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# EQUIPMENT SYSTEMS AND TECHNOLOGY SUPPORT FOR THE KOSOVO FOOD PROCESSING INDUSTRY

**KOSOVO CLUSTER AND BUSINESS SUPPORT PROJECT**

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# EQUIPMENT SYSTEMS AND TECHNOLOGY SUPPORT FOR THE KOSOVO FOOD PROCESSING INDUSTRY

Kosovo Cluster and Business Support project: "Equipment Systems and Technology Support for the Kosovo Food Process Industry".
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# PURPOSE OF ASSIGNMENT

This assignment is designed to assist three targeted processing companies in fully evaluating all aspects of equipment line expansion and, by so doing, to accelerate their rollout of new production lines.

The rationale behind this activity is to quicken the pace of development in the processing sector, to reintegrate processing and input production, and to do so in a way that meets market demands and replaces imports.

# BACKGROUND

The current processing sector capacities across Kosovo are poorly aligned with domestic consumer demand and domestic input production capabilities. Export markets that may be served by products produced in Kosovo have been slow to be identified by domestic processors who find themselves in a fast paced world market that demands higher standards and different products than processors are used to producing. At the same time because of political developments over the past five years, input supply chains that were traditional to Kosovo have fractured and costs have changed for procuring inputs from abroad.

With these factors in mind KCBS seeks a specialist in processing equipment who will be able to evaluate older Balkan equipment and infrastructure and suggest a series of improvements to address critical bottlenecks across the operations of identified food processors. This assistance will involve providing several sourcing options, determining all costs in installation and maintenance of facilities, and being able to provide information of basic costs/benefits analysis.

Time is of the essence in creating value-added products driven by demand that illustrate the ability of Kosovo to be a viable commercial entity and forge an integrated production system.

# EXECUTIVE SUMMARY

The Kosovo fruit and vegetable food processing industry is undergoing a gradual rebirth after losing most all of their past processing enterprises resulting from the 1999 conflict. Only one major vegetable processing plant has reopened under a 10-year lease arrangement, and a few new enterprises have emerged, mostly on a very small scale with limited financing and tight budget constraints. These enterprises all began operations within the last two years, struggling with new operations and with no immediate plans for expansion.

The original purpose of this assignment - to assist targeted food processing companies to accelerate their plans for implementation of new product lines - was determined not achievable, and was therefore adjusted to focus on the new potato processors and assist them in technology and equipment issues.

During the course of visits to these clients and to the main fresh produce and grocery markets, it was apparent that despite the relatively large agricultural base in Kosovo, there is a high percentage of imported processed foods. This represents a viable opportunity for import substitution in the domestic market rather than targeting on the export market and is more appropriate for the small size farms and acreage in the region.

However for this to occur, a number of issues must be addressed, including improved sources of financing, technical support including business plan development and access to processing methodology. There also needs to be a vehicle to provide guidance for reliable sources of process equipment, both new and used, including education on sound purchasing practices.

KCBS can provide a vital role in certain aspects of promoting the restoration of the food industry by developing and publicizing a program to offer technical services for parties interested in establishing a food processing operation. This should include:

- Develop and publicize a program offering technical services for parties interested in establishing a food processing operation.
- Provide seminars or guidance for recommended equipment purchasing practices of both new and used equipment.
- Develop regional resources for small capacity equipment sourcing.
- Business plan development assistance to avoid poorly planned investments.
- Develop a library available to interested clients for process technology.
- Obtain data on type and varieties of fruits and vegetables grown in Kosovo, including harvest periods and characteristics for process planning purposes.
- Obtain information on preferred varieties for various processes.
- Obtain information on imported processed products including volumes and pricing

- Participate in test plots for serious clients to identify suitable processing varieties.

- Provide technical support specifically for potato processing technology including storage technology during the active processing period.

- Maximize exposure of local staff personnel to the important aspects of food processing through the use of contract specialists, seminars, equipment conventions and processing plant tours.

- Closely monitor the privatization of food processing companies and offer technical assistance to potential/successful buyers early in the privatization process.

- Identify one or two clients to work very closely with to establish a good "example of success" for others to follow.

With the advent of the privatization of the state-owned food processing plants, it is important for KCBS to position themselves to provide the appropriate assistance to potential buyers in order to insure their success and accelerate operational efficiencies and product quality.

# FIELD ACTIVITIES TO ACHIEVE PURPOSES

## I. INTRODUCTION

The Kosovo food processing industry is in its infancy for all practical purposes. Prior to the 1999 conflict, there were a dozen or so processing operations, mainly State-Owned Enterprises (SOEs), and included beer, juice, canned and frozen fruit and vegetables, sunflower oil, sweets, snacks and pasta production. These were all shut down and are candidates for privatization; however only the vegetable processing plant has reopened four years ago under a 10-year lease arrangement. Since then, a few new enterprises have started up on a small scale and with limited financing and tight budget constraints.

Due to the relatively large agricultural base in Kosovo, with fertile soil and mild climate, combined with the high percentage of imported processed foods, it would seem that opportunities exist for increasing processing capabilities within Kosovo, if only for import substitution as opposed to significant export volumes.

For this to happen, there needs to be improved sources of financing, and technical support including business plan development and processing methodology. There also needs to be a vehicle to find reliable sources for process equipment, both new and used, including guidance on sound purchasing practices.

The raw material, although mostly produced on many small farms with a few hectares or less, is less of a problem for products processed for the domestic market than exports. The quality and volume requirements necessary for export markets is not an issue at present, and will take years of evolution before it becomes an issue. By then, the experience gained will better prepare them for entering this market.

## II. OBJECTIVES AND SCOPE OF WORK

The purpose of this assignment was to assist targeted food processing companies to fully evaluate all aspects of equipment line expansion and accelerate their plans for implementation of new product lines. Specific targeted companies included Delta Pomfrit, Pestova, Laberian Company, Abi Elif (Progres), and Zahag Agricultural Association.

During the course of the assignment, additional companies were visited including Albi, Agroprodukt, Luko, and Eko-Giliq Company. Laberian Company, a juice-from-concentrate processor, declined to meet since any expansion plans were indefinitely postponed. Also the Zahag Agricultural Association Collection Center was visited, however the principal interested in freezing mushrooms and blueberries was not available, and only a freezer was being considered.

It was evident after initial visits to the first six companies that the original scope of work could not be accomplished as outlined, due to the lack of any near term plans to either expand existing operations or add new process facilities. For the most part this appears to be caused in part by lack of financing brought on by the interim situation, but for whatever the reason no interested clients could be found.
The scope of work was therefore adjusted to work more closely with the existing potato processors on a more “hands-on” basis to improve their operational efficiencies, output capacity and quality. In this regard, a number of problem areas

were identified with each of these companies and progress made toward resolving them. These are described for each of the enterprises below.

**Target Clients Visited**

| Client Company | Start Date | Product(s) | Output Capacity | Type Process |
|---|---|---|---|---|
| Delta Pomfrits | 2004 | Frozen French Fries | 80 kg/hr | Batch |
| Pestova | 2004 | Potato Chips &<br>Frozen French Fries<br>Fresh potatoes<br>Potato seed<br>Farm Machinery | 200 kg/hr<br>500 kg/hr | Continuous<br>Continuous |
| Luko | 2004 | Potato Chips | 100 kg/hr | Batch/continuous |
| Agroprodukt | 2004 | Dehydrated Herbs & Spices | kg/day | Batch |
| Abi Elif (Progres) | 2001 | Canned, Frozen Fruits & Vegetables | 4,500 mt/yr | Continuous |
| Albi | 2001 | Juice | Unk | Continuous |
| Eko-Giliq | 2004 | Dehydrated fruit, vegetables & herbs | Kg/day | Batch |

## III. GENERAL OBSERVATIONS, FINDINGS AND ACTIONS TAKEN

### III.a Delta Pomfrits

Company owned by two brothers, Enver & Hizri Sherifi, and produces 150 tons of frozen French fries per year on a small batch system with 80 to 90kg/hr capacity. Their facility is new, well constructed in terms of use of sanitary materials. Most of the equipment was manufactured by Dornow of Germany, and some locally manufactured. Due to limited funds, not all the equipment for a complete line was installed. For instance, instead of a hot water blancher, they use one side of a two-compartment batch fryer to blanch and fry in the second compartment.

The company sells all they can produce, in part because of a lower than market price. Their current price is .63 -.65EU/1kg bag, and 1.60EU/2.5 kg bag. Market selling price is about .79EU/1 kg bag, .10 - .15EU below imported fries. They sell to a few restaurants including Pinocchio's, who said their fries are very popular and well liked.

Their production capacity is limited by insufficient freezing capacity. The batch freezer was built locally at an initial cost of 8,000EU. A second unit would cost approximately 5,000EU, and potentially double their sales without much additional labor, but they lack sufficient funds at this time.

Their annual raw requirement is 300-350 mt, of which they produce 120 mt on their 6 hectare farm. The main varieties are Agria and Fontana. The balance is from about 7 farmers on 20 hectares. They do not use contracts, but provide the seed to growers and for every kg get 2 kg of potatoes.

General Assessment

Positive:

1. Finished product of very good quality, color, size and taste despite limited process equipment.
2. Facility interior is of sanitary construction materials, with all tile floors and walls.
3. Equipment quality is good, although not complete for all steps.
4. Current production volume can be doubled with addition of a few additional pieces of equipment, with a small increase in labor.
5. Market entry is in place due to product quality, lower price, and increasing popularity of French fries.
6. Frequent power outages have less impact on this operation than if it were a continuous line, although losses are nonetheless still incurred.
7. Small labor force, normal training and personnel issues not as significant.

Negative:

1. Lack of financial resources to purchase the additional needs, which include:
    - Second freezer.
    - Separate blancher.
    - Standby diesel generator.
    - Refrigerated delivery truck.
    - Larger frozen storage capacity.
    - Air dryer and oil removal improvements.
    - Precool improvements.
    - Small (slivers and nubbins) pieces remover.
2. Small production volume.
3. Low profit margins in order to penetrate market, which may be difficult to change.

Actions Taken

1. Sketch prepared for suggested line modifications to increase capability for drying, oil removal and separate blancher utilizing waste heat from fryer exhaust stack to minimize energy and capital costs.
2. Included air pre-cooler utilizing well water to cool air through a heat exchanger.
3. Suggested a solution to eliminate oil coating on floors, a serious safety hazard.

Conclusions

This operation is an example of identifying a need, researching a solution, and taking the initiative to start a business with limited financial resources. The family owned a grocery market, which they eventually sold to provide total support to the French fry operation. They are gradually improving their financial position and plan to improve their operation a step at a time.

While not a commercial sized operation, their attention to quality and benefiting from experience being gained, may be instrumental to their eventual success. Entering a market served only by imported products, the recent introduction and growing popularity of French fries, the attraction to the homemaker of an “easy-to-use” product, all are favorable for the timing of this company. What success they enjoy in the longer term depends on the competition that develops, and their ability to obtain future financial support.

From the KCBS standpoint, very little support can be provided until additional financing is secured. At that time, technical support should be made available to assist in evaluating the best use of those funds based on their ROI.

## III.b. Pestova

The processing plant was completed last year and is designed to produce both frozen French fries and potato chips. The receiving system includes the capability to receive, clean, store, inspect and size-grade incoming potatoes. This allows flexibility to select the proper raw material to either process line, with the option to package the balance for the fresh market.

The owners, Kosumi brothers, have a background in agriculture including a mechanical farm equipment business and also seed sales. They are one of the major growers of potatoes grown on 100 hectares. They have several raw potato storages, the largest being a recently completed 700mt storage not far from the process plant. This was built for long-term (6-7 months) storage, but did not work satisfactorily, so they have decided to store in new wooden bins. An inspection of the storage revealed serious design flaws, which were pointed out and proper design modifications provided to them.

The process plant is well arranged, simple and of reasonably good quality construction. Last year was their first year of operating the chip line, and a number of problems were experienced. One was the electric fryer, which they replaced with a natural gas unit. Also the bag machine too slow, and replaced with a higher capacity machine.

### General Assessment

Positive:

1. The raw receiving, cleaning, storing and size grading system have all the essential elements for a processing plant with fresh packing capability, providing for maximum utilization of their raw material.
2. Both process lines have the basic equipment necessary for the production steps. The equipment, although much of it is used, appears to be of good quality and condition.
3. The building facility is of acceptable construction for a food processing operation, with only minor concerns mentioned later.
4. The company is well integrated vertically, being a seed and farm equipment supplier, grower, fresh market supplier and processor of two major potato products.
5. Company has several raw potato storages, the largest being a 700mt long-term storage.

Negative:

1. Both process lines consist of used equipment purchased from different sources and not all properly matched for capacity range. This is more severe on the French fry line, with an undersized blancher and may require further modification or additional equipment to correct.
2. Additional concerns on the French fry line are high operating costs. The electric heated blancher and fryer will be expensive to operate, as will the freezer, which operates on CO2.
3. The process area is in one large room, including final packaging. This can result in moisture and oil vapors drifting to the packaging area, causing damage to their packaging materials, and caking in the spice/salter on the chip line. Of more concern is the resulting condensation on the metal building structure during the winter months, which can cause rusting, peeling paint and metal deterioration as well as potential product contamination.
4. Lack of proper ventilation and makeup air in the process area. Introducing filtered, heated outside air in sufficient volumes strategically located will resolve item 3 above, improve containment of the "dirty" air from the wet process, and pressurize the room to minimize entry of flying insects and dust.
5. Some electrical lines were run on the floor in the fryer area. Although covered, this is poor practice, being an unsafe condition for the workers, and potential of electrical shorts from washdown water.
6. Lack of stairs from the upper process floor approximately 30 cm above the packaging area floor without a protective rail is another unsafe condition.
7. The raw potato storage has serious design flaws that are preventing extended storage life.

Actions Taken

1. Initial assessment of each line with made and discussed with the owner, including recommendations for improvement. These included the following:
    - Fry line blancher too small – add 3-4 meter space with a conveyor or water flume pre-dryer for future addition of a second blancher.
    - Add outside air system ducted in to packaging area for reasons mentioned above.
    - Consider adding a steam boiler system to provide heat for both blancher and fryer as well as other hot water needs including cleanup.
2. Provided assistance in contacting and communicating with the manufacturer of the "used" bag filler weigh system recently purchased for the chip line, which was not working. Although not yet resolved, this may be another costly example of the hazards of purchasing used equipment.
3. Provided recommendations for modifications to their raw product storage in order to increase storage period.

Conclusions

Pestova Company has invested a large sum of money in a potentially very profitable operation. Being vertically integrated, it has many advantages and flexibility over less integrated companies. However, their current situation is reflective of not obtaining competent technical support prior to implementing this project, which might have minimized their current as well as more problems in the future.

The equipment was purchased used, not all as a complete system with some items individually purchased. Lack of sound technical advice to insure compatibility of the separate purchases is obvious, and possibly the result of over-reliance on the used equipment company.

Buying used equipment is always a risk, and often the money saved initially is more than offset by problems later. Generally the equipment comes with either no warranty or only for a short period, no spare parts, no installation-operator-maintenance manuals, and no manufacturer support. The current situation with the bag filler weigh scale system manufactured by Anritsu Company of Japan is a good example. The model has not been made for 10 years, and spare parts are no longer available. They may end up having to purchase another machine.

Pestova recently began working with a potato specialist from France, Mr. Bernard Jouglard, involved with the European Bank to provide consulting for the coming year. The financing for the project was through the European Bank. Mr Jouglard has a long career in the potato processing industry internationally. His role is to provide consulting advice, but will not be staying full time in Kosovo. His areas of expertise are stronger in some areas than others, so additional support will most likely be needed in the future.

KCBS could provide a valuable service to companies such as Pestova if they can be involved earlier in the planning stages to insure the process steps and equipment is appropriate, and used equipment thoroughly evaluated.

**III.c. Luko**

This plant produces potato chips at the rate of 100kg/hr, or 800 to 1000 kg/day, requiring 450kg/hr or up to 4,500kg/day of raw potatoes. They employ 20 people, operate one shift per day from end of July until the end of May. They have a 600 mt storage equipped with temperature control.

The plant director is also President of IDEAS (Independent Development Experts Association), an NGO based in Switzerland. IDEAS has been managing the operation for two years, based on an arrangement from an organization in Luxembourg. They are scheduled to leave next year. IDEAS support personnel from Switzerland are providing assistance in implementing administrative, quality control, and process documentation.

Raw potatoes are from local growers, primarily through 4-5 grower associations. Initial efforts to contract direct with the growers didn't work. The growers used them to their own benefit as much as possible. They have been providing seed potatoes to the growers, and also want to end that practice to eliminate any subsidies or obligatory situations. They pay according to random sample results based on starch level and a "baking test" as well as size and quality. Their top price currently is 12 cents/kg, and is scaled down according to the above sample results.

Plant consists of a concrete building with receiving, raw storage, process area, and finished goods storage. Office and laboratory facilities are in the same building. The process line is a continuous system except for two batch fryers. They use sunflower oil imported from Bulgaria and is poor quality. He said Kosovo had a sunflower oil extraction plant before, but now is not running. Should be evaluated.

General Assessment

Positive:

1. Overall plant layout of acceptable design, with good raw storage and finished goods storage space.
2. Use of durable wooden bins for temperature-controlled storage.
3. Main items in process line manufactured by Inbramag, a Brazilian Company, and overall quality reasonably good.
4. Separation of main process from raw preparation area.

Negative:

1. Lack of technical and management skills available in local work force.
2. Technical support and spare parts for Brazilian manufactured equipment a serious problem without local support capability.
3. Raw material supply lacks positive relations with growers.
4. Uncertain future of management and ownership structure of company after IDEAS group departs.
5. Sanitary plant design practices not completely followed:
    - Process floor is not sloped to drains, which will result in standing water.
    - No separation between fryer area and packaging.
    - No outside makeup air to pressurize process area and protect dry packaging materials.
    - No protective shields under fluorescent lamps.
6. Marketing effort for a new product in a highly competitive situation not well defined.
7. Poor sunflower cooking oil quality.
8. Problems with spice/salter caking – close to fryer area, poor exhaust system.
9. Dividing wall under construction was of aluminum framing. Most cooking oils will attack aluminum over time.
10. Fryer compartments appeared to be extremely large for the volume of chips being fried. This can lead to more rapid oil deterioration.
11. No oil fines filter in the system, which will also cause more rapid oil deterioration.

Actions Taken

1. Discussed most of above items with Director and staff with recommendations.
2. Agreed to convey their concerns over raw supply and grower contract needs to KCBS specialist.

Conclusions

Discussions with the director, while very cordial, were not conducted in an open manner and appeared to involve a “hidden agenda”, which involved other than the process technology. He expressed an interest in discussing some issues with Mr.Tokar, and also with Mr. Rizo-Patron regarding grower contract issues.

He seemed very concerned about the sustainability of the operation after they leave next year, and briefly mentioned their plan to provide shares in the company, beginning with the interested growers, then management, and then others. No details were discussed, but the impression was that this would then be a grower-owned operation, much like a cooperative.

No further action was planned, as the director was leaving for a 10-day trip.

### III.d. Agroprodukt

Mr.Avdijaj, owner, began operations 2 years ago with assistance from Intercorporation, a Swiss organization providing assistance in Kosovo. The facility is in a single building housing a large open area, being used for storing juniper berries. There are three drying tunnels, with one completed and in operation. The design is from Serbia, using burning wood as the fuel source.

Each tunnel houses two tray carts, each holding 48 trays for a total of 96 zinc metal trays. The maximum capacity of the tunnel is 1,300 kg. Drying time varies depending on the product being dried, and can range from 4 to 24 hrs. He mentioned mint takes 6 hrs, mushrooms 8 hrs, and plums 14-18 hrs.

At present, he is “experimenting” with a variety of medicinal herbs including mint, basil, oregano, mushrooms, berries and various teas. He is growing many different herbs on the property as well behind his home nearby, and is also drying some tea leaves in a solar heated (black plastic covered) quonset style room outside the plant.

#### The Technology

Tray drying tunnels are widely used in many countries, mainly for tree fruit such as prunes, apples, peaches, pears and cherries. Product is cleaned and prepared, placed on drying trays and placed on shelves in a tray cart, and placed in a tunnel with recirculating hot air until dry. This can take 4 to 30 hrs, depending on the product.

Herbs and spices are generally sun-dried outside the more developed countries. This method results in a lower quality product, with some loss of color, nutrients and aroma, and potential contamination from dust, sand, and pest and bird droppings. While mechanical drying is preferred, the higher energy cost, usually natural gas, fuel oil or steam is often the main deterrent.

#### General Assessment

Positive:

1. Virtually no-cost energy source, using readily available wood from nearby forests. Energy cost is normally the highest cost for producing mechanically dried products.
2. Mechanically dehydrated products result in higher quality than sun-dried, retaining more color, nutrients and require less cleaning after drying.
3. Experience gained from first drying tunnel before investing in cost of completing the two additional tunnels for capacity expansion.
4. Supply of raw material readily available.
5. Drying tunnels flexible for a wide variety of other fruit and vegetable products.

Negative:

1. Limited funds for expansion and equipment needed for processing both fresh and dried material on a larger volume basis.
2. Competition from nearby countries, primarily Macedonia, whose drying methodology not known, but should be investigated.

Actions Taken

1. Discussed a wide variety of issues regarding herb and spice dehydration, market potential and advantages of mechanical drying over sun drying.
2. Discussed the significant cost advantage of using readily available wood v.s. fuel oil or natural gas.
3. Discussed in some detail the steps involved in onion dehydration and some of the potential hazards to be avoided.
4. Prepared an outline of steps for onion dehydration including a preliminary cost estimate for equipment.
5. Provided a Best Practices Guide that provides an overview of the various drying equipment and methodology for the common fruits and vegetables as well as various herbs and spices prepared earlier for the Egyptian Dehydration Industry.

Conclusions

Typically the highest cost of producing dried herbs and spices is the energy cost. Next is the raw material, followed by the packaging costs (if retail, not bulk). Using wood as a fuel source provides a substantial advantage over others using natural gas or oil and also over sun-dried processors in terms of higher quality and product cleanliness.

Although in a very limited early stage, the operation has the potential to become a viable business and would justify some financial and technical support to insure continued growth and diversification to improve his asset utilization.

Mr. Avdijaj cannot afford the equipment required for onions now, but thinks it's an opportunity later if he is successful with current efforts. He wants to gather information and technology now so he can better plan for the future. I told him he is wise to do so.

As for his immediate situation, he said he has potential buyers for some of his herbs by various arrangements such as being provided with the plastic containers in return for the product plus some revenue, etc. He plans to sell the tea leaves in bulk to processors who have the packaging equipment for now.

## III.e. Abi-Elif (Progres)

Met with Mr. Irfan Fusha, General Manager, who provided a brief background on his operation. The plant was formerly government-owned and was built primarily to provide goods to the military. In 2001, Mr. Fusha and a partner leased the operation for ten years, under the name of Abi & Elif 19, although they still use the "Progres" label.

The main products are tomato concentrate, ketchup & jam, but they also produce mayonnaise, pickles, and other canned, bottled and frozen vegetables. They have a separate operation in the same complex for dairy products production. 95% of their raw material sourcing is from local farmers. They do not use contracts, although they do communicate their forecasted needs to them. They generally pay market price. Mr. Fusha said in the event of a shortage or poor quality, they simply import the material from nearby countries.

About 20% of their products are exported. Their glass bottles are imported from Serbia and Croatia, and their cans from Bulgaria and Turkey. They produce their own poly containers for ketchup with an extrusion machine.

In the receiving yard were large quantities of vegetables in field sacks including peppers, carrots, egg-plant, and onions being prepared manually (peeled, trimmed, deseeded, sliced, etc) by workers sitting outside on the asphalt pavement. Adjacent to this outside preparation area is an uncultivated area with weeds and trees. There were flies all over. We were told the workers are paid by quantity cleaned per day.

Their finished goods storage contained a large quantity of product from 4-5 months production. Last year they produced about 4,500 tons, about 50% of their total capacity.

The wet processing area begins with 5 or 6 separate preparation lines, each for different raw products. This continues into various further processing steps followed by bottling and canning lines, pasteurizers and static retorts. A Frigoscandia freeze tunnel was also observed but not in operation.

General Assessment

Positive:

1. By far the largest food processing operation visited. Capability to process a wide variety of fruits and vegetables into canned and frozen products.
2. Equipment is of older technology, but in general of good quality from reputable manufacturers.
3. Large steam boiler system, which is essential for efficient processing operations.

Negative:

1. The plant is a large, old and badly in need of general housekeeping, pest control and improved sanitation and food safety practices.
2. Warehouse full of finished products, raising concerns over product sales.
3. Products perceived as not good quality, even though priced lower than some imports.
4. Labeling not attractive or eye-catching.
5. Lack of interest in investing in improvements or expansion
6. Large labor force of approximately 150 workers

Conclusions:

Discussions with the director indicated an unwillingness to make any improvements or policy changes while leasing the facility. They are in the fourth year of a ten year lease, and are concerned that any investments could be lost if the company is purchased by another entity, which he claims is possible under the present arrangement.

Under these circumstances, he is content to operate the facility "as is", and therefore is not interested in any outside technical services at this time. No further action contemplated with this company.

### III.f. Albi

The plant is a juice reconstitution operation originally in Albania and moved to Peja a few years ago. Their juices are made from imported concentrate and consist of water purification/filtration systems, reconstitution into single strength juice, pasteurizing and aseptic carton filling.

The equipment is of very high quality from European manufacturers and housed in a uniquely designed facility of concrete construction with the processing on the second floor, and finished goods storage on the main floor. Mr. Nimani will be adding a juice bottling line from Germany and knows what he needs without additional assistance.

### III.g. Zahaq Association

Visited the Rugova "Zahaqi" Association Collection Center for wild fruits and berries. We toured the facility, and collected their activity reports. The principals interested in adding a freezing system for their blueberries were not present at the time.

### III.h. Eko-Giliq

Visited this facility located north of Mitrovitsa. They began operations earlier this year, purchasing 6 solar-heated cabinet dryers built in Serbia for 1,500EU each. They are part of an association of 15 farmers and began this project to better utilize their crop surplus, improve their raw quality, horticultural practices and educate their growers.

They also believe there is a large potential market in medicinal herbs. They have been conducting experimental drying to produce samples for trading companies, which include sour cherry and plums. They have 100mt of prunes, although they crop yield this year was poor. So far the response to their product quality has been positive.

#### Equipment Description

The dryers are solar-heated and supplemented with a 1 kw electrical heater. Each cabinet houses 6 trays of raw material. Airflow is by natural draft only. The maximum capacity of each cabinet is 150 kg of raw material. They can achieve 70 – 100 deg C with the solar units, which is interestingly high, since that is 158 – 212 deg F, the latter being the boiling point of water. They claim the units work well even in the winter.

#### Discussion & Comments

They were interested primarily in the equipment for preparing the products for drying, and also post-drying. I described the equipment and needed for some of the fruits they are drying. I also suggested they build a hot water heater, well insulated and heated with burning wood instead of electrical or other fuel. They also need more airflow to the dryer to remove the high moisture air, and they agreed and plan to do this. Pre-sizing of the fruit is also beneficial for uniform drying, which they have already experienced.

Overall, I am skeptical that these cabinet dryers will perform as they stated. They are not designed for high efficiency, uninsulated and with glass front doors. There are no heat coils, only a single copper tube, and no positive air system. The value in these is to monitor the performance of the solar panels, for other potential processing applications.

# TASK FINDINGS AND RECOMMENDATIONS

As the original Scope of Work was adjusted to work more closely with the existing potato processors on a more "hands-on" basis to improve their operational efficiencies, output capacity and quality, the original tasks as listed below no longer applied.

Task 1. – Create compete implementation plans for the procurement of necessary equipment and equipment lines given, needs and resources.

Findings and Recommendations – No new lines or line expansions planned by the targeted companies visited and no other companies identified.

Task 2. – Consult on the creation of value added products using above described inputs and or other suggestions that may become clear while conducting tour.

Findings and Recommendations – Several suggestions made for additional products with existing potato processors, mainly for future consideration and include dehydrated potato flakes, potato puffs, pom parisienne, triangles and tater tots. For the dehydrated vegetable processor, processing technology and equipment descriptions provided for onion dehydration. In all cases, no funds were available for near term expansion so no details were developed.

Task 3. – Provide KCBS with a report describing these plans in detail, the costs involved, the timelines that implementation could occur within and a full analysis of what the maximally cost effective course of action is in each case.

Findings and Recommendations – No new lines or line expansions planned by the targeted companies visited and no other companies identified.

Task 4. – Review previous reports on production for potential processing line expansions using local inputs.

Findings and Recommendations – Reports reviewed and identified prospective companies contacted with negative results regarding future expansion plans.

With regard to the revised work scope, a number of problem areas/issues were identified with each of these companies and progress made toward resolving them.

<u>Delta Pomfrits</u>

1. Sketch prepared for suggested line modifications to increase capability for drying, oil removal and separate blancher utilizing waste heat from fryer exhaust stack to minimize energy and capital costs.
2. Included air pre-cooler utilizing well water to cool air through a heat exchanger.

3. Suggested a solution to eliminate oil coating on floors, a serious safety hazard.

Pestova

1. Initial assessment of each line with made and discussed with the owner, including recommendations for improvement. These included the following:
    - Fry line blancher too small – add 3-4 meter space with a conveyor or water flume pre-dryer for future addition of a second blancher.
    - Add outside air system ducted in to packaging area to pressurize process room and protect the dry end of the plant.
    - Consider adding a steam boiler system to provide heat for blancher and fryer as well as other hot water needs including cleanup.
2. Provided assistance in contacting and communicating with the manufacturer of the "used" bag filler weigh system recently purchased for the chip line, which was not working. Although not yet resolved, this may be another costly example of the hazards of purchasing used equipment. The alternative may be to purchase another weigh scale system, incurring additional cost and delays.
3. Reviewed the lines with their French consultant to provide a consensus of the areas of concern and recommendations.
4. Visited the facility 4 times to observe startup on the chip line, which still has not taken place. French fry line is incomplete and will not start up for another month.
5. Provided recommendations for modifications to their raw product storage in order to increase storage period. Will follow up with recommended building modifications as well as complete air supply system design and controls.

Luko

1. Abrasive peeler roll spacing allows small potatoes to get lodged. Suggested they add a stainless steel rod between the rolls to eliminate the problem.
2. Several food safety issues discussed and recommendations made.
3. No oil fines filter, which will cause more rapid oil deterioration. I will send information on cartridge type filters now used by most processors.
4. Problems with spice/salter caking – close to fryer area, poor exhaust system. Suggested they add outside air supply directed into packaging area and toward fryer exhaust hood to eliminate moist air from salter area.

Agroprodukt

1. Provided Discussed a wide variety of issues regarding herb and spice dehydration, market potential and advantages of mechanical drying over sun drying.
2. Discussed the significant cost advantage of using readily available wood v.s. fuel oil or natural gas.
3. Discussed in some detail the steps involved in onion dehydration and some of the potential hazards to be avoided.

4. Prepared an outline of steps for onion dehydration including a preliminary cost estimate for equipment.
5. Provided a Best Practices Guide that provides an overview of the various drying equipment and methodology for the common fruits and vegetables as well as various herbs and spices prepared earlier for the Egyptian Dehydration Industry.

# CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ACTIVITY

**ISSUES/CONCERNS**

- Food processing operations almost non-existent
- Plant capacities are small, difficult to enter export market
- New plants beginning with used equipment/limited financing.
- Lack of experienced support for:
    1. Process technology
    2. Process equipment manufacturing
    3. Equipment buying strategy
    4. Sanitary facility design
    5. Good manufacturing practices
- Lack of investments/interest in food processing industry
- Majority of very small farms, few large farms, limited raw supply volumes.
- Unreliable electrical supply

**STRENGTHS**

- Established market for processed foods, currently dominated by imported goods
- Good climate and soil conditions for raw material supply

**OPPORTUNITIES**

- Import substitution in a wide variety of processed fruits and vegetable products.
- Entering an “infant” food processing industry without mature domestic competition, which in turn will provide opportunities for growers with additional outlets for their crops, and with processor support, improve their horticultural practices, yields and quality.
- Rapidly growing popularity of certain recently introduced processed foods such as French fries. Other “fast foods” such as hamburgers and pizza also popular.
- Large volume of peppers consumed and grown but not currently processed except by one processor not providing high quality products.
- Export potential for fresh fruit used for imported juice concentrate.
- Export potential for fresh vegetables used for imported snack foods as well as canned and frozen products.
- Herbs and spices grown that can be economically dried using a cheap fuel source such as solar and/or wood.
- Development of a sheet metal/equipment manufacturing operation for basic items i.e. tanks, conveyors, heat exchangers etc. to supplement process lines.

**RECOMMENDATIONS**

- Develop and publicize a program offering technical services for parties interested in establishing a food processing operation.
- Provide seminars or guidance for recommended equipment purchasing practices of both new and used equipment.
- Develop regional resources for small capacity equipment sourcing.
- Business plan development assistance to avoid poorly planned investments.
- Develop a library available to interested clients for process technology.
- Obtain data on type and varieties of fruits and vegetables grown in Kosovo, including harvest periods and characteristics for process planning purposes.
- Obtain information on preferred varieties for various processes.
- Obtain information on imported processed products including volumes and pricing
- Participate in test plots for serious clients to identify suitable processing varieties.
- Provide technical support specifically for potato processing technology including storage technology during the active processing period.
- Maximize exposure of local staff personnel to the important aspects of food processing through the use of contract specialists, seminars, equipment conventions and processing plant tours.
- Closely monitor the privatization of food processing companies and offer technical assistance to potential/successful buyers early in the privatization process.
- Identify one or two clients to work very closely with to establish a good "example of success" for others to follow.

With the advent of the privatization of the state-owned food processing plants, it is important for KCBS to position themselves to provide the appropriate assistance to potential buyers in order to insure their success and accelerate operational efficiencies and product quality.

# ANNEXES

Annex I – Plant Visit Reports

Annex II – Onion Dehydration Outline

Annex III – Plant Photos

# ANNEX I – PLANT VISIT REPORTS

**Company:** Agroprodukt Syne
**Date of Visit:** 12 Sep 05
**Contact Person(s)/Title(s):** Mr. Halit Avdijaj–Mgr
**Visit Purpose:** Initial Visit

Visited the facility with Reshat Ajvazaj to tour the facility and discuss the owner's interest in dehydrating onions. The facility is in a single building housing a large open area, temporarily being used for storing juniper berries. In one corner there were three drying tunnels, only one being completed and in operation.

Mr.Avdijaj began operations 2 years ago with assistance from Intercorporation, a Swiss organization providing assistance in Kosovo. The drying tunnel design is from Serbia, using burning wood as the fuel source. Each tunnel houses two tray carts, each holding 48 trays for a total of 96 trays. Trays are made of perforated zinc metal. The maximum capacity of the tunnel is 1,300 kg. Drying time varies depending on the product being dried, and can range from 4 to 24 hrs. He mentioned mint takes 6 hrs, mushrooms 8 hrs, and plums 14-18 hrs.

At present, he is "experimenting" with a variety of medicinal herbs including mint, basil, oregano, mushrooms, berries and various teas. He is growing many different herbs on the property as well behind his home nearby, and is also drying some tea leaves in a solar heated (black plastic covered) quonset style room outside the plant.

We discussed a wide variety of issues regarding herb and spice dehydration, market potential and the advantages of mechanical drying these products over sun-drying, which is common practice in many countries. We also discussed the significant cost advantage he has by using readily available wood v.s. fuel oil or natural gas. Only solar drying would be as cheap or cheaper, but not practical in this climate.

<u>Onion Dehydration</u>
We discussed his interest in dehydrating onions. He was told Kosovo grew 1.5 million kg of onions last year, and despite a market price as low as .15EU/kg, could not sell the total crop. Dehydrated onions are being used in the country, but all is imported. Drying onions could be done after the medicinal herb harvest is completed and would extend his drying operation. He discussed with a German company to get equipment quotes, and expects these soon. He said some of the equipment is available in Serbia, but does not trust the quality or technology.

I told Mr. Avdijaj that the Germans have good technology and equipment for dehydrating onions, and also have a good market for the products. The U.S. also has the equipment and good technology, being the largest dehydrator of onions in the world. I offered to obtain quotes for him after we determine the capacity requirements. I asked what the raw onion soluble solid content was, and he didn't know. Reshat said he could get some samples tested in Pristina. This will determine the output yield and establish the capacity requirements for milling and packaging steps after drying.

Fresh market onions typically will be in the 8 to 12% soluble solid content range. In Egypt, their onions are 9 to 13% solids, while in the U.S., dehydrator onions have been developed with 28 to 32% solids. Yield difference is 10 to 1 v.s. 4 to 1 and the difference in drying cost is substantial.

I explained the importance of finding out what size products are in demand locally. On the international market, there are 5 main products made from dehydrated onions, each progressively smaller in size and correspondingly lower in market price. These are slices, kibbles, minced, granules and powder. I told him I will give him more information on processing and equipment required.

We also discussed the preparation of onions before drying. He mentioned the German automatic and semi-automatic peelers he heard about. I told him that there is no automatic peeler made that will work reliably without high maintenance and problems. In part this is due to the irregularity in shape and size of most onion varieties. Manual peeling as is done in Egypt makes more sense for small lines, which he agreed with.

I should have mentioned (and will next visit) that onions in the U.S. are not peeled, since the industry has bred white-skinned high solid onions specifically for dehydration, and with the skin the same color as the meat, peeling is no longer necessary. The light skin material is removed in the milling process after drying, and is used for making powder. Ideally, white-skinned high solid onions would be the best raw material if grown here.

Mr. Avdijaj said he cannot afford the equipment required for onions right now, but thinks it's an opportunity later if he is successful with his current efforts. He wants to begin gathering information and technology now so he can better plan for the future. I told him he is wise to do so.

As for his immediate situation, he said he has potential buyers for some of his herbs by various arrangements such as being provided with the plastic containers in return for the product plus some revenue, etc. He plans to sell the tea leaves in bulk to processors who have the packaging equipment for now.

Initial Conclusions

Typically the highest cost of producing dried herbs and spices is the energy cost. Next is the raw material, followed by the packaging costs (if retail, not bulk). Using wood as a fuel source provides a substantial advantage over others using natural gas or oil and also over sun-dried processors in terms of higher quality and a cleaner product.

Although in a very limited early stage, the operation has the potential to become a viable business and would justify some financial and technical support to insure continued growth and diversification to improve his asset utilization.

Next Steps

We agreed to continue communicating via email, and I will send him information on onion dehydration as well as herb and spice cleaning systems and pricing. We would then meet together again before I leave Kosovo. I will also investigate the possibility of companies interested in a joint-venture arrangement such as is being done in Egypt.

Reshat and I will investigate what onion varieties are grown locally, and arrange for soluble solid testing as well as if there are any white-skin varieties.

**Company:** Albi Company
**Date of Visit:** 08.09.05
**Contact Person(s)/Title(s):** Mr. Ymer Nimani
**Visit Purpose:** Initial Visit
**Submitted By:** Ed Hayashi – Process Consultant

Visited this facility with Mr Muhamed Disha. The plant is a juice reconstitution operation originally started in Albania and transferred to Peja a few years ago. All of their juice products are made from imported concentrate and consists mainly of water purification/filtration systems, reconstitution into single strength juice, pasteurizing and carton filling.

The equipment used is of high quality and in a uniquely designed facility of concrete construction with the processing on the second floor, and finished goods storage on the main floor. Mr. Nimani mentioned that he will be adding a juice bottling line from Germany. The bottles will be imported from Turkey.

This visit was only to observe the operation, as there is no need for our services at this time.

After the visit we also visited the Rugova "Zahaqi" Association Collection Center for wild fruits and berries. We toured the facility, and Muhamed collected their activity reports. The principals interested in adding a freezing system for their blueberries were not present at the time.

**Company:** Delta Pom Frits
**Date of Visit:** 6 September 2005
**Contact Person(s)/Title(s):** Mr. Enver Sherifi, Owner
**Visit Purpose:** Initial visit
**Submitted By:** Ed Hayashi – Process Consultant

Mr. Reshat Ajvazaj and I visited this facility to observe their operation. It is located in what appeared to be a converted two-story medium sized residential home in the back of the main residence. The process area consists of a small room housing the peeling system, and a main room housing the processing equipment. An adjacent room houses a batch freezer and a manual packing area. The overall interior process room is constructed of acceptable sanitary materials, using tile on the floors and walls. The process is a small batch operation, producing 80 - 90 kg per hour of frozen French fries. The line was installed in 2003 and consists mainly of equipment manufactured by Dornow Company of Germany.

**Process Description**
The incoming raw potatoes are stored in sacks outside in an open area in front of the facility, where a simple "homemade" rotary screen size grader is used to grade out the undersized potatoes, operated manually with a hand-crank to rotate the screen.

The larger potatoes are hand-dumped into an abrasive peeler, which discharges the peeled potatoes onto an inspection table, then transferred down a chute into a slicer. The sliced potatoes discharge into a tank, passing over a slide of parallel rods spaced to remove any "slivers". The strips flow into a level of water and into plastic perforated tubs, which are removed when full and allowed to drain on a nearby table.

There's no hot water blancher in the line, so the first stage compartment of a two-stage batch fryer was being used to blanch the strips before frying in the second stage compartment. After blanching, the basket full of strips is removed and allowed to drain before submersing the basket into the fryer compartment. After frying, the basket is drained of oil, hand-carried and dumped onto a long cooling table.

The cooled strips are again inspected and placed onto metal trays which are inserted into a shelf racked dolly and placed in a homemade batch "shock freezer" until frozen. The frozen strips are dumped onto an inspection table where the bags are hand-filled in either 1kg or 2.5kg bags. The bags are put in shipping cases and stored on pallets in an outside frozen storage room until shipped.

Mr. Sherifi told us that he is selling as much product as he can produce, (in part because he sells below the market price) and his production capacity is limited mainly by insufficient freezing capacity. He also needs a separate blancher so he can use both fryer stages, and also equipment for sliver and nubbin (small pieces) removal.

**Other Observations**
1. The line is operated by a 6-person crew.
2. Peel loss – 10 to 20%.
3. Unused waste loss – 10 to 12%
4. Blanching – 2 to 4 min @80 to 90 deg C.
5. Frying – 170 deg C.
6. Freezing - 130 –180kg in 1.5 to 2 hrs (-32 to –38).

7. Sell price – 1kg - .65EU, 2.5kg – 1.60EU. “Must keep price low to compete”.
8. Raw potato cost on the average is .12 - .14 EU per kg.

**Comments**
In general, the process line is capable of producing an acceptable product although on a small volume basis. With the addition of a few pieces of equipment, it should be capable of producing 300kg or more per hour, almost double current output. However, the problem seems to be the lack of funds to pay for the modifications needed.

Freezing Capacity
The existing batch freezer was built locally based on guidance from a German consultant. Initial cost was not mentioned and needs further investigation including compressor and refrjgeration system capacity before identifying various alternative solutions.

At present, product leaving the fryer should be thoroughly drained of oil. The basket full of strips is removed, placed on a drain pan on top of the fryer compartment hood and allowed to drain. The strips are dumped onto a long ss table with a perforated bed top, with room air blowing up through the bed with room air to cool the product. Of course this works better in the winter months than during the summer. This also explains why there is fry oil residue on the walls and floors, making the entire area very slippery and unsafe.

Rather than just addressing insufficient freezing capacity, the related problems including poor oil drainage from the product and airborne oil in the process area should also be addressed at the same time. Product temperature after frying, after draining, and after “cooling” should all be determined to establish the cooling load and heat load in the freezer. This may lead to a solution to increase freezing capacity and also resolve the other problems as well.

Blancher
The current use of one fryer compartment for blanching is limiting fryer capacity. The line also lacks proper drying equipment after blanching and before frying. Both should be addressed together. Both need a heat source and the plant has no steam boiler. Ironically, a few meters away, they are removing heat from the product which is lost to the room, and even closer, considerable heat is lost by exiting out of the fryer stack. I suspect the heat losses would be sufficient to serve the blancher and drying needs, but involves a heat balance calculation and cost for heat transfer equipment (coils, fans,etc)..but may be evaluated given time. Rather than a conventional screw-type blancher, a simple tank with recirculating hot water would suffice.

Sliver & Nubbin Removal
Slivers are the small pieces from the outer perimeter of the potato and do not have a square cross section. Nubbins are the short pieces that do not make acceptable fries. Normally these are removed from the line with two separate pieces of equipment. After cutting, the product flows across a parallel series of rollers spaced to allow the slivers to fall through the adjustable space between the rollers, while the good fries travel across the rolls. The good fries then drop onto a vibratory shaker with a perforated bed with holes sized to remove the short pieces nubbins). Both equipment are relatively expensive, do an effective job, but may not be justifiable in this case. The existing homemade parallel rod device may have to do for now.

Related to this is the fact that slivers and nubbins represent a significant quantity (10 to 20%) of the raw material that is lost to waste or animal feed. Larger processors cannot afford to waste this product and recover them for use as a by-product, usually a formed product such as hashbrowns, tater tots or triangles. This, however requires additional capital cost for a separate process line and is not justified here.

Summary

Further thought will be given to an economical approach to resolving the above priorities and discussed with the owner. Another problem they are faced with the frequent power outages, which interrupts the process and can cause substantial product losses and cost. Here the obvious solution is a standby diesel generator, which again is a cost probably beyond their current capability.

When we arrived, the crew was on a lunch break so the line was not running. After lunch, they lost power, so they could not restart the line. We elected to leave and return at another time when the line is running.

**Company:** Delta Pom Frits
**Date of Visit:** 19 September 2005
**Contact Person(s)/Title(s):** Mr. Enver Sherifi, Owner
**Visit Purpose:** Follow-up visit
**Submitted By:** Ed Hayashi – Process Consultant

Followed up with a second visit to the plant to observe the line in operation. It was clear that the process being limited by the freezer capacity and remains their main problem. We discussed various ways to improve the situation without major costs. We were told that their annual sales is around 150 mt and an average sell price of .63-.65EU/kg. Their raw requirement is 300-350mt, of which they produce 120 mt on their 6 hectare farm. The main varieties are Agria and Fontana.

The balance is from about 7 farmers on 20 hectares. They provide the seed to growers and for every kg get 2 kg of potatoes. Their raw purchase price is .11 cents/kg. Some of the markets that buy their fries include Benaf, Interminex and Albi. They don't pursue the restaurants right now, due to limited time and volume, although they do sell to Pinocchio's. They feel they can sell as much as they can produce, so increasing their freezing capacity could potentially double their sales without much additional labor. This needs to be costed out.

We reviewed the proposed improvements needed including a separate blancher, drying before frying and improved pre-cooling. To minimize costs, we discussed using existing sources of heat and cooling – the fryer exhaust stack as a heat source and well water as a cooling source through heat exchangers. They will measure these temperatures.

They showed us a cabinet dryer using electric heat that they already had, but being stored and not accessible to inspect. They said they don't use it for drying before the fryer during the summer because it heats up the entire process room. With a proper exhaust system, it still may be useful if possible to replace the electric heating with another heat source.

We agreed to stay in touch and meet again on resolving the limitations identified.

**Company:** Eko-Giliq Company
**Date of Visit:** 27.09.05
**Contact Person(s)/Title(s):** Mr. Savic - Manager
**Visit Purpose:** Initial Visit
**Submitted By:** Ed Hayashi – Process Consultant

Visited this facility with Reshat and Bane. They began operations earlier this year, purchasing 6 solar-heated cabinet dryers built in Serbia for 1,500EU each. They are part of an association of 15 farmers and began this project to better utilize their crop surplus, improve their raw quality, horticultural practices and educate their growers.

In addition to their fruit and vegetable crops, they believe there is a large potential market in medicinal herbs. They have been conducting experimental drying to produce samples for trading companies, which include sour cherry and plums. They have 100mt of prunes, although they crop yield this year was poor. So far the response to their product quality has been positive.

**Equipment Description**
The dryers are solar-heated and supplemented with a 1 kw electrical heater. Each cabinet houses 6 trays of raw material. The trays are of a light aluminum-like material, finely perforated and 90 cm x 65 cm each. Airflow is by natural draft only, with a slide damper opening at the bottom and two adjustable openings at the top.

The maximum capacity of each cabinet is 150 kg of raw material. They can achieve 70 – 100 deg C with the solar units, which is interestingly high, since that is 158 – 212 deg F, the latter being the boiling point of water. In any case, they claim the units work well and even in the winter months with supplemental electric heat.

**Discussion & Comments**
It was mentioned that the units could be taken to the growing area and used to dry products there. I said that a central location would be best, since each product should be properly washed and/or cleaned before drying. I asked if they depitted the plums and cherries and when, and they told us this was done before drying. I explained that it is better to dry to a certain moisture level first, then pit and final dry. This reduces the juice and meat loss, and increases their yield.

Most processors dry to 28-35%, pit the prunes, and then final dry to 18%. The higher moisture of 28% and above will limit the shelf life to 4-6 months, while drying to 18%, they can be stored for up to 2 years in cold storage. Prunes are usually packaged and sold at around 28-32% moisture, since that provides a tender, juicy product.

The other equipment required for tree fruit is minimal, and the required steps such as good washing, inspection and cleaning can be done without much cost. Also, the equipment after drying by manual selection and packaging is minimal. Apples can be dried without peeling or deseeding, and can be an acceptable product.

I mentioned that there are manual cherry pitter tools that are inexpensive. Also there are moisture meters that are the hand-held type that will give them a better idea of moisture level. It is important to set target moisture levels for each product, and eventually they would have to invest in laboratory equipment to do this.

They mentioned that they plan to dry during the winter months. I recommended they consider building a hot water heater, well insulated and heated with burning wood instead of electrical or other fuel. Add a small hot water tank, either insulated and/or buried underground, and use it when the solar units don't provide enough heat.

They should also consider adding more air flow to the dryer to remove the high moisture air, and they agreed. They need more air recirculation and plan to do this. We discussed the fact that larger size fruit dries slower than smaller fruit, and should be separated on the trays. Also, the bottom trays will dry faster than the upper trays, due to moisture pickup in the air flowing upward. They experienced this, and reposition the trays periodically during drying.

There was some discussion as to their growing practices, and availability of the herbs they want to dry, which apparently are not locally grown. These are available closer to Pristina, and Reshat agreed to investigate these sources.

**Conclusions**

Overall, I am skeptical that these cabinet dryers will perform as stated. They are not designed for high efficiency, uninsulated and with glass front doors. There are no heat coils, only a single copper tube, and no positive air system. The value in these is to monitor the performance of the solar panels, for other potential processing applications.

**Company:** Luko
**Date of Visit:** 20 September 2005
**Contact Person(s)/Title(s):** Mr. Jan Stiefel - Director
**Visit Purpose:** Initial visit
**Submitted By:** Ed Hayashi – Process Consultant

Reshat and I visited this potato chip plant to tour the facility and identify areas to provide technical assistance. The plant director is also President of IDEAS (Independent Development Experts Association), an NGO based in Switzerland. Their purpose is to support development, technology transfer and sustainability, financed primarily through member fees and donations. Their actual role with Luko was not clearly explained, but it appears some support or financing was from Luxembourg. IDEAS has been managing the operation for two years, and are scheduled to leave next year. Also present were Ms. Elvira Prohaska, an IDEAS board member, Dr. Thomas Luthi, and one of his students. All were from Switzerland to implement improvements, primarily administrative, quality control, documentation and GMPs.

The plant produces potato chips at the rate of 100kg/hr, or 800 to 1000 kg/day, requiring 450kg/hr or up to 4,500kg/day of raw potatoes. They employ 20 people, operate one shift per day from end of July until the end of May. They have a 600 mt storage equipped with temperature control. The potatoes arrive in field sacks, and are transferred into wooden bins holding 540-550 kg each. The bins conform to EU standard, locally built for 50-70EU apiece.

Raw potatoes are from growers in the area, primarily through 4-5 grower associations. They tried contracting with the growers, and it didn't work. The growers used them to their own benefit as much as possible. They have been providing seed potatoes to the growers, and also want to end that practice, to eliminate any subsidies or obligatory situations. They pay according to random sample results based on starch level and a "baking test" as well as size and quality. Their top price currently is 12 cents/kg, and is scaled down according to the above sample results.

They process four main varieties:

Agria – Short term storage only, but good for processing, low in starch
Diana - Short term storage only
Sirius – Medium term storage
Lady Claire – Best for longer term storage
Lady Rosetta – New variety being tested this year

**Plant Tour**

Plant consists of a concrete building with receiving, raw storage, process area, and finished goods storage. Office and laboratory facilities are in the same building. The process line begins with a manually fed abrasive peeler & raw inspection line, which feeds a slicer, rotary washer and into drain pans (no pre-dryer). There are two twin batch fryers, gas heated exchangers, each with a 15kg capacity per batch. Fry time is approximately 2.5 min in sunflower oil. Each fryer holds 2000 liters of oil.

Mr. Stiefel said the oil is imported from Bulgaria and is poor quality. He said Kosovo had a sunflower oil extraction plant before, but now is not running. He believes there is a need to local good quality sunflower oil. The fryers have a ss mesh chain filter for "crumb" removal, but no fines filter. He is looking for an inexpensive system.

After frying, the chips are emptied onto a conveyor, cooled and transferred under a salter, and an incline belt to the bag filler machine.

**Problem Areas**

The main equipment items were manufactured by Inbramag, a Brazilian Company, and overall quality was reasonably good. The line is continuous except for the fryers. Mr. Stiefel said technical support and parts are difficult, but on-site technical skills are an even bigger problem. He said this is his biggest problem – lack of management and supervisory skills as well as technical skills and experience. Last year the line had a number of problems, which would have been avoidable or easily resolved with skilled technicians on the staff. He seemed very concerned about the sustainability of the operation after they leave next year.

He briefly mentioned their plan to provide shares in the company, beginning with the interested growers, then management, and then others. No details were discussed, but the impression was that this would then be a grower-owned operation, much like a cooperative.

**Comments**

The line has all the elements of a standard line with exception of a continuous fryer. Batch frying reduces the consistency of the final product, but is less expensive initially, and can be more forgiving if problems occur. They lack a pre-dryer before the fryer, which could improve chip quality by reducing the oil uptake, and also oil deterioration. There is no hot air oil removal system after the fryer, which would help. The salter after frying caused some problems with uneven feeding and caking. I said I'd send them information on the Christy Machinery salter many of the major processors use. The best way to eliminate the caking is to provide an outside filtered air supply into the packaging area. The fryer exhaust hood will remove the "oil-laden moist air' and keep the high-humidity air away from the salter and packaging area. It also reduces the chance of airborne insects entering the process area.

At the time they were completing the installation of a dividing wall of metal framing and glass to separate the peel area from the process area. I told them this is a good step, but the glass should be shatterproof. I also pointed out the fluorescent lights should have a shatterproof protective shield on them. Not sure what the metal framing was, but appeared to be aluminum. If so, many cooking oils attack aluminum, which may cause a problem later.

The plant will be undergoing startup on 21 September, and it would be interesting to visit again to see the line in operation.

**Company:** Pestova
**Date of Visit:** 07.09.05
**Contact Person(s)/Title(s):** Mr. Bedri Kosumi – Owner/Gen Mgr
**Visit Purpose:** Initial Visit
**Submitted By:** Ed Hayashi – Process Consultant

Visited this facility with Mr. Reshat Ajvazaj. The plant was completed last year and is designed to produce both frozen French fries and potato chips. It also processes and packages potatoes for the fresh market. The process lines were not running, and they were preparing for a startup of the chip line sometime next week.

The owners, Kosumi brothers, have a background in agriculture including a mechanical farm equipment business and also seed sales. They are one of the major growers of potatoes grown on 100 hectares. The plant facility is well arranged, simple and of reasonably good metal prefab construction. Last year was their first year of operating the chip line, and they experienced a number of problems, which were addressed in preparation for this year. One of the main problems was the electric fryer, which was very expensive to operate and has been converted to natural gas. They also had problems with the cooking oil (filtration system) and packaging (bag machine too slow).

**Process Description**
The process begins outside with a main raw receiving belt feeding a dirt eliminator, transfer into the raw receiving building to an incline belt feeding raw storage bins. From there are raw inspection, size graders and cleaning systems, feeding the selected size to the process line beginning with an abrasive peeler. There is also a raw potato bagging line for the fresh market.

The peeled potatoes feed onto an inspection conveyor, into a surge tank and up a vertical elevator discharging into a two way chute, either to the chip line slicer or to the French fry slicer. The French fry line consists of a vibratory shaker to remove the short pieces and off-cuts, a blancher, a space for a future dryer, an electric fryer, a deoiling shaker with two overhead air fans, and a multi-level cooling conveyor. The cooled and fried strips are fed to a freeze tunnel using CO2, followed by a packaging machine.

The chip line consists of the a washer to remove the starch from the cut slices, a dewatering conveyor, cross conveyor and a wire mesh conveyor feeding into the fryer. The fryer was electric-heated, and converted to natural gas to reduce operating costs. The fried chips are discharged into a deoiling system and onto elevating conveyor to a flavoring depositor (salt, spices) and into a rotary mixer. The flavored chips travel up a long incline cooling conveyor to the packaging machine.

**Comments**
Both process lines appear to have the basic elements necessary for the production steps. The equipment, although much of it is used, appears to be of good quality and condition. There are a number of potential concerns and problem areas discussed that need to be looked into in more detail, and can be evaluated after observing the lines in operation.

Mr. Kosumi told us that the potato crop is good this season, but the solids are low. Last year they had up to 23% solids, and this year 20% may the highest. He expressed concern that this may affect his chip quality. I pointed out that he needs to dry the chips

as much as possible before frying, as it will help maintain the crispiness, especially if the solids are marginal. We agreed to pursue this further once the line is in operation.

Another problem he mentioned, was the salt and spice dispenser, which did not perform well last year, due to caking. This is probably due to high humidity in the process area, since they lack proper hoods for exhausting vapors, and are not introducing any outside air into the plant.

We were introduced to their new marketing manager, Edvin Kotheri. He is working on a new logo for their chip packages, as well as expanding their market penetration, mainly for chips. Mr. Kosumi said that he may not operate the French fry line since there is too much competition and he does not feel it would be profitable. The line has not yet been put into operation, and still lacks a few equipment items. We did not discuss this in detail, but suspect that the electric fryer may be part of his high production costs, as well as the CO2 required for the freezer. These will be addressed later.

Mr. Kosumi invited us to return next week at any time, and hoped that we could spend time there to assist in their startup and fine tuning of the chip line. We agreed to this.

**Company:** Pestova
**Date of Visit:** 14.09.05
**Contact Person(s)/Title(s):** Mr. Edvin Kotheri – Marketing Mgr
**Visit Purpose:** Follow up Visit
**Submitted By:** Ed Hayashi – Process Consultant

Visited this facility with Matt Tokar. Bedri Kosumi, General Manager, was out of the office so we met with Edvin Kotheri and Bedri's brother. The plant was shut down, and we were told they have a problem with the chip fryer oil temperature readout. It was not reading the proper temperature when tested on hot water, so they are trying to get help to resolve. The earlier problem mentioned during the last visit with the control of the bagging machine weigh scales was also not yet resolved. They purchased this machine (No.2) this year for the chip line since the original (No.1) machine was too slow. The machine is rated for 70 bags/min.

We attempted to get a clearer picture of their plans for both lines, and were told the chip line will start as soon as the fryer temperature problem is resolved. They were putting the old bag machine in place, which will be used until the other machine is fixed. Plans are to start up the French fry line next month. By then they hope to have the new chip filler (No.2) fixed, and will move the No. 1 machine to the fry line.

For future reference, the following information was collected on the bag machines while we were there:

No.1 Filler was made in Turkey by RolPak Co. It has two linear scale lanes, and operates at 10 strokes/min.

No 2 Filler was made by two different companies: the scales by Anritsu of Japan, and the bag machine unknown, since it is in transit from Holland. The scale system was made in 1992, is an 8 head followed by a 16 head rotary system – Model K723A, Serial No,.110058. It was purchased from a used equipment company - Budelpak Co.- phone no: 31 (0) 164-212750. The scale system control is not working, and they are trying to locate the part(s) needed or technical assistance. Budelpak gave them the email address of Anritsu, but they have not responded.

The chips are sold in 3 size bags: 25g, 45g and 90g, and French fries in 1kg bags. They told us the chip line produces 200 kg/hr, and the fry line 1,000 kg/hr. These may not be valid numbers, since they lack operating experience on the lines. Based on their numbers, the chip line bagger will require 13.3 bags/min on 25g bags, 7.4 bags/min on 45g bags, and 3.7 bags/min on 90g bags. The No.1 filler should be able the two larger bag sizes, and the 25g bags at 80%. The 45g bags are the largest anticipated volume of sales.

The fry line will require 16.7bags/min at 1kg/bag. The No.1 machine alone will not handle this volume. They feel they can supplement with another semi automatic bulk bagger they have for bulk packaging needs. We believe this needs further discussion with Bedri.

We also need to discuss his plans on the French fry line, since it would appear that there are various equipment items of mismatched capacity. The blancher appears too small

for the line, and the fryer oversized. We were also told that the gas burning chip fryer was a replacement for the electric fryer, which is now on the fry line. The temperature control that is not working properly is made in Japan.The freezer performance is another unknown quantity at this point.

We visited the raw potato storage not far from the plant, and met Bedri's father there. We were told the storage did not work satisfactorily, and they have decided to store in new wooden bins, which we saw earlier at the plant. The building is an insulated structure with good ceiling height, and had air pipes installed in the floor. These were approximately 10cm diameter, spaced about every 3 meters, and with small holes drilled every 2 meters or so. They were piling about 4-5 meters high, and it was obvious they needed much more air than the small pipes could supply.

They tried using pallets to form a V duct over the pipes to increase the airflow to the piles, but this will not help, since the air restriction is the undersized pipe and small holes. The easiest solution would be to use perforated galvanized corrugated pipe of much larger diameter (700-800cm) above ground, with larger air supply fans. Humidity and temperature control are also critical for a good storage, and I will try to get specific information for them later. A properly designed storage can hold potatoes 6-9 months or longer with minimal shrink loss if well managed.

**Conclusions**

At this point the plant is "scrambling" to resolve their equipment problems during the week they had planned to begin operations. For whatever reason, these problems were not identified and resolved earlier between seasons. The fry line is still lacking a piece of equipment (predryer) before the line can be run. The predryer is in transit from Holland with the bag machine and should arrive this week. Resolving the packaging machine situation may also impact when startup can occur on this line.

We were told that the lines were not all purchased as a system, but some items individually purchased. Not sure who if anyone provided technical advice to insure compatibility of the separate purchases, but suspect it may the used equipment company. Their current situation is reflective of not having competent technical support prior to implementing this project, which might have minimized their problems. Buying used equipment is always risky, and often the money saved initially is more than offset by problems later. Generally the equipment comes with either no warranty or only for a short period, no spare parts, no installation-operator-maintenance manuals, and usually no manufacturer support.

The electric fryer on the fry line and the CO2 freezer need close evaluation, not only as to performance, but operating costs. I believe both will add substantial cost to their production, and may make this line uneconomical to compete in the local market.

**Next Steps**

Monitor their progress on resolving the fryer and packaging machine issues, and arrange another visit as needed to assist. Provide them information on potato storage technology as an alternative (or supplement) to storing in wooden bins. Attempt to make contact with Anritsu for technical support assistance.

**Company:** Pestova
**Date of Visit:** 22.09.05
**Contact Person(s)/Title(s):** Mr. Bedri Kosumi – Owner/Manager
**Visit Purpose:** Follow up Visit
**Submitted By:** Ed Hayashi – Process Consultant

Visited the plant with Reshat to check on the chip line startup delays. We met with Mr. Bedri Kosumi, who introduced us to Mr. Bernard Jouglard, a potato specialist also involved with the European Bank and hired to provide consulting for the coming year. Mr.Jouglard has been working with plant for two days on the chip line to prepare it for startup. We reviewed the corrections made during their test runs, which they are satisfied will allow starting up the line on Monday.

The remaining problem is the Anritsu control system on the bag filler, which we have been assisting them with to contact the manufacturer. Anritsu advised that they stopped manufacturing this model 10 years ago, and parts are no longer available. Mr. Bedri said their electrician knows exactly what part he needs, and has been in contact with the Anritsu Vienna office, but has no answer yet. They will use the slower machine until the problem is resolved, but are also looking for another used weigh system that might be available.

Mr. Jouglard had suggested that there should be a wall between the two process lines to protect the high moisture and oil-laden air from the chip line salter and packaging area. I told them that a properly located outside filtered air supply duct would serve the same purpose, and better protect the plant from flying insects and ceiling condensation. If they install a dividing wall, it would be better to locate a wall across both lines between packaging and wet processing instead of between the two lines. We then reviewed the French fry line, and both agreed the existing blancher may be undersized, and to make provisions for adding a second blancher before the line starts next month. We both mentioned concerns about the electric fryer and the CO2 freezer.

We toured their three raw potato storages, and pointed out the changes necessary to improve the stored potato quality. Mr. Jouglard and I both agreed more air is needed, and I will prepare some information, which we can review next week. We agreed to participate in their startup on Monday.

**Company:** Pestova
**Date of Visit:** 26.09.05
**Contact Person(s)/Title(s):** Mr. Bedri Kosumi – Owner/Manager
**Visit Purpose:** Follow up Visit
**Submitted By:** Ed Hayashi – Process Consultant

Visited the plant with Reshat to assist with startup/problems on the chip line and also obtain dimensional and structural information on the potato storage. They were having problems with the chip fryer thermostat and had to relocated it, so they were still not running.

General Discussions - We discussed a variety of issues, and Mr. Bedri told us that he borrowed from the European Bank to finance the plant on a 3-year loan at 12.5%. The French consultant, Bernard was part of the arrangement. He spoke highly of Bernard, but said he keeps telling him changes he must make, and he can't afford to do all this right now. He prefers to find ways to run the lines with what he has for now. He repeated his gratitude for the assistance from KCBS, in that all the technical consultants have been very helpful and practical.

Bernard recommended he install a steam boiler to use for heating the fryer and blancher instead of electric. Mr. Bedri said this is another cost he can't afford, and the electrical costs are not that bad. He said the fryer represents 120 kw, and will cost about .4 -.5EU per hour. I did not pursue this. We also discussed the small blancher, and he said he will move the line down to leave space for a larger blancher later.

Potato Test Plots - We reviewed the test plot results, which showed good yield, but low solid content in most all the varieties. He is concerned about the low solids, but concluded that it was due more to weather conditions than grower practices. He said last year potatoes sold for .35EU/kg, and this year is a good crop and the selling price is only .09EU/kg. With low solid potatoes and a low fresh price, he is not optimistic about his situation.

Raw Potato Storage - We took the dimensions on the potato storage, and inspected the air supply fan. The insulation is only part way up the wall inside, and none on the ceiling. We calculated the air requirement for the size of the storage and provided a manual to them. I will follow up with a ventilation system layout, sizing and recommendations.

Anritsu Scale Problem – Despite the numerous emails, faxes and phone calls, we still don't have a solution or any support from Anritsu. I told them I emailed the U.S. office in Illinois, and hope to get an answer this week.

Mr. Bedri asked if we could return on Wednesday or Thursday if they can get the line running by then.

**Company:** Pestova
**Date of Visit:** 01.10.05
**Contact Person(s)/Title(s):** Mr. Bedri Kosumi – Owner/Manager, Edvin
**Visit Purpose:** Follow up Visit
**Submitted By:** Ed Hayashi – Process Consultant

Met with Mr. Bedri and Edvin

**Company:** Progres
**Date of Visit:** 13 Sep 05
**Contact Person(s)/Title(s):** Mr. Irfan Fusha - Manager
**Visit Purpose:** Initial Visit

Visited this plant with Messrs. Oscar Rizo-Patron and Muhamed Disha. We met with Mr. Irfan Fusha, General Manager, who provided a brief background on his operation. The plant was formerly government-owned and was built primarily to provide goods to the military. In 2001, Mr. Fusha and a partner leased the operation for ten years, under the name of Abi & Elif 19, although they still use the "Progres" label on their products.

The main products are tomato concentrate, ketchup & jam, but they also produce mayonnaise, pickles, and other canned, bottled and frozen vegetables. They have a separate operation in the same complex for dairy products production. We discussed their raw material sourcing, and were told 95% is from local farmers. They do not contract with the farmers, although they do communicate their forecasted needs to them. They generally pay market price. Oscar pursued this issue to point out the risks and benefits to both them and the grower of securing their raw by contracting, however Mr. Fusha said there has been no problems so far, and in the event of a shortage or poor quality, they simply import the material from nearby countries.

About 20% of their products are exported. Their glass bottles are imported from Serbia and Croatia, and their cans from Bulgaria and Turkey. They produce their own poly containers for ketchup with an extrusion machine.

We toured the receiving yard, where we observed large quantities of vegetables in field sacks including peppers, carrots, egg-plant, and onions being prepared manually (peeled, trimmed, deseeded, sliced, etc) by workers sitting outside on the asphalt pavement. Adjacent to this outside preparation area is an uncultivated area with weeds and trees. There were flies all over. We were told the workers are paid by quantity cleaned per day.

We then toured their finished goods storage, which housed a large quantity which Mr. Fusha said represented about 4-5 months production. Last year they produced about 4,500 tons, about 50% of their total capacity.

We toured the processing area, which begins with 5 or 6 separate preparation lines, each for different raw products. This continues into various further processing steps followed by bottling and canning lines, pasteurizers and static retorts. A Frigoscandia freeze tunnel was also observed but not operating at the time.

Due to Mr. Fusha's tight schedule, we did not spend much time in each area, and finished with a tour through their plastic bottle extrusion room, and refrigeration compressor room. He pointed out the coal-fired boiler room, but we did not see the equipment.

**Initial Conclusions**
The plant is a large, old and badly in need of general housekeeping. Much of the equipment is of older technology, but in general of good quality. Cleaning up the operation, eliminating spillage points and addressing worker attire (and visitors) would

be an essential first step. There were a lot of workers in the area, but only one was observed cleaning the floors with a water hose.

The outside manual preparation of raw material badly needs implementation of a good sanitation, pest control and housekeeping program.

**Next Steps**
Arrange another meeting with Mr. Fusha to discuss specific needs and areas of possible assistance.

# ANNEX II – ONION DEHYDRATION PROPOSAL

**ONION DEHYDRATION FOR AGROPRODUKT**

**PLANNING STEPS**

1. The first step to take is to research the use of dehydrated onions in Kosovo including:
    - Importing company(s)
    - Volume per month (or year)
    - Type of cut size(s) & how used
    - Variety(s) of raw onion used
    - Price structure
    - Quality specifications if possible

2. Research the onion varieties produced locally:
    - Harvest period for each variety (beginning and length of harvest)
    - Soluble solid content of each variety
    - Skin color & meat color of each variety
    - Average size and shape of each variety
    - Growers of onions and variety(s) grown
    - Average grower price

3. Establish drying capacity per tunnel:
    - If the maximum capacity of each tunnel is 1,300 kg per tunnel, we should use 1,000 kg per tunnel of raw material to be safe.

    - There are 96 trays per tunnel, or 48 trays per dolly. This means 3 rows of 16 trays each. At 1,000 kg, each tray should hold 10.4 kg (23 lb) of sliced onions. This should be verified by actual testing.

    - Output capacity of dryer depends on raw input solid content. Final product moisture target should be 5% moisture or 95% solids. For now assume raw onion content is around 10%, or 90% water. This means a yield ratio of peeled raw to dry is 9.5 to 1. (10.526kg of finished product for every 100kg of raw peeled onion). But there are also losses from peeling, top & tail trimming of the raw onion, normally representing a loss of around 20% of each raw onion. This represents 20kg of additional loss, so we need 120kg of raw onions to produce 10.526kg of final dry product (yield ratio of 11.4 to 1).

    - Using these yield ratios, one drying tunnel should dry 1,000kg of peeled sliced onions per day. It should produce 1,000/9.5 = 105kg of dry product. The amount of raw material required 105 x 11.4 = 1,197kg of raw onions at 10% solids.

4. Determine the product size(s) to produce:

- Not all the final dry product is useable for the market, since it depends on the market needs. If most of the market demand is kibbled (3.5 – 10 mm size), then about 70 – 80% of the final volume can be made in kibbles (80kg). The rest will be used for smaller sizes or powder. International standard definition of sizes used in Europe is as follows:

| Product | Size Range |
|---|---|
| Slices | 10mm – 60mm |
| Kibbles | 3.5mm – 10mm |
| Minced | 1mm – 3mm |
| Granules | .2mm - .7mm |
| Powder | <.2mm |

There are also specifications for color, microbial levels, and other requirements generally set by the buyer. Actual requirements may vary depending on the target market(s), however in general, the larger the finished size, the higher the value. The higher the yield of dehydrated slices the better the return, so it is important to maximize the yield of sliced product. Minimizing line breakage through excessive and improper handling is a critical aspect of the milling and packaging process.

## PROCESSING REQUIREMENTS

1. Peeling – Should be done manually at first. Peelers can be paid on the basis of kg produced (not kg peeled). They will need training on how to peel properly to minimize the loss of onion meat. The will have to slice off the center top part of the onion where the leaves grow, and also the bottom root core before removing the outer dry skin (unless the onion has white skin). Both portions do not make good final product, and also is where most of the bacterial contamination enters the onion. The peeled onions are put into baskets, and when full, are weighed for pay control.

2. Washing – Two washing steps are normally required. Equipment can be locally made and not expensive. Step 1 can be done by batch with a tank full of water. Chlorine should be used, and the water should be recirculated with a small pump to agitate the onions (onions float). Over the tank is a series of rotating paddles that “dunk” the onions and keep them moving to the discharge end. At the end of the tank is an opening with the last paddle designed to push the onions out of the tank, sliding into a rotary washer, Step 2. This can be a simple rotating drum with peforations. Through the middle of the drum is a manifold of spray nozzles that rinse of the onions with chlorinated water.

3. Slicing – The washed onions are discharged onto a simple belt conveyor to inspect the onions, and flow into the onion slicer. Many use an Urschel Model CC slicer, which is expensive. There are other slicers made that are less expensive, and used Urschel slicers can usually be found also.

4. Dewatering – It is important to remove surface moisture from the slices before entering the dryer and is normally done with a vibratory conveyor. However, since the energy cost using wood is minimal, it may be suitable to skip this step and go directly to the dryer with the wet product.

5. Drying – The slices are spread out evenly onto the drying trays and placed in the dryer. The time and temperature of drying must be developed by trial and error, since this information is not readily available, and depends on many variables.

6. Cooling & Equilibration – Recommend that once a sample of the dried material is tested and meets final moisture requirements, the tray dollies be removed from the tunnel and place into another unused tunnel. Turn on the air to cool down the product. After cooling, the trays should be emptied into a holding bin to allow equilibration, or evening out the moisture throughout the product for about 24 hours. This last step may or may not be necessary, but is normal practice by most processors.

7. Milling – Before the dried material can be packaged, it must go through the following steps:
    - First sifting step to separate out the good kibble sized material.
    - "Crushing" oversize material into kibbled size and smaller.
    - Removing dry skin material
    - Removing root core material
    - Removing "bold cuts"
    - Removing off-color material
    - Sifting into different final sizes
    - Milling small pieces, removed skin and core material into powder.

    The sifting can be done with an inexpensive vibratory unit with two or three decks for different sizes. The existing unit at the plant will work with some modification. The crusher can be purchased from Egypt for a much lower cost than Europe or U.S. Removing the dry skin can be with a vacuum system added to the crusher. Removing root core, off-color material and bold cuts can be done manually, spreading product on a table. Final sifting can be done on the same sifter.

8. Packaging – Material ready for packaging should be fed through a metal detector before manually placing in bags and weighed. A simple scale and scoop are all that's needed, along with an inexpensive bag sealer.

## BUDGET COST ESTIMATE

### I. PREPARATION (FOR 3 TUNNELS)

| ITEM | QUANTITY | CAPACITY | SOURCE | NEW COST |
|---|---|---|---|---|
| Miscellaneous hand tools, knives | | | Local | 100EU |
| Platform scale | 1 | 50 kg | Local | 150EU |
| Wash tank (SS) | 1 | | Local | 2,000EU |
| Rotary washer (SS) | 1 | 500kg/hr | Local | 3,500EU |
| Inspection conveyor | 1 | 500kg/hr | Local | 800EU |
| Slicer | 1 | 500kg/hr | Knott Co. (U.S.) | 8,000EU |
| Spare parts (knife blades, etc) | | | As needed | 500EU |
| | | | | |
| **BUDGET COST** | | | | **15,050EU** |

## II. MILLING & PACKAGING*

| ITEM | QUANTITY | CAPACITY | SOURCE | COST |
|---|---|---|---|---|
| Holding Bins, MS with liners | 3-6 | 100kg | Local | 300EU |
| Sifter (SS screens only) | 3 | 100kg/hr | Local | 300EU |
| Crusher w/ vacuum (SS) | 1 | 100kg/hr | Egypt | 6,000EU |
| Inspection Table | 1 | 100kg/hr | Local | 800EU |
| Metal detector | 1 | 100kg/hr | Europe, U.S. | 8,000EU |
| Bagging Platform Scale | 1 | 100kg | Local | 150EU |
| Bag sealer | 1 | N/A | Europe, U.S. | 2,000EU |
| Misc items, spare parts | 1 lot | | | 500EU |
| **BUDGET COST** | | | | **18,050EU** |

* Powder mill not included. May range from 14,000EU to 22,000EU for a new unit.

The two areas represent a budget cost estimate of 33,100EU. This will vary depending on what can be found locally or by some other means.

# ANNEX III – PLANT PHOTOS

**DELTA POMFRITS**
**Gilan**


**Main Entrance Driveway**

**Hand Trimming Cut Slices**

**Batch Fryer**

**Cooling Table**

**Batch Tray Freezer**


**Product Bag & Case**

**PESTOVA**

**Vustri**

**Main Entrance**

**Raw Potato Receiving Equipment**

**Raw Potato Storage Bins**

**Fresh Pack & Peeling Systems**

**Process Area – Chip Line**

**Process Area - Fry Line**

**PESTOVA (CONT"D)**

**Raw Potato Storage**

**Stored Potatoes**

**Potatoes Being Delivered**

**Transferring to Piler**

**AGROPRODUKT DEHYDRATION COMPANY**
**Burim-Istog**

**Front of Process Building**

**Inside Process Area with Dryers**

**AGROPRODUKT (CONT'D)**

**Tray Dryer #1**

**Full Set of Tray Carts**

**Sun Drying Berries**

**Hot-House Drying Tea Leaves**

**Growing Herbs for Drying**

**More Herbs Being Grown**

**PROGRES**
**Prizren**

**Red Peppers Arriving at Plant**

**Vegetable Preparation Area**

**Cleaning Peppers**

**Peeling & Trimming Onions**

**More Peppers Being Cleaned**

**Cleaning & Slicing Egg Plant**

**PROGRES (CONT'D)**

**Vegetable Feed Elevators**

**Processing Area Preparation Lines**

**Another Preparation Line**

**Ayvar Bottling Line**

**Bottle Pasteurizer**

**Fruit & Vegetable Concentrators**

**ALBI JUICE COMPANY**
**Peja**

**Factory Building Entrance**

**Pasteurization Systems**

**2nd Floor Process & Packaging Area**

**Combibloc Packaging Line**

**EKO-GILIQ**
**Socanica**


**Solar Dryer Cabinet**


**Serious Discussions**

**Solar Panel Heat Source**

**Interior with Metal Trays & Heat Coils**