

## **ESTABLISHMENT OF COLD CHAIN SYSTEM UNDER “NATIONAL TRADE CORRIDOR IMPROVEMENT PROJECT”**

### **Executive Summary**

Horticultural sector contributes about 12% to the national agricultural GDP of Pakistan, and holds great potential for increasing export of premium quality horticultural produce, and offering multiple employment opportunities throughout the supply chain, particularly in rural areas. However, its growth and profitability is restrained mainly by the lack of proper postharvest management and transport infrastructure. Out of 13.67 million tonnes of fruits and vegetables produced annually, about 25% goes waste, between farms to consumers, while only 4% is exported at far lower price (41%) compared to world average price, owing to poor produce quality and relying on traditional low end markets. Improving the postharvest management infrastructure (grading, packing, storage and transport/cold-chain) will help reduce high postharvest losses, increase production surplus along with improving shelf life and quality of fresh produce, which will help to stabilize prices in domestic markets as well as to substantially boost export to highly lucrative and competitive international markets. Keeping in view the importance of the cold chain, Ministry of Commerce, Government of Pakistan, initiated to carryout a Pre-feasibility study on “Establishment of Cold Chain System” under “National Trade Corridor Improvement Project”. M/s Arch Vision, was assigned to conduct the studies, while, Pakistan Horticulture Development & Export Board (PHDEB) was responsible for overseeing the project.

The pre-feasibility study consists of two aspects: background studies of the horticulture sector including production, exports, imports, commodity losses etc (Vol.-I); and technical and financial details for the components of the cold chain system including Pack houses (Vol.-II), Cold stores (Vol.-III) and Reefer containers (Vol.-IV), with overall objective of establishing an interconnected series of export/pack houses, cold stores, and credit pool for refrigerated containers.

### **FRESH PRODUCE INDUSTRY**

During the last decade, horticultural crop production has increased from 11.3 million tonnes to 13.7 million tonnes, which is expected to reach 19.4 million tonnes by the year 2009-10. The production analysis shows that share of fruits and vegetable is 48.6% and 51.4% respectively. Among the major fruit crops, citrus, mango, dates, guava and apple contribute 30, 25, 9, 9, and 5%, respectively in production. While in vegetable production potato, onion, and tomato share 29, 25 and 6 % respectively. The production mapping shows that huge potential in citrus processing, storage and exports exists in Sargodha. However, Toba Tek Singh and Mandi Bahauddin (Punjab) are also potential areas for establishing new grading, packaging and cold storage facilities. Mango is predominantly grown in Punjab, with Multan, Rahim Yar Khan and Muzaffar Garh districts sharing 54.9% of total production. However, the importance of Hyderabad and Mir Pur Khas remains obvious for domestic and export markets, due to one-month advance season. Khairpur (Sindh), Turbat and Punjgur (Balochistan) and D.I. Khan (NWFP) produce

dates of remarkable quality. Grapes are mostly cultivated in Balochistan (Pishin 68%, Quetta 9%). Major apple producing districts include South Waziristan (16.9%) and Swat (13.9%) in NWFP and Zhob and Mustang in Balochistan together share 22.5%. In apricot, Killa Saifullah and Loralai (Balochistan) are main areas with 50 and 13.82% production respectively. About 57% of Peaches are produced in Swat (NWFP), while premium quality plums are produced in Kalat (Balochistan), Mardan and Swat (NWFP). Among vegetables, onion is the leading vegetable crop; Chagi (Balochistan), Hyderabad and Sanghar (Sindh) are the leading production districts. Potato is mainly grown in Okara and Sahiwal in Punjab (> 43%). Top tomato producing areas include Kila Saifullah, Barkhan, Nasirabad and Jaffarabad districts in Balochistan and Swat district in NWFP. Establishment of modern packing grading and storage facilities in the production areas will not only help boost export of fresh produce, but also will help in the rural development and well-being of millions associated with this sector.

Pakistan has 162.4 million people, with 17.6% in 10 main cities. Over the last decade, population increased by 2.62% annually (2.62 millions per annum). Increased urbanization has resulted in increased volumes of fresh produce transported to main consumption /trade centers. Most of fruits and vegetables are produced in distant areas across the country, and the current state of transport (open non-refrigerated trucks) is one of the major factors contributing to the heavy postharvest losses (20-40%). The challenge of providing enough fruits and vegetables to the growing population @2.0% per annum, fast urbanization, and increasing exports can only be met by reducing post-harvest losses. The improvement in postharvest handling and establishment of cold chain, especially the availability of refrigerated containers will help reduce postharvest losses, improve shelf life while maintaining produce quality at destination.

Although Pakistan produces large quantities of fruits and vegetables, however its exports are negligible, with large price gap compared to international average prices. Total export of fruits and vegetables during 2005-06 was only 0.557 million tonnes (4%) worth \$168 million, @ \$301.6/t, which is almost 41% less than the average price of same commodities in international markets. Among the main reasons of lower prices include poor produce quality, export to low-end market, and limited market access on account of compliance issues (wood packing, fruit fly, pesticide residues and contaminants etc) by many of the importing countries. The absence of modern packing, grading and refrigerated transport facilities is primary obstacle to improve quality and compliance to standards and food safety needed to enter into more lucrative but competitive markets like EU, Japan and China. Establishment of such facilities will greatly enhance competitiveness of our product, thereby increasing export.

Pakistan, itself is a large market for quality fruits and vegetables. However, the marketing system lacks proper cold storage facilities and integrated cold chain, thereby has substantial postharvest losses with reduced shelf life and quality of fresh produce. The domestic price analysis shows large fluctuation in prices of most of the commodities; with minimum at peak supply periods and maximum at short supply time. Establishing cold storage facilities and storing fresh produce at peak time, while releasing at lean time

will ensure availability of produce over extended period thus stabilize prices along with improving shelf life and quality.

Regarding the overall cold chain infrastructure, recent studies show that total cold storage capacity of country is around 6.37%, of which >95% is in Punjab, mostly concentrated in main cities and potato growing areas. There is little concept of crop specific humidity and temperature regulation in storage thus the produce suffers both qualitatively and quantitatively due to water loss or chilling injury, etc. None of the airport, seaport or terminal (Exit/Entry) land routes has cold storage facility. As a national strategy, Pakistan needs to increase the cold storage capacity, well distributed in production areas and linked to domestic markets as well as to export points. Further, helping private sector in technology up gradation of the existing cold storage and providing training in maintenance of cold stores will help improve the quality of produce in existing storage as well.

It can be concluded that Pakistan produces abundant quantities of premium quality fruits and vegetables. Provided the high postharvest losses are minimized, country would have large production surplus with better shelf life and quality of fresh produce for export. From the aspects of sustainability, profitability and competitiveness, Pakistan needs to modernize its horticulture sector and investing in postharvest management and cold chain infrastructure is among the foremost steps to go forward. The overall constraints to Horticulture sector and recommendation for its improvement are summarized below.

### ***Constraints***

- Small landholdings of more than 80% farmers
- Soil and ground water salinity and irrigation constraints
- Quality and availability of inputs (seeds/ nursery/fertilizers/pesticides).
- Large yield variation, high postharvest losses and poor produce quality at destination.
- Contractual marketing, absence of market information system, and lower returns to growers
- Large price fluctuation (domestic market) and export price gap
- Lack of technical labour
- Lack of modern packing grading and storage facilities.
- Compliance issues (Quality standards, Sanitary & Phytosanitary issues, Food safety, Pesticide residues, Traceability)
- Non availability of independent Food Testing Laboratories
- Poor transportation means and absence of cold chain infrastructure
- Absence of any standard R&D facility for postharvest and cold chain.
- Lack of integration between research, academia and extension

### ***Recommendations***

- Changing industry from production based to quality and export based.
- Infrastructure development (Physical: Farm to market roads, railway, airways and shipping: cold chain: packing, storage, reefer containers) and involving private sector investment in cold chain infrastructure

- R & D capacity building in the area of fresh produce cold chain, by establishing a Centre of Excellence in Postharvest Science and Technology.
- Human resource development and strengthening R & D and linkage between the institutions and industry
- Intelligent Marketing: Improving quality for compliance, exploring new markets and developing Market Intelligence System
- Policy making: Subsidize certification of EUREPGAP, HACCP, etc., ensuring credit facilities, and duty free import of machinery of cold chain infrastructure

## **PROPOSED COLD CHAIN INFRASTRUCTURE**

In the light of horticulture outlook discussed and by using production-mapping technique and survey, packing/grading and storage plants have been proposed in areas of prime importance to serve as a model for establishing such facilities by private investors in future.

State of the Art facilities are proposed for all components of national cold chain infrastructures. Pack Houses are most modern, completely automated and equipped with advanced electronic devices. Palletized cold stores are proposed along with all requisite handling and safety equipments while refrigerated containers must meet requirements for ATO approval.

### **EXPORT PACK HOUSES (WITH COLD STORE FACILITIES)**

<b>Province</b>	<b>City/Area</b>	<b>Proposed Pack House /Cold Store</b>	<b>Storage Capacity (Tonnes)</b>	<b>Commodity*</b>
<b>Punjab</b>	Bhalwal	1 PH & 1 CS	5000 (10 X 500)	Kinnow (20 t/h)
	Multan	3 PH & 3 CS	1000 (4X250)	Mango (8-10 t/h)
	R.Y.Khan	2 PH & 2 CS	1000 (4X250)	Mango (8-10 t/h)
	Muzafar Garh	2 PH & 2 CS	1000 (4X250)	Mango (8-10 t/h)
	Sahiwal	2 PH & 2 CS	2000 (4 X 500)	Potato (10 t/h)
	Okara	2 PH & 2 CS	2000 (4 X 500)	Potato (10 t/h)
	Pak Pattan	1 PH & 1 CS	2000 (4 X 500)	Potato (10 t/h)
	Sialkot	1 PH & 1 CS	1000 (4 X 250)	Potato (10 t/h)
	Kasur	1 PH & 1 CS	1000 (4 X 250)	Potato (10 t/h)
	T.T. Singh**	1 PH & 1 CS	3000 (6 X 500)	Kinnow (5 t/h)
	Mandi Bhaudin**	1 PH & 1 CS	3000 (6 X 500)	Kinnow (5 t/h)
	Khanewal	1 PH & 1 CS	2000 (4 X 500)	Mango, Citrus & Vegetable (5 t/h)
	Sheikhupura**	1 PH & 1 CS	2000 (4 X 500)	Vegetable (5 t/h)
	Gujranwala**	1 PH & 1 CS	2000 (4 X 500)	Vegetable (5 t/h)
Faisalabad**	1 PH & 1 CS	2000 (4 X 500)	Vegetable (5 t/h)	
<b>NWFP</b>	Swat	1 PH & 1 CAS	4000 (8 X 500)	Peach, Apple (10-12 t/h)
	D.I. Khan**	1 PH & 1 CS	2000 (4 X 500)	Vegetable (5 t/h)
	Peshawar	1 PH & 1 CAS	3000 (6 X 500)	Apple (5 t/h)
<b>Sind</b>	MirpurKhas	1 PH & 1 CS	1000 (4 X 250)	Mango (8-10 t/h)

	Hyderabad	1 PH & 1 CS	1500 (3 X 500)	Mango (8-10 t/h) + Banana Ripening Facility
		1 PH & 1 VS	1000	Onion (10 t/h)
	Sanghar	1 PH & 1 VS	1000	Onion (10 t/h)
<b>Balochistan</b>	Quetta	1 PH & 1 CAS	2000 (4 X 500)	Apple (5 t/h) & Grapes
	Kalat	1 PH & 1 CAS	1500 (3 X 500)	Apple, Apricot (10-12 t/h)
	Kila Saifullah	1 PH & 1 CAS	2000 (4 X 500)	Apple, Apricot (10-12 t/h)
	Pishin	2 PH & 2 CAS	2000 (4 X 500)	Apple, Apricot, Peach (10-12 t/h) & Grapes
	Mastung	1 PH & 1 CAS	2000 (4 X 500)	Apple (5 t/h) & Grapes
	Loralai	1 PH & 1 CS	1000 (4 X 250)	Apple, Apricot (5 t/h)
	Zhob	1 PH & 1 CAS	2000 (4 X 500)	Apple, Apricot (10-12 t/h)
	Chaghi	1 PH & 1 VS	1000	Onion (10 t/h)
	Panjgur	1 PH & 1 CS	5000 (10 X 500)	Dates (4 t/h)
	Kharan	1 PH & 1 VS	1000	Onion (10 t/h)

*PH: Pack House; CS: Cold Storage; CAS: Controlled Atmosphere Storage; VS: Ventilated Storage*

*\* A part from commodities shown in table, citrus mango and tomato can be processed on same plant, while apple, peach, apricot and pear can also be graded on same plant. Plants for onion and potato will be separate as the technology is different. Similarly for grapes special equipment is used and these cannot be processed with other commodities. Additional packing line grapes will be provided at the indicated location. Infrastructure for grapes can also be used for strawberries.*

## **COLD STORAGE AND CONTROLLED ATMOSPHERE STORAGE**

<b>Province</b>	<b>City/Area</b>	<b>Requirement</b>	<b>Capacity (Tonnes)</b>	<b>Commodity*</b>
<b>Punjab</b>	Sargodha (Production Area)	1 CS	3000 (6 X 500)	Kinnow
	Sargodha (F & V Market)	1 CS	1500 (3 X 500)	Fruits and vegetables
	Kot Momin	1 CS	5000 (10 X 500)	Kinnow
	Islamabad	1 CS	5000 (10 X 500)	Kinnow, Apple Potato
<b>NWFP</b>	Peshawar	1 CS	5000 (10 X 500)	Peach, Apple Potato
	Mardan	1 CS	2000 (4 X 500)	Peach & Apple
	Waziristan	1 CS	2000 (4 X 500)	Apple
	Chitral	1 CS	1000 (4 x 250)	Fruits and vegetables
<b>Balochistan</b>	Chaman	1 CS	1000 (4 X 250)	Fruits and vegetables
	Quetta	1 CAS	5000 (10 X 500)	Apple and other fruits and vegetables
	Turbat	1 CS	5000 (10 X 500)	Dates & other Fruits
<b>Sindh</b>	Khairpur	1 CS	5000 (10 X 500)	Dates
	Sukkur	1 CS	3000 (6 X 500)	Dates & other Fruits

*\* Proposed cold /controlled atmosphere stores are for immediate needs ad the assessment is based on survey results and feedback from stakeholders*

## PROPOSED COLD STORES REQUIREMENT AT AIRPORTS AND SEAPORTS

<b>Air Ports/Sea Ports</b>	<b>Capacity Cold Store + Freezer Unit (Tons)</b>	<b>Products</b>	<b>Remarks</b>
Karachi	500 (5 x 100)	Fruits and vegetables, Meat, frozen food and pharma products.	----
Lahore	300 (3 x 100)		Extendable to 500
Faisalabad	200 (2 x 100)		Extendable to 300
Multan	200 (2 x 100)		Extendable to 300
Quetta	200 (2 x 100)		Extendable to 300
Peshawar	200 (2 x 100)		Extendable to 300
Islamabad	200 (2 x 100)		Extendable to 300
<b>Sea Ports</b>			
Port Qasim, Karachi	5000 (10 x 500)		----
Karachi Port	5000 (10 x 500)		----
Gwadar*	5000 (10 x 500)	----	

*Note: One out of proposed compartments may be made as freezer unit for frozen foods, meat, pharmaceutical etc at each airport and seaport, are suggested to enhance utility of facility and to make it more sustainable.*

*\* Proposed cold /controlled atmosphere stores are for immediate needs and the assessment is based on survey results and feedback from stakeholders*

## REFRIGERATED CONTAINERS

National cold chain system cannot function effectively in the absence of a national pool of refrigerated containers. It is proposed to establish two containers yards in Karachi and Lahore with a pool of 200 refrigerated containers and 50 CA refrigerated containers in each location. Karachi pool will serve the requirement of Sindh and Balochistan provinces while Lahore pool will serve the requirement of Punjab and NWFP.

## **SUMMARY OF FINANCIAL ANALYSIS OF PROJECT\***

<b>Component</b>	<b>Description</b>	<b>Numbers/ Capacity</b>	<b>Estimated Cost</b>	<b>IRR</b>	<b>NPV</b>	<b>Benefit Cost Ratio</b>
1.	Pack house with Cold Stores	39 Facilities / 71,000 Tons	Rs. 5.40 billions	42.40%	Rs. 15.69 billion	2.14
2.	Cold/Controlled Atmosphere Stores	23 Facilities / 60,300 Tons	Rs. 1.84 billions	30.81%	Rs. 3.09 billion	1.76
3.	Reefer Containers	500 Nos.	Rs. 2.16 billions	32.00%	Rs. 3.87 billion	2.03
	<b>Total Cost</b>		<b>Rs. 9.40 billions</b>			

*\*Project will be established as Public Private Limited Company with 15%: 15% equity and 70% loan from banks.*

The financial analysis clearly indicates that all three components of the project are financially viable.

For the success of the project the corporate setup of the project is suggested as Public Limited Company comprises of public and private sponsors sharing equal equity. The public subscription will be equal to sponsors equity and the remaining project cost will be met through long term project financing on the basis of 70%-30% debt/equity (15% government equity 15% private sponsors' equity).

The private sector equity is quite high for which financially very sound sponsors are required to be selected by providing them feasibility of the project and marketing campaign.

Since the break even point of Refrigerated containers is on higher side, government must formulate policy for existing banking/financial institutions to create special credit pool for procurement of refrigerated containers at lower than existing markup. (i.e. 6% for Cold chain).

## **CONCLUSION**

- It must make compulsory that plants and machineries suppliers will provide technical know how to operate and maintain the project. Training programs for sponsors and investors shall be organized for technical and administrative staff including visits to foreign countries. This will help in learning the functioning of state of art facilities and proper implementation of the project.
- Potential users will be persuaded for extensive utilization of cold chain facilities for local distribution of fruits and vegetables as well as export.

- Private entrepreneurs and exporters should participate in equity.
- Government should organize initial investment 15% as government equity for the project.
- Awareness campaign through workshops, banners distribution of handouts highlighting the benefits of utilizing cold chain system shall be arranged to motivate the stakeholder.

For sustainability of the project policies shall be formulated in following areas.

- Employment of highly qualified managerial staff with relevant experience.
- Training of technical and administrative staff for human resource development.
- Constant Research and Development in horticulture sector.
- Future expansion and acquiring updated equipment and technologies.
- Constant follow up to explore and capture new export markets.
- Making mandatory to use cold chain facilities for export of fruits & vegetables.
- Establishment of local industry to manufacture refrigerated containers in Pakistan.
- Establishment of credit pool for Refrigerated Containers and its effective disbursement arrangement to make the use of refrigerated containers a success as a backbone of national cold chain system.