

PRACTICAL GUIDE
FRUITS AND VEGETABLES PROCESSING
IN DEVELOPING COUNTRIES

1. INTRODUCTION

Projects in the fruits and vegetables processing, both established and forthcoming, aim at solving a very clearly identified development problem. The raw material producer, due to insufficient demand, weak infrastructure, poor transportation and perishable nature of the produce lose, substantial money. During the post-harvest glut, the loss is imaginable and often the fruits have to be fed to animals or allow to rot.

Even established fruit and vegetable canning factories or small / medium scale processing {centers suffer huge loss due to erratic supplies. The grower may like to sell his produce in the open market for table purpose, or the produce may not be of good enough quality for processing even though it is adequate for table use and this results in grave underutilization of processing capacities.

The main objective of fruit and vegetable processing is to supply wholesome, safe, nutritious and acceptable food to consumer throughout the year. Fruit and vegetable processing projects also aim to replace import of products such as squashes, jams, tomato sauces, pickles, etc., besides earning foreign exchange by exporting finished or semi-processed products.

The fruit and vegetable processing activities was set up or have to be established in developing countries. for one or other of the following reasons:

- diversification of the economy, in order to reduce their present dependence on export products;
- industrialization policy of the government;
- reduction of imports and meeting export demands;
- stimulate agricultural production by obtaining marketable consumer products;
- generate both rural and urban employment;
- reduce fruits and vegetables losses;
- improve farmers nutrition by self consumption of processed fruits and vegetables during the off season;
- generate new sources of income for farmers/artisans;

develop new value-added products.

What fruits and vegetables can be processed

Practically any fruit and vegetable can be processed, but some important factors (which determine whether it is to be processed or not) are the followings:

a) the demand for a particular fruit or vegetable in the processed form; b) the quality of the raw material, I . e. whether it can stand processing; c) regular supplies of the raw material.

For example, a particular variety of fruit which may be excellent to eat fresh is not necessarily good for processing. Processing requires frequent handling, high temperature and pressure. Many of the ordinary table varieties of tomatoes, for instance, are not suitable for making paste or other processed products. A particular mango or pineapple may be very tasty at the table, but when it goes to the processing center it may fail to stand up to the processing requirements due to variations in its quality, size, maturity, variety and so on.

Even when a variety is suitable, it is not reliable for processing unless regular and large supplies are made available. An important processing center or a factory cannot be planned to depend only on seasonal gluts; although it can take care of the gluts, it will not run economically unless regular supplies are guaranteed.

To operate a fruits and vegetables processing center efficiently it is of utmost importance, to pre-organize growth, collection and transport of suitable raw material, either on the nucleus farm basis or using out growers.

Processing Planning

The secret of a well planned fruits and vegetables processing center is that it must be designed for operation for as many months during the year as possible. This means the facilities, the buildings, the material handling and the equipment itself must be interlinked and coordinated properly to allow as many products as possible to be handled at the same time, and yet the equipment must be versatile enough to be able to handle many products without major alterations.

A typical processing center or factory should process four or five types of fruits harvested at different times of the year and two or three vegetables. This processing unit must also be capable of handling dried / dehydrated finished products, juices, pickles, tomato juice, Ketchup and paste, jams, jellies and marmalades, semi-processed fruit products.

Advanced planning is necessary to process a large range of products in varied weather and temperature conditions, each requiring a special set of manufacturing and packaging formula. The end result of the *effort should* be a well-managed processing unit with lower initial investment.

Location

The basic objective is to choose the location which minimize the average production cost, including transport and handling.

It is advantageous, other things being equal, to locate a processing unit near the fresh raw material supply. It is a necessity for proper handling of the perishable raw materials, it allows the processing unit to leave the product to mature to its best stage, and lessens injury from handling and **deterioration from** changes during long transport after harvesting.

An adequate supply of good water, availability of manpower, proximity to rail or road transport facilities and adequate markets are other important requirements.

Processing Systems

A. Small-Scale Processing

This is done by small-scale farmers for personal subsistence or for sale in nearby markets. In this system, processing require little investment: however, it is time consuming and tedious.

B. Intermediate-Scale Processing

In this scale of processing, a group of small-scale processors pool their resources. This can also be done by individuals. Processing is based on the technology used by small-scale processors with differences in the type and capacity of equipment used.

The raw materials are usually grown by such processors or purchased on contract from other farmers. These operations are usually located at the site of production to assure raw materials availability and reduce cost of transport. This system of processing can provide quantities of processed products to urban areas.

C. Large-Scale Processing

Processing in this system is highly mechanized and requires a substantial supply of raw materials for economical operation. This system requires a large capital investment and high technical and managerial skills.

Because of the high demand for foods in recent years many large-scale factories were established in developing countries. Some succeeded, but the majority failed.

Perhaps the most important reason for failure was lack of adequate quantity and regular of raw materials to factories. Despite the failure of these commercial operations, it is felt that they can succeed with better planning and management, along with the undertaking of more in-depth feasibility studies.

It can be concluded that all three types of processing systems have a place in developing countries to complement crop production to meet food demand. Historically, however, small and intermediate scale processing proved to be more successful than large-scale processing in developing countries.

Choice of Processing technologies for developing countries

According to FAO published document, the leitmotif for choosing a processing technology for developing countries ought to be to combine labor, material resources and capital so that

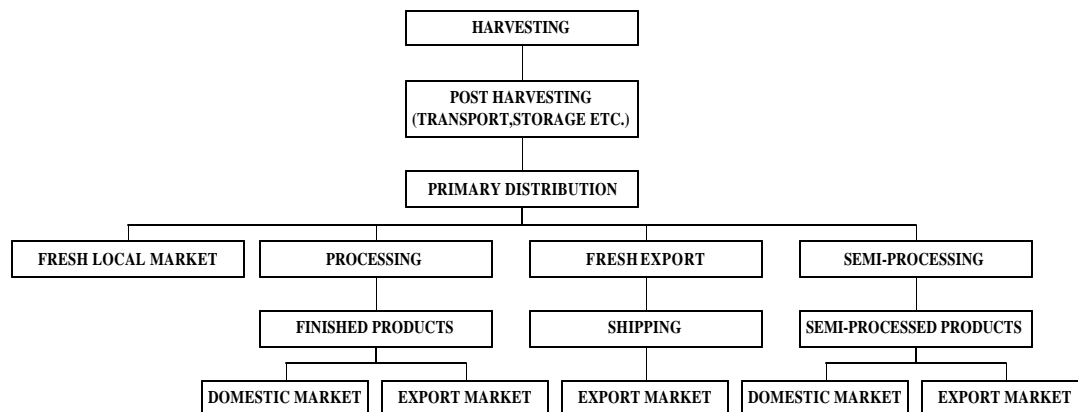
not only the type and quantity of goods and services produced are taken into account, but also the distribution of their benefits and the prospects of overall growth. These should include:

- a) increasing farmer / artisan income by full utilization of available indigenous raw material and local manufacturing of part or all processing equipment;
- b) cutting production costs by better utilization of local natural resources (solar energy) and reducing transport costs;
- c) generating and distributing income by decentralizing processing activities and involving different beneficiaries in processing activities (investors, newly employed, farmers and smallscale industry);
- d) maximizing national output by reducing capital expenditure and royalty payments, more effectively developing balance-of -payments deficits through minimizing imports (equipment, packing material, additives), and maximizing export-oriented production;
- e) maximizing availability of consumer goods by maximization of high-quality, standard processed produce for internal and export markets, reducing post-harvest losses, giving added value to indigenous crops and increasing the volume and quality of agricultural output.

Knowledge and control of the means of production, local manufacturing of processing equipment, and development of appropriate / new technologies and more suitable raw material for processing must all be better researched. Decentralization of activities must be maintained and coordinated. The introduction of more sophisticated processing equipment and packaging material must be subordinated to internal and export marketing references.

Choosing a technology solely to maximize profits can actually work against true development, and also requires a solid, long-term market opportunity to ensure viability. The internal market should be given greater consideration, safeguarded and supported. Training courses, at all levels, in processing and preservation of indigenous crops, must be expanded.

Fruits and Vegetables - global market view



II. PRELIMINARY STUDY

Each new fruit and vegetable processing center needs a good, specific preliminary study including, among other considerations, the following aspects:

1. Raw material availability;
2. Raw material quality adequate varieties for the types of finished products that will be manufactured;
3. Harvesting and transport practices and organization from the field to the processing center;
4. Processing capacity related to raw material availability: quantities, seasonability, etc.
5. Processing equipment size / capacity according to above mentioned points;
6. Availability of trained operators and resources to improve their knowledge;
7. Availability of work force in the area and resources for training them in order to be able to assure adequate trained operators;
8. Availability of utilities: electricity, water, etc.
9. Position of the future processing center as related to raw material fields and to closest transportation means; road access, railroad access.
10. Last but not least, market availability for finished products and for optional semi-processed products.

The decision to invest in fruit and vegetable equipment **MUST** be taken case by case and only after an adequate / specific preliminary study was performed by specialized people or organization.

III. HOW TO PREPARE, START AND OPERATE A FRUIT AND VEGETABLE PROCESSING CENTER

Additional recommendations and "hints to prepare, start and operate a fruit and vegetable processing center are as follows:

1. Assure a raw material temporary storage capacity/ surface for 2-5 processing days. Invest in an adequate size cold room for sensible raw materials;
2. Plan the equipment to operate at the start-up for at least one working shift (about 7-9 hours) per day, for 5 working days per week; when needed, a second shift could be organized;

3. Plan to operate the processing center as long as possible during the year (e.g. a maximum of working days per year); in order to achieve this, invest in the buildings and equipment which will enable to:

A) process as many species of fruits and vegetables as possible / as available;

B) use as many preservation methods as possible, e.g. drying, dehydration, concentration, sugar preservation, etc.

4. Whenever possible, "rush" the utilization of available raw materials during crop season by additional manufacturing of semi-processed products and transform these into consumer finished products during the off season.

5. Excessive automatization of processing equipment DOES NOT imply directly a good quality of finished products;

6. Raw material quality is a major element with positive impact on the finished products quality;

7. Initial and continuous people training and motivation is also an important factor in the success or failure of a processing center and in assuring a constant finished product quality;

8. Keep finished products stocks at a minimum adequate level;

9. Remember that the three main "outputs" of the processing center have to be prioritized in the following order:

Priority 1: Finished Product quality inside / in conformity with specifications and standards: national and/or international, consumer special requests, etc.

Priority 2: Continuous and reliable supply of finished products to the domestic and export markets all over the year (or at least all over the "marketing season" of specific products);

Priority 3: Manufacturing and transport costs as low as possible, inside the stringent need to cover the first two priorities;

10. When deciding on the equipment output, take into consideration all elements specified and mainly raw material availability and market demand for a specific finished product;

11. Invest in simple, "modular" processing lines which enable, with some simple "on-site", configuration modifications, to become versatile for processing various types of finished products; this is mainly important for- the first technological steps (preparation of raw materials, etc.);

12. Plan to use as much as possible of the raw materials supplied / received to the processing center.

This should be facilitated by the initial design and by a good day to day organization and management; all these should enable to make, if necessary, a different use of each "quality" / grade of raw materials, e. g. using them for different finished products: one quality for drying/g/ dehydration, an other quality for juices, etc.

13. Take into account the fact that the "marketable" finished products **will** be different in terms of types and quality for domestic markets as compared to export market.

Be sure that an export specialized people / organization will help with specific export advice. To export successfully is a different job from that one of processing fruits and vegetables.

14. Avoid to invest in one "big" processing line, very sophisticated in terms of automation, etc. with a high output capacity but having potential following drawbacks: a) being able to "generate" / produce only one finished product type from only one raw material; b) having a too high degree of equipment fixation work for installation and therefore very high difficulties to use the processing equipment in a modular "interchangeable" way.

15. As initial investment prefer small size processing lines, with modular equipment disposal (e.g. being able to be. integrated in various -technological, configurations for manufacturing of as much as possible raw materials and generating different finished products).

16. As compared with developed countries important processing units usual size of equipment, for a comparable environment frame ' it is possible to integrate as a very general rule for developing countries that the scale / size should be approximately 1:10 from those actually in use in developed countries.

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