4. FINANCIAL ANALYSIS

Keeping in view the low yields and smallholding prevalent in Pakistan's agriculture sector, detailed financial modelling was conducted for a drying and storage facility of 10,000 tons capacity for rice paddy with three silos of 3,300 tons each of US origin and 30 tons per hour drying capacity. Annex 9 shows the results based on an estimated investment cost of Rs. 250 million with a debt-equity ratio of 60:40. The results did not show a commercially attractive return even with the storage charges set at higher levels than those paid during the pilots conducted for the warehouse receipts regime in Pakistan. For example, even at a rate of Rs. 25 per maund per month for storage of paddy and Rs. 15 per maund per month for wheat, the IRR to equity was found to be 10.9 percent and simple payback at 9.9 years (see annex 9). The business exhibited liquidity constraints in its first five years—of debt repayment—as shown in annex 9 using IRR to equity as a proxy. With a longer debt tenor and even higher rates for storage and drying, the IRR to equity rises to 23 percent and simple payback to 7.4 years.

To address these returns, a number of measures and interventions were evaluated to help improve these returns. Two measures were found to be more effective than the others. The reduction of the sales tax on services from 16 percent to 5 percent increased the base case IRR to equity from 10.9 percent to 21.6 percent while reducing the simple payback to seven years and also improved the liquidity position of the business with each year. By comparison, the other measure of providing grant support to the project to the tune of 50 percent of the proposed equity increased the equity IRR to 18.1 percent with the simple payback falling to 8 years. But this measure did not ease the liquidity constraints of the business during the tenor of its debt. Given these results (summarized in annex 9), the capacity of the drying and storage was lifted to 15,000 tons and analysis was conducted to evaluate the returns at this as well as the modes of policy support required.

Detailed scenario analysis was conducted to evaluate the 10,000-ton, 15,000-ton, and 20,000-ton configurations with US- and Turkish-origin silos. Table A9 in annex 9 summarizes the results of this analysis. Based on these results, the 15,000-ton configuration using Turkish silos was selected for further evaluation in this section as the recommended initial investment for this business which can be expanded with additional silo capacity once the business gets established.

The assumptions used for the analysis in this section, intend to mirror the numbers tested in the pilots. The choice of the pilot results (see table 4) as the basis of a base case is to establish a minimum of what we know can be accomplished in the market. The pilots enabled a test of the market demand, gain insights into the feasibility of providing storage services as well as identifying potential challenges as well as opportunities that could proactively be addressed through a more responsive marketing and business strategy. Similarly, the value chain mapping (see section 2.2) illustrates the market value being created and highlights the potential to charge a premium for the services being provided. These insights have been used to define and evaluate a 'high case' case towards the end of this report (see section 4.7.5) that, despite associated challenges, should be the target for investors.

4.1. DESCRIPTION OF THE FINANCIAL MODEL

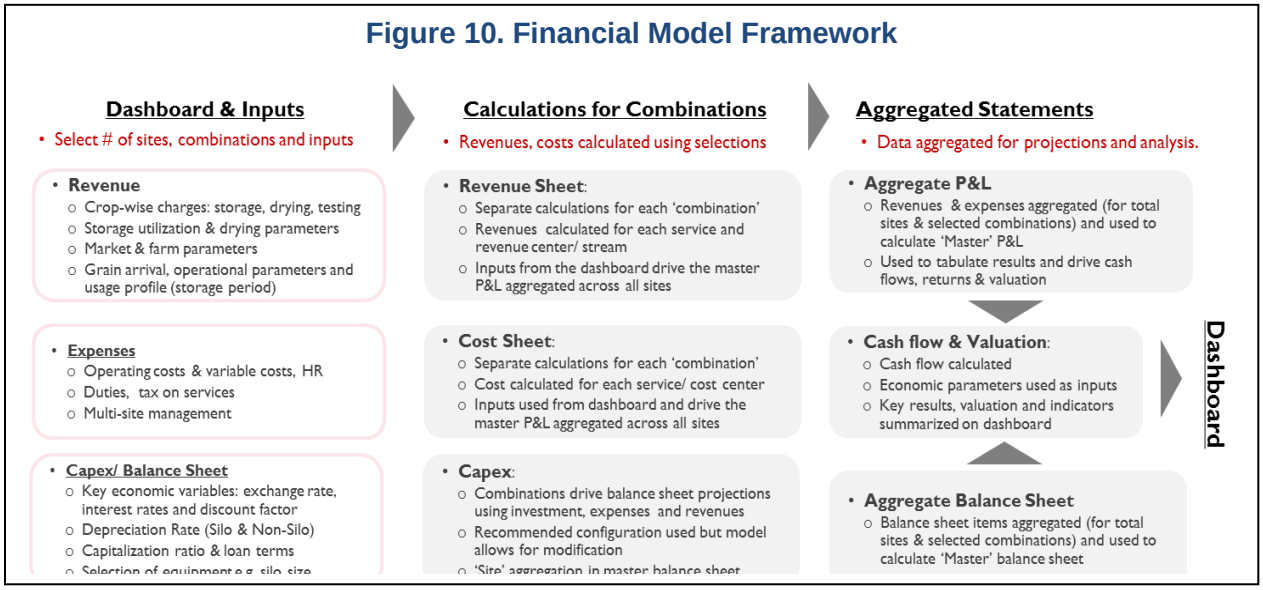
The model has been structured with the objective to effectively i) simulate the market dynamics and operational complexities impacting the business, ii) build in the requisite

flexibility allowing for strategic analysis, and iii) ensure robustness and accuracy of the results and outputs. The overall financial modeling framework and information flow is illustrated in figure 10.

This financial modeling employs a 10-year horizon for detailed modeling and employs terminal calculations for all subsequent cash flows. The complete list of variables and assumptions can be reviewed for an in-depth assessment of the model's capabilities – salient capabilities include:

- allowance for four crop and geography combinations
- modeling crop seasonality and impact on expenses, revenues and timing of cash flows
- tailoring service variables for each crop and geography combination
- incorporating variances in consumer preferences and market dynamics for each crop and geography such as holding period and lot sizes which are important for the business
- accommodation for utilization of storage and drying services
- flexibility to configure the facility (capacity and origin of equipment)
- comprehensive modeling of revenues, expenses and cash flows
- incorporation of taxation, depreciation, interest
- fully linked and automated annual financial statements

Figure 10. Financial Model Framework



4.2. FINANCIAL PROJECTIONS

Unless noted otherwise, the projections and analysis conducted in this section rely on a 'base case' that uses the combination of key business variables listed in the table below and assumes a 15,000 MT storage facility with the configuration recommended in Section 2.5 that ramps up to full storage utilization during the third year of operations (70% for Year 1 and 85% in Year 2).

For clarity and effective articulation, the *wheat & paddy grain combination in Punjab* will be the primary configuration analyzed. However, the impact of changes in geography and grain combinations is covered as part of the comprehensive scenario analysis later in this section. A complete list of assumptions and variables is included in a separate worksheet in the financial model.

Figure 11. Annual Grain Storage Volume

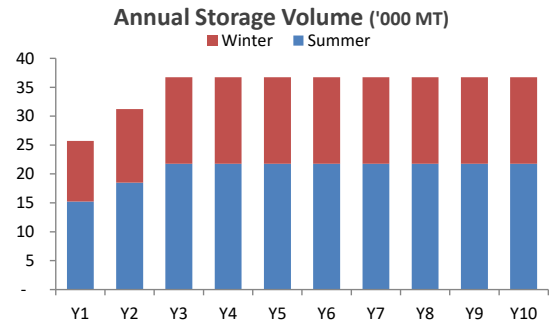


Table 4. Variables – Base Case

Sr	Variable	Value	Wheat	Paddy	Maize Summer	Maize Winter
1	Storage Capacity (Metric Tons)	15,000				
2	Loan Tenor	5 years				
3	Debt to Equity Ratio	60:40				
4	Storage Charges (PKR/Maund per Month)		15	18	18	18
5	Drying Charges (PKR/Maund)		-	70	60	60
6	Testing Charges (PKR/Test)		5,000	5,000	5,000	5,000
7	Holding Period (Months)		5	5	5	5
8	Import Duties on Equipment	28%				
9	Tax on Services (Punjab)	16%				
10	Borrowing Rate	6%				
11	Exchange Rate (USD to PKR)	165				

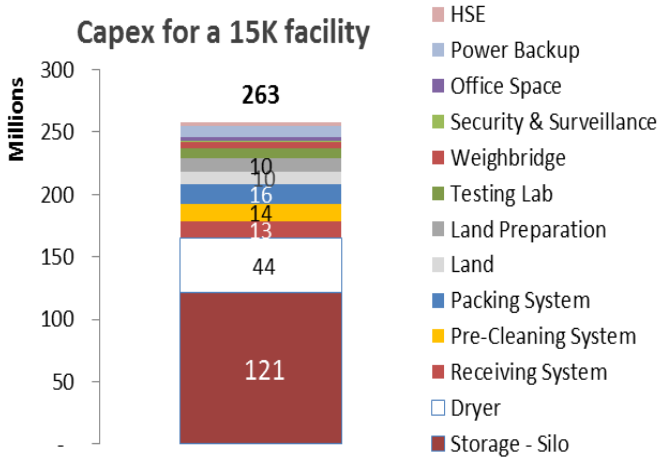
4.3. INVESTMENT REQUIREMENT

An initial investment of PKR 283 million (USD 1.71 million) is required for this business. This includes

i) capital expenditure of an estimated PKR 263 million (USD 1.59 million) that includes the cost of purchase, transportation, installation and the applicable taxes & duties;
ii) initial cash reserves of PKR 20 million (USD 0.12 million) required to cover operating expenses during the ramp up period.

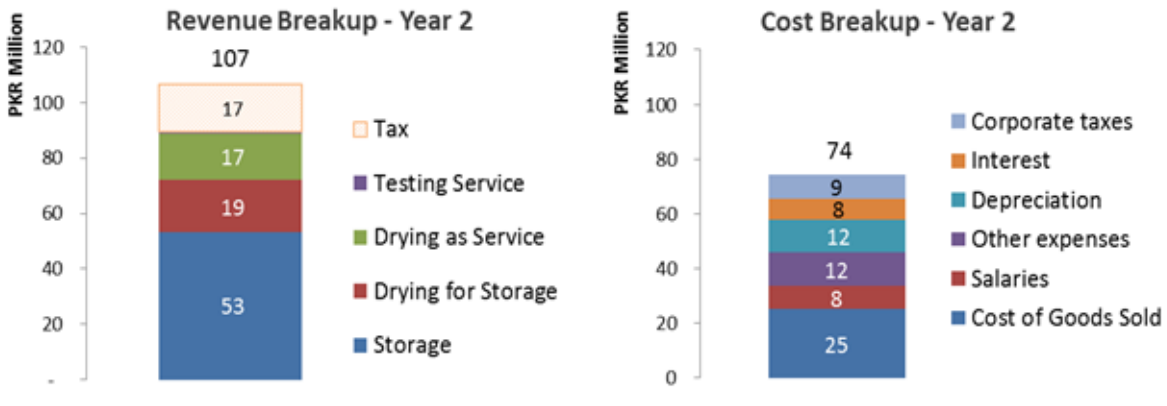
Capital Structure: The base modeling has been done using a *debt-to-equity ratio of 60:40.* This has been validated using various studies analyzing non-financial firms in Pakistan – a study employing panel data from 179 companies between 2000-2015 puts the average debt ratio at 0.56 which increases for firms with a higher capital requirement (e.g., it increases to 0.61 for textile companies)[17]. The accompanying financial assumptions used in the model, including the borrowing rate (6% as under the State Bank of Pakistan's Financing Facility for Storage of Agricultural Produce) and a loan tenor of 5 years are typical in Pakistan's corporate sector. The scenario analysis that follows compares the impact of deviations from this structure on the sustainability and profitability of the businesses. These deviations may be driven, among others, by the size of the initial investment, size & predictability of cash flows and the risk appetite of financial institutions and the investors.

Figure 12. Capital Expenditure Breakdown



Capital Expenditure A breakdown of the overall capital expenditure is outlined in figure 12. The 'category-wise' costs shown below are all-inclusive and each category includes the equipment, civil & electrical works (including labor and material for installation) as well as all the applicable duties and taxes. As the figure shows, the storage and the drying systems

Figure 13. Total Revenues and Costs



[17] Tauseef, Sana & Lohano, Heman. (2017). Capital structure and profitability of firms in the corporate sector of Pakistan. 12. pp55.

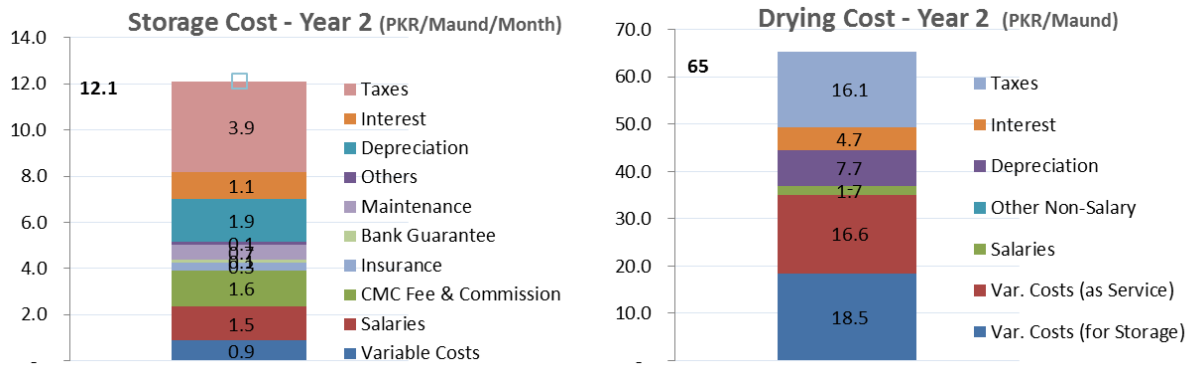
constitute the bulk (63%) of the total capex. The silos and the testing lab equipment (30% of the total capex) are imported items and are subject to a 28 percent import duty. The equipment costs about 72 percent of the total capex, the civil works around 26 percent and the electrical works 2 percent.

Revenues and Costs The storage business requires strict adherence to certain quality and technical parameters prior to being allowed for storage at the facility. This entails the testing, cleaning and drying (if required) of the incoming grain before being stored. The storage fee is a 'bundled' charge based on the weight of the grain and the storage period that includes grain testing and cleaning as well. However, the customer is charged (one-off) separately for any drying that may be required. In case of excess capacity – both drying and testing can be extended (as supplementary services) to other customers as well who require these services without the need to store the grain. The breakdown of the service-wise contribution to the overall revenues is illustrated alongside the overall cost structure in figure 13.

As can be noted, storage accounts for 59% of the net revenue of PKR 89 million (after adjusting for taxes amounting to PKR 17 million) with the remaining largely contributed from drying. The split between revenues from drying for storage and drying as a service depends on the various factors including but not restricted to capacity of storage and dryer, grain combination, location and harvest duration. Revenues of testing as a service are not as substantial as other revenue sources. It should be noted that taxes are sizeable compared to the total revenue and limit the ability of the business to pursue an optimal pricing strategy in a market with relatively low willingness to pay.

Details of Operating Expenses The breakdown of the operating expenses for the two primary services (storage and drying) is outlined in figure 14. As a leveraged business with high capex, interest and depreciation expenses both form a significant part of the overall non-variable expenses (25% for storage and 19% for drying) as illustrated in the figures below. The variable costs (primarily energy costs) of providing storage services are relatively low and when combined with salary expenses, only account for 19% of the expected monthly cost of PKR 12.1/maund. The remaining cost attribution for storage largely comprises of taxes (33%), CMC fee & commission (13%) and insurance/ bank guarantee charges among others.

Figure 14. Cost Breakdown for Storage & Drying Services



Drying is an energy intensive process, and expectedly this is also the main component of the variable cost (54% of the cost/ maund) with taxes accounting for 25% of the total attributable costs/maund. Given this association, any volatility in the changes in per-unit energy costs will

significantly impact service profitability. The energy costs were assumed to be constant over the period of the financial projections.

Lifetime of Storage Infrastructure & Investment Horizon The primary components of the storage and associated infrastructure have a long useful life with a well-maintained silo lasting more than 20 years, dryer lasting up to 14 years and other components such as the pre-cleaning, receiving and packing systems with useful lives of 10+ years. The wear and tear of moving parts will require routine maintenance and it is critical to maintain the machinery to maximize their useful life. The financial model and analysis incorporate both the depreciation and maintenance expenses.

Given the nature of the business and the initial capital requirement, the cash flows will improve over time as the debt is paid off and the investor will only reap benefits upon the completion of the loan tenor – 5 years for the base case. Therefore, the investment horizon should be 5 years or more.

It must be noted that in the absence of a secondary market, the investor does not have well-defined exit options at the time of their initial investment and may only be able to divest by bringing on additional investors. Large corporate investors and conglomerates are likely to have access to additional divestment options – but are presented with a similar investment horizon. The detailed cash flow analysis and returns (see below) include a sensitivity analysis of various variables on the overall profitability and sustainability of the business and also provide additional context to the investment horizon.

4.4. FINANCING OPTIONS

The financial modelling and scenario analysis in the subsequent sections underscores the importance of the many variables impacted by the choice of financing and their impact on the conglomerates returns to equity (as measured by the internal rate of return to equity), the payback as well as the sustainability of cash flows.

The variables of particular interest include the:

- interest rate (and the ability to borrow at a preferential rate e.g., in the SBP facility)
- capital structure (and the impact of a lower leverage e.g., a 50:50 debt to equity ratio)
- loan tenor (and its effect on easing liquidity challenges during the initial period)

4.5. PRO-FORMA FINANCIALS

The technical and financial assumptions for the base case as outlined within this document were used to develop the following pro-forma financials over 10 years (Annex 9).

1. Annual Income Statement
2. Annual Balance Sheet
3. Annual Statement of Cash Flows

It is pertinent to note that the accompanying financial model can be used to simulate various scenarios and generate accompanying financial statements. The results from detailed simulations conducted by the team are analyzed in the next section.

4.6. RETURNS

The calculations of the internal rate of return (IRR) to equity as well as the payback rely on the detailed annual cash flow simulations based on the assumptions outlined earlier. The cash flows over 10 years have been used to project all future cash flows and, in turn, calculate a terminal value representing all future business activity as represented by

i) cash flow from operations (including all revenues and expenses affecting cash)

ii) cash flow from investing (to address additional capital expenditure required after each 20-year period signaling the end of the plant & equipment's useful life)

The IRR to equity and payback is calculated using all cash inflows and outflows from the perspective of the investor. The following terminal value assumptions have been used for the base case as well as the scenario analysis in the next section.

Table 5. Factors Impacting Terminal Value	**Values used for Analysis**
Free Cash Flow Growth	No growth
Weighted Average Cost of Capital (WACC)	14%
Increase in nominal CAPEX after 20 Years	350% (~7% per annum)

The base case for this business shows only moderate returns and is structured as a low margin, high volume business that will likely struggle to generate significant cash flows after demanding debt and tax obligations.

As structured presently, the business yields *an internal rate of return (IRR) to equity is 16.6% and a pay back period of 8.1 years*. The net present value is a modest Rs. 64.8 million, but remains highly sensitive to assumptions affecting the terminal value including nominal changes in price, the discount factor used (weighted average cost of capital) and the sustainability of the business.

4.7. SCENARIO ANALYSIS

The analysis in this section relies on detailed simulations and market validation to i) identify the most sensitive variables impacting the profitability and sustainability of the business and ii) to develop an achievable 'high case' that represents a 'sweet spot' for private investors by building on lessons learned from pilots conducted.

Impact and Likelihood of Changes of Key Variables: Using financial model simulations, the role of key 'business and economic environment' variables on the profitability and sustainability of the business was studied. The impact of these variables was observed individually as well as in conjunction with others. The impact of select key variables is detailed in Annex 9.

The ensuing analysis employs the internal rate of return to equity and the payback period as key indicators of impact. However, it must be noted that these are not the only crucial aspects – for instance, the sustainability of the business needed to be assessed as measured by its cash flows, its resilience and ability to overcome liquidity challenges. In addition to this table,

the scenario analysis that follows will address these issues holistically. For this analysis, the impact of each 'unit change' (approximately 10% of base case or as defined otherwise below) in the variable to the IRR and payback period has been noted under two cases:

i) Plus 10% increase (or as defined otherwise) in the underlying variable
ii) Minus 10% decrease (or as defined otherwise) in the underlying variable

This sensitivity analysis intends to go beyond a simple intellectual exercise and seeks to inform the strategic decisions of potential investors on charting their own investment plans and strategic decisions. The following two examples illustrate this point:

Example 1 – Capital Expenditure & Returns: The base case assumes the selection of brand of Turkish origin. Switching to a top global brand from the USA increases the initial capital requirement by Rs. 36 million or 12 percent - which reduces the IRR to equity by 2.8 percent and increases the payback period by almost a year.

Example 2 – Financing Facility & Returns: The base case assumes that the investor borrows at 6 percent under the SBP financing facility (such financing support exists in various forms and has historically been used as a tool to catalyze investments in specific sectors). The removal of (or the inability to secure) financing support can significantly impact the IRR to equity and the payback period. The insights from this sensitivity analysis form the basis of the various scenarios selected for analysis in the section that follows.

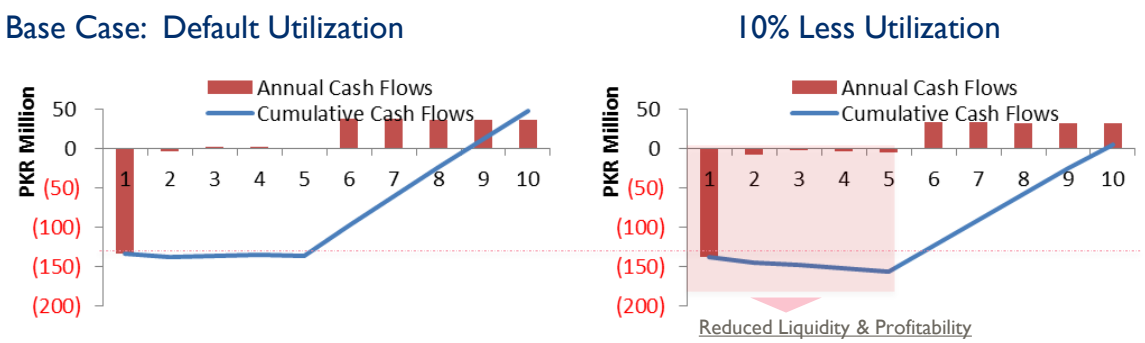
4.7.1. Storage Configuration, Origin and Utilization

The choice of the total storage capacity, the number of silos as well as that of the silo manufacturer (country of origin) has direct implications on the profitability of the business. In addition to reducing capital expenditure, these choices (along with the storage utilization) also provide an opportunity to improve revenues and reduce per-unit cost of storage services through economies of scale.

Table 6. Storage Capacity & Origin

Sr	Configuration	Capex (PKR m)	IRR & Payback	NPV (PKR m)
1	Turkish 15,000 Ton (Base Case)	**283** USD1.7m	**16.6%** **8.1Y**	**64.8**
2	Turkish 20,000 Ton	**310** **+27** USD 1.9m	**22.6%** **+6.0%** **6.8Y** **-1.3**	**141.0** **+76.2**
3	US 15,000 Ton	**319** **+36** USD 1.9m	**12.9%** **-3.7%** **9.2Y** **+1.1**	**31.8** **-33.0**
4	US 20,000 Ton	**339** **+56** USD 2.2m	**17.5%** **+0.9%** **7.9Y** **-0.2**	**97.1** **+32.3**

Figure 15: Impact of Lower Storage Utilization



It should be noted that i) higher storage capacities tend to have an overall positive impact on the IRR and payback and ii) lowering initial capex (without compromising on reliability) also helps improve returns. Utilization of the installed capacity is critical in ensuring business profitability as any excess capacity will serve to increase per unit costs as well as reduce the capability and improve cash flows through additional revenues.

4.7.2. Grain Combinations and Geography

The profitability of the business varies by crop combination and geography. The impact of geography on profitability will primarily be driven by differences in the following:

i) *overall size of the addressable market*, as measured by the total grain volume available to be stored or dried at the facility. This is in turn determined by the regional crop yield, transportation time & convenience, etc. This will directly affect the ability to maximize utilization of storage and drying services.
ii) *willingness to pay for storage & drying services,* that is determined by the perceived value created (through price appreciation and minimizing loss in grain value/quality) and competing services available (including self storage). This directly impacts the ability to charge a certain fee for services.
iii) *grain profile (quality, variety, climate),* refers to the underlying characteristics of the incoming grain. As all these factors directly affect the price appreciation potential, they also impact the willingness to pay (indirectly) and affect profitability.
iv) *average lot size of incoming grain* refers to the variation in average grain volume per customer (owing to underlying differences in average farm sizes and yields across regions). This indirectly impacts our profitability through changes in cost of testing and handling in bulk.
v) *minor cost implications* from regional differences in input, fixed and variable costs (including but not restricted to energy, HR cost, initial setup)

The cost implications, although important, are less significant compared to the 'demand side' impact that will affect our pricing strategy and utilization of storage & drying services. Prior market research and choice of the facility's location will help address any profitability issues.

However, as the grains have underlying differences in bulk density (weight per unit of volume) and storage requirements – the effective storage capacity available for storing

each grain is different. Table 7 compares the returns of the business across the different geography and grain combinations owing to these differences.

Table 7. Financial Results by Geography & Grain Combination					
		Punjab (base case)	**Upper Sindh**	**Punjab**	**Punjab**
		Paddy-Wheat	**Paddy-Wheat**	**Maize-Wheat**	**Maize-Maize**
1	IRR to Equity	16.6%	17.2%	22.6%	30.9%
2	Payback Period (years)	8.1	8.0	6.8	5.7
3	NPV (million PKR)	64.8	70.1	124.9	205.4
4	Project IRR	5.8%	6.1%	9.6%	14.3%

Maize (1.33) and wheat (1.45) both have higher relative bulk densities than paddy (1) – allowing for not only a higher storage of grain with the same configuration, but a significantly higher drying volume as well. This results in improved profits being generated (owing primarily to increased volume instead of differences in price) using the same initial investment.

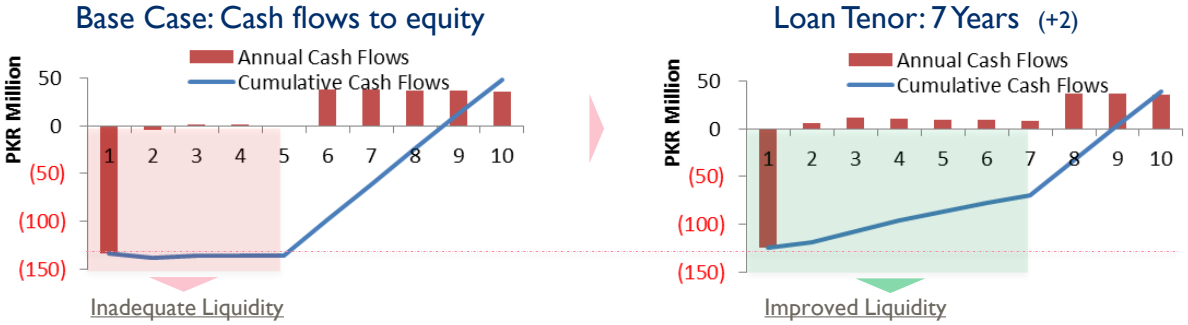
4.7.3. Liquidity Challenges and Impact of Capitalization Preference

As highlighted earlier, as a low-margin and high-capex business, we expect this business to be susceptible to liquidity problems during the first 3 to 5 years which can only be addressed by addressing its ability to pay its debt obligations. It must also be noted that the model incorporates a starting cash reserve of Rs. 20 million to cover short term expenses over the first couple of years and additional leveraged cash reserves are likely to be detrimental in the face of increased interest payments.

One way to address this is through higher service charges (evaluated later in this section) and the other is through a less aggressive undertaking of debt. A longer loan tenor, a lower debt-to-equity ratio and a more favorable financing rate are all useful measures to alleviate this problem.

An increase in loan tenor from the base case of 5 years to 7 years significantly improves

Figure 16: Change in Loan Tenor & Improved Liquidity



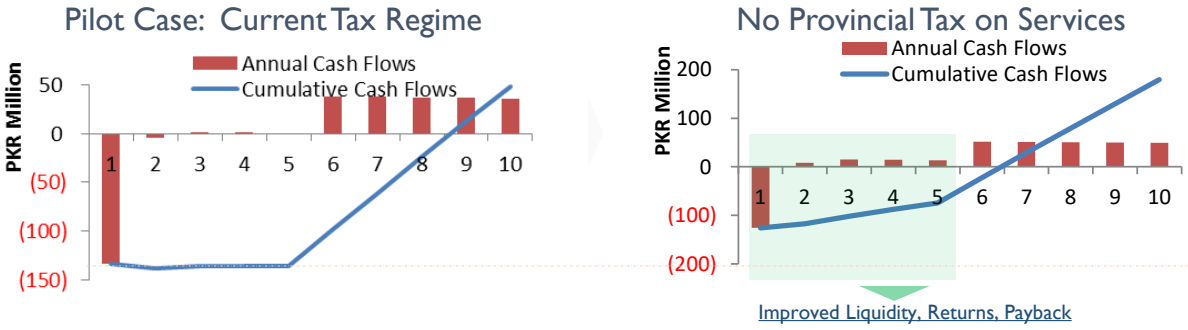
the liquidity challenges emanating from debt payments improving the outlook of the business and its projected sustainability. The accompanying figure illustrates the improvement to the cash flows to equity over the base case and also highlights the limited impact of the change on the underlying profitability and the payback period.

4.7.4. Taxation and Profitability

The sensitivity analysis of the variables earlier in this section revealed the positive impact of reduced taxation on the overall business outlook. A detailed analysis reveals that a favorable tax regime will not only improve the overall returns and payback to the investor, it also improves the early-stage liquidity challenges through better cash flows. The impact of a 10-year exemption from the provincial tax on services (from 16% to zero) is illustrated in the figure below.

The IRR to equity increases to 27.8% from the base case of 16.6% accompanied by an improvement of the payback to 6 years from 8.1 years – significantly improving the commercial desirability to private investors. The project IRR rises from 5.8 percent to 12.7 percent. The foregone tax revenue over the 10-year period is PKR 185 million (~USD 1.1 million) for a wheat & paddy grain storage facility with the proposed setup and will vary marginally for other grain combinations and geography.

Fig 17. Exemption from Provincial Tax on Services and Impact on Profitability



4.7.5. Analyzing the 'High Case'

As has been established earlier, the utility of using the base case was in i) establishing a 'minimum' case based on evidence from the pilots conducted and ii) in identifying potential challenges to this business as well as opportunities that if adequately addressed can significantly boost the viability of this business. As an outcome of these projections and financial analysis, a 'high case' was developed that, while ambitious, seeks to highlight the commercial potential of this business if certain challenges can be overcome.

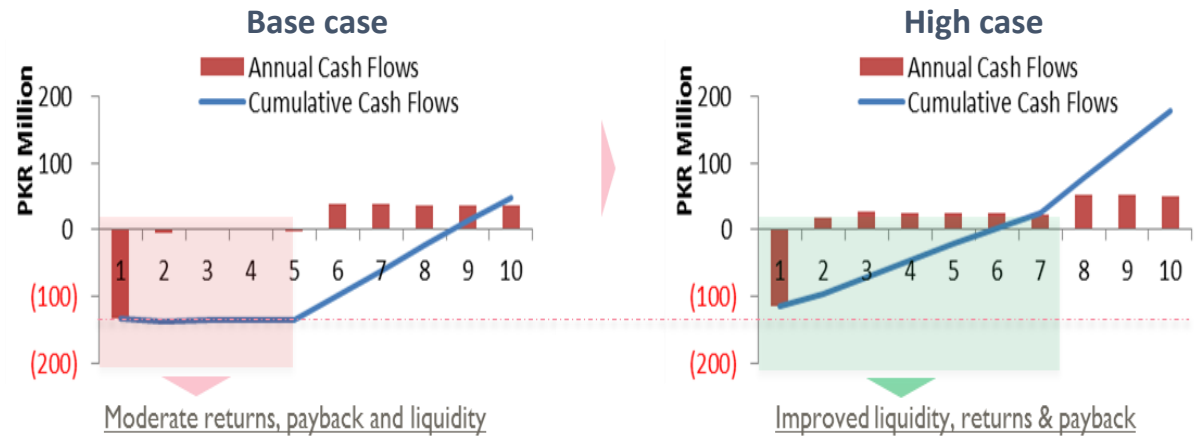
For this case, it is proposed to increase the services charges (for both storage and drying) in addition to increasing the loan tenor to mitigate any liquidity challenges arising during the initial period. The other assumptions and variables, including the capitalization and the average holding period remain unchanged.

Table 8. Variables for the High Case

Variable	High Case	Base Case
Storage Charges (PKR/Maund per Month)	Wheat: 18 Paddy: 25	Wheat: 15 Paddy: 18
Drying Charges (PKR/Maund)	Wheat: - Paddy: 75	Wheat: - Paddy: 70
Loan Tenor (Years)	7 Years	5 Years
Debt to Equity ratio	60:40	60:40
Holding Period (average)	5 Months	5 Months

As discussed earlier, the impact of the increased loan tenor on liquidity is evident in this case as well and is perhaps the most achievable improvement to the base case. Secondly, as is the case with any other high-volume business, the increase in service charges drastically improves the business outlook with the IRR increasing to 32.2% (and increase of 15.6%) and the payback improving to 5.0 years (reduction of 3.1 years) – a significant change over the base case.

Figure 18. Building the High Case



5. CONCLUSION AND RECOMMENDATIONS

The proposed business is to become the pillar of a new eco-system to transform Pakistan's agriculture sector by:

- Preservation of quality and quantity through reduction of post-harvest losses
- Financial inclusion of farmers
- Increase in holding power for farmers
- Opening up new business avenues for insurance and banking
- Activation of agri-trading on Pakistan Mercantile Exchange
- Price discovery of leading agri-commodities

These benefits can only be achieved through a network effect—a few of the proposed facilities will not be able to make this impact. A critical mass of the proposed drying and storage facilities is required to bring about the benefits outlined above.

Table 2 of this report presents a commodity storage universe of 6.5 million tons in Punjab and 1.4 million tons in upper Sindh for the three target crops: wheat, maize, and rice paddy. Section 2.2 of the report uses a case study of modern storage capacity at feed mills in District Okara to indicate that fifty percent of the commodity cultivated in the district may not be preserved with modern drying and storage. If only a quarter of the crop is estimated to be in need of such preservation, the 7.9 million tons mentioned above give an estimate of nearly 2 million tons. This means that some 131 facilities of 15,000 tons each will be required to preserve a quarter of these crops in the above-mentioned areas as identified in this report. This would require a total investment of US$ 225 million.

The case for public support is strong for this since the above-mentioned facilities would save some Rs. 11 billion of maize alone. They would also involve the creation of about 5,000 quality jobs in the rural areas. A 10-year exemption on sales tax on the warehousing service would mean a foregone sales tax revenue of Rs. 18.5 million per annum from each of the above facilities while each facility would pay a corporate tax of Rs. 16.9 million per annum.

Attracting private investment to this level in these facilities will need serious public support. As table 9 shows, public support for such investments in common even in countries like the USA where agriculture-related infrastructure is mature.

Pakistan's EWR regime is preparing for launch. Its benefits to farmers will depend heavily on the establishment of stand-alone drying-and-storage facilities near farms. Pakistan's leading business groups, financial houses as well as key stakeholders in the agriculture landscape have shown keen interest in the grain warehousing investment opportunity. USAID has funded a feasibility study for this investment. Now, a serious effort is required to

(i) attract investment in these facilities,
(ii) support the financing of these facilities and the financial stability of the EWR regime,
(iii) address fiscal hurdles to this investment, and
(iv) facilitate coordination of the EWR regime with provincial authorities.

Key measures are required related to investment & finance, fiscal considerations, and provincial coordination matters which are critical for realizing the benefit of the EWR regime to Pakistan's farmers. The next steps are to make focused efforts to remove the hurdles in the way of these investments. These hurdles are identified below.

Table 9. Public support for grain warehousing in other countries

	USA	*Turkey*	*Ukraine*
Types of investors in grain storage (mostly private)	Traders Processors Grain co-ops Investment funds	Traders (exporters/importers) Processors Large farmers Large financial-industrial groups	Traders/exporters Processors Large agri holdings Large retail/financial groups
State support offered to facilitate investment, create demand and build credibility	Investment tax reduction	Land tax deduction Government land in SEZs Reduction in investment tax & corporate tax	Tax-free period (3-5 years) State picks up interest cost on investment

5.1. INVESTMENT AND FINANCE

A. Attracting investment in grain stations

Pakistan's leading business groups have expressed interest in setting up grain warehousing businesses. Financial institutions are interested in financing such facilities. And leading agri stakeholders (millers, traders, etc.), who already have experience with grain warehousing, are taking interest in this opportunity. In-depth knowledge about the agriculture sector of Pakistan is often missing among Pakistan's leading business groups and the financial sector, in particular. Now that an in-depth feasibility study and financial model have been developed for this investment opportunity with USAID support, a coordinated and sustained effort is required to present this opportunity to these players to build their confidence about this investment.

B. SBP's facility for warehousing services needs to be replenished

The State Bank's Financing Facility for Storage of Agricultural Produce (FFSAP) was announced in 2010 by SBP with the intention of matching it with the launch of a warehouse receipts regime and a transition of the government's commodity storages to the private sector. Since then, the SBP facility has financed a large number of grain storages with its incentivized

mark-up, strong track-record with banks, and clear processes. However, the storages financed under this facility are nearly all inside mill premises to support milling operations. Today, this SBP facility must be replenished with a clear focus on supporting stand-alone agri-warehousing. This step will be a major support that will enable a new agri-ecosystem to evolve in Pakistan.

C. Risk Mitigation Fund/Indemnity Fund

The international practice is that, in economies where 'uninsurable risks' such as contract breach are possible, the holders of warehouse receipts (including banks) are paid out of a risk mitigation fund (also called an indemnity fund) which then proceeds against the defaulting warehouse operator to recover the claims. A precedent for such a fund was created in Pakistan in the year 2000 at the introduction of microfinance, at the time of the creation of Khushhaali Bank under advice from the Asian Development Bank. The main concern of bankers was: what will be a lender's recourse in case of default when microfinance does not involve any collateral? To allay banks' concerns, a Risk Mitigation Fund was created as a dedicated facility for microfinance borrowers. Clear criteria were laid out for accessing the fund. The Risk Mitigation Fund (RMF) was placed under the State Bank in accordance with RMF Rules 2000 with contributions invested in instruments approved by the State Bank. The Risk Mitigation Fund was initially capitalized with a grant of Rs. 295 million from the Government of Pakistan and Rs. 1 million from Khushhaali Bank in 2001-02 (equivalent to US$ 5 million at the time). There were annual contributions from Government (from its ADB loan spread) and Khushhaali bank as a fraction of its after-tax profit. With the significant expansion of the microfinance industry, the risk mitigation fund was wound up in 2014. Similar to the microfinance precedent, a risk mitigation fund for the warehouse receipts regime needs to be initially capitalized through grant funding and thereafter will receive a minute fraction of the proceeds from each transaction. The regime will also become more secure as the fund expands. An initial grant of US$ 5 million to establish this fund is recommended to launch the regime.

5.2. FISCAL MEASURES

I. Provincial sales tax on warehousing services

Formal sector players are expressing keen interest in modern warehousing on a stand-alone basis since these capital-intensive projects can only be done in the formal sector. But the sales tax on services (16% in Punjab and 13% in Sindh) significantly impacts the viability of such warehousing services especially when the informal sector is providing a much cheaper service to farmers with serious imperfections. For example, in Punjab, the sales tax on services is listed in the Second Schedule (Taxable Services) of the Punjab Sales Tax on Services Act 2012, as amended in Clause 50 (machinery-based services which includes drying) and Clause 61 (warehousing services):

Current tax:	Rationale for change	Proposal
Clause 50. Services in relation to supply of tangible goods including machinery, equipment and appliances for use, without transferring	Currently, most of the agri-related services are provided by informal service providers. These are typically sub-standard services causing loss to farmers. Formal	To facilitate farmers' access to modern machinery and storage facilities, it is proposed that this tax be exempted for

right of possession and effective control of such machinery, equipment and appliances. [Respective headings] *Sixteen percent*	sector players are keen to start providing these services but the sales tax on services makes them unviable compared to informal providers who deal in cash.	agriculture for a 10-year period in Punjab and Sindh.
Clause 61. Services provided by warehouses or depots for storage including cold storages. [9833.0000 and respective headings] *Sixteen percent.*		

II. Taxation of agri-commodity trading on Pakistan Mercantile Exchange

Pakistan Mercantile Exchange (PMEX) is intended to provide a regulated platform for trade of agricultural commodities using electronic warehouse receipts while facilitating repayment of any collateralized loan and settlement of warehousing charges electronically. The farmer or any other holder of an electronic warehouse receipt will be able to buy or sell the receipt on PMEX. This will result in creating a national market for agri-commodities in Pakistan thus leading to price discovery of these commodities as practiced in advanced agricultural economies. This will also bring greater comfort to banks which are keen to participate in the EWR regime but require a market where they can dispose of EWR's pledged to them, as and when required. These outcomes will contribute greatly to the financial inclusion goals of the Government of Pakistan.

Current tax	Rationale for change	Proposal
1. Withholding tax on trades involving physical settlement on Pakistan Mercantile Exchange under Section 153 of Income Tax Ordinance 2001	Section 153 requires buyers of commodities to withhold tax before making a payment to the seller, except growers. Presently, the majority of agri-commodity trades are not documented and therefore do not involve withholding of tax so this tax is a disincentive for agri stakeholders to come to PMEX and the warehouse receipts regime.	Exempt commodity contracts and electronic warehouse receipts (EWRs) on PMEX from the application of withholding tax under Section 153.

III. Duties on import of silos and associated drying facilities/other equipment

Modern and reliable storage of field crops associated with Pakistan's food security require silos and associated drying facilities/other equipment which will be the core of the warehouse receipts regime.

Current tax	Rationale for change	Proposal
1. 28% import duty on silos (under HS Code 9406-0030) and associated drying facilities/other equipment	Farmers and other agricultural stakeholders will have to pay more for modern and reliable drying and storage services by	Give a 10-year exemption on import duties and GST to silos (under HS Code 9406-0030) and associated drying facilities/other equipment.

2. 17% General Sales Tax on associated drying facilities/other equipment produced locally	stand-alone warehouses accredited under this regime.	

5.3. COORDINATION WITH PROVINCIAL GOVERNMENTS

i. Provincial laws related to trading of agricultural produce

For decades, Pakistan has had a system in place for the regulation of sale of agricultural commodities outside notified market areas overseen and regulated by market committees, i.e., through the Agricultural Produce Markets Act, 1939. Under the Sindh Wholesale Agricultural Produce Markets (Development and Regulation) Act, 2010, the earlier law has been repealed in its application to Sindh, and private and direct sales and purchases of wholesale produce outside the territory of a market committee are now permitted. The implementation of this Act remains sparse, however, and earlier market practices are reported to continue in most cases.

In Punjab, the current law in effect on the subject is the Punjab Agricultural Marketing Regulatory Authority Act, 2018 ('the PAMRA Act'). The Punjab Agricultural Marketing Regulatory Authority has the power to levy annual fees on warehouses and other fees. The rate of such fees has not yet been stipulated since PAMRA has only recently been formed. PAMRA is now the primary regulator for agriculture produce markets. Under Section 11 of this law, a warehouse is defined as a 'key service provider' and it needs to be registered with PAMRA. PAMRA is also authorized to collect an 'annual fee' and to regulate the business of warehousing on a provincial level. Since PAMRA has not yet framed its own rules and regulations, the precise scope of its interaction with the business of agri-warehousing is still uncertain.

Recommendation: It is important to clarify how a CMC licensed by the corporate regulator SECP under the warehouse receipts regime can partner with PAMRA. A CMC (like Naymat Collateral Management Company Limited, already licensed by SECP) can be a reliable source of information to PAMRA regarding the volumes and types of stocks in storage in its accredited warehouses.

ii. SECP consultation with provincial governments regarding trading on PMEX

PMEX intends to introduce six deliverable commodity future contracts based on wheat, rice and paddy which will facilitate trading of EWRs. PMEX has devised contract specifications (e.g., for Wheat, Super Basmati Milled Raw Rice, Brown Raw Rice and Super Basmati Paddy, etc.) for deliverable futures contracts. These contracts require PMEX to seek SECP approval for listing of these deliverable commodity future contracts at PMEX. In this connection, Section 14(2) of the Futures Market Act 2016 requires that prior to approving a futures contract where the underlying commodity is an essential food item, the SECP shall consult the provincial governments. Accordingly, SECP consults the Punjab Agriculture Department for its feedback/comments, if any, on the proposed contract specifications. To date, SECP has approved the maize contract produced by SECP since maize does not fall in any provincial list of essential food items.

iii. Food laws

The electronic warehouse receipts regime should be in good coordination with the authorities that implement laws related to essential food items

- West Pakistan Foodstuffs (Control) Act, 1958 (subsequently amended and adopted by each of the respective Provinces), defines 'foodstuffs' to include wheat, rice, paddy, and such other commodities as each respective Provincial Government may choose to regulate at its discretion. Section 3 of the law confers broad power on the Provincial Government to pass an order 'so far as it appears to be necessary or expedient for maintaining supplies of any foodstuff or for securing its equitable distribution and availability at fair prices'.
- Sindh and Punjab have also enacted laws in respect of anti-profiteering and hoarding of 'essential commodities' and 'essential articles', namely, the Sindh Essential Commodities Price Control and Prevention of Profiteering and Hoarding Act of 2005 and the Punjab Essential Articles (Control) Act of 1973 as well as the Punjab Prevention of Hoarding Act 2020. These laws essentially regulate the hoarding of and profiteering in 'essential commodities' and 'essential articles'. The Sindh Act mentions wheat flour, and rice, but not wheat or paddy. Meanwhile, the 2020 Punjab Act mentions paddy and wheat flour. Under these laws the respective Provincial Governments are empowered to regulate price of notified commodities, and to ensure the availability for sale of produce.

6. ANNEXURE/ APPENDICES

ANNEX-1: SOW OF THE ASSIGNMENT

Chemonics International Inc.
USAID Small & Medium Enterprise Activity

Investment in Grains Station Under Warehouse Receipts Regimes in Pakistan

SOW # C1BEE19

Scope of Work Summary:

Pakistan's weak food security situation has become a concern due to the Covid-19 crisis. It has become clear that significant investment in agriculture storage is the need of the hour. Since most modern storage is within mill premises in Pakistan, a framework is needed to make stand-alone agri-warehousing a feasible business. Towards this goal, the electronic warehouse receipts (EWRs) regime is ready to be launched in Pakistan's agriculture sector. Preparations and pilots led by Pakistan Agricultural Coalition have brought the regime to full readiness. The State Bank of Pakistan recently adjusted the prudential regulations to allow EWRs to be used as collateral by banks. The first warehouse accreditation and EWR repository company to be launched under this regime, Naymat Collateral, has been incorporated with permission from Securities and Exchange Commission of Pakistan (SECP).

Through this scope of work, USAID Small and Medium Enterprise Activity has been directed to conduct a technical and financial feasibility study for Grain Silos in Punjab, Sindh and KP. The study should explore the viability of setting up commercially operated silos, focused on Pakistan's main agriculture commodities (wheat, rice and maize).

1. Position Title & Department:

Short Term Technical Experts - Business Enabling Environment Component.

The proposed team composition for this arrangement will include the following:

- Activity Manager for overall guidance and advisory (This will be a pre-selected senior policy representative from SMEA)
- Local business model development expert [warehouse receipts regulatory & commercial]- Technical Team Lead
- International advisor on warehouse receipts-based investments
- Local warehousing (silo) expert [technical]
- Local financial modelling expert
- Local legal counsel

The consultants will be required to work together to complete the tasks under this scope of work.

2. General Summary:

Chemonics International is implementing Pakistan Small and Medium Enterprise Activity (SMEA), which is a 5-year, $35 million project that is aimed at improvement of financial and operating performance of small and medium enterprises (SMEs) in Pakistan in selected high-performing industrial, manufacturing and services sectors. Creating an enabling business environment is one of the objectives of SMEA. As such, the Project in its third year of implementation, engaged with the Government of Khyber Pakhtunkhwa to identify key areas of collaboration.

3. Objective of the Consultancy:

Objectives:

The objective is to conduct a feasibility study for establishing warehouses/silos in the provinces of Punjab Sindh and KP. The study should explore the viability of setting up commercially operated silos, focused on Pakistan's main agriculture commodities (wheat, rice and maize), how various stakeholders will be involved, their financial returns and the steps that are needed to scale such operations with the private sector. The study will identify and assess potential geographical locations for the silos and make recommendations on the ones with the greatest financial viability. In doing so, the study will take into account the demand profile of the various customers who will utilize the grain silos (such as commercial producers, processors and traders) and the connection between the players in the grain supply chain. The supply chain itself will be compared to the existing system, with cost and benefits to various stakeholders clearly articulated

Under a warehouse receipts-based financing regime, any owner of an eligible commodity can get it tested for entry into an accredited warehouse/silo and secure bank financing against their warehouse receipt as collateral. Commodities eligible for EWR-based financing are usually non-perishable and have a highly liquid market. In Pakistan, these commodities are; wheat, maize, rice paddy, rice, sugar, oilseeds, etc. Further, Banks as well as holders of commodities are looking for an alternative to using land as collateral for Agri-financing. The prospect of receiving bank financing creates a strong incentive for all stakeholders to preserve their commodity's quality so it can pass the testing requirements for proper storage. This will reduce Pakistan's high post-harvest losses. USAID has supported the development of the business model for warehouse receipts in Pakistan through a pilot with the maize crop in 2018.

Scale-up of the above-mentioned business model is to be conducted through the warehouse accreditation and EWR repository companies to be established under the Collateral Management Companies (CMC) Regulations 2019. Under these regulations, SECP will register private CMCs. Each CMC will accredit warehouses after inspection of their facilities, processes, and risk mitigation as prescribed by the CMC regulations. Accredited Warehouse Operators will issue EWRs against each lot of commodity placed in their warehouses. The key point is that CMCs will

be service companies, not financial entities, but will bring confidence to banks about the warehousing and the associated arrangements to secure the commodity which is under lien in accredited warehouses. The CMC regulations say that an EWR issued against some commodity stored in an accredited warehouse can be traded on Pakistan Mercantile Exchange (PMEX, the national commodity exchange) with the sale settled electronically.
Leading private sector players expressed strong interest in investing in this new space. The key next step is to encourage Agri-warehousing investment, particularly stand-alone facilities, to scale this regime up and bolster Pakistan's food security. This can be facilitated through a feasibility study which is intended to support leading business groups of Pakistan and abroad in their investment decisions for grain warehousing. Investments in this sector would bring in multiple stakeholders, both at local level such as medium sized traders and processors, as well as large US companies such as Brock and GSI who specialize in warehouse setup, design and logistics.

4. Principal duties and responsibilities

- Identify market needs of grain traders, second-tier processors, medium and small farmers for warehousing and gauge their willingness to pay for such services.
- Comparative Analysis & Supply Chain Recommendations for all three major commodities (rice, wheat and maize) with the viability of each clearly spelled out along with recommendations in order of most to least profitable commodity.
- Identify missing elements in the current system and suggest suitable surveillance technology options for warehouse operations. Recommend suitable quality assurance technology options for leading grains.
- Financial and risk assessment from the perspective of various stakeholders (investor, farmer, warehouse operator, bank, etc.), highlighting the immediate and long-term costs and benefits.
- Recommendations for optimal taxation structure for EWR regime that would create incentive for broad investment and participation by the private sector while at the same time allowing sufficient tax revenue collection for the government.
- Financial model of a warehousing investment that takes into account all of the above analysis. Work closely with SMEA's technical team to understand their requirements from the assignment
- Develop trip reports and meeting notes
- List of stakeholders met and compilation of key findings
- Lead consultant to coordinate the efforts of the team and shall be supported by the local business model expert (Sub-Lead) to finalize all the deliverables under this activity.

5. Specific Tasks of the consultants

Below are the areas to be covered in the study and the associated tasks:

Market Demand Assessment: Identify market needs of grain traders, second-tier processors, medium and small farmers for warehousing and gauge their willingness to pay for such services. This will also include the geographic location with respect to wholesale markets, production areas

and aggregation points, the logistical and operational costs for the small/medium player looking to utilize the silos.

Comparative Analysis & Supply Chain Recommendations: Comparison of traditional supply chain vs. bulk storage and logistics supply chain with view to price points, bottlenecks, including implications for distortions due to government's involvement in the market. Recommend storage and logistics technology options (e.g., bagged storage vs. bulk storage, bagged transport vs. bulk transport, small locally adapted qingqi-based bulk transport, drying technology, etc.) based on what is in operation in Pakistan and what can be adopted from international experience. This comparative analysis would be for all three major commodities (rice, wheat and maize) with the viability of each clearly spelled out along with recommendations in order of most to least profitable commodity.

Technology Recommendations: Identify missing elements in the current system and suggest suitable surveillance technology options for warehouse operations (e.g., Internet of Things applications connected to sensors/weighbridges, integrated MIS, etc.). Recommend suitable quality assurance technology options for leading grains (e.g., testing, fumigation, etc.)

Financing Options: Assessment of SBP Financing Facility of Storage of Agricultural Produce (FFASP) based on interviews of banks, warehouse operators, technology vendors, to identify bottlenecks, suggested design improvements, and lessons learned to help USAID design its interventions. Identify financial tools and instruments that may benefit and further WHR operations such as crop insurance, mid-level loan facilities for different stakeholders and/or guarantees.

Stakeholder Financial Feasibility: Financial and risk assessment from the perspective of various stakeholders (investor, farmer, warehouse operator, bank, etc.), highlighting the immediate and long-term costs and benefits.

Taxation: Recommendations for optimal taxation structure for EWR regime that would create incentive for broad investment and participation by the private sector while at the same time allowing sufficient tax revenue collection for the government.

Financial Model: Financial model of a warehousing investment that takes into account all of the above analysis. The analysis would at a minimum include:

- Pro-forma financials – scenarios for various investment sizes, amount of uptake and different models (stand-alone vs. networked?)
- Supply chain comparison of current system vs. proposed system including costing at various nodes
- Identification of taxation impacts under different possible regimes
- Financing options for investors and cost benefit to other stakeholders

6. Job Qualifications

Advisor	Person Specifications	Level of Effort
Activity Manger for guidance and advisory	- This will be a pre-selected senior policy representative of SMEA (senior policy advisor) with sufficient years of experience	45 days

	in public and private sector along with necessary knowledge in the subject area.	
Local business model development expert [warehouse receipts regulatory & commercial]- Technical Team Lead	- Minimum qualifications: master's degree in business, policy, finance, or related discipline. - 10+ years of experience in business model development and strategy, - Deep understanding of Pakistan's emerging warehouse receipts regulations and exposure to the global experience with warehouse receipts, - Experience with financial modeling for pitching investments, - Exposure to the grain warehousing business in Pakistan, - Strong writing and communications skills,	50 days
International Advisor	- Minimum qualifications: master's degree or above with focus on grain economics, commodity investments, or related discipline - 20+ years of international experience with warehouse receipts-based finance systems is desirable, - Deep understanding of grain warehousing and handling operations, particularly of rice, wheat, and/or maize, - International experience with grain sector investments	15 days
Local warehousing (silo) expert [technical]	- Minimum qualifications: bachelor's degree in engineering, agriculture, or related discipline - 10+ years of experience with silo storage and handling operations for grains in Pakistan, particularly silo storage of rice, wheat, and/or maize, - Deep knowledge of silo storage technology and key choices for development and optimization of silo storage facilities, - Familiarity with upcoming warehouse receipts regime in Pakistan	35 days
Local financial modelling expert	- Minimum qualifications: master's degree in business, finance, or related discipline	35 days

	- 7+ years of experience with financial modeling for investments, - Deep knowledge of financial structuring and investment appraisal, - Deep exposure to expectations of Pakistani investors as well as foreign investors considering investment in Pakistan, - Strong communication and presentation skills for finance and business, - Knowledge of warehousing business would be given preference	
Local legal counsel	- Minimum qualifications: LLB, Bar at Law, LLM or equivalent qualification - 7+ years of experience with legal advice for commercial investments in Pakistan, - Deep knowledge of company law, regulatory concepts, legal aspects of construction projects, etc. - Deep exposure to expectations of Pakistani investors as well as foreign investors considering investment in Pakistan, - Strong communication and presentation skills, - Familiarity with upcoming warehouse receipts regime in Pakistan,	35 days

7. **Duty Station:**

The consultant should be available to work with the SMEA team preferably out of SMEA's Islamabad office or alternatively based out of Karachi. In case of non-availability of a suitable resource, we could look into the possibility of hiring a consultant based in any other city. The costs of traveling and accommodation will be paid according to the standard Chemonics policy.

8. Workspace and Use of Personal Laptop and Software(s):

The consultant will be required to use his own personal laptop and must certify that all software used are genuine and licensed; to ensure that the project's IT resources are protected from accidental destruction or deliberate attempts at sabotage by computer viruses and other hazards.

9.Reporting:

The consultant(s) will be required to report to the Team Lead for this activity, along with the BEE Deputy Component Lead from SMEA.

10. Duration of the Assignment:

This will be an intermittent effort of 215 days of LOE spread over a period of 2 months. This job is planned to take place as per a start date of on or around July 15, 2020 and end date of on or around September 30,2020 (subject to date of mobilization of consultants). The period of performance of consultants will be till October 31, 2020

11. Deliverables:

Report: The main deliverable will be in the form of a report (and a presentation) which will cover the following sections:

- Presentation of initial findings of the study to the Mission.
- Draft Report:
    - Executive Summary (up to 1 page) – A summary of findings and the technical approach utilized by the consultants in completing the assignment
    - Background & Context (up to 2 pages) – Overview of existing system, current challenges and the proposed interventions and their potential impact, which this report will explore. Brief analysis of stakeholders involved.
    - Methodology (up to 2 pages) – Clear explanation of the approach used to complete the study. The people met, markets/zones visited, laws and papers considered, models from other countries reviewed and any other desk work completed. Place lists and non-analysis details in the appendix if needed.
    - Intervention Analysis (up to 30 pages) – Main body will be all the requirements as stated in the SOW given above. A detailed analysis will include at a minimum:
        - Overview of markets/zones and players in Punjab and Sindh provinces.
        - Comparison with current system along with proposals for new system. This analysis may include comparisons to WHR regimes in other comparable countries with similar market dynamics and legal framework (tables might be useful for comparisons).
        - Cost Benefit Analysis for various stakeholders in the short and long term.
        - Tax implication under a few viable scenarios that maximize investment, involvement and registration for taxation for different players linked to the supply chain
        - Financial investment scenarios and support for financial model.
        - Risks and assumptions of each model
        - Timeline for interventions and sequencing of activities
    - Recommendation (up to 3 pages) – Prioritization matrix which shows the feasibility of each model prioritized on the criteria of impact, cost of intervention, ease of execution and sustainability beyond life of project.
    - Annexes:
    - The report needs to be properly cited and footnoted for any references. All contacts met, field reports and background information should be included in the appendix. It is expected that the report will be completed within 40 working days from the time the award is granted to the contractor.

- Infographic for the study.
- Final report and presentation to stakeholders.

The timeline for the LOE assigned for each activity as per the deliverables mentioned in the above table will be discussed and agreed with the consultants. The final report will be a combined deliverable with inputs from all the consultants.

No.	Activity	LOE(Days)
1	**Meetings/discussions with SMEA Team to understand the scope of work**	**5**
2	**Workplan with indicative timelines of individual tasks and responsibilities under the consultancy**	**7**
3	**Methodology: Literature review and stakeholders' consultations**	**40**
4	**Review by International Advisor**	**10**
5	**Presentation of initial findings of the study to the Mission.**	**5**
6	**Draft Report- Overview of markets/zones and players in Punjab and Sindh provinces, comparison with current system along with proposals for new system, cost benefit analysis for various stakeholders in the short and long term, tax implication under a few viable scenarios that maximize investment, involvement and registration for taxation for different players linked to the supply chain, financial investment scenarios and support for financial model, risks and assumptions of each model and timeline for interventions and sequencing of activities.**	**40**
7	**Quality assurance and review of draft report by International Advisor**	**10**
8	**Recommendation (up to 3 pages) – Prioritization matrix which shows the feasibility of each model prioritized on the criteria of impact, cost of intervention, ease of execution and sustainability beyond life of project.**	**40**
9	**Finalization of recommendations by International Advisor**	**8**
10	**Infographic for the study**	**10**
11	**Final report and presentation to stakeholders.**	**40**
	Total	**215 days**

ANNEX-2: COMPARISON OF STORAGE TECHNOLOGIES

Parameters (for Summer Harvest Maize)	**'Ganji'** (pyramid of bags under tarpaulin)	**Flat Warehouse**	**Silo**
Max Storage Time (Months)	2	6	24
Cost & efficiency of land use Capital Expense excluding land cost (PKR / MT) Area utilization (kg / square foot)	 200 66	 16,000 100	 4,200 1,300
Aeration Control of stored commodity environment Aeration cost (PKR /MT/Month)	 No 0	 No 6	 Yes 5
Efficiency of grain handling	None (only tarp; manual handling)	Minimal (manual handling)	Fully mechanized & automated handling
Loading/Unloading Cost (PKR / MT)	250	185	In bags: 90 in bulk: 40
Wastage & Spillage (%)	1.5	1	0.25
In-storage Drying Capability	No	No	Yes
Quality monitoring	Easy up to 100 tons	Easy up to 500 tons	Easy for even 50,000 tons
Maintenance Requirement	Low	Low	Medium
Pest control	Very weak	Weak	Weak if not sealed
Rodent control	Weak	Weak	Strong
Fumigation	Difficult	Easy	Somewhat difficult

ANNEX-3: INTERNATIONAL EXPERIENCE WITH GRAIN WAREHOUSING FACILITIES

	USA	*India*	*Turkey*	*Ukraine*
Main crops produced & stored	Maize, Soybeans, Wheat, Barley, Oats, Rice	Rice paddy, Wheat, Maize	Wheat, Maize, Barley, Oats, Rice	Maize, Wheat, Barley, Sunflower, Oats
Average capacity of commercial grain warehouse	Medium & Large 20,000 tons-75,000 tons	Small & Medium 5,000 tons-25,000 tons	Medium & Large 25,000 tons-100,000 tons	Medium & Very Large 20,000 tons-150,000 tons
Storage models & technology	Up to 65% of grains are stored on-farm. Off-farm commercial storage is mostly vertical metal silos & complex of mechanisms to support adequate grain storage. There are still some traditional concrete elevators at commercial locations, mainly located at the edges of water bodies (river, lake, ocean) or next to railways.	Commercial grain storage is mostly oriented to small-scale producers (1-5 hectares of farmland). Off-farm commercial storage is diversified and includes both traditional, small (5,000-10,000 MT) flat warehouses & some modern vertical metal silos facilities.	Modern, mostly newly-built, well-equipped vertical & metal silos; mainly located in the commercial hubs, where grains are processed (flour mills, feedstuff plants, etc.) Some flat storage facilities which are not so well-equipped (up to 20,000 MT) are mainly located in grain-producing areas.	Vertical, flat, and a combination of flat & vertical; still many old Soviet style concrete elevators (100,000-150,000 MT) and flat facilities (up to 25,000-40,000 MT), that suffer from a lack of modern equipment. Currently, private businesses are investing in new grain storage facilities so total number of warehouses is growing rapidly.

	USA	***India***	***Turkey***	***Ukraine***
Quality tests & equipment compulsory?	Yes. Compulsory at all off-farm commercial storage facilities	Only at modern storage facilities mainly for wheat & rice. Most facilities do not have testing.	Yes. 'Authorized Classifier' compulsory at all licensed warehouses	Yes. Compulsory to have at least express quality test unit at an accredited grain warehouse.
Efficient grain cleaning equipment	Compulsory	Compulsory	Compulsory at licensed grain warehouses	Compulsory at accredited grain warehouses
Drying	Maize & soybean: compulsory; Wheat, barley, oats, and rice: not always (depending on location) Drying equipment is mainly vertical & highly efficient for large-scale drying.	Depends on the region and crop. In semi-arid regions, where wheat is produced, drying is not compulsory but it is important for rice	Wheat: not compulsory (no need to dry wheat in Turkey). Maize: drying is compulsory at licensed warehouses.	Drying compulsory for all accredited warehouse (even for wheat). Most are modern, vertical & highly efficient for large-scale drying.
Average distance from farm to a commercial grain storage facility	Up to 40 km	25 – 30 km	40 – 60 km	25 – 50 km

ANNEX-4: EXAMPLE OF GAINS DURING MAIZE PILOT

Table A4: Calculation of farmer gains on a single lot

26-ton lot stored by farmer Muhammad Asif

Assumptions

Deduction at mandi (% of sale price)	5%	Warehousing charge(Rs per maund per month)*	6.5
Mark-up charged by bank (% per annum)	12%	Exit charge Rs. (if not sold to IFM, Rs per maund)	13
Loan as % of commodity value	70%		

At the time of entry into warehouse:	**21-Jun-18**	**At the time of exit from warehouse**	**07-Sep-18**
Price at entry (Rs./maund)	960	Sold price	1150
		Price appreciation during storage (Rs./maund)	190
Quantity at entry (maunds)	651	Quantity of Maize at exit (maunds)	651
Loan disbursed (Rs.)	437,472	Duration of loan (days)	45
If the maize had been sold at the Mandi at harvest		**Sale of maize after holding for 45 days**	
Value of maize (Rs.)	624,960	Value of maize	748,650
Deductions at Mandi	31,248	Mark up paid for 45 days' loan	6,472
		Warehousing charges	6,347
		Exit charge (for sale outside IFM)	8,463
Net proceeds if farmer sold crop at harvest	**Rs 593,712**	**Net proceeds from sale after holding crop**	**Rs 727,368**
		Gains over sale in Mandi at harvest	23%

*Storage, testing, insurance by IFM & oversight by Agility

Source: Pakistan Agricultural Coalition

ANNEX-5: COMPARISON OF CURRENT VALUE CHAINS WITH PROPOSED EWR MODEL

Table A5. 1 Comparison of existing system with proposed model for rice paddy

Key Assumptions		
Price at Harvest (PKR/Maund)		2,200
Price Appreciation (PKR/Maund)		500
KIBOR		7.30%
Loan to Value (%)		70%
Loan Tenor (Months)		4
Bag weight rice paddy (kg)		65
Storage Charge (PKR/40kg/Month)		18

EXISTING SYSTEM

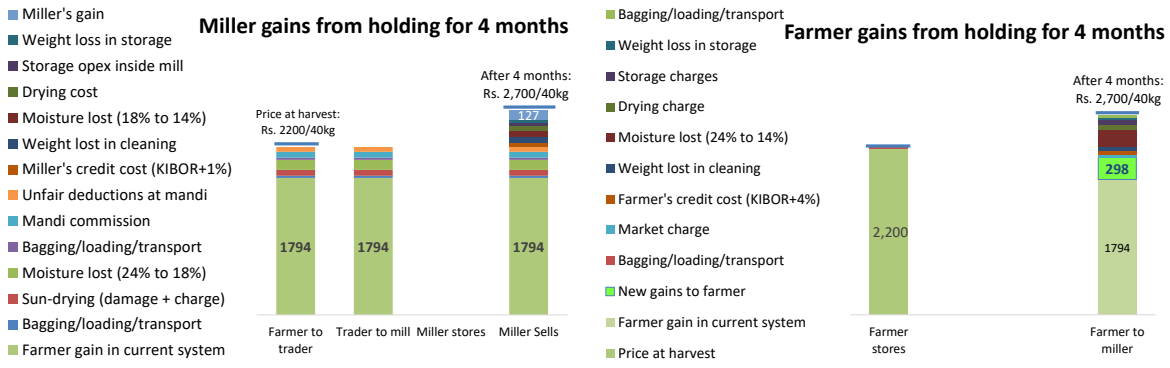
All prices and costs in Rs. per 40kg		Price at harvest	Farmer to trader	Trader to mill	Miller stores	Miller Sells
Farmer gain in current system		2200	1794	1794		1794
Bagging/loading/transport			30	30		30
Sun-drying (damage + charge)			75	75		75
Moisture lost (24% to 18%)			132	132		132
Bagging/loading/transport			30	30		30
Mandi commission			77	77		77
Unfair deductions at mandi			62	62		62
Trader's profit: 1%	1%			22		22
Miller's credit cost (KIBOR+1%)	1%					61
Weight lost in cleaning						66
Moisture lost (18% to 14%)						88
Drying cost						62
Storage opex inside mill						40
Weight loss in storage						34
Miller's gain						127

PROPOSED MODEL

All prices and costs in Rs. per 40kg		Price at harvest	Farmer stores			Farmer to miller
Price at harvest		2,200	2,200			
Farmer gain in current system						1794
New gains to farmer						298
Bagging/loading/transport			30			
Market charge						27
Trader's profit: 1%						22
Farmer's credit cost (KIBOR+4%)	4%					58
Weight lost in cleaning						55
Moisture lost (24% to 14%)						220
Drying charge						62
Storage charges						72
Weight loss in storage						34
Bagging/loading/transport						28

Source: Team calculations based on market research

Figure A5.a. Comparison of existing system with proposed model for rice paddy



Source: Team calculations based on market research

Table A5. 2. Comparison of existing system with proposed model for winter maize

Key Assumptions	
Price at Harvest (PKR/Maund)	1,200
Price Appreciation (PKR/Maund)	400
KIBOR	7.30%
Loan to Value (%)	70%
Loan Tenor (Months)	4
Bag weight maize (kg)	40
Storage Charge (PKR/40kg/Month)	18

EXISTING VALUE CHAIN

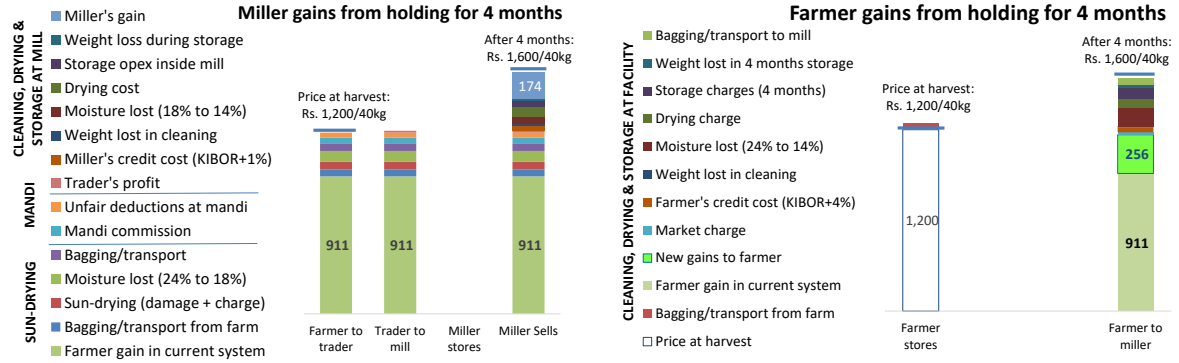
All prices and costs in Rs. per 40kg		Farmer to trader	Trader to mill	Miller stores	Miller Sells
Farmer gain in current system		911	911		911
Bagging/transport from farm		46	46		46
Sun-drying (damage + charge)		50	50		50
Moisture lost (24% to 18%)		72	72		72
Bagging/transport		46	46		46
Mandi commission		42	42		42
Unfair deductions at mandi		33	33		33
Trader's profit			12		12
Miller's credit cost (KIBOR+1%)					33
Weight lost in cleaning					12
Moisture lost (18% to 14%)					48
Drying cost					62
Storage opex inside mill					40
Weight loss during storage					18
Miller's gain					174

PROPOSED MODEL

All prices and costs in Rs. per 40kg		Price at harvest	Farmer stores			Farmer to miller
Price at harvest		1,200	**1,200**			
Farmer gain in current system						911
New gains to farmer						256
Bagging/transport from farm			46			
Market charge						16
Trader's profit						12
Farmer's credit cost (KIBOR+4%)	4%					32
Weight lost in cleaning						10
Moisture lost (24% to 14%)						120
Drying charge						62
Storage charges (4 months)						72
Weight lost in 4 months storage						18
Bagging/transport to mill						45

Source: Team calculations based on market research

Figure A5.b. Comparison of existing system with proposed model for winter maize



Source: Team calculations based on market research

Table A5. 3. Comparison of existing system with proposed model for summer maize

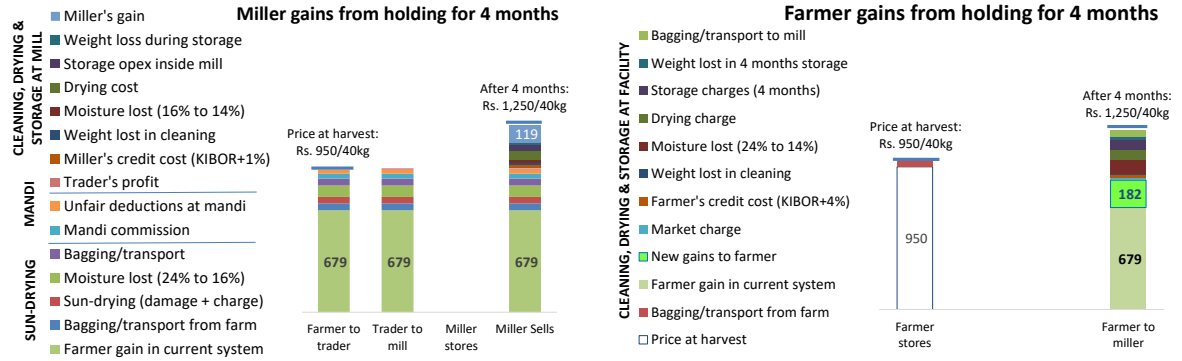
Key Assumptions	
Price at Harvest (PKR/Maund)	950
Price Appreciation (PKR/Maund)	300
KIBOR	7.30%
Loan to Value (%)	70%
Loan Tenor (Months)	4
Bag weight maize (kg)	40
Storage Charge (PKR/40kg/Month)	18

EXISTING VALUE CHAIN					
All prices and costs in Rs. per 40kg		Farmer to trader	Trader to mill	Miller stores	Miller Sells
Farmer gain in current system		679	679		679
Bagging/transport from farm		46	46		46
Sun-drying (damage + charge)		44	44		44
Moisture lost (24% to 16%)		76	76		76
Bagging/transport		46	46		46
Mandi commission		33	33		33
Unfair deductions at mandi		26	26		26
Trader's profit			10		10
Miller's credit cost (KIBOR+1%)					26
Weight lost in cleaning					10
Moisture lost (16% to 14%)					19
Drying cost					62
Storage opex inside mill					40
Weight loss during storage					15
Miller's gain					119

PROPOSED MODEL						
All prices and costs in Rs. per 40kg		Price at harvest	Farmer stores			Farmer to miller
Price at harvest		950	950			
Farmer gain in current system						679
New gains to farmer						182
Bagging/transport from farm			46			
Market charge						13
Trader's profit						10
Farmer's credit cost (KIBOR+4%)	4%					25
Weight lost in cleaning						8
Moisture lost (24% to 14%)						95
Drying charge						62
Storage charges (4 months)						72
Weight lost in 4 months storage						15
Bagging/transport to mill						45

Source: Team calculations based on market research

Figure A5.c. Comparison of existing system with proposed model for summer maize



Source: Team calculations based on market research

Table A5. 4. Comparison of existing system with proposed model for wheat

Key Assumptions	
Price at Harvest (PKR/Maund)	1,600
Price Appreciation (PKR/Maund)	115
KIBOR	7.38%
Loan to Value (%)	70%
Loan Tenor (Months)	4
Bag weight for wheat (kg)	100
Storage Charge (PKR/40kg/Month)	15

EXISTING SYSTEM

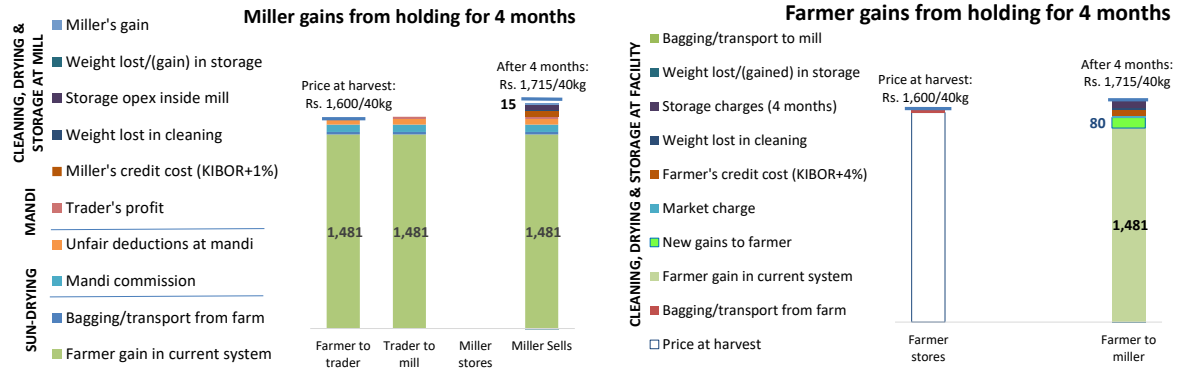
All prices and costs in Rs. per 40kg		Farmer to trader	Trader to mill	Miller stores	Miller Sells
Farmer gain in current system		1,481	1,481		1,481
Bagging/transport from farm		20	20		20
Mandi commission		56	56		56
Unfair deductions at mandi		44	44		44
Trader's profit			16		16
Miller's credit cost (KIBOR+1%)					45
Weight lost in cleaning					8
Storage opex inside mill					40
Weight lost/(gain) in storage					(8)
Miller's gain					15

PROPOSED MODEL

All prices and costs in Rs. per 40kg		Price at harvest	Farmer stores			Farmer to miller
Price at harvest		1,600	**1,600**			
Farmer gain in current system						1,481
New gains to farmer						80
Bagging/transport from farm			20			
Market charge						17
Farmer's credit cost (KIBOR+4%)	4%					42
Weight lost in cleaning						13
Storage charges (4 months)						60
Weight lost/(gained) in storage						(8)
Bagging/transport to mill						10

Source: Team calculations based on market research

Figure A5.d. Comparison of existing system with proposed model for wheat



Source: Team calculations based on market research

ANNEX-6: FARMER FINANCIAL NEEDS FOR NEXT CROP

When a maize farmer harvests the winter maize crop and place it in the silos of the proposed facility after drying, the crop's 65 maunds per acre priced at Rs. 1,200 per maund at winter harvest would have a value of Rs. 78,000 per acre. The bank would lend 70 percent of this value to the farmer which is Rs. 54,600. This can address the farmer's need for next crop. Since only about 50 percent of the total expenditure on a crop is disbursed at the beginning of the season, the farmers can collateralize only half of the winter crop to get the cultivation of the summer crop started. Beyond this, the price appreciation of collateralized winter crop can give (65 maunds per acre x Rs. 256 per maund =) Rs. 16,640 per acre.

Table A6: Maize farmer's financial needs

Summer Maize crop: Cost of production

Yield in maunds per acre (hybrid seed)	100	
Rs. per acre	**Costs**	**Revenue**
Seed bed preparation	7,000	
Water	8,000	
Seed	8,000	
Urea (3 bags/ acre)	6,000	
DAP	5,400	
SOP	2,100	
Sulphur	1,000	
Pesticide - Carbofuran	3,200	
Pesticide (2 sprays) & fungicide etc.	2,200	
Weedicide	800	
Labour	1,000	
Harvesting (cutting, picking, shelling)	10,000	
Cost per acre	**54,700**	
Revenue per acre		**98,500**
Net profit per acre		**43,800**

Source: Team calculations based on market research

ANNEX-7: HUMAN RESOURCES REQUIRED FOR PROPOSED FACILITY

#	Title	Responsibility	Count
1.	Manager Site	Responsible for all site matters (operations, administration, quality, inventory, HSE, HR and security) as a team lead.	1
2.	Silo Operator	Responsible for all maintenance of machinery, storage operations (aeration, fumigation and monitoring) and grain handling operations (unloading of grain, precleaning of grain, drying of grain, loading of silos and transfer of grains to packing point)	1
3.	Silo Helper	To support silo operator	2
4.	Lab Technician	Responsible for all Laboratory operations and its inventory; samplings and their record keeping/entering	1
5.	Samplers	Responsible for all grain sampling of grain receiving, unloading, drying, loading and packing	2
6.	Electrician	Responsible for all matters of maintenance and operations of Pneumatic, MCC, PLC and Genset	1
7.	Mechanic	To provide mechanical support to Foreman	1
8.	Boiler/Foreman	Responsible for all matters of maintenance and operations of mechanical machinery and Boiler	1
9.	Boiler Helpers	To provide boiler operation support to Foreman	2
10.	Marketing Manager	For promotion, marketing and sales of the facility's services and coordination with related parties (banks, etc.)	1
11.	Marketing officers	To support marketing manager	3
12.	Accounts officer	Responsible for all inventories of the facility	1
13.	Store Helper	To support the accounts officer	1
14.	Gate Clerk	To keep/enter all gate in-out	1
15.	Security Supervisor	Responsible for site security	1
16.	Security Guards	To support security supervisor	4
17.	Gardner	For housekeeping of site landscape	1
18.	Fire Fighters	To support HSE	2
19.	Sweeper	For housekeeping of site	1
20.	Office Boy	To serve officers and guests/visitors	1
21.	Driver	To assist manager site	1

ANNEX-8: MINIMUM ACCREDITATION REQUIREMENTS OF THE EWR REGIME

PHYSICAL AND PROCESS

Outline of the Warehousing Guidelines for Silo Storages

- Physical Infrastructure & Equipment
  - General requirements
  - Specific Requirements (for over 5,000 tons, for less than 5,000 tons)
  - Quality analysis equipment
  - Receiving, sampling/testing
  - Pre-cleaning, Drying, Bulk weighing,
  - Silo loading/unloading turnaround
  - Silo temperature monitoring, fumigation, aeration, control
  - Sweep Auger System, recirculation
  - Dispatch of grain and of waste
  - Safety precautions
- Handling & Management Process
  - Adequate technical staff
  - Depositor identification & address
  - Automated process flow
- Miscellaneous Provisions (record keeping, Audits and Verifications, Measures against non-compliance, list of crops)

COMMERCIAL

Outline of the Standard Operating Procedures (SOPs)

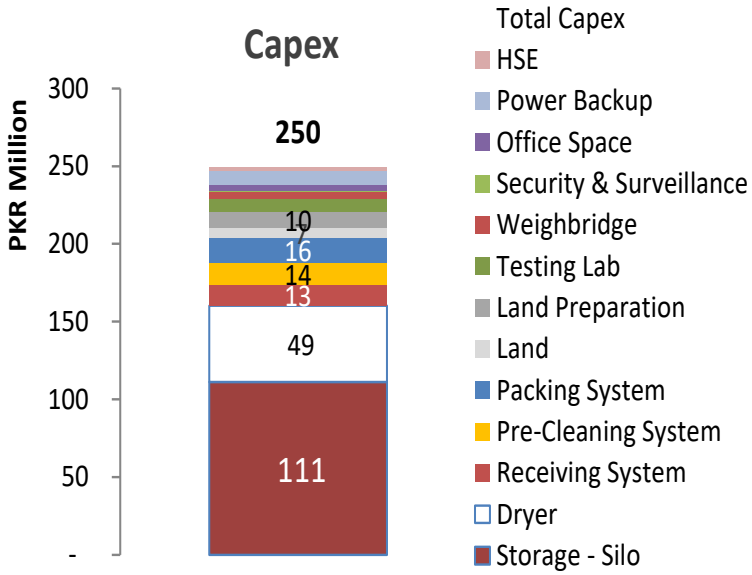
- Accreditation of Warehouses
- Obligations of Warehouse Operators
- Inspection of Accredited Warehouses by CMC

- Suspension, Expiry and Revocation of Warehouse Accreditation
- Electronic Warehouse Receipts
- Procedures for Transfer of EWRs and Taking a Security Interest in EWRs and the Produce Covered by EWRs
- Claims resolution
- Information and Documents to be Included in Warehouse Application; Fit and Proper Criteria for Specialized Staff

INSURANCE

Risk to product in accredited warehouse	**Insurance cover (as a percentage of total value of produce proposed to be stored at the warehouse)**	**Insurance policy**
Fire & Lightning	100%	**Fire & Allied Perils insurance**
Riot & Strike Damage	100%	
Malicious Damage	100%	
Earthquake (Fire & Shock)	100%	
Explosion	100%	
Atmospheric Disturbance (hail, wind, hurricane, snow, flood, etc.)	100%	
Aircraft Damage	100%	
Impact Damage	100%	
Burglary & Housebreaking [external]	100%	
Fraud/fidelity and negligence from warehouse [internal]	Up to 30% of value when taken together with bank guarantee	**Fidelity/professional liability insurance**

ANNEX-9: RESULTS FOR FACILITY OF 10,000 TONS

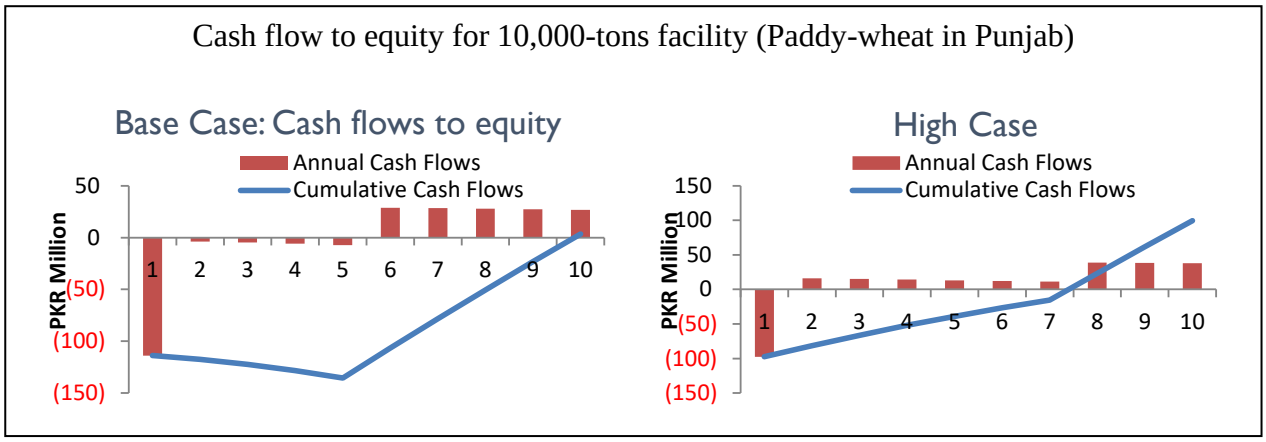


Investment	PKR m	US$ m
Investor equity	100	$ 0.60
Grant support	-	$ -
Debt	150	$ 0.91
Total	250	$ 1.51

Staff headcount: 23	
Storage & drying	9
Marketing	2
Security	5

Assumptions and results

Punjab – Wheat & Paddy	Base Case Equity IRR: 10.9% Payback: 9.9 years	High Case Equity IRR: 23.0%. Payback: 7.4 years
Loan Tenor	5 Years	7 years
Debt : Equity ratio	60 : 40	60 : 40
Storage Charges	Wheat: 15 Paddy: 25	Wheat: 20 Paddy: 30
(PKR/40kg/month)	Cost: 14.4	
Drying Charges	Wheat: - Paddy: 65	Wheat: - Paddy: 70
(PKR/40kg)	Cost: 63.7	
Holding period	5 months	5 months
by customers on average		



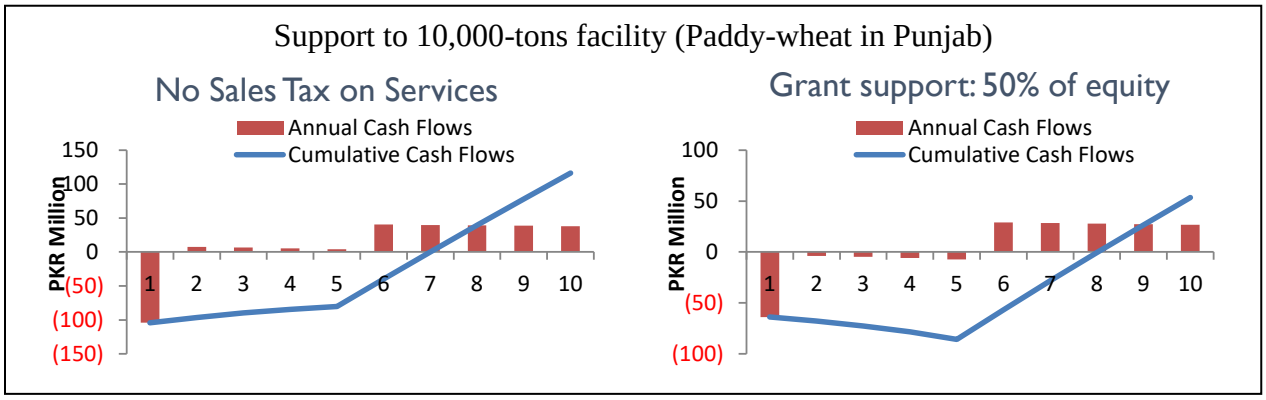


Table A9. Storage Capacity & Origin

		Turkish			US		
Sr	**Configuration**	**10,000 Ton**	**15,000 Ton***	**20,000 Ton**	**10,000 Ton**	**15,000 Ton**	**20,000 Ton**
1	**Capex (PKR m)** Difference from 15,000 tons configuration Capex (US$)	**261** -22 USD 1.6m	**283** USD1.7m	**310** +27 USD 1.9m	**285** +2 USD 1.7m	**319** +36 USD 1.9m	**359** +76 USD 2.2m
2	**IRR - Equity**	**8.1%** -8.5%	**16.6%**	**22.6%** +6.0%	**5.8%** -10.7%	**12.9%** -3.7%	**17.5%** +0.9%
3	**IRR - Project**	**-0.2%** -6.0%	**5.8%**	**9.8%** +4.0%	**-1.9%** -7.7%	**3.3%** -2.5%	**6.6%** +0.8%
4	**Payback**	**10+Y** -1.9+	**8.1Y**	**6.8Y** -1.3	**10+Y** -1.9+	**9.2Y** +1.1	**7.9Y** -0.2
5	**NPV (PKR m)**	**-16.1** -80.9	**64.8**	**141.0** +76.2	**-38.4** -103.3	**31.8** -33.0	**97.1** +32.3

ANNEX-10: PRO-FORMA FINANCIALS AND SENSITIVITY ANALYSIS (BASE CASE: 15,000 TONS)

Income Statement

	June 2021	June 2022	June 2023	June 2024	June 2025	June 2026	June 2027	June 2028	June 2029	June 2030
Total Revenue										
Total Revenue	74,582,813	106,878,750	122,046,563	122,046,563	122,046,563	122,046,563	122,046,563	122,046,563	122,046,563	122,046,563
Provincial Sales Tax on Services	11,933,250	17,100,600	19,527,450	19,527,450	19,527,450	19,527,450	19,527,450	19,527,450	19,527,450	19,527,450
Net Revenue	62,649,563	89,778,150	102,519,113	102,519,113	102,519,113	102,519,113	102,519,113	102,519,113	102,519,113	102,519,113
Variable Cost of Services (COGS)	22,186,367	25,113,899	27,688,441	27,688,441	27,688,441	27,688,441	27,688,441	27,688,441	27,688,441	27,688,441
Gross Profit	40,463,196	64,664,251	74,830,672	74,830,672	74,830,672	74,830,672	74,830,672	74,830,672	74,830,672	74,830,672
	54%	61%	61%	61%	61%	61%	61%	61%	61%	61%
Expenses										
Salaries & Benefits (Excl. Admin)	8,031,900	8,433,495	8,855,170	9,297,928	9,762,825	10,250,966	10,763,514	11,301,690	11,866,774	12,460,113
General & Admin (w/ Rent)	1,269,000	1,299,750	1,332,038	1,365,939	1,401,536	1,438,913	1,478,159	1,519,367	1,562,635	1,608,067
Other Non-Salary Expenses	8,205,371	10,955,996	11,993,808	11,993,808	11,993,808	11,993,808	11,993,808	11,993,808	11,993,808	11,993,808
Total Operating Expenses	17,506,271	20,689,241	22,181,016	22,657,676	23,158,169	23,683,687	24,235,481	24,814,865	25,423,218	26,061,988
Operating Income										
EBITDA	22,956,925	43,975,010	52,649,656	52,172,996	51,672,502	51,146,984	50,595,190	50,015,807	49,407,454	48,768,683
Depreciation & Amortization	(11,792,385)	(12,261,513)	(11,662,293)	(11,092,358)	(10,550,275)	(10,034,684)	(9,544,290)	(9,077,861)	(8,634,226)	(8,212,272)
Interest	(9,361,184)	(7,511,550)	(5,547,834)	(3,463,001)	(1,249,580)	0	0	0	0	0
Earnings Before Taxes	1,803,356	24,201,948	35,439,528	37,617,637	39,872,647	41,112,300	41,050,901	40,937,946	40,773,227	40,556,411
	2%	23%	29%	31%	33%	34%	34%	34%	33%	33%
Net Earnings										
Corporate Taxes	(4,629,079)	(8,627,742)	(11,774,437)	(12,300,624)	(12,845,376)	(13,149,543)	(13,134,755)	(13,107,505)	(13,067,743)	(13,015,389)
Earnings After Taxes	(2,825,724)	15,574,206	23,665,091	25,317,013	27,027,271	27,962,757	27,916,146	27,830,441	27,705,484	27,541,022
	-4%	15%	19%	21%	22%	23%	23%	23%	23%	23%

Balance Sheet

	Beg. Balance	June 2021	June 2022	June 2023	June 2024	June 2025	June 2026	June 2027	June 2028	June 2029	June 2030
A - Total Assets		**249,878,969**	**233,614,894**	**223,477,989**	**212,908,173**	**201,835,193**	**229,797,950**	**257,714,096**	**285,544,537**	**313,250,021**	**340,791,043**
Current Assets											
Cash & Cash Equivalents (External Financing)		(1,021,985)	(5,024,547)	(3,499,159)	(2,976,617)	(3,499,322)	34,498,120	71,958,555	108,866,857	145,206,567	180,959,862
Total Current Assets		(1,021,985)	(5,024,547)	(3,499,159)	(2,976,617)	(3,499,322)	34,498,120	71,958,555	108,866,857	145,206,567	180,959,862
Long Term Assets											
Equipment & Assets	0	250,900,954	238,639,442	226,977,148	215,884,790	205,334,515	195,299,831	185,755,541	176,677,681	168,043,454	159,831,182
Accumulated Depreciation											
Capital Expenditure											
Total Long Term Assets	0	250,900,954	238,639,442	226,977,148	215,884,790	205,334,515	195,299,831	185,755,541	176,677,681	168,043,454	159,831,182
B - Total Liabilities & Equity		**249,878,969**	**233,614,894**	**223,477,989**	**212,908,173**	**201,835,193**	**229,797,950**	**257,714,096**	**285,544,537**	**313,250,021**	**340,791,043**
B1 - Total Liabilities		**139,627,357**	**107,789,076**	**73,987,080**	**38,100,251**	**0**	**0**	**0**	**0**	**0**	**0**
Current Liabilities											
Short Term Loans		0									
Total Current Liabilities		0	0	0	0	0	0	0	0	0	0
Long Term Liabilities											
Long Term Loans	0	139,627,357	107,789,076	73,987,080	38,100,251	0	0	0	0	0	0
Total Long Term Liabilities	0	139,627,357	107,789,076	73,987,080	38,100,251	0	0	0	0	0	0
B2 - Total Equity & Retained Earnings		**110,251,612**	**125,825,818**	**149,490,909**	**174,807,922**	**201,835,193**	**229,797,950**	**257,714,096**	**285,544,537**	**313,250,021**	**340,791,043**
Shareholder's Equity											
Equity Capital	0	113,077,336	113,077,336	113,077,336	113,077,336	113,077,336	113,077,336	113,077,336	113,077,336	113,077,336	113,077,336
Net Income (Current Year)		(2,825,724)	12,748,482	36,413,573	61,730,587	88,757,857	116,720,615	144,636,761	172,467,201	200,172,686	227,713,708
Total Shareholder's Equity	0	110,251,612	125,825,818	149,490,909	174,807,922	201,835,193	229,797,950	257,714,096	285,544,537	313,250,021	340,791,043

Cash Flow Statement

	June 2021	June 2022	June 2023	June 2024	June 2025	June 2026	June 2027	June 2028	June 2029	June 2030	June 2031
A - Cash Flow from Operations											
Net Income	(2,825,724)	15,574,206	23,665,091	25,317,013	27,027,271	27,962,757	27,916,146	27,830,441	27,705,484	27,541,022	
Depreciation	11,792,385	12,261,513	11,662,293	11,092,358	10,550,275	10,034,684	9,544,290	9,077,861	8,634,226	8,212,272	
Cash Flow from Operations	8,966,662	27,835,719	35,327,385	36,409,371	37,577,546	37,997,441	37,460,436	36,908,302	36,339,711	35,753,294	263,513,119
											Terminal CFO
B - Cash Flow from Investing											
Capital Expenses	(262,693,340)	0	0	0	0	0	0	0	0	0	
Cash Flow from Investing	(262,693,340)	0	0	0	0	0	0	0	0	0	(25,022,153)
											Terminal CFI
C - Cash Flow from Financing											
Loan Activity	169,616,004	0	0	0	0	0	0	0	0	0	
Loan Payment	(29,988,647)	(31,838,281)	(33,801,996)	(35,886,829)	(38,100,251)	0	0	0	0	0	
Investment Activity	113,077,336	0	0	0	0	0	0	0	0	0	
Cash Flow from Financing	252,704,693	(31,838,281)	(33,801,996)	(35,886,829)	(38,100,251)	0	0	0	0	0	
Total Cash Flow	**(1,021,985)**	**(4,002,562)**	**1,525,388**	**522,542**	**(522,705)**	**37,997,441**	**37,460,436**	**36,908,302**	**36,339,711**	**35,753,294**	**238,490,966**
											Terminal Value

Variable Sensitivity Analysis – Wheat & Paddy in Punjab						
Sr	**Variable**	**Change Units**	**Minus 10%** IRR & Payback	**Base Case** IRR: 16.6% Payback: 8.1Y	**Plus 10%** IRR & Payback	**Impact & Observations** (High, Medium, Low)
1	Storage Charges (PKR/Maund per Month)	Wheat: ± 1.5 Paddy: ± 2.5	**13%** -3.6% **9.2Y** +1.1	Wheat: 15 Paddy: 18	**20.1%** +3.5% **7.3Y** -0.8	**High:** Expectedly, plays an important role in improving profitability & cashflows. Degree of impact is linked to storage utilization and bound by customer's willingness to pay
2	Drying Charges (PKR/Maund)	Wheat: n/a Paddy: ± 6.5	**14.2%** -2.4% **8.8Y** +0.7	Wheat: n/a Paddy: 70	**18.9%** +2.3% **7.6Y** -0.6	**High:** Improves profitability & cashflows. Degree of impact is dependent on minimizing idle capacity and bound by customer's willingness to pay
3	Storage Utilization (% of Installed Capacity) First four years only	± 10%	**12.9%** -3.7% **9.2Y** +1.2	Y1: 70% Y2: 85% Y3: 100% Y4: 100%	**17.4%** +2.8% **7.9Y** -1.0 Affects Y1&Y 2 only	**High:** Full utilization is critical. Linked to storage charges and marketing strategy.
4	Capitalization Ratio	± 10%	**16.1%** -0.5% **8.0Y** -0.1	60%	**17.1%** +0.5% **8.2Y** +0.1	**High:** Critical for sustainability by addressing early liquidity challenges. Limited impact on overall profitability. Linked to loan tenor.
5	Loan Tenor	± 2 Years	**15.1%** -1.5% **7.9Y** -0.2	5 Years	**18.2%** +1.6% **8.4Y** +0.3	**High:** Critical for sustainability by addressing early liquidity challenges. Limited impact on overall profitability. Linked to capitalization.
6	Capital Expenditure	± 10%	**20.4%** +3.8% **7.4Y** -0.7	263 million	**13.6%** -3.0% **8.8Y** 0.7	**Medium:** Despite a significant impact on profitability, any reduction in CAPEX may adversely impact service delivery.
7	Salaries	± 10%	**17.3%** +0.7% **7.9Y** -0.2	Base	**15.9%** -0.7% **8.3Y** +0.2	**Medium:** Moderate impact on profitability but ability to further reduce these costs is limited.
8	Tax on Services	± 10%	**23.5%** +6.9% **6.7Y** -1.4	16%	**9.3%** -7.3% **10+Y** ~1.9	**High:** The highest impact variable for profitability & sustainability. Critical for early stage cashflows.
9	Import Duties	± 10%	**17.3%** +0.7% **7.9Y** -0.2	28%	**15.9%** -0.7% **8.3Y** +0.2	**Medium:** Low impact on profitability useful to reduce CAPEX and mitigate barrier to entry
10	Borrowing Rate	± 5%	**18.3%** +1.7% **7.6Y** -0.5	6%	**14.8%** -1.8% **8.7Y** +0.6	**Medium to High:** Moderate impact on profitability. Also addresses early-stage liquidity challenges.
11	Weighted Average Cost of Capital (WACC)	± 5%	**18.1%** +1.5 **8.1Y** -	14%	**15.1%** -1.5% **8.1Y** -	**Low to Medium:** High impact on terminal value but does not impact cashflows early on.

12	Exchange Rate (USD to PKR)	± 16.5	**17.5%** -0.9% **7.9Y** -0.2	165	**15.7%** -0.9% **8.4Y** +0.3	**Low:** Limited impact on profitability.

ANNEX-11: INTERNATIONAL COMPARISON OF PAKISTAN'S EWR REGIME

	Pakistan	India	Turkey	Ukraine
Form of Receipt	Legal framework for EWR has now been enacted. The EWR Regime does not permit physical / paper receipts.	Primarily paper, but in transition towards the EWR regime since 2016.	Legal framework exists for EWR and it is in common use. No paper WHRs are allowed in the country.	Legal framework exists for EWR and it is in common use.
central repository	'CMC' (a private body licensed by the SECP) acts as a central repository.	Repositories are licensed by government authority.	Securities Depository ('MKK') acts as a central / national depository.	Central Electronic Warehouse Receipt Register ('State Registrar of Ukraine') acts as the central / national repository
Accrediting Agency	Accreditation is not mandatory. Registered CMCs are privately owned, but regulated by the SECP, and may accredit warehouses.	WDRA (a statutory authority) may register a warehouse itself, or through a registered private accrediting agency	Warehouses are licensed by the Ministry of Industry & Trade. Licensing is mandatory for all newly-built warehouses.	Mandatory state accreditation was abandoned in 2014, but it remains used on a voluntary basis.
Agricultural Produce Standard	No central Body.	Directorate of Marketing & Standards sets standards.	Grading through well-equipped laboratories licensed as 'Authorised	State (National) Standards maintained by the regional Agricultural

			Classifier' that are supervised by the Central/National Grain Lab of the Turkish Grain Board (TMO).	Quality Control (former Bread Inspection) organization, and being monitored and arbitraged by the Central/National Grain Lab.
Commodity Exchange Operations	Pakistan Mercantile Exchange (PMEX) is the only one national derivatives exchange. There is no spot trading on the central exchange (PMEX).	As of 2018 several stock exchanges also launched trading in commodities. Futures and spot trading are permitted.	Primarily spot trading at regional / province commodity exchanges, but few futures contracts on wheat, cotton, and maize are traded and supported by the EWR at central mega exchange Bourse Istanbul.	There are some commodity exchanges (like, Agrarian Commodity Exchange, Ukrainian Universal Exchange and Ukrainian Commodity Futures Exchange), but operations are rather limited and not supported by the EWR.

7. REFERENCES

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