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**ECONOMIC FEASIBILITY STUDY
(UP-DATED)**

**FRESH PRODUCE
COLD STORAGE FACILITY**

**QUEEN ALIA INTERNATIONAL AIRPORT
AMMAN - JORDAN**

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ECONOMIC FEASIBILITY

The following budget estimate, tables and narratives apply to an outside cold storage facility measuring 12m wide x 40m long, located near the S.W. corner of the existing Air Cargo Building with the building and refrigeration from the USA.

I. CAPITAL COSTS

The capital costs associated with the cold storage facilities proposed to be built in Queen Alia International Airport (QAIA) are itemized in Table 1. Investment in building, equipment and site preparation is estimated at 385,000 JD or \$ 550,000. An estimated 34 percent of the capital investment is in building, 23 percent is in the refrigeration package, 26 percent is in conveyor system, and 17 percent is site preparation and miscellaneous cost.

II. ANNUAL OPERATING COSTS

Estimates for operating costs per year for the proposed cold storage facilities in Queen Alia Airport are outlined in Table 2. The annual cost of each item is described in this section and based on a six month operating season.

- 1. Utilities:** It is estimated that total electricity cost per month to operate the refrigeration system is 1,000 JD. Total annual cost, based on eight months operating period per year, is 8,000 JD.
- 2. Maintenance and Repair:** The maintenance and repair cost for the refrigeration system, including the humidifier, is 466 JD per month. Annual maintenance cost for the refrigeration system, based on six months operating period, is 2,800 JD. A maintenance cost of 360 JD for doors, curtains and lights and 300 JD for the conveyor system per year are also included in the operating cost estimates. The total annual maintenance cost is estimated at 3460 JD.
- 3. Spare Parts:** Average annual cost for the purchase and installation of spare parts needed for the refrigeration system, including the humidifier, is estimated at 4,500 JD. This is based on 5 percent of the purchasing value of the refrigeration package. This percentage is considered maximum allowable by most experts for spare parts.
- 4. Depreciation Reserve:** The depreciation reserve is generally used as a reserve fund for the replacement of building and equipment at the end of their useful economic life. A straight

line depreciation method with zero salvage value is used. The historical performance of cold storage facilities in the Gulf area with specifications similar to what have been recommended in this study, is used to estimate the useful life of the building and equipment.

The following useful economic life is used for the building and each of the pieces of equipment: (a) twenty five (25) years for the building, (b) fifteen (15) years for the refrigeration package including the humidifier, and (c) eighteen (18) years for the conveyor system.

Total annual depreciation reserve is estimated at 16,700 JD to pay for the replacement cost of the building and the equipment of the cold storage project. This depreciation reserve is distributed as follows: (a) 5000 JD per year to replace the building, (b) 6000 JD per year to replace the refrigeration package, and (c) 5,500 JD per year to replace the conveyor system.

5. Labor Cost: One person year of labor is allocated to operate the cold storage, maintain exact temperature and humidity and to keep a complete record of the quantity of all products that enter and leave the storage facility. The one person year labor cost is estimated at 4000 JD.

6. Total Annual Operating Cost: The total annual cost to operate, maintain and replace the building and equipment is estimated at about 36,600 JD. The next section will analyze the break even operating cost or average operating cost under various assumed quantity of air cargo shipments of fresh produce from Queen Alia International Airport.

III. AVERAGE OPERATING COST

Average operating costs, or cost per unit, is estimated for various quantities of produce projected to be handled by the cold storage. The quantity of fruit and vegetables shipped by air from Jordan during the 1988-94 period varied from 3265 metric tons in 1989 to 2164 metric tons in 1994, with a low shipment of 1559 metric tons in 1992 and peak shipment of 5281 metric tons in 1991 (Table 3). Average shipment of fruit and vegetables by air during this period was 3272 metric tons.

The results of a recent interviews of several growers, shippers and exporters who are actively involved in the air cargo export of fresh produce show that the availability of cold storage and the proper handling of fresh produce at Queen Alia International Airport will increase air cargo shipments of fresh produce by 20 per cent over the 1993 level. It is also estimated cargo shipment of fresh produce will continue to increase by 7 percent annually. Air cargo shipment of fresh produce will reach and may exceed the 1990 level within 10 years after the establishment of the cold storage facilities at Queen Alia International Airport.

Average operating costs per ton is an indicator of the cost per ton the airport authority has to charge the shippers in order to cover the annual cost of providing this service. The cost per ton

charge the shippers in order to cover the annual cost of providing this service. The cost per ton will vary by the quantity shipped as shown in Table 4. The average operating cost ranges from 16.9 JD per ton based on the 1994 air cargo shipment to about 5.80 JD per ton based on the projected air cargo shipment in year 2008. The estimated average operating cost based on the 1990 and 1991 air cargo shipment of fresh produce from Queen Alia International Airport is about 6.9 JD per ton. In general, the average operating cost or charges for cold storage per ton to maintain the high quality of Jordanian produce in the export market is insignificant. It ranges between 1.6 percent to less than 0.6 percent of the product value at the export market.

IV. RETURN TO INVESTMENT

Total investment cost in the cold storage facilities to handle fresh fruit and vegetables at the Queen Alia Airport for air cargo shipment is estimated at 385,000 JD. The cold storage facility is expected to increase the value of the fresh produce at the export markets by about 8 percent. Estimated total annual net return attributed to the cold storage facility each year from 1994 to 2008 is shown in Table 5. This net return is based only on the benefit to shippers from maintaining quality of the produce during the process of shipping. It does not include the benefit to Royal Jordanian Airlines from increase in cargo shipments or reducing losses to shippers from incidents of product loss caused by departure delay..

Return to Investment

Annual net increase in the value of fruit and vegetable exports by air ranges from 122,181 JD in 1994 to 351,568 JD at the end of fifteen years from the initial investment in the cold storage facility. Average annual increase in net return over the 1994-2008 period is estimated at 283,161 JD. The discounted average annual increase in net return over this period is 160,435 JD.

The benefit-cost ratio of this investment, based on a 15 year useful life and discounted value of the annual increases in export is estimated at 6.25. The annual rate of return to the investment in cold storage facilities is calculated using the following formula:

$$QNR = TIC(1+r)$$

Where:

QNR=Discounted Net Return

TIC = Total Investment Cost

r=Internal Rate of Return

t=Time

The internal rate of return to this investment is conservatively estimated at about 11.2 percent. This rate of return is based on the useful life of the investment of only 15 years, no benefit to Royal Jordanian Airlines from increases in air cargo shipment, and no benefit to shippers from reducing losses caused by departure delay.

V. CONCLUSIONS

Agriculture is a major industry in Jordan. It accounts for over 21 percent of Jordan's total export. The fruit and vegetable sector represents about 29 percent of the value of agricultural production. This sector also accounts for about 68 percent of total agricultural exports. Jordan exports about 44 percent of its annual production of fresh fruit and vegetables.

Fruit and vegetables will remain important to Jordan's economic growth and it is a significant part of the Nation's export. Air cargo shipment of fruit and vegetables is becoming an increasingly important transportation mode for most exporting and importing countries of the World. Israel, for example, ships an estimated 80,000 metric tons of fresh produce by air every year and has airport cold storage facilities to handle this quantity. Airport cold storage for fresh produce in Israel is estimated to range from 1-2 days before shipment. Jordan's traditional market, the Gulf, is receiving fresh produce by air cargo from other countries. This traditional market for Jordan's fresh produce will soon require increasing quantities of air cargo shipments to maintain high quality.

Most major airports in countries that export fresh produce have cold storage facilities. In order for Jordan to realize its potential in the export of fresh produce, an airport cold storage facility is a must. The estimated cost per ton for cold storage services is very low and may be less than 50 percent of the costs reported in Israel.

Table 1. COLD ROOM - CAPITAL COST ESTIMATE

#	Category	Jordanian Dinars	(USD @ .7)
1	Cold Room: Modular, Prefab Panels with Doors and Lights, Dock Levelers, Roof Coated, Exterior Painted	130,000	\$ 186,000
2	Refrigeration Package: Nominal 25 Ton Operating Load, Including Installation	90000	\$ 128,000
3	Conveyor System: Includes Re-activating some idle RJ Equipment, and purchase of certain items. RJ to do installation	100000	\$143,000
4	Engineering, Site prep, Utility Stubs, Permits	5000	\$ 7,000
5	Concrete floor with drains, fork-lift ramp, refrigeration pad rails for transport vehicle	20000	\$ 30,000
6	Packing and ocean freight (No customs/duty) 8 containers	29000	\$ 41,500
7	Technical Assistance from USA Suppliers	10000	\$ 14,000
TOTAL CAPITAL COST		385000	\$ 550,000

TABLE 2. ANNUAL OPERATING COST

#	Cost Category	Cost/Month JD	Cost/Year JD
1	Utility*	1,000	8,000
2	Maintenance	577	3,460
	a. Refrigeration Package	466	2,800
	b. Doors, etc.	60	360
	c. Conveyor	50	300
3	Spare Parts	750	4,500
4	Depreciation	2,783	16,700
	a. Building	833	5,000
	b. Refrigeration Package	1,000	6,000
	c. Conveyor	917	5,500
5	Labor	333	4,000
Grand Total		6,193	36,600

* Utility cost is based on industrial rate, the size of the condenser and the capacity of the cold storage room. Utility cost is estimated at 1000 JD per month for an 8 month operating period.

TABLE 3. AIR CARGO SHIPMENT OF FRUIT AND VEGETABLES FROM JORDAN, 1988-94.

Year	Air Cargo Shipment In Metric Tons		
	Fruit	Vegetables	Total
1989	594	2671	3265
1990	349	4779	5128
1991	436	4845	5281
1992	552	1007	1559
1993	781	1451	2232
1994	349	1815	2164

Source; Agricultural Marketing Organization

TABLE 4. AVERAGE OPERATING COST PER UNIT AIR CARGO SHIPMENT OF FRUIT AND VEGETABLES.

#	Year	Estimated Average Shipment (Metric Ton)	Average Cost (JD/Ton)	Average Cost (JD/Kg)
1	1994	2164	16.9	0.0169
2	1995	2595	14.1	0.0141
3	1996	2777	13.1	0.0131
4	1997	2972	12.3	0.0123
5	1998	3180	11.5	0.0115
6	1999	3402	10.7	0.0107
7	2000	3640	10.5	0.0105
8	2001	3895	9.4	0.0094
9	2002	4168	8.7	0.0087
10	2003	4460	8.2	0.0082
11	2004	4772	7.6	0.0076
12	2005	5106	7.1	0.0071
13	2006	5463	6.6	0.0066
14	2007	5845	6.2	0.0062
15	2008	6255	5.8	0.0058

TABLE 5. NET RETURN ATTRIBUTED TO INVESTMENT IN THE COLD STORAGE AT QUEEN ALIA INTERNATIONAL AIRPORT, 1994-2008.

#	Year	Air Cargo Shipment (ton)	Value at Export Market*		Increase in Net Value of Export by Air**		Discounted Increase in Net Value of Export*** (JD)
			S	JD	S	JD	JD
1	1994	2164	2,164,000	1,514,800	173,120	121,184	114,324
2	1995	2595	2,595,000	1,816,500	207,600	145,320	129,750
3	1996	2777	2,777,000	1,943,900	222,160	156,212	186,689
4	1997	2972	2,972,000	2,080,400	237,760	166,432	188,698
5	1998	3180	3,180,000	2,226,000	254,400	178,080	191,278
6	1999	3402	3,402,000	2,381,400	272,160	190,512	193,021
7	2000	3640	3,640,000	2,548,000	291,200	203,840	194,133
8	2001	3895	3,895,000	2,726,500	311,160	217,312	195,698
9	2002	4168	4,168,000	2,917,600	333,440	233,108	198,476
10	2003	4460	4,460,000	3,122,000	356,800	249,760	199,329
11	2004	4772	4,772,000	3,340,400	381,760	267,232	201,989
12	2005	5106	5,106,000	3,574,200	408,480	285,936	203,223
13	2006	5463	5,463,000	3,824,100	437,040	305,928	210,115
14	2007	5845	5,845,000	4,091,900	467,600	327,320	212,545
15	2008	6255	6,255,000	4,378,500	500,240	351,568	214,690

* Value of fresh fruit and vegetables exported via air cargo shipments from Jordan is estimated to average 1.00 JD per Kg. C.I.F. London.

** Based on 8 percent increase in value at the export market.

*** A discount rate of 6 percent is used.