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Expert Group Meeting on Design, Development and  
Manufacture of Simple Food Processing and  
Preserving Equipment\*

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DESIGN, DEVELOPMENT AND MANUFACTURE OF  
SIMPLE FOOD PROCESSING AND PRESERVING EQUIPMENT\*\*

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\* Organized by UNIDO in co-operation with the Government of Zambia and the Village Industry Service

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F O R E W A R D

The Ethiopian Food Corporation has recently established a Food Research and Development Center (FRDC) within itself. One of the main objectives of the Center will be the conducting of planned programmes for the development of indigenous design and manufacturing capabilities within the food subsector. This is, undoubtedly, a vast and intricate task.

This paper has two main parts. Part I deals with the design, development and manufacture of simple food processing and preserving equipments in Ethiopia. Part II deals with the main activities of the Ethiopian Food Corporation, the background behind the establishment of the Center, the performance of this Center since its establishment and the potential role of the Center regarding design and manufacture of food processing equipment and in the overall development of the Corporation.

1. FOOD PROCESSING PLANTS AND EQUIPMENTS IN ETHIOPIA

Food processing plants and equipments in Ethiopia can be divided into three groups:

a. Simple food processing implements

These are owned by private individuals and not registered under the Handicraft and Small-Scale Industries Development Agency (HASIDA). They are small-cottage or household-type food preparation facilities. They are in most cases manually operated and sometimes mechanical or semi-mechanical.

Such implements are often found in villages, small towns and may sometimes be traced to the big cities. Examples include traditional food drying and grinding implements.

b. Small-scale food processing plants

These are small plants established and/or run with the help/consultancy of HASIDA. They are owned by individuals or co-operatives. The group consists of small-scale oil mills, flour mills (stone mills), bakeries, confectionaries, etc. They are found in small towns and big cities.

At the village level, this group of food processing equipment is moving from individual hands into the collective ownership of farmers co-operatives as a result of the effect of villagization and formation of co-operative organizations. In the towns and cities, these small equipments are grouped and transferred into the collective ownership of producers' co-operatives.

At both the village and city levels, HASIDA gives more emphasis to the formation and promotion of food processing plants owned by co-operatives in line with the government's policy. The main problems of these groups of plants are the lack of trained manpower and the lack of organization.

c. Industrial-scale food processing factories

These are owned by the state under:

- The Ethiopian Food Corporation (EFC), Ministry of Industry (MOI), to run edible oil mills, flour mills, baked and extruded food products of wheat/maize flour and baby-food plants;
- The Ethiopian Sugar Corporation (MCO), to run sugar factories and confectioneries;
- The Horticultural Corporation, Ministry of State Farms Development (MSFD), to manage fruit and vegetable processing plants;
- The Ethiopian Livestock and Meat Corporation (MSFD), for meat and dairy products; and
- The Ministry of Tea and Coffee Development, for the preparation of tea and coffee.

Even though the Government has direct responsibility over these groups of food processing plants, there exists in the country the problems of trained and skilled manpower for the proper upkeep of the plants in general, the lack of knowledge of the various food processing technologies and the lack of facilities, which are prerequisites for the design and development of food processing equipment.

## 2. DESIGN OF FOOD PROCESSING EQUIPMENTS

In any manufacturing industry, the type of technology to be used is determined by the quality and purpose of the end product required or vice versa. In the food processing sector, great care should be taken for the selection of the right technology as the product is meant for human consumption. This is very important especially in modern food preparation and processing plants and equipments.

Equipments for the preparation of subsistence food should be simple and cheap. Commercial food processing equipments may range from simple and cheap to complex and expensive. In such cases, the investment costs, the cost of production and the selling price of the finished products should be carefully studied and assessed before proceeding to the selection and design of the equipment should also be given due consideration.

There are food processing technologies already in use, both in developed and developing countries. Acquired technologies are the ones obtained from other (developed) countries and then:

- used as they are, or
- modified to suit local conditions.

The use of acquired technologies is more advantageous as a shortcut but must soon be adapted to local situations. This practice will also help to upgrade one's skill and capability for further development.

A technology may originate somewhere, but it is always subject to changes and improvements--so much so that in most instances, its origin will be difficult to trace. Even then, there will always exist some sort of an indigenous or a local technology. Such technologies and equipment must be identified, studied, improved and developed.

Injera is one of the staple foods of the Ethiopian society. It is similar to the Indian chappati but made from the flour of an indigenous cereal called teff. Traditionally injera from teff flour is baked in a large pan (about 70 cm in diameter; made from polished and baked mud) placed on tristone over firewood.

Even though this is still the way injera is made in the villages and small towns, the equipment in the big cities has been developed to operate with electric energy instead of firewood. This has been done by simply embedding an electrical resistance coil at the back surface of the pan and connecting the coil terminals to the electric supply. This simple food processing equipment has been designed and developed as a result of the acute shortage of firewood in general and, in particular, in the big cities.

Further studies on the injera processing equipment are underway to develop it from a static machine to an automatic one. A long-term plan is also believed to exist for developing the equipment into an industrial scale for the mass production of injera.

In the big cities, traditional bakeries operating on firewood have also been locally developed into simple electric ovens for lack of firewood. Static ovens are further developed into automatic electric ones.

Teff flour is ground with traditional stone mills. An experimental study is underway at the Debre-Zeit Wheat Mill to develop a teff flour mill by a complete modification and adaptation of a small wheat mill to suit the milling of teff.

### 3. DESIGN FACILITIES FOR FOOD PROCESSING EQUIPMENT

Before discussing design facilities for simple food processing equipment, it is imperative to consider the establishment of research, design and development centers. The role of such institutions will be to define policies and guidelines that direct their activities in general and particularly for the food sector to draw up food policies, food standards, nutritional needs, etc., to govern the design of food processing equipment, food production, packaging facilities and the distribution of food to the consumer.

Under the guidance of the Ethiopian Science and Technology Commission, the Ministry of Industry has set up a Science and Technology Department in 1985 to encourage the establishment of design facilities and research and development centers for the manufacturing of industrial machinery, equipment and spare parts in the corporations under it.

The Ethiopian Food Corporation, on its part, has, therefore, set up a Food Research and Development Center (FRDC) in 1987 to specifically promote and carry out design, development and manufacture of food processing and preserving equipment, which is the main point of discussion of this meeting.

At the moment the Center is at its embryonic stage, but it is moving fast with time to speed up the construction of its facilities in an area of more than 18,000 m<sup>2</sup>, consisting of:

- offices;
- training halls and classrooms;
- manufacturing workshops;



- research, design and development laboratories;

- etc.

As pointed out earlier, food processing in Ethiopia can be seen in three stages, i.e., the traditional household method of food preparation, cottage or small-scale food processing plants and the industrial scale of food production. The present trend of food processing is shifting toward the last two stages. However, the equipments and processes in both cases are at a low level of development.

The present food processing equipments are those acquired from developed countries and have been used as they are with very little or no further development and improvement for a long time--over 30 to 40 years in some cases. They are, therefore, considered obsolete by today's standards in the countries of origin. The qualities of food products processed by these equipments are often inferior and sometimes unhygienic.

There is very little attempt to develop and modernize traditional food preparation equipment or conversely to modify, adapt and develop acquired equipment/technologies for the processing of traditional foods from local raw materials.

The establishment of the PRDC by the EFC was, therefore, necessary mainly to:

- undertake studies aimed at modernizing existing obsolete food processing equipments and technologies;
- carry out engineering designs for the development and manufacture of food processing equipment locally;
- promote research work for the development of local products and improvement of existing ones;

- carry out research work for the modification and adaptation of acquired technologies to suit local conditions wherever applicable and to upgrade indigenous technologies;
- help in the selection, acquisition and assimilation of technologies transferred from developed countries; and
- provide training on food technology, food chemistry, food engineering, plant maintenance and operation and management of food processing enterprises in general.

To fulfill the above objectives efficiently, the Center will have to work closely with institutions such as the Ethiopian Science and Technology Commission (ESTC), the Ethiopian Standard Institute (ESI), the Ethiopian Nutrition Institute (ENI), the Institute of Agricultural Research (IAR) and others.

Even though the Center is at its infant stage, it has already started implementing some of its projects parallel to the construction of the physical plant. These research projects include:

- the hydrogenation of nigerseed oil for the production of margarine.  
Nigerseed is an oil seed indigenous to Ethiopia and its oil has not been used elsewhere for the production of margarine.
- the possibility of using rapeseed meal (solvent extracted cake) as fuel and fertilizer.
- the production of CERIFAM, a pre-cooked baby food from wheat and maize flours to replace baby food made from imported soyabean flours.
- the production of FAFA, a baby food, from local sorghum flour to replace the type prepared from imported soyabean flour and other ingredients.

- the determination of aflatoxin and gossipol levels in cottonseed oil and meal and the means to eliminate them during processing.
- the application of local bleaching earth in edible oil refining to replace imported raw material for the same purpose.

More details on the above projects and other not mentioned here will be given in another paper. In addition to these activities, the Center has also provided intensive training for technical and production personnel at the various levels of the food processing plants.

#### 4. CONCLUSION

The Center will soon engage itself fully in the design, development and manufacture of food processing equipment, as one important aspect of its task incorporated both in the short-term and long-term plans of action. The construction of the Centre's workshop will, no doubt, speed up this activity.

Even though practical work is underway at the Debre-Zeit Flour Mill to modify an existing wheat mill for the purpose of milling teff flour, an indigenous cereal, we could not at this moment present to this meeting a technical paper that specifically deals with the design, development and manufacture of food processing and preserving equipment(s).

However, we strongly believe that this workshop meeting will-- without a question--give us the opportunity to acquire the knowledge and experience of other countries in this field.