PROCESSING TECHNOLOGY FOR THE LDCs IN THE CARIBBEAN

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Introduction

Technology may be defined as the practical application of the results of scientific study of the industrial arts. It is most important that this definition be kept in mind, particularly the word 'practical' which, more often than not, is overlooked by LDC States when considering the industrial arts of development.

To determine the practical application of scientific information, it is necessary to determine three (3) parameters quite early, before technological design can commence.

(i) The existing state of the art of technology.

(ii) Objectives of the technological application.

(iii) The mechanisms to be employed in moving from (i) to (ii) above.

Technological Options

The application of a new or improved technology for LDC States, where capital resources are low, unemployment high and land holdings small and diversified, should seek to accomplish as many of the following as possible:

(a) maximising the utilization of capital investment;

(b) maximizing employment opportunities;

(c) handling a range of raw materials usually seasonal and in comparatively small quantities;

(d) producing a range of safe products for which there is a ready market or where, with Government support, import substitution can be effected; and

(e) minimizing waste, while maintaining the highest nutritional value of the food, where practical.

Generally, in the Region, there is the scientific knowledge which can readily be applied, but practical constraints, e.g. levels of production, high cost of production and marketing uncertainties, combine to limit application.

Traditionally, processing installations are designed and implemented around guaranteed raw material inputs and, as such, maximum efficiency can be designed for the specific raw material (sugar factories and reconstituting plants in the MDCs).

Unfortunately, the technologies to be employed to service small scale production of a multiplicity of raw materials must give up in some measure

some of the operational efficiencies of plants for single crop processing. In small scale production, therefore, the technology revolves more around the design of the plant equipment to handle specifically and practically the levels of production envisaged.

Unfortunately, plant design and fabrication in metropolitan countries are not generally applicable to the scale of operation envisaged in the Region. On the one hand, equipment specialized to large scale crops are usually highly automated while, on the other hand, there are very small appliances and home canning equipment for use in farming communities where production is seasonal, and for personal consumption.

In the case of plants specialized to large scale crops, the obvious limitations are:-

(a) limited raw material to keep the plant running efficiently;

(b) limited use of facility due to seasonality of crops; and

(c) limited employment generation.

It should be stated, however, that quality control and hence product quality are easily maintained at a high level.

With regard to home canning operations the limitations are:

(a) very low levels of production per operating unit;

(b) product variations from batch to batch, which obviously limit market potential; and

(c) lack of facilities for quality control maintenance.

The employment generated from these home canning units is considerably high when compared with the investment, and it may be argued that a number of such small home canning units could possibly overcome the problem of production levels. However, it should be noted that such an approach would lead to even greater levels of variation in the product, further affecting consumer acceptance. In addition, the greater health risk should not be overlooked.

It would seem, therefore, that neither of these approaches to food processing is practical or relevant to the industrial development of the LDC States.

Requirements for Technological Implementation

It was noted in the previous discussion that the traditional approach of food technological development will not be strictly applicable to the Region. The following are the requirements for a technological package:

(a) identification of raw material sources - availability, quantity and seasonality, and the limits of their expansion;

(b) determination of marketing potential for processed products from the raw materials available; and

(c) planning and designing plant and equipment:

  (i) capable of adequately and efficiently transforming the range of raw materials into the proposed finished products, i.e. flexibility;

(ii) which will be as labour-intensive as possible keeping in line with codes of good manufacturing practices; and

(iii) which will be simple, so as to allow easy maintenance and cleaning to ensure food safety.

As regards the first two topics listed above, very little detailed thought had been given to them in the past, as most of our agriculture has been oriented towards export of primary commodities, and over the years we have grown more and more accustomed to exposure to imported processed convenience foods.

Further, to complicate the potential for development, present installations (reconstitution plants) are "straight-run" design and their production is based on a guaranteed raw material input imported from extra-regional sources. As such, there has been very little pressure to design or modify available equipment to suit local needs, i.e. small scale, and in keeping with the needs of good manufacturing practices. There has been some limited development, but in most cases these developments have not been such as to ensure the high quality of products to which the consuming public has grown accustomed and, secondly, the design allows neither the flexibility of multi-use equipment nor the efficiency expected from specialized design.

Technology for the LDCs

Raw Material Base

The technological input for a specific project is to a large extent dependent upon raw material availability. Unfortunately, too little attention is paid to this matter and projects develop which either do not have an input for efficient operation, the input is in excess of plant design or is varied, irregular or concentrated within a specific time period. In all cases, the operations are not practical. It cannot be over-emphasized that the technology to be applied is closely linked with the raw material base. An analysis must be made of the existing raw material base, planned increases in production, crop diversification and government policies as they relate to primary production and farmers' income.

After careful consideration as to raw material availability, the actual mechanism for collection must be regularized. Most of the present production of fruit and vegetables is from small, widely scattered farms. It would appear logical that the existing marketing organizations which have been established to promote the development and marketing of non-traditional export crops be responsible for the raw material acquisition and supply for processing.

Guaranteed prices for existing fruit and vegetable production coupled with producer contracts for new cultivation would help to ensure minimum supply to the processing plant.

Marketing

Peoples within the Region have become more urbanized, particularly over the past two decades and have developed specific taste patterns and increased dependence upon processed foods. This preference which is usually coupled with brand names and a "built-in" prejudice against locally produced

materials which is so prevalent in the Region makes the marketing situation quite difficult. This difficulty is further worsened by the existing structure of importer/distributor sector in the community. This sector has long standing association with existing brand names, a reasonably guaranteed market and a healthy assured mark-up. These two problems associated with marketing must be clearly and rationally considered.

With regard to the first, it is clear that for the product to compete on the market it must be a real alternative to what is currently on the market and its manufacture must be such that the quality is comparable to that currently imported. In this regard, the scale of the operation is not what is relevant, but the technology utilized. A code of good manufacturing practices must be rigidly adhered to and the correct technology supplied (from building, equipment, packaging with built-in sanitation and quality control).

The second constraint with regard to marketing is inherently more difficult. In addition to the long standing association which is established between brand names and importer/distributor and producer is the real problem of cost to the consumer, unless the distributor is prepared to reduce his normal mark-up. Because the scale of operation is small and the raw material cost is comparatively high, the cost of the local product is higher than that of the similar product which is imported. Unless the distributor is prepared to reduce his normal mark-up, the local product has to face the additional obstacle of being more costly to the consumer. There is little indication that the present importer/distributor outlook will change voluntarily and it would appear that some government intervention in the market place will be necessary if agro-industrial development is contemplated as a real strategy for development in the Region.

Another aspect of the marketing difficulties and constraints to technological implementation in the LDCs is the small domestic and regional markets. This, coupled with the similarity of available raw material and, therefore, potential processed products, could easily lead to a situation of over-production with depressed market prices and failure of the ventures. For these reasons it would seem logical for production to be geared not only for domestic and regional markets, but to include extra-regional markets.

However, the level of product from any one small plant might not be large enough to satisfy extra-regional demand. As such it might be useful to consider that small scale LDC plants should utilize the same technology, producing to a common standard with a view to exploiting extra-regional markets.

Plant Design

The technological alternatives available for the Region are:

Freezing: This technology, with appropriate pre-treatment, can be used to preserve most of the raw material available in the LDC States. The equipment is comparatively simple to operate. However, the lack of a "cold chain" (distributive outlet with freezer facilities) is a great limitation to the development of this technology. Because the marketing of such products poses serious problems and domestic refrigeration is not yet commonplace in the target area, this science is not practical at this time - it is not a technology for the LDC States.

Osmotic Preservation: The treatment of foods, fruit, vegetables and meats with chemicals, primarily sugar and salt, has been utilized by man for some time and has now reached the stage where the technology is used primarily to satisfy a specific taste requirement as opposed to avoidance of wastage, e.g. cured meats, pickles, jams, etc.

The initial cost of the physical installation for preservation by salt or sugar is comparatively cheap and the technological requirements are much simpler and more easily implemented, as evidenced by the multiplicity of home preserves currently processed in "kitchen" operations.

Unfortunately, this multiplicity of small operations leads to a wide variation in quality. This variation can be avoided or reduced by centralizing the production and producing on a larger scale. However, as the raw material base in the Region is quite similar and the market to be served is quite small, over-production is not only a possibility, but a distinct reality.

Export markets will have to be realised which in themselves dictate high levels of quality control and uniformity.

This exemplifies the situation where the "art" of production in available and actually being used, but because of quality variation and market constraints, expanded application of this technology must be judicious.

Heat Processing: This technology has gained in popularity over the past century. The process involves a specified combination of time and temperature, dependent upon the food to be processed. This process is used to produce sterilized and pasteurized food products. There are no special storage requirements for sterilized foods and as such they are ideal for the proposed market sector. Pasteurized products on the other hand require specific storage conditions, i.e. refrigeration and have a limited storage life (3-5 days). Because of limitations of "cold chains" the market for pasteurized foods is considerably small.

A processing facility which produces sterilized foods with some small capacity for pasteurized foods would hence appear to be a practical approach to food preservation problems.

Packaging: Packaging materials used in the food industry include - tin plate, aluminium, cellophane, glass, polythene and laminates made from aluminium and a range of plastic materials. These various materials all have specific advantages and disadvantages and the choice of material is dictated not only by the properties of the material, but also by the products to be packed.

(a) *Glass:* This type of packaging is used primarily for foods which are processed by osmotic preservation, e.g. jams, jellies, pickles, etc.

This type of packaging has the advantage of being recycled, but is generally limited in its application and should not be used for foods where light would have an effect on the food and/or where there might be aesthetic difficulties - products where settling can be a problem. In addition, there is the possibility of shattering.

(b) *Plastics:* Various plastics on the market are being used either singly or in combination primarily to package snack foods.

The advantage of such packaging is that it is generally the cheapest available and secondly, for some foods, the "see through" effect is positive advertising.

However, the type of plastic must be judiciously chosen as oxygen permeability could lead to rancidity and other changes in the food, whereas moisture uptake could lead to loss of crispness. The type of plastic material must, therefore, be chosen carefully with regard to the specific food.

(c) *Laminates:* Laminates, usually combinations of two or more plastic materials and aluminium used in a similar manner as plastic packaging, but designed to overcome the shortcoming of single plastics, present a moisture and air barrier for the food thereby reducing rancidity and loss of crispness.

The laminates on the market are also sterilizable and hence offer a comparatively cheap alternative to tin plate.

(d) *Tin Plate:* Most sterilized foods on the market are packaged in tin cans. Such packaging satisfies all the basic requirements for a packaging material being air and moisture proof, rigid and shatter proof. All other packaging materials suffer from one or more of the above drawbacks. Unfortunately, as a packaging material, cans are the most expensive - adding approximately 40 cents(EC) per pound of food processed. This is the biggest limitation to the food processing development in the LDCs.

At the present time canning holds the more immediate appeal to the potential processor, because the consuming public has grown accustomed to such packaging material and hence this is seen as the area from which the competition will have to come.

Suggestions for Processing Facility

As previously indicated, raw material supply for any proposed food processing installation is not only irregular, but reasonably high in cost. Based on an analysis for production levels of 2,500 units per day and current market prices, a food processing facility in the LDCs would have a financial rate of return of less than 10 per cent - surely not enough to interest private sector investment.

Without such an installation, however, the existing seasonal gluts will continue with direct losses to farmers and/or to the government agencies which now function as guaranteed markets. It is believed that both of these sectors will have to collaborate to alleviate this situation.

The form of collaboration envisaged is a jointly owned processing facility with equity being held by the farming community and the marketing agency. Apart from the production from the equity-holding farmers, the processing facility should contract with farmers for the production of specific crops for processing. In order to stimulate this production, the marketing organization should provide the technical, chemical and seed inputs required for efficient production.

It is believed that such an association will assure the raw material supply to the plant, guarantee farmers' income and, further, offer a share of the value added by processing to the farmer.

The decision on raw material production should take into account fresh market demand and processing potential. By this is meant that the material should be convertible into a processed product which has ready regional acceptance and a reasonably stable market, e.g. tomatoes which have fresh market demand as well as a demand in processed form (juice, paste, ketchup, etc.) as opposed to cabbages which have little regional demand in a processed form (sauerkraut).

The distribution/marketing of the production also needs consideration and it is suggested that such production, particularly in the LDCs, should be handled in the same manner as primary production and be protected by the Agricultural Marketing Protocol, with production over domestic demand being allocated within the Region.

However, it is felt that some areas of production, particularly tropical fruit products, will be greater than the Region can absorb. In this context it will be useful for potential processors of such products to consider production using a standard technology and labelling for joint marketing outside of the Region. This device is suggested not only to ensure uniformity of production but also, as levels of production in any one state tend to be comparatively low, the volume will probably be too small to interest a non-regional promotion or marketing agent. The combined marketing of production might overcome this limitation.

Conclusion

It is only after all the components of a technology have been appropriately packaged (as opposed to appropriate technology) is there hope for the industrial development in the Region. The raw material availability must be assessed and planned in accordance with market demand and strategies. Further, it is considered that this can more easily be achieved if the farming community is involved as equity participants in the processing facility. After this is completed the physical plant design can be accomplished suitable to the raw material and capable of a production reflecting market demand. Because of the scale of operations and, everything else being equal, production cost may be comparatively high, necessitating Government interference in the market place to ensure the viability of the project.

In order to assist in the marketing within the LDC States, production should be designed with the same technology allowing for uniformity and potential exploitation of non-regional markets. The AMP should include processed goods, assisting with marketing within the Region. Initially, production will be geared towards packaging in tin plate with a change over to laminates as soon as is technically feasible.