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AZERBAIJAN COMPETITIVENESS AND TRADE (ACT) PROJECT

Cold Storage Operations Assessment

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Azerbaijan Competitiveness and Trade (ACT) Project

Cold Storage Operations Assessment

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TABLE OF CONTENTS

1. Executive Summary.....	2
1.1 Cold Chain Sector.....	2
1.2 Action Plan.....	4
2. Cold Storage Operations.....	4
2.1 Introduction.....	4
2.2 Cold Storage Facilities Reviewed.....	5
2.3 Business Profiles.....	49
2.4 Building Construction.....	50
2.5 Refrigeration and Controls.....	52
2.6 Business Management.....	54
2.7 Product Knowledge.....	55
2.8 Value Added Services.....	56
3. Workshop.....	57
3.1 Introduction.....	57
3.2 Component – Financial Management.....	58
3.3 Operations Management.....	59
3.4 Equipment Preventive Maintenance.....	60
3.5 Food Safety, Rodent & Pest Control.....	60
3.6 Additional Considerations.....	60
4. Conclusions and Recommendations.....	61
4.1 Next Steps.....	64
4.2 Pilot Program.....	65
4.3 Analysis of Survey (including Costs and Benefits).....	66
5. Appendix 1.....	69

1. Executive Summary

1.1 Cold Chain Sector

Modern Azeri cold storage operations are a recent addition to the food supply chain of Azerbaijan. To put this into perspective; of the 10 operations visited during this assessment all were newly constructed within the past 2 years. In Azerbaijan, produce, meats, and other food products are typically managed with centuries old processes used to maintain shelf life. Thus, rarely are foods subjected to cold storage techniques as a normal methodology in day to day Azeri life. The aims of cold storage are to extend shelf life, slow the aging process, maintain quality and taste, maintain resale value, reduce losses, and maintain food safety. Building upon these realized goals, and introducing marketing strategies, a more viable domestic and export market can emerge.

As noted in an earlier report from Dr. Pica...

“Agriculture in Azerbaijan provides 39.3% of all employment or 2.3 million workers (as compared to approximately 1% or 58,000 workers from oil) but only 6% of GDP or 4.5 billion USD (2008). Azerbaijan’s major cash crops are grapes, cotton, tobacco, citrus fruits, and vegetables, and all of these but cotton and tobacco are dependent upon an effective cold chain if they are to be economically viable and sustainable. The UN Food and Agriculture Organization estimates that approximately 40% of the value of these crops (or over US\$2 billion) is currently lost due to the lack of adequate cold chain facilities. Accordingly, improvements in the country’s cold chain segment of major cash crops such as fruits and vegetables will have a very significant monetary impact.”

With these figures and information in mind, it is significantly valuable to develop traditional food chains into a modern “cold chain” methodology. To do so would provide an economic injection into the agricultural sector (including in support of exports) of Azerbaijan, serve as a new employment sector in the country, especially in the rural traditionally agro-economic areas, aid in the mitigation of food borne illnesses and prolong product value and shelf life.

Cold storage warehouses are an essential supporting component impacting nearly every value chain. Traditionally referred to as the “cold chain”, it can be reduced to its most basic elements as follows:

1. Harvesting
2. Pre-Cooling
3. Processing, (Sorting, Grading, Value Added Services)
4. Cold Storage (commonly includes humidity control for produce)

5. Cold Transportation
6. Wholesale/Retail

In a more modern, robust cold chain, many of these components will be shared or merged within a single facility, operation, or process. A typical modern cold chain might appear as follows:

1. Harvesting, Pre-Cooling, Sorting and Grading
2. Wholesale, Cold Storage, Transportation,
3. Retail

Of the many tenets a robust cold chain will follow, one of them is: “fewer touches, fewer problems”. As the three steps above show, this means simply, that the product is handled, manipulated, moved or engaged as few times as possible. The primary reason for this stems from efficiency gaining and cost control. However a positive bi-product of this philosophy is that foods are damaged less and arrive at retail in much better condition as a result of these more efficient processes.

The Government of Azerbaijan has determined that agriculture is a priority growth area and is working to develop the sector. This is obvious in the cold storage arena where new, modern cold storage facilities have been built with the aid of the Government of Azerbaijan (GOAJ). Further processing (fruit juice concentrates, etc.) opportunities for growth will emerge in time as a result of the increase in food related infrastructure. Processing industry growth is commonly viewed as a significant target for many countries, thus this extension or bi-product of an emerging sector will also aid in the economic growth in rural areas and the country as a whole.

Azerbaijan has many resources and infrastructure bases already in place. Adding to, repairing, and further supporting these areas can lead to an increase in production of agricultural commodities and increased economic opportunities naturally stemming from them. The country has a very viable climatic opportunity for a variety of agricultural commodities, has an extensive transportation network, and has linked most agricultural areas to traditional infrastructures, such as water, energy, telephone, etc. The primary highway arteries are in place and in good repair, thus moving commodities to transportation and logistical hubs should be efficient. Secondary highways and roads are in need of attention and currently add to the damage that produce incurs when being transported. Again however, a base of secondary roads has already been developed, lending to re-surfacing as the target opportunity in this regard.

Cooperative extensions, GOAJ, and NGO training opportunities exist at the farm level for extension training in crop management, pesticide and herbicide use, as well as proper harvesting and post-harvest handling.

1.2 Action Plan

High quality produce exports are an opportunity market for Azerbaijan. To seize this opportunity, there are several infrastructure and support areas which need to be addressed before being considered a viable competitor in the international market. First, the harvesting and pre-cooling of product must be managed and better understood at the farm level. Second, the roads leading from agricultural areas to collection/infrastructure areas must be sufficiently wide and smooth to reduce damage to, and to aid in the efficient movement of the trucks and the produce to the market. Currently significant product loss occurs as a direct result of post-harvest and transportation related damage.

Technical training and a basic understanding of refrigeration systems and operation, and product handling is missing and must be addressed in the near-term, to allow for the proper use, and protection of the product, equipment, and facilities. Further, warehouse operations management training must be initiated to aid the businesses in reaching a positive return on investment, and to aid the industry in moving forward with efficiencies and higher standards of care. Though opportunities exist for robust use of the new cold storage facilities, a lack of marketing expertise related to agriculture is apparent. Further training and support should be leveled at this issue.

Finally, a significant supporter of these sectors globally is the industry associations. All links in the food supply chains and cold chains should join or develop industry associations, designed to further their economic interests, provide training and technical knowledge, aid in the development of marketing and other business materials, and serve as knowledge pools and network links to the global food industry.

2. Cold Storage Operations

2.1 Introduction

The ACT Project is focused on expanding business development and increasing opportunities in high potential value chains. One such arena of this support is the cold supply chain, or food supply chain. Of particular interest and need in this chain is the design, development, and professional operation of cold storage warehouse facilities.

The core concepts and deliverables provided are as follows:

1. Developed and conducted a thorough firm level questionnaire to ground truth/reconfirm the previous findings by PSCEP (the previous USAID value chain project), and attempted to ascertain a firm understanding of the cost of operations.
2. Visited and surveyed cold storage operations in an effort to gain first-hand knowledge of the situation on the ground, and to have a clear understanding of them to conduct an effective and productive workshop for cold storage operators and interested parties.
3. Conducted an industry-wide workshop providing cold storage management with financial and operational training complete with an introduction to cost-benefit analysis, recommendations on break-even points, inventory turns, storage recommendations, mechanical systems recommendations, and human resource needs. Included in the workshop were safe handling and application of products for rodent control, and preservation of products.
4. Developed and delivered a cost – benefit analysis tool and trained attendees (of the workshop) in the use of the tool.
5. Developed numerous necessary and helpful cold storage plain language guides to all sectors including consumers explaining the value of proper cold storage and outlining specific “Do’s and Don’ts” with regard to handling and storage of various products.
6. Selected a pilot group of cold chain operators to support improvements working through the BDS and technical experts including staff. The ultimate goal is to increase utilization of the facilities and at the same time increase the earning potential of sector farmers.

2.2 Cold Storage Facilities Reviewed

During the course of the project, Ten (10) Cold Storage Facilities were visited, reviewed and discussed with local management or ownership contacts. These facilities were located in several different areas of the country. Facilities/towns visited included Saatli, Salyan, Hajigabul, Shivan, Sabirabad, and Guba.

All facilities visited were new or near new construction (within 3 years) and of common, modern design in the cold storage industry. Refrigeration and humidification equipment was also new, as were ancillary components such as doors, lighting, weather stripping, concrete finish, walls, insulation, and load bearing design.

Most facilities were located in the heart of the produce farming/harvest areas, and in many cases were quite literally located adjacent to the very farms they served. This of course should have a positive impact on the time used from harvest to processing, grading, sorting, pre-cooling and storage. Though this concept was common, it was *not* consistent.

Road and highway infrastructure is a common support element vital to the cold supply chain, and one that will be looked at in greater detail later. Most facilities visited were NOT near major highways or arteries, nor were the roads adjacent to the buildings in good condition.

Electrical and water infrastructure is stabilized in nearly all areas visited, though common black-outs are reported at an average of one hour per day. This of course demands that alternative energy (generators) be employed to augment the electrical supply.

A synopsis of each of the ten facilities along with supporting pictures is provided below to give the reader a visual cue to the report contents to follow. In many cases, pictures are noted to guide the reader to the condition, situation, concern, or equipment of note.

1st Cold Storage Location

Name: NNEM Farming LLC

Region/City: Salyan

Contact: Nadir Abdulov

Contact Position/Duty: Executive Director

Total Storage (SM): 10000

Total Pre-Cooling (SM): 450

Total Processing (SM): 8200

Year Built: 2008 -2010

Anticipated Produce: pomegranate, persimmon, grape, potato

Percentages of Produce stored:

- Pomegranate 30%
 - Grape – 30 %
 - Persimmon – 30%
 - Other fruits and vegetables – 10 %
- Building – New Modern Turkish Design (multi room facility)
 - Insulated walls – height: 9-10 meters (too high- no racks);
 - Insulated ceiling;
 - Vapor barrier flat concrete floor;
 - Insulated doors;
 - Air curtains at exterior doors;
 - Strip curtains at interior doors;
 - Covered docks;
 - Central air controlled corridor to separate storage rooms;
 - Pre-cooler room; and
 - Processing/sorting room
 - Refrigeration Equipment - New Turkish manufacturer
 - Humidification Equipment – New Turkish manufacturer
 - Ethylene reduction - Vent holes from storage rooms to plenum. (draw down fans)
 - Material handling equipment – New electric forklift US manufacturer
 - Processing equipment – Belted conveyor processing “station” system
 - Business Model – 50% public storage (farmers are customers) 50% purchase from farmers (customer is self)
 - No business plan in effect
 - No marketing plan in effect
 - **Current Status – Empty, equipment running**



Exterior Condenser/Compressor – Turkish “MesSan” Manufacturer



Sorting, Grading Conveyor Equipment



Grading Tables



Overhead Roller Doors to Cooler



New Forklifts



Processing Room with Conveyor system



Strip Curtains at Doors



Evaporators and Humidifier in each cooler



Central Corridor to coolers on each side



Temperature/Humidity controller at door



Air curtain above door protecting evaporator



Finished, Paved Entrance for trucks



Elevated, Covered docks. Covered Equipment



Strip Curtain Air protection. White color exterior

2nd Cold Storage Location

Name: Aladdin LLC

Region/City: Salyan

Contact: Rovshan Ashirov

Contact Position/Duty: Executive Director

Total Storage (SM): 3800

Total Pre cooling (SM): 250

Total Processing (SM): 3300

Year Built: 2007 -2010

Anticipated Produce: pomegranate, kiwi, persimmon, grape and other fruits

Percentages of Produce stored:

- Pomegranate 50%;
 - Kiwi 20%;
 - Persimmon 15%; and
 - Other fruits 15%
-
- Building – New Modern Turkish Design
 - Insulated walls – height: 9-10 meters (too high- no racks);
 - Insulated Ceiling;
 - Vapor barrier flat concrete floor;
 - Insulated Doors;
 - Strip curtains at exterior doors;
 - Strip curtains at interior doors;
 - Covered docks;
 - Central Air controlled corridor to separate storage rooms;
 - Pre-cooler room; and
 - Processing/sorting room
 - Refrigeration Equipment - New Turkish manufacturer
 - Humidification Equipment – New Turkish manufacturer
 - Ethylene Reduction – None
 - Material Handling Equipment – New electric forklift US manufacturer
 - Business Model – 50% Vertical Business. Farmer owns storage
 - Minimal Business plan in effect
 - No Marketing plan in effect
 - **Current Status – Empty – Finishing Construction, Equipment NOT Running**



Difficult Entrance for trucks, unfinished/ungraded



Central Corridor with adjacent storage rooms



Plastic, sturdy storage crates (however bruising/cutting may occur)



Future Processing Area

3rd Cold Storage Location
Recommended for Pilot Program

Name: Yurd EI LLC

Region/City: Hajigabul

Contact: Ilgar

Contact Position/Duty: Executive Director

Total Storage (SM): 2100

Total Pre cooling (SM): 144

Total Processing (SM): 1850

Year Built: 2009- 2010

Anticipated Produce: pomegranate, persimmon, grape and other fruits

Percentages of Produce stored:

- Pomegranate 50%
 - Persimmon 25%
 - Grape and other fruits 25 %
- Building – New Modern Turkish Design
 - Insulated walls – height: 9-10 meters (too high- no racks);
 - Insulated Ceiling;

- Vapor barrier flat concrete floor;
- Insulated Doors;
- Strip curtains at exterior doors;
- Strip curtains at interior doors;
- Covered docks;
- Central Air controlled corridor to separate storage rooms;
- Pre-cooler room – low ceiling (good design); and
- Processing/sorting room
- Refrigeration Equipment - New US (Carrier) Manufacturer
- Humidification Equipment – New Turkish manufacturer
- Ethylene Reduction – NONE
- Material Handling Equipment – New electric forklift US manufacturer
 - Business Model – Purchase from farmers?
 - No business plan in effect
 - No marketing plan in effect
- **Current Status – Empty, Equipment Turned Off**



VERY high ceilings (waste)



New Condensers/Compressors (US Mfg.)



Good access road



Modern equipment (no strip curtains)



Pipe “bollards” protecting walls from equipment

4th Cold Storage Location

Name: Saatli Cold Storage

Region/City: Saatli

Contact: Jamal Hamidov

Contact Position/Duty: (Mr. Hamidov was unavailable, visit contact was Warehouse Supervisor

Total Storage (SM): 2100

Total Pre cooling (SM): 144

Total Processing (SM): 1850

Year Built: 2009- 2010

Anticipated Produce: pomegranate, persimmon, other fruits and vegetables

Percentages of Produce stored:

- Pomegranate 50%
 - Persimmon 20%
 - Other fruits 15%
 - Vegetables 15%
- Building – New Modern Turkish Design
 - Insulated walls – height: 9-10 meters (too high- no racks);
 - Insulated Ceiling;

- Vapor barrier flat concrete floor;
- Insulated doors;
- Strip curtains at exterior doors;
- Strip curtains at interior doors;
- Covered docks;
- Central air controlled corridor to separate storage rooms;
- Pre-cooler room; and
- Processing/sorting room
- Refrigeration Equipment - New Turkish manufacturer
- Humidification Equipment – New Turkish manufacturer
- Ethylene Reduction – Evacuation fan holes drilled in high ceiling, no equipment connected to fan mounting plates (incomplete equipment installation)
- Material Handling Equipment – New electric forklift US manufacturer
 - Business Model – Purchase from farmers
 - No business plan in effect – Manager unable to answer *any* questions relative to building, business, equipment, or planning
 - No marketing plan in effect
- **Current Status – Empty, Equipment turned off**



Highway Frontage (Perfect Marketing opportunity)
Paved and Graded, Secure driveway



Turkish mfg. Temperature/Humidity controller (humidity is OFF in picture)



Strip Curtains and Pipe Bollards protections. High Ceiling (waste)



Central, cooled corridor with adjacent storage rooms



Ethylene evacuation vents cut into high wall location (Good). (contractor failed to connect fans to vents, though wiring is installed and ready for fans)



External, raised condensers and compressors (not covered)



Equipment – Turkish mfg.



Secure, gated entrance off main highway

5th Cold Storage Location

Name: Unalagro LLC

Region/City: Guba

Contact: Zulfugar Mammadov

Contact Position/Duty: Executive Director

Total Storage (SM): 1300

Total Pre Cooling (SM): 80

Total Processing (SM): 1220

Year Built: 2007

Anticipated Produce: apple, sweet cherry, plum

Percentages of Produce:

- Apple 90%
- Sweet cherry 5%
- Plum 5%

• Vertical Business:

- Equipment intensive farming
- Processing/Dehydration
- Pre-Cooling

- Storage
- Processing facility designed for Dehydration of Fruit for further process by other:
 - Hydro Cooler
 - Sanitizer
 - Dicing/Slicing
 - Waste/Debris Sorter
 - Dehydration Heater
- Efficient Large Crate (apples) for storage
- Efficient Material Handling Equipment (forklifts, pallet jacks)
- Modern retrofit of older existing building
 - Insulated Sandwich panels;
 - New refrigeration equipment;
 - Oversized Humidification equipment;
 - Utilization and reliance upon “old traditional methodology” in lieu of training on and understanding new technology/equipment; and
 - Maintenance person unwilling to change processes



Large apple crates for storage, forklifts and pallet jacks for efficient movement



Covered dock, covered storage for crates



Protected refrigeration equipment (no cover)



Fully vertical Farm/Processing/Storage facility



Apple Dehydration Processing Equipment



Sample: Finished Product (dehydrated apple bits)



Heater for dehydration



End of 1st stage cooling, cleaning, dicing section of process



Separator (removes small pieces/debris)



Refrigeration/Humidity controllers (Off)



High velocity humidifiers instead of traditional new humidifiers (waste)



Future processing/cleanup area



Strip curtain protection low ceiling height (good) in pre-cooler

6th Cold Storage Location

Name: Farmer name unknown

Region/City: Guba

Contact: Mammadhuseyn Mammadov Director-GMC

Position/Duties: Owner of farm and equipment

Total Storage (SM): 60

Total Pre cooling: 0

Total Processing: 0

Year Built 2009

Anticipated Produce: Apple, plum

Percentages of Produce:

- Apple 80%
 - Plum 20%
- Storage consists of three, twenty ton refrigeration containers with Carrier refrigeration units
 - Debris, vegetation and filth consistent around units, including evidence of rodent and pest control problems
 - Mildew and filth in excess inside containers
 - No access to containers
 - No strip curtains inside doors
 - Dubious inspection of refrigeration equipment performed (sight glasses inoperable)



Three - twenty ton refrigerated containers used as cold storage



Severe rodent/pest control problem (rotting tomatoes next to cooler)



Owner/farmer believes the equipment has been recently calibrated. The Thermometer *may have been*, however as the image shows, the hygrometer (humidity) was not.



Vegetation is growing up into the refrigeration units



The owner/farmer noted the air intake (upper left) as the humidity control device. This is sufficient for low-mid humidity levels, for short periods of time. However when 90-95% humidity is required, this is not effective.



The refrigeration sight glasses appeared damaged or ineffective



Carrier equipment on all three containers



View of Cold Storage (3 containers) note rusty vessels adjacent to food storage containers



Gate to facility, possibly impassible for large trucks

7th Cold Storage Location

Name: Meyvechi LLC

Region/City: Guba

Contact: Teymur Huseynov

Contact Position/Duties: General Director

Total Storage (SM): 1400

Total Pre cooling (SM): 120

Total Processing (SM): 1280

Year Built 2004

Anticipated Produce types: apple, plum and sweet cherry

Percentages of Produce:

- Apple 80 %
 - Sweet Cherry 15%
 - Plum 5%
- Retrofit of existing building

- Maintenance person has convinced the General Director of the inaccuracy of refrigeration and humidity monitoring devices, and instead employs “feel” to know when the refrigeration and humidity are accurate;
- Maintenance person had hi-volume humidifiers placed in rooms because they want “powerful fog” in the rooms. (They want to see and feel the humidity); and
- Maintenance person also purges all air from rooms to relieve excess ethylene. When informed ethylene is lighter than air and rises to the ceiling, he rejected the advices and instead will employ hi velocity fans on the floor in open doorway to purge the rooms of ethylene gas.



Flat, graded driveway



Hi Volume Humidifiers. (Replaced new humidifiers)
Note Mildew on ceiling above humidifier



New evaporators



Note humidifier and evaporator close to door



Unfinished, un-insulated ceiling (note water on floor, water is sprayed on floor to add more humidity)



Raised, covered dock



Refrigeration equipment elevated. (Note excess articles stored near refrigeration equipment)

8th Cold Storage Location
Recommended for Pilot Program

Name: Agroline LLC

Region/City: Guba

Contact: Galib Yehyayev

Contact Position/Duties: Technical Manager

Total Storage (SM): 3000

Total Pre cooling (SM): 250

Total Processing (SM): 2500

Year Built: 2011

Anticipated Produce: Apples

Percentages of Produce stored:

- Apple 100%

- Retrofit of existing building shell;
- Controlled Atmosphere rooms;
- Cooler rooms;
- Pre Cooling rooms;
- Processing rooms;
- Raised platform mezzanine for refrigeration and atmosphere equipment;
 - Refrigeration and CA Technicians office in Mezzanine with computer control of all equipment; and
- Currently under construction (completion scheduled: August 2011)



Controlled Atmosphere (CA) rooms for apples



Central corridor adjacent to all rooms



Note: CA stack in center-top of picture



Mezzanine equipment control area



Pallet jack and new apple crates



Graded, paved lot outside (under construction)



Refrigeration technician office in Mezzanine Computer controlled equipment throughout



Storage room with evaporator

9th Cold Storage Location
Recommended for Pilot Program

Name: Bakuba LLC

Region/City: Guba

Contact: Zaur Aliyev

Contact Position/Duties: Executive Director

Total Storage (SM): 4500

Total Pre cooling (SM): 300

Total Processing (SM): 4000

Year Built: 2007-2011

Anticipated Produce: apple, sweet cherry

Percentages of Produce stored:

- Apple 90%
- Sweet cherry 10%

- Elevated Docks;
- Shipping and Receiving office on dock;

- Well designed room heights;
- Well positioned temperature and humidity monitoring devices;
- Poor road to facility;
- “Barn Doors” as opposed to overhead roller doors or rapid roll doors (waste/inefficient); and
- Azeri Design and Construction of Building and Equipment.



Covered, elevated dock, for more efficient loading/unloading of trucks



Covered dock with shipping/receiving office near the work (good). Forklift for efficient product movement.



Retrofitted existing building with modern components



Unfinished road to facility



Elevated dock (good), flat driveway is average



Condensers above compressors and vessels



Refrigeration equipment in protected cage



Humidifier in good location (away from door)



Good floor finish



Good ceiling height for pre-cooler (no wasted head space)

10th Cold Storage Location

Name: Barakat I LLC

Region/City: Guba

Contact: Alyosha Abdulmanafov

Contact Position/Duties: Executive Director

Total Storage (SM): 2100

Total Pre cooling (SM): 144

Total Processing (SM): 1750

Year Built: 2010

Anticipated Produce: apple, persimmon

Percentages of Produce:

- Apple 70%
 - Persimmon 30%
-
- Ethylene Scrubber (no documentation or user instructions available;)
 - Auto shut off for lights in storage rooms;
 - Pipe Bollards for wall protection;
 - All new equipment;
 - Raised docks;
 - No strip curtains; and
 - Hi ceilings in corridor (waste)



Automatic shut off switch for lights when door is closed



Ethylene Scrubber (Note: management did not understand how the equipment worked, nor were they able to locate the manufacturer's documentation)



Wooden fruit crates on pallets, good storage configuration. Dehumidifiers and evaporators present (Note: no strip curtains)



Plastic, nesting totes on pallets. Good storage configuration



Pallet jacks for efficient product movement



Central corridor with pipe bollard protection (high ceiling waste)



Portable roller conveyor for efficient sorting/grading



Unfinished, ungraded driveway, covered dock



Covered compressor farm



Elevated condenser farm

2.3 Business Profiles

The common business profile observed was one of “agrarian support”. In other words, the cold storage businesses observed did not appear to have been the construct of a carefully considered construction and business model, followed by a cost-benefit analysis, and further investigation into market opportunities, including external forces, domestic and export market reviews, etc. Rather, due to the availability of government sponsored low interest lending, the farmers and other agri-business related persons capitalized on this available low interest funding and set out to build a large complex that would certainly help them with their crop harvest by providing them longer times to store their produce, and thus extend the season and further capitalize on margin gains as time progressed away from the typical harvest season. However beyond this minimalist approach, no other considerations of a business plan seem to have materialized. So, the typical business plan is: Harvest – Store – Sell – Shut Down. Though not *all* of the operations follow this thinking, (1 operation is working on further processing of dehydrated apple products), it certainly is the norm.

This is a common situation observed in many developing and emerging areas wherein the government has sponsored similar programs. A cursory review from the outside would suggest that these applicants and applications for the state sponsored loans are not being reviewed as comprehensively as they should be. It also appears that not a lot of effort was leveled at making sure there was a sound business model in place prior to the loans being approved. One common marker for this assessment is; of the 10 facilities visited, all of them were non-

operational. That is to say, nearly all of the equipment was turned off, and there was *no product* in storage at any of the facilities. Another marker resulted from discussions with the business directors and general directors. In almost every instance when asked of their plan to develop the business and begin to operate it profitably, the standard response is, “we will wait until the harvest season, then fill it up, then sell the product”. When asked what happens after the harvest season and subsequent selling season, there were no plans for future business. One very good outcome of these conversations is that the directors were *extremely* interested in obtaining help in marketing their businesses. They were generally very direct and frank in their self-assessment that they did not know how to market the business or buildings and needed help from experts. This marketing help will be further discussed in the “Recommendations” section of this report.

2.4 Building Construction

As mentioned earlier in this report, all of the facilities identified were of new or near new construction. Most of them were of Turkish design and construction, though one facility was designed by an Azeri firm.

All of the facilities observed appeared to be designed according to “best design” or latest known technology, though certainly much smaller than most facilities found in the West. The materials and applications used were “modern”. The following principle areas of construction were observed and considered appropriate for the purpose and of “good design” among ALL facilities visited:

- Wall Insulation – Sandwich Panel;
- Ceiling Insulation – Sandwich Panel;
- Floors – Vapor Barrier, Insulated, Polished Slab (limited deviation);
- Doors – Insulated, over-door roller;
- Refrigeration Equipment – Industrial - Freon based, new compressors, condensers and evaporators with centralized control panels;
- Humidifiers – industrial;
- De-Humidifiers – (None Observed);
- Ethylene “Scrubbers” – (1 US made model observed);
- Controls – Digital, externally monitored; and
- Material Handling Equipment – Forklifts, Pallet Jacks, and Hi-Lifts.

In most cases, refrigeration, humidification, controllers and other technical equipment was of Turkish manufacture, though Dutch, German and US manufacturers were also noted.

Obvious cold storage design knowledge was observed in the following ancillary design concepts:

- Pipe “Bollards” – Protecting walls from Forklifts and other heavy equipment;
- Automatic Light Switches – mounted on doors to automatically turn lights off when doors are closed;
- Combined Temp/RH% Monitors – located Outside of Cold Rooms near door;
- Refrigeration Equipment Load Design – appears to be designed to properly manage heat load;
- Room heights – designed for racking and more modern logistics approach as business evolves;
- Pre-Cooling Rooms – low ceiling height, sized to maximize pre-cooling process; and
- Poly “Through Wall” Bolts – used to mitigate heat transfer between hot/cold areas.

In some cases, it was noted that design considerations were not as thorough as they should have been. Though overall the buildings seem to have been designed very well, and with a great degree of knowledge as to the cold storage industry’s needs, it is apparent that there was not a lot of effort given to the specific needs of each separate facility. In other words, with some small differences, most of the facilities appear to have followed certain “design molds”. Some of the areas overlooked in many facilities are:

- Ethylene removal – with the exception of One (1) facility, there were no remedies provided in design for the off-gassing of storage rooms;
- Low Heat/Low kwh Lighting – In almost all facilities, typical fluorescent tubing fixtures were noted;
- Motion Sensors – No motion sensors for lighting noted;
- Room Design – in most cases, the products stored cannot be stacked to maximize the height of the rooms, nor are there immediate plans to add racking to the facilities. Thus, much of the storage space is wasted;
- Strip Curtains – though present in most facilities, the use of strip curtains at ALL doorways was not Standard, nor the use of “air curtains” in lieu of strip curtains, though one (1) air curtain was observed in one building;
- Driveways- Unfinished in all facilities. This is unsatisfactory, and all should have been Graded at a minimum at the conclusion of construction;
- Exterior Color Used – White is the standard color (to reflect heat/sunlight away from the building. Dark colors were observed on several buildings; and
- Temp/Humidity Sensor location – Generally the sensors were placed in less-than-optimal locations. (away from equipment, doors and other devices which could alter the sensor readings) The sensors should be

placed so as to read the average environment the product will be subjected to.

In numerous instances it was noted that after construction was completed, local, “age-old” methods were re-introduced to the building to supplant the equipment or methodology designed into the building. Generally speaking, the mechanical repair persons responsible for the equipment are un-trained and unfamiliar with refrigeration equipment, especially new, state-of-the-art computer assisted equipment. As a result, these people turn to what they know and convince the directors they know what they are doing. The following improper or damaging examples were noted:

- Turn off Humidifier – Spray water on the floors;
- Disregard Thermometers and Hygrometers – Apply “wisdom and knowledge” in lieu of calibrating and trusting the equipment;
- Replace newer humidification equipment with older larger equipment – *Larger equipment is more powerful* and “creates a fog” in room. (thus, if you can see fog, it is better than the pre-set humidification percentages being set precisely to the needs of the produce); and
- Open cooler doors all the way and purge air to evacuate ethylene (NOTE: when told to add ventilation system at the top of the rooms to evacuate ethylene with low-volume fans, *most* repair persons argued that Ethylene was *heavier than air* and would drop, not rise in the room. This is *not* scientifically based. Ethylene is slightly lighter than air and does rise.

2.5 Refrigeration and Controls

The refrigeration equipment observed was consistent with the best design equipment of its size and type elsewhere. Most equipment observed was of Turkish manufacture, and some US and German condensers were observed. Two “outlier” pieces of equipment were observed; a US manufactured Ethylene Scrubber and an Azeri designed refrigeration system.

All of the equipment observed was new and still under warranty according to management contacts. It was impossible to review the equipment under normal operating conditions as the facilities were empty of product, and the equipment was turned off. Management was advised to cycle the equipment often, according to manufacturer’s recommendations, and monitored and documented to assure that it would be effective when the harvest season begins. (At the time of this writing, the cherry season is approximately 10 days from harvest). The rooms should be cooled and humidified at least 3 days in advance of the first shipment to evaluate, measure, and react to equipment and atmosphere requirements.

Refrigeration and Humidity control devices are consistently in place among the facilities, however a general lack of knowledge exists regarding the methodology of the equipment, its accuracy, and re-calibration methods. Also, it should be noted, a general, if not cultural distrust of monitoring equipment. In short, trusting temperature and humidity readings will not occur overnight, first an understanding must be gained of proper calibration methodology, and subsequent benchmarking against the calibrations must be made and accepted before broad acceptance of control devices will be gained.

The largest concern is management's disregard of mechanical requirements and preventive maintenance of mechanical equipment. The expert was unable to confirm, among ten facilities visited, a single person to be considered refrigeration, or humidity experts, nor anyone who has been trained in the maintenance and operation of refrigeration equipment. Further, there was no evidence to support that management would follow the advice to send a technician for training. Routinely, it was noted that the equipment was "under warranty" for two to three years, and until then, it would not be a concern. Further attempts to argue this point were unsuccessful.

Also of particular concern is the lack of documentation. Manufacturers' specifications and operations and repair manuals were not in evidence. Nor were there any preventive maintenance plans or check lists available. This will require a remedy in the short term, lest significant mechanical breakdowns and ineffective operations will begin to occur when the equipment is subjected to normal operating loads.

Replacement parts and spare parts to be stored for emergencies are also a concern to be addressed. All attendees of the workshop, as well as facilities visited were provided with a list of common replacement parts and spare parts that should *always* be stored and available immediately upon an equipment malfunction emergency. Refrigeration equipment can be quite sensitive and unforgiving with little to no redundancy in system design. When a part malfunctions, often, the unit disengages, the result of which is no refrigeration. Since it was noted that most spare parts come from Turkey, and that 7-10 days in transit is common, the adoption of a "spare parts shelf" becomes an operational necessity.

Lightning protection of building and equipment was not in evidence, and when questioned, management was consistently unable to verify the existence of lightning protection. The solid state design of most new refrigeration control equipment (control panels) is significantly susceptible to voltage spikes, especially spikes as significant as a lightning strike to the building. The buildings tend to be large, metal structures, with a relatively high amount of electrical use and consumption. It is strongly encouraged to add lightning protection to the buildings and the equipment.

2.6 *Business Management*

The science and application of business management practices is obviously an integral part of the successful operation of a cold storage facility. As noted in previous sections of this report, numerous areas for improvement exist in this arena. Owners and management are strongly encouraged to invest in training in the following disciplines related to the effective and profitable operation of a cold storage facility and related supply chain operations:

- Core Training Disciplines
 - Economics
 - Operations Management
 - Post Harvest Handling
 - Refrigeration Equipment Repair and Maintenance
 - Humidification Equipment Repair and Maintenance
 - Energy Management
 - Rodent and Pest Control
 - Food Safety (HACCP)

- Additional Education Disciplines
 - Marketing
 - Produce Science and Harvesting Techniques
 - Building Repair and Maintenance
 - Material Handling Equipment Repair and Maintenance

A marked lack of knowledge in the marketing arena was also observed. Facilities are empty, with equipment turned off, and no marketing efforts being made to off-set the fixed costs of the business during the “off season”.

The expert encouraged attendees of the workshop to assess their local markets and economies, and look for opportunities to store different products or provide other services to markets other than the farmer/produce market. Examples such as bio-medical supplies, pharmaceuticals, micro-chips, ice-cream, fresh meat, frozen meat, dairy, as well as other cold storage intensive items were mentioned. Also, conducting an “open house” picnic for local and regional retailers, wholesalers, restaurants, hotels and other institutions was encouraged, if for no other reason than to announce to the local market that a new professional operation was available for short and long term needs. It was also encouraged to view the facility as an opportunity to create revenue streams from a variety of different vehicles, not only “rent for space”. A primary example of unique marketing opportunities to be attempted is notifying local retailers that they now had the ability to buy in bulk when they were presented with volume discounts, and that they could store excess volume with the cold storage facility. Also, the concept of volume discounts for retailers or wholesalers who used the facility

consistently was discussed. All of these ideas were delivered as “thinking outside of the box” and a way to view the operation in terms of opportunities to offer something new and better. It was stressed that there are no “rules” that must be followed regarding marketing of the operation.

Personnel management, documentation and data management and control, budget forecasting and management, and product safety and control are also of significant importance to the business. These areas, though administrative in nature, are extremely important to the short and long term “management” of the business. Documentation and data management and retention, provide the successful business person with the opportunity to deeply review history and derive trends and additional future opportunities from it. For example, if proper receiving documentation were managed and maintained over time, specific abusers (shippers or farmers) of temperature or of product would become known through trending analysis. This would allow the business to address the situation directly with the abuser and work with that particular operator to fix the problem, and would provide the business with the financial impacts related to this specific farmer or shipper. In short, it would provide the business with the opportunity to save money by avoiding future problems.

Again education and training in these disciplines is strongly encouraged. Most of these disciplines appear to be in short supply as observed during the facility visits. Also, operations management is of significant importance to the business. The understanding of the value of energy efficiency, the knowledge of the costs of various components, exercises, movements, and commodities, and the complex nature of internal logistics and inventory management are all extremely important to the successful business. As volumes and inventories continue to rise for the business, so to do the opportunities to leverage knowledge gained against inefficiencies in the business, and constantly work toward increasing the margins between costs and revenues.

All of these areas noted are of significant concern to business partners in the global market as new export opportunities arise. Tighter control of the business and a keener understanding of the business being managed provide the business owner and manager with the opportunity to compete for lower interest lending, appear more profitable to potential buyers, and more professional to new investors or customers.

2.7 *Product Knowledge*

In numerous visits it was noted that the farmers were the owners of or somehow involved in the ownership or management of the new cold storage operations. This became increasingly interesting when discrepancies appeared in the survey regarding the impressions each sector of the supply chain gave the other. In

other words, though the cold storage operators gave the farmers high marks for farming and harvesting the produce, the marks dropped significantly in the arenas of post harvest handling of the product between the farm and the facility. Of course this is remarkable because the people involved at the farm, during post harvest, during shipping and in cold storage, are generally part of the same group, business or farm.

What can be gained from this is the fact that a high degree of product knowledge exists among specific people in the group, but that successful knowledge transfer or teaching is not occurring between them. For instance, the farmers seemed to intuitively understand that reducing temperatures as soon as possible after harvest was important, but many in the supply chain at the warehouse facility seem to be unfamiliar with the concept.

It is not only important to the profitability of the warehouse to understand the products it stores, but it is also very important for the warehouse manager to understand that intuitively, that cold storage and humidity management are designed to prolong the shelf life, quality and taste of the product. It is further necessary to understand the product, science, and the interrelation of the product, temperatures, humidity, ethylene gas, and a host of other factors in order to be successful at achieving the goals of cold storage, extending time for quality and saleable shelf life.

When this level of understanding is reached, and the training necessary to fulfill it has been reached, the business will undoubtedly be successful to its customers on each end of the supply chain. However, without this body of knowledge about the product the warehouse stores, it will never be able to adequately fulfill the expectations of the customers it serves.

2.8 Value Added Services

Value added services are those services or offerings beyond the typical “space for rent” concept, and are considered additional sources of revenue to the cold storage operation. Typical value added services include:

- Blast Freezing (meats);
- Hydro-cooling;
- Pre-cooling (excessive temperatures);
- Re-packaging (from 1 large container to smaller retail sized containers);
- Washing, waxing;
- Sorting, grading;
- Stamping, branding;
- Packaging;

- Processing (concentrates, dehydration, pre-packaged, ready-to-eat);
- Lease of additional refrigeration equipment for farm-side pre-cooling;
- Lease of material handling equipment for harvesting; and
- Consulting at the farm or customer level

As a general rule, if personnel, equipment, or services are available and not in use, an opportunity exists to provide these assets to others for a fee. This is generally considered a cost-mitigation technique, as most of these assets are fixed costs. They can also be leveraged as a marketing technique, providing the business with the opportunity to showcase its talents, equipment and expertise to the market, and to become more valuable to the customer as a “problem solver” partner for them.

Opportunities to provide value added services will grow as the markets and economy of Azerbaijan continue to increase in the food supply chain sector. Those businesses that are pre-positioned in the market place, and who have the requisite knowledge, equipment, materials, and ability to succeed, along with the drive to fulfill niches of opportunity for potential customers, will be poised to capitalize on these opportunities.

As the marketplace continues to expand, its nature is to fill all the quality and efficiency voids it creates. When this is understood by the Azeri cold storage operators, they will then be able to fulfill those market needs, by reacting to the market as opposed to providing what it has to the market, and for the market to adapt to it. This concept of “provide what is wanted, not what you have” will continue to drive this market, and the successful business will capitalize on it.

3. Workshop

3.1 *Introduction*

The cold storage operations workshop was conducted in one full day at the Guba Marketing Center (GMC) in Guba, in the Northern region of the country. The workshop was a lecture format, driven by PowerPoint presentations by the expert. It was broken down into two components, “Operations Management” and “Financial Management”, and 17 attendees participated in addition to ACT staff members.

In addition to the two components listed and their various subcomponents listed below, a one hour “hands on” lecture was conducted on the use of a new

cost/benefit analysis tool which was provided to the attendees. As well as a final wrap up and question and answer period, which brought about many topics, clarifications and opportunities for continued learning.

Numerous attendees voiced their appreciation for the workshop, and their interest in further opportunities of this kind. Many of them have asked for continued contact with the expert, and further educational opportunities, especially as the harvest season advances.

Training and knowledge transfer opportunities should continue to be a leading deliverable service of ACT and its partners and affiliates.

3.2 Component – Financial Management

- Budget
 - Fixed Cost
 - Variable Cost
 - Income
 - Other

- Target Market
 - Product
 - Volume
 - Turns
 - Price
 - Requirements (Equipment, Building, Personnel)

- Product Cost Margins
 - Historical evidence
 - Critical partners

- Handling & Storage Quality
 - Good IN = Good OUT... Bad IN = Bad OUT... the product you receive only LOSES quality/value
 - Temperature & Humidity Abuses cause damage/loss
 - Humidity = product weight

- 80/20 rule?
 - Does 80% of annual billable business occur in 20% of the year? (2 Months, 2 Weeks)
 - Does 20% of annual billable business occur during the other 9 Months, 2 Weeks?

- Is the Building, Equipment, Space, Personnel capable of meeting the operational needs with the Seasonal Volume needed to meet budgeted requirements?
- How can the business extend the season?
 - New Markets
 - New Customers/New Products
- What is the Total Annual Budgeted Billable Income?
 - How many tons of products must be received, stored, and shipped to attain this Income?
 - In what time frame will this product be received?
 - Is there sufficient storage space, equipment, personnel to accommodate the volume of product?
 - How long will the product stay in building?
 - Is there a Rotation Plan to ship the oldest product first?
 - If the building is full of product, what is the total tonnage?
 - How many times must the building be filled and emptied to bill the budgeted amount?

3.3 Operations Management

- Receiving
 - Temperature
 - Inspection (Pests, Condition, Filth)
 - Inventory (Weight/Count)
- Processing
 - Sorting
 - Grading
 - Packaging
 - Pre cooling
- Storage
 - Stable
 - Air Flow Consistency
 - Cleanliness
 - Lot/Crop/Farm Management
 - Temperature/Humidity Management
- Shipment
 - Temperature
 - Inventory
 - Inspection

- Documentation
 - Receiving
 - Storing
 - Shipping

3.4 Equipment Preventive Maintenance

- Refrigeration
 - Compressors
 - Condensers
- Humidification
 - Humidifiers
 - De-Humidifiers
- Measurement Equipment
 - Thermometers
 - Hygrometers
- Material Handling Equipment
 - Forklifts
 - Jacks

3.5 Food Safety, Rodent & Pest Control

- Temperature & Humidity Control
 - Daily Readings & Records Management
- Rodent & Pest Control
 - Weekly Observation
 - Pest Control Plan
- Product Placement & Separation
 - Produce
 - Protein
- Access Control
 - Keyed Access to Doors
- No Unauthorized Access

3.6 Additional Considerations

- Energy Efficiency
 - Lighting
 - Doors/Windows
 - Peak vs. Off Peak Hours?
 - Don't give away cold air "Free of Charge"

- Operational Efficiency
 - Fewest Moves or "touches"
 - Shortest distance between 2 points
 - Fast movers in front, slow movers in back
 - The correct person for the correct Job
 - Reward profitable behavior... it is contagious!

4. Conclusions and Recommendations

A wide variety of cold storage operations were visited in Azerbaijan, providing a well-rounded understanding of the complexities and difficulties the industry is faced with, as well as the opportunities that are being presented to it. One of the most consistent observations made is the state of the construction and equipment in most of these operations. It is very modern and well designed for its purposes. With the proper training, volume opportunity, and ability to repair and replace vital components, the Azeri cold chain can rapidly gain through the advancement and promotion of the cold storage operations.

The other most consistent observation is the lack of general knowledge regarding cold storage operations, refrigeration basics, refrigeration repair and maintenance, logistics, post harvest handling science and methodology, and a general lack of business acumen, especially in the business development (marketing) arena.

Several members in attendance at the workshop drove a considerable distance to attend after having met the expert and ACT staff at their operations in the days leading up to the workshop. Also, many of them voiced their willingness and excitement at being "partners" or in some other way, affiliated and tied to the ACT Project in a more formal manner. It is clear that these specific individuals are eager to learn, grow their businesses, and are willing to ask for help. These are the very pilot program members addressed below, and have been noted in red text in the preceding sections of this report.

The cold storage operations reviewed, the information gained, and the resulting analysis from the surveys suggests several recommendations be made. Numerous new, functional and effective facilities are available for use leading up

to the approaching harvest season. However specific operations, product, equipment and adjacency component education needs remain.

To this end, the following recommendations are presented as an opportunity to continue to educate, reform, and raise the level of care, standards, efficiency and profitability among the cold supply chain, primarily through the effective increase in quality centric cold storage operations.

- **Recommendation 1: Intensive Targeted Training**

Conduct a 3-day series of educational workshops in multiple regions during the approaching harvest season. Included in the education workshops should be the following areas of knowledge:

- Refrigeration Equipment Maintenance
- Cold Storage Operations
- Cold Supply Chain Marketing
- Produce Post Harvest Handling
- Association Building at all levels
- Meat and Poultry Post Processing Handling

- **Recommendation 2: Peak Season Operational Analysis and Review**

Utilizing the same experts conducting the educational series in Recommendation 1”, conduct an on-site “hands-on” review of the operations during the operational season, to evaluate the processes, equipment, assets and business operations with the management of the facilities. This can and should be scheduled in harmony with Recommendation 1 as the education workshops travel through the country.

- **Recommendation 3: Cold Supply Chain Pilot Program**

Conduct a 3 Phase Pilot Program aimed at creating “Model” cold storage operations, to be used as Benchmarks, and Platforms for future cold supply chain infrastructure linkages, as well as serve as model operations for further cold storage business growth. Phase 1 of the Pilot Program is nearly complete as a result of the current project deliverables. (Pilot Program details below)

- **Recommendation 4: Marketing Programs Consultancy**

Obtain consulting advice and programs from a Produce and Cold Chain Marketing Specialist, with experience in the specific concerns, obstacles,

opportunities, and specific knowledge of markets similar to Azerbaijan. If Possible, this Marketing Specialist should also be utilized in conjunction with Recommendations 1 and 2 above.

- **Recommendation 5: Knowledge Transfer Training**

Contract with an expert to research, write, and produce a ***Cold Storage “Basic Operations” Manual*** to be the property of ACT, and to be used as a primary educational component and deliverable to cold storage operations management, as well as adjacent cold supply chain partners interested in learning more about the “basic requirements” of operating a cold storage operating facility.

- **Recommendation 6: Knowledge Transfer Training**

Pilot Program members and other selected cold storage operators sent to US or other area known to have leading industry members to tour harvesting operations, processing, grading, sorting and cold storage operations, and learn first-hand the best in class processes, latest technology, industry trends, and learn from other cold storage operations management.

- **Recommendation 7: Sourcing Monitoring Devices**

Many manufacturers offer numerous high quality, inexpensive, measuring instrumentation. A recommended source for temperature and humidity recording and monitoring devices is the “Taylor” company. Following are links to specific recording devices from Taylor:

- Re-calibratable thermometer, and complies with HACCP.

<http://www.taylorusa.com/5-commercial-anti-microbial-instant-read.html>

- Re-calibratable thermometer provides reading in 1 second.... Also complies with HACCP

<http://www.taylorusa.com/restaurant-hospitality/featured-restaurant/5-commercial-anti-microbial-instant-read.html>

- Sling Psychrometer (measures EXACT humidity)

<http://www.taylorusa.com/pocket-sling-psychrometer-1.html>

- Wall Mounted Hygrometer (humidity)

4.1 Next Steps

Beyond the “Recommendations” noted above, several other areas can be considered for inclusion as well. These “next steps” should be considered as minor in operational importance, or take lesser priority under the recommendations, but can nonetheless be effective controls, tools, and leveraging opportunities for the advancement of the ACT goals, both near and long term.

Step 1

Immediately define the basic parameters of the pilot program and prepare to meet with the participating program members to arrive at agreed upon deliverables from both sides. At a minimum, operators must agree to maintain daily, weekly, monthly, and seasonal documentation for specific operating areas as noted herein. Also, operators must agree to share financial and other information related to the operation, including but not limited to:

- cost of produce purchased from farmers or other, and all other costs of the operation;
- revenue related to produce sales, and all other revenues of the operation; and
- ancillary services costs and revenues (example, processing, grading, sorting, etc.)

Step 2

Contract with and retain a technical consultant for limited technical consulting guidance related to the approaching harvest season, technical guidance related to the pilot program, and guidance with specific technical, operational, or business related questions from operators.

Step 3

Develop a “kit” containing “plain language guides” both printed and electronic versions to be provided to all cold storage providers and related food supply chain members.

Step 4

Develop a local consortium of interested participating actors associated with the cold supply chain. To put this into context the reader should view it as a mini

association, loosely developed for the mutual benefit of all parties. Examples of participants in this “consortium” are the following:

- Refrigeration maintenance companies in Azerbaijan;
- Refrigeration parts suppliers in Azerbaijan;
- Refrigeration tools suppliers in Azerbaijan (thermometers, hygrometers, etc.);
- Refrigeration Education providers in Azerbaijan; and
- Produce Export, Brand Management, and, Business Development (Marketing) consultant.

4.2 Pilot Program

Azerbaijan Competitiveness and Trade (ACT) Cold Storage Operations Pilot Project

Phase I, Completed during initial expert visit prior to the harvest season of the reference year:

Cold storage management are trained in workshop(s) in the basics of cold storage operations, including refrigeration equipment, building design, document and data control, temperature and humidity monitoring, cost benefit analysis, food safety, and business management. Pilot participants are selected for inclusion from among this group in the initial ACT cold storage survey sample and further screened to verify their operating status and to determine whether they are capable and willing to produce information targeted for data collection. This first phase is merely a screening questionnaire used to improve survey efficiency; it does not contribute to the user data files. Of importance is the willingness of the operators to store and share business related data, including financially sensitive data.

Phase II, conducted in the busy (harvest) season of the reference year:

Randomly selected operating cold storages from Phase I are interviewed to collect information on their training, operations, business acumen and management skills and practices. Phase II data are collected at the individual operational unit level. Phase II is a series of surveys conducted to obtain physical, management, and economic data on operational inputs/outputs, management practices, document and data controls, training retention and costs of operations.

ACT will provide personnel from selected operations to refrigeration, mechanical, and management trainings, as well as provide management of selected operations, with cost benefit analysis tools, Marketing strategies, access to experts among various fields including operations management, marketing, mechanical maintenance, product and post harvest control specialists.

Phase III, conducted in the following busy (harvest) season the year after the reference year:

Selected operating cold storages from Phase II are again interviewed to collect information on their operations and management practices. Phase III mirrors the former Interviews and Surveys of Phase II. Phase III data are collected at the individual operational unit level. Phase III is also a series of commodity surveys conducted to obtain physical and economic data on operational inputs/outputs, management practices, document and data controls, training retention and costs of operations. Then assessed, measured and studied against the Phase II collections of data.

4.3 Analysis of Survey (including Costs and Benefits)

A survey was conducted of management personnel from 13 Azeri cold storage operations from among various agricultural regions of the country, cutting across numerous produce commodities. The survey data was compiled, averaged and studied by the STTA. The following analysis of the survey data is empirical, and reflects the opinion of the STTA of the collective answers of those persons surveyed.

The summary that follows groups or generalizes the data sets and the associated analysis in narrative form to provide the reader with a logical and comprehensive picture of the answers. For further review and assessment, the data compilation and raw survey data are available.

This summary assumes Point Scale Grading of the survey questions as follows:

1= Very Bad, 2= Bad, 3= Average, 4= Good, and 5= Very Good

The survey respondents generally gave Government “Average” grades regarding the existence, enforcement, and helpfulness of laws in the food sector, and they tend to believe there is adequate farm land available to meet the current and future agribusiness needs of the country and for exporting purposes. Though the respondents did not give the government a high rating, nor did they give government a below average rating; the actual rating was slightly above Average for government related questions.

Cold storage volumes reported show that the average cold storage operation receives between 400 and 500 metric tons of produce per month, and sends approximately 158 metric tons to retail during these months. The data further goes on to suggest that transportation of produce to market is paid for by the wholesaler or purchaser, which means the cold storage “experts” are not in control of the quality of the transportation. If this follows true to form with many of the emerging and developing food systems in the world, this would mean that the

lowest cost provider is transporting the products, which also means they generally will not operate the refrigeration units adequately during the transportation cycle.

The Baku region is clearly listed as the largest area for sales and marketing. All respondents listed it as the primary domestic market, and clearly consider it the target market for all of their efforts. A secondary market occupying the business concerns of the Azeri cold storage management is Russia for a select grouping of products; primarily apples. With the Azeri economy moving in a positive direction generally, the respondents anticipate a 29% increase in the domestic sales of their produce products, and are optimistic that within a few years, the export market will increase sharply, and the produce sector will increase a remarkable 200%!

Within the confines of the cold storage space available, the following figures reflect the percentage of space generally allocated per produce type:

Apple = 50%, Pomegranate = 23%, Persimmon = 14%, Cherries and Plums = 10% and Grapes and Vegetables = 2%

Cold storage operators report farmers charging a general commodity price of 4 gepik per kilogram for produce, however follow-on questions related to wholesale and retail charges for the same were unproductive. The next round of surveys or questions should be aimed at the wholesale, retail and logistics sectors. With various surveys leveled at consecutively linked cold chain sectors and with linked questions, the economic figures should become more apparent.

With regards to specific Post harvest handling knowledge, and expertise, the survey respondents begin to vary in their responses and though the averages are still available, the picture is blurred slightly in contrast to many of the other survey questions. For example, though the opinions suggest average to above average "grades" for harvesting knowledge, heat reduction, and the quality and understanding of the types of equipment, boxes, totes, containers and other articles necessary for post harvest, interestingly, the respondents give a general grade of Bad to Very Bad in the areas of grading, sorting, and inspecting product. Clearly this shows a general acceptance of the farmers handling and understanding of their product, while at the same time the processing and other post harvest arenas are not viewed as having the necessary knowledge to maintain a high level of quality and care.

Cold storage management grades itself with average to above average in their knowledge of and commitment to maintaining appropriate temperatures and humidity, using appropriate cooling methods, cooling and storing for the correct length of time, measuring and recording of temperatures, storage methods, storage packaging, and maintaining a clean and healthy environment and atmosphere. Conversely, they regard those who package or box products prior

to arrival, and following shipping from cold storage as inadequate with an average rating of “Bad”. It can be summarized then that the storage operators view farmers as having the knowledge to properly harvest, pre-cool, package and transport the product to cold storage, however they are viewed as completing these necessary processes to only a minimally acceptable level.

The operators also see themselves as correctly handling, storing and protecting the product while in their own care. However interestingly, the cold storage respondents give “Bad” marks to their ability to source repair parts, obtain repair and maintenance support and equipment, recording temperatures, using racking, and stacking appropriately. When viewed independently, the data clearly shows the inconsistency in the responses; though they wish to believe they are doing well, their own answers show that they do not have the required knowledge and sourcing needed to maintain a high value of product for an extended period of time, as industrial refrigeration equipment is technically demanding, and requires constant monitoring and attention to maintain appropriately, by a well trained professional.

Regarding cost of operation, taxes, electricity, staffing and transportation are listed as the primary cost centers, and electricity costs average 2 AZN per square meter of space. The average cold storage facility can store approximately 2000 metric tons of products at one time, which equals roughly 56,540 storage spaces, holding approximately 84 kilograms each. When full, the respondents claim the total cost per square meter is roughly 5 AZN, and 1 AZN per square meter when empty. Again, with a cost of 2AZN p.s.m. for electricity, we can ascertain that 3 AZN (when full) is the fully loaded cost for all other cost centers. (Including taxes, transportation and staffing). We can also surmise that the equipment is turned off during the lean months.

Finally, with regard to facility placement in relation to both markets and farms, the respondents give “Good” grades to the facility placement. Though most facilities are not on major arteries or highways, many are, and for those that are not, they are placed very close to the farms themselves. At this early stage in the development of the industry, the placement of facilities should work well as it progresses into the next stage of development, and roads and highways are improved. When the roads and highways are improved, care of and management of transportation equipment must also improve. Currently, the refrigerated transport is unhealthy, and is inconsistent in its usage. Most respondents give Very Bad grades to transportation providers, in both their equipment state of repair, and the providers willingness to use the equipment properly, and maintaining appropriate levels of refrigeration.

5. Appendix 1

Document	Target Audience	Type	Document	Target Audience	Type
5 Keys to Food Safety	Home	PDF	10 Steps to a Safe Kitchen	Home	Word
Apple Fuji	Post Harvest	Word	Kiwifruit	Post Harvest	Word
Apple Gala	Post Harvest	Word	Lemon	Post Harvest	Word
Apple Golden Delicious	Post Harvest	Word	Onion - dry	Post Harvest	Word
Apple Granny Smith	Post Harvest	Word	Onion - green bunching	Post Harvest	Word
Apple Red Delicious	Post Harvest	Word	Orange	Post Harvest	Word
Apricot	Post Harvest	Word	Peach/Nectarine	Post Harvest	Word
Carrot	Post Harvest	Word	Persimmon	Post Harvest	Word
Cucumber	Post Harvest	Word	Plum	Post Harvest	Word
Feijoa	Post Harvest	Word	Pomegranate	Post Harvest	Word
Grape	Post Harvest	Word	Potato	Post Harvest	Word
Herbs	Post Harvest	Word	Radish	Post Harvest	Word
Management Checklist	Post Harvest	Word	Sweet Cherry	Post Harvest	Word
Most Common Concerns	Post Harvest	Word	Tangerine	Post Harvest	Word
Receipt of Product	Post Harvest	Word	Trout	Post Harvest	Word
Common Diseases & Pests	Post Harvest	Word	Workshop PPT Presentation	Post Harvest	PPT
Fruits & Veg. Compatibility Chart	Post Harvest	Word	Cost Benefit Analysis Explanation	Post Harvest	Word
Dew point Calculator	Post Harvest	Excel	Cost Benefit Analysis Worksheet	Post Harvest	Excel
Milk Heat Calculator	Post Harvest	Excel	Energy Conservation in Cold Storage	Post Harvest	Word
GCCA Handout	Post Harvest	Word	Low Cost Pre cooling Construction	Post Harvest	Word
Store It Don't Ignore It	Home	PDF	Volume-Space Available Worksheet	Post Harvest	Excel