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Technical report: Food technology subsector\*

Prepared for the Government of Zambia  
by the United Nations Industrial Development Organization,  
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## 0.0 ABSTRACT

This Technical Report seeks possibilities of speedy improvement within ZIMCO/INDECO of the utilization of raw materials and of product upgrading in the area of food processing.

On the basis of information available from the field mission and from a previous project (the ZIMCO Technology Audit), it is concluded that a R & D Unit is to be built up at ZIMCO/INDECO, incorporating the services of a food specialist. His primary activity will be to assist research, development, and innovations in the food subsector in line with the Government's priority of making the nation self-sufficient in the sphere of food production.

Technology and R & D related information is given for the production of

- meat, fish, and poultry,
- milk
- edible oils
- baker's products
- beer
- sugar
- coffee, tea, etc.

This Technical Report is an integral part of the Terminal Report "Assistance to ZIMCO RDI".

## 1.0 INTRODUCTION

This report is concerned with a key subsector of the Zambian Economy - food processing and food products.

A basic notion of any successful approach to industrial rehabilitation must be that efforts to rehabilitate manufacturing industry necessitate taking into account key characteristics of the national economy. The most characteristic feature of Zambia's economy is, of course, its dependence on copper but apart from this, the absence of strong enough links between agriculture on the one hand and industry and manufacturing on the other hand account for many of the problems faced by Zambia's food industry.

Zambia's food processing technology is in great need of innovative R & D which would result in and organize new programs. First of all, measures will have to be taken to boost domestic food supply, increase reliance on local raw materials, and diversify the economy's export base in order to broaden sources of foreign exchange. To achieve this, attention must continue to be paid to pricing policy and, particularly, to agricultural producer prices. Low agricultural prices, designed to reduce food costs in urban areas, have in the past kept rural incomes low and have proven detrimental to the goal of increased agricultural production. Through proper pricing of agricultural commodities, Zambia could increase exports, achieve self sufficiency in food, and acquire a stable resource base for agro-related industries which are so important in supplying the domestic market with consumer goods. A more prosperous and vibrant food processing subsector would also provide a larger market for industrial products. The results of agricultural policy reforms that have been implemented thus far are encouraging.

Large, multi-sectorial companies like ZIMCO and INDECO have an important role to play in the food subsector. In addition to the activities of their own subsidiaries, they can also take steps which would make it easier for the private sector to command a substantial share of Zambia's food industry.

However, the success of the basic and emergency food programs will continue to depend on the degree of flexibility of the key policy measures initiated by GRZ to cope with the changing economic situation.

The manufacturing sector employs some 63,000 persons or approx. 13 per cent of the total formal sectors labor force. Another 500,000 are believed to work in small-scale enterprises in the informal sector. At least 10 per cent of all these work in the

various areas of food processing, and RDI is one of the ways toward upgrading this subsector to the benefit of the whole population. Apart from these problems and constraints relating to Zambia's position in the global economy, the manufacturing sector also faces obstacles to development that are related to the regional and subregional situation.

## 2.0 ANALYSIS OF PRESENT SITUATION IN FOOD PROCESSING

This Chapter addresses the present situation in the food subsector; lists its major companies and institutions; reviews the results of the ZIMCO Technology Audit in food technology; and outlines the trends and existing RDI.

### 2.1 Zambia

In the food manufacturing sector, 78 per cent of firms are privately owned. The remaining 22 per cent are parastatal or partly controlled by ZIMCO/INDECO. All together they cover Zambia's national needs and hold a large potential for the future.

Raw materials are mostly of domestic origin but there are notable exceptions. For instance, in the oils and fats branch, much crude vegetable oil is imported and then refined in the country.

The food processing subsector needs increased amounts of tools and inputs, preferably produced locally.

Major problems are related to poor capacity utilization, caused to some extent by non-availability of spare parts and insufficient supply of raw materials. Several branches - such as flour milling, oilseed processing, and stockfeed manufacturing, suffer considerable losses from breakdown of equipment and machinery.

Judging from past experience of the UNIDO experts, these breakdowns are in part due to excessive quantities of impurities in the raw materials, as well as inadequate plant design. For instance, cleaning equipment is usually not included in the process flow, and interlocking of electrical installations is absent. Hence, the poor performance of many processing plants is a consequence of inadequate plant procurement and contracting.

Installed capacities are invariably not achieved. In fact individual machinery is seldom tested, either for capacity or performance, prior to final takeover. Sometimes, entire processing lines in the plants are not subject to tests required as a part of normal commissioning procedure.

There is also room for improvement in the area of standards, hygiene, and veterinary regulations. An urgent problem is the utilization of wastes and byproducts.

### 2.1.1 Major areas of food processing

The following major food processing lines can be distinguished:

- meat, fish and poultry
- milk
- edible oils
- baker's products
- beer
- sugar
- coffee, tea etc.

GENERAL. Given the strategic emphasis on resource-based industrialization, and the crucial importance of linkages with the agricultural sector, high priority should be accorded to all agro-allied industries. Not only are they less reliant on imported inputs, but they also have a high labor to capital ratio, provide opportunities for import replacement, and utilize technologies that are appropriate resource endowments. Besides, these industries, especially food processing ones, are of strategic importance for meeting the basic needs of the people in any country.

Zambia's Economic Recovery Program declared priority to three categories:

- (a) Those producing needs and essential goods;
- (b) Those producing intermediate items; and
- (c) Those producing for export.

The industrial strategy aims at implementing policy and institutional reforms designed to encourage the local processing of raw materials, reducing dependence on imported inputs, and increasing levels of capacity utilization.



Rehabilitation and re-investment is to be concentrated in these three main categories and to that end, increased foreign exchange has been allocated to such firms in order to improve capacity utilization.

Export production is being encouraged through an export retention scheme, reduced tax on export earnings, an export revolving fund, and an export guarantee scheme. Industries producing intermediate items used by agriculture, mining, and other manufacturers are also targeted to receive increased resources.

MEAT, FISH, AND POULTRY. The meat processing branch incorporates slaughtering and processing of cattle, pigs, sheep and poultry. As for cattle, this situation is better than in the other groups. According of Ministry of Agriculture statistics (October, 1990) there are ca. 2,100,000 cattle in the stock. The major problem is than over 50% of the heads are in the South, and the cattle produced by the commercial farmers has a low weight. The ranch-grown cattle are heavier and provide choice meat.

The main objective of both the TNDP and FNDP was to increase beef production, especially among small-scale and peasant farmers. However, implementation of the planned programs faced serious financial and operational problems. In the traditional sector, the main constraints were inappropriate land tenure systems, limited credit facilities, and inadequate extension services.

The objectives are to

- increase beef production;
- increase per capita consumption; and
- expand the export markets for beef.

Cattle slaughtering during the FNDP is as follows ('000 heads):

1988	1989	1990	1991 <sup>1</sup>	1992 <sup>1</sup>	1993 <sup>1</sup>
84	87	90	93	96	99

The various pork products, including processed products such as sausages, polonies, hams, bacons, and ready-to-eat sausages, account for about 7% of total domestic meat consumption in Zambia. This has not changed substantially over the years. The greatest problem in the pork products branch at present is the

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<sup>1</sup>FNDP projection by Ministry of Agriculture for the New Economic Recovery Programme

shortage of slaughtering pigs. Another problem is the price of live pigs - the price per 1 kg L.W. is ZMK 70-80 (May, 1991) which is too low to provide an incentive to farmers.

Another problem is the shortage of spare parts for some essential equipment. It is the policy of GRZ to encourage the export of meat and meat products. Major efforts are necessary however to promote pig production and processing and to make it economically viable. Large White and Landrace are the only breeds of significance in the commercial sector. The efficiency of commercial pig production is low in Zambia even by African standards. The average number of pigs slaughtered per sow each year is estimated to be 11 and the over-all feed conversion (total feed consumed divided by total cold dressed weight) is reportedly 7.24. Similarly, the feed conversion ratio for slaughter pigs is only four to one. The main reasons for these low total slaughtering figures ('000) are low management standards, low quality of feed, and unreliable supply of feed:

1988	1989	1990	1991 <sup>2</sup>	1992 <sup>2</sup>	1993 <sup>2</sup>
16.2	17.1	18	19	20.1	21.3

The growth in slaughterings lags behind the increasing food requirements due to population growth.

Sheep and goats (in '000 in the table below) are also very popular in Zambia but account for only a minor portion of the total meat supply:

	1988	1989	1990	1991 <sup>3</sup>	1992 <sup>3</sup>	1993 <sup>3</sup>
Sheep	62	64	66.3	68.3	70.6	72.9
Goats	425	433	441	449	458	466

Inadequate and poor quality stockfeed supply resulted in a contraction of the poultry industry, especially among small-scale commercial producers. Production of poultry meat and eggs was further constrained by erratic and inadequate supply of day-old chicks because of forex allocation difficulties. The FNDP aimed at increasing production of poultry meat and eggs for domestic consumption as well as for export, and a number of measures were taken, particularly in the area of stockfeeds.

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<sup>2</sup>FNDP projection by Ministry of Agriculture for the New Economic Recovery Programme

<sup>3</sup>projection by NCDP

Poultry production ('000 tpy), production of eggs (millions), and stockfeed requirements (tpy) are illustrated below:

	1988	1989	1990	1991 <sup>4</sup>	1992 <sup>4</sup>	1993 <sup>4</sup>
poultry meat	14.4	16	18	19	21	24
eggs	228	246	265	292	319	347
stockfeed	120	135	149	166	183	203

Fish continues to play a very important role in the country's economy. Fish farming is supported by some 2,500 private fish farmers, mostly smallholders. Inadequate fishing gear and boats are the constant complaints. Improved marketing, handling, and processing of fish is also required.

MILK. The objective for dairies in the TNDP was to increase marketed milk production from 13.9 million to 20 million liters by 1983. This was to be achieved through the Rural Milk Production Scheme, the Dairy Crossbreed Heifer Supply Scheme, the National Milk Recording Scheme, the Batoka Dairy Crossbreeding Program, the Dairy Development Program, the Smallholders' Dairy Development Project, Training and Extension, and the Dairy Produce Board (DPB).

The Dairy Produce Board support to the TNDP was through the establishment of new processing plants; rehabilitation of refrigeration equipment, and assistance to farmers by importation of dairy farm machinery. As result of the above dairy development program, fresh milk intake by DPB increased steadily. The total intake by DPB and Zambezi Cooperative was 16.3 mln liters in 1983. However, considering milk marketed through informal channels the target of 20 mln was met. The involvement of small scale farmers in milk production through the above projects was successful although constrained by relatively poor producer prices, limited credit facilities, insufficient supply of crossbreed dairy heifers, inadequate extension services, and delays in issuance of title deeds at dairy settlement schemes.

The objective of the TNDP was to increase marketed milk production and expand the processing facilities.

The target of 25.2 mln liters in 1988 through DPB and Zambezi Co-operative was not attained due to unattractive producer price. However, when sales through other channels were included the

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<sup>4</sup>FNDP projection by Ministry of Agriculture for the New Economic Recovery Programme

total marketable milk production was estimated at 31.5 mln liters. The DPB embarked upon processing capacity expansion program. However, this was constrained by inadequate financial resources.

The objectives are to:

- (a) increase production of milk and milk byproducts in conformity with public health standards;
- (b) increase processing capacity, and
- (c) improve the milk marketing system.

The target is to increase total milk production from 60.5 mln liters in 1988 to 70.3 mln liters in 1993:

(mln liters)	1989	1990	1991	1992	1993
Marketed milk production	32.2	33.9	35.6	37.3	39.1
Unmarketed milk production	30.0	30.3	30.6	30.9	31.2
Total milk production	62.2	64.2	66.2	68.2	70.3

#### EDIBLE OILS

PREMIUM OIL INDUSTRIES LIMITED is one of companies where the potential for research and development is considerable. It is also one of those few that already have a research and development department, and more extensive (though basic) research facilities. The management seems to be keen on exploiting the research and development potential so they should be given encouragement by ZIMCO, and enough latitude to engage in profitable liaisons with other companies. The technology auditors never had an opportunity to examine the contents of Premium Oil management's (or any other) management and technical contract, so this should possibly be done by the RDI Unit, for the purpose of examining the effectiveness of individual contracts by contrasting the performance of the companies involved with the contract clauses. The Marketing and Sales Department recognize very well the role of and need for better marketing. At present emphasis is laid upon packaging and sales promotion. Market research is confined to desk research. While all these activities should be continued, it is recommended to assist the on-going R & D on product quality improvement and new products from the market side: the product development function within the marketing mix should be strengthened to deal not only with packaging but with products as well. Market research should reveal how a particular product is valued by various groups of consumers, which aspects or parameters of products they would like to have improved, how

great is the willingness to pay higher price for a better product etc. This marketing information may help the food producers in guidelining their technology research devoted to product development. At the same time it could influence the decisions of the management on the business strategy as far as product mix is concerned.

#### BAKER'S PRODUCTS

This line of business experiences quite a lot of variation in the quality of various inputs, especially flour, which is the basic raw material. In order to get a reasonable quality of bread consistently and to avoid wastages there should be a well equipped laboratory facility to carry out requisite tests. This is considered a priority project by the bakeries, though due to financial constrains it has so far been neglected.

For the long term, Supa Baking requires to diversify into new product lines of a premium nature for future survival. As a matter of priority the company needs to be assisted in researching into the matter.

#### BEER

All breweries in Zambia are ZIMCO subsidiaries. Beer is also imported from R.S.A. For R & D in malting, see Technical Report "A". Beer making proper is an issue to be handled through technology transfer (Heineken et al.).

#### WATER

Water today is becoming a commodity. Imported cans of natural water<sup>s</sup> are going at ZMK 35 to ZMK 40 in various city supermarkets in Zambia but CEDRICS Farm in Kitwe had to abandon plans to sell local natural water because of the prohibitive costs of the project (the costs involving plastic bottles, labels, and transportation). With reusable bottles the project could be made viable.

#### SUGAR

Zambia has only one sugar factory, Nakambala Estate under ZIMCO, covering domestic consumption and exporting 1/5 to 1/4 of production (cf. Technical Report "A").

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<sup>s</sup>Times of Zambia, 24 April 1991.

## COFFEE & TEA

The situation in this branch is described in the Technical Report "A" dealing with agronomy.

### 2.1.2 Companies and institutions

In addition to ZIMCO/INDECO subsidiaries and an extensive non-ZIMCO food industry, this also includes GRZ bodies and other national institutions:

- Ministry for Agriculture
- NCSR
- Mount Makulu
- UNZA.

The Ministry of Agriculture does not exercise control over the food industry. The ZIMCO subsidiaries within the food subsector are controlled by MCI. NCSR and Mount Makulu research station are concerned with the quality of crops, livestock and other inputs to the food industry. UNZA is embarking on a food technology program and intends to establish a Department and Degree program in food science and technology. The School of Veterinary also borders on the food section.

## 2.2 ZIMCO and INDECO

A complete list of subsidiaries is given, and the situation at selected subsidiaries is analyzed.

### 2.2.1 List of subsidiaries

ZIMCO subsidiaries and associate companies involved in the food processing sector are listed in Annex F-1.

### 2.2.2 Analysis of subsidiaries visited by the team

The following ZIMCO/INDECO subsidiaries were the subject of a technology audit under DP/ZAM/88/028 (1989):

- KAWAMBWA TEA COMPANY LIMITED
- MPONGWE DEVELOPMENT COMPANY LIMITED
- ZAMBIA AGRICULTURAL DEVELOPMENT LIMITED
- ZAMBIA CASHEW COMPANY LIMITED (cf. Technical Report "A" for details)
- ZAMBIA COLD STORAGE CORPORATION LIMITED
- INDECO MILLING COMPANY LIMITED
- DAIRY PRODUCE BOARD
- NATIONAL MILLING COMPANY LIMITED
- NATIONAL BREWERIES LIMITED
- ZAMBIA BREWERIES LIMITED
- PREMIUM OIL INDUSTRIES LIMITED (cf. Technical Report "C" for details)
- ROP (1975) LIMITED
- NATIONAL HOTEL DEVELOPMENT CORPORATION LIMITED
- NIEC AGENCIES LIMITED (see details below)
- ZAMBIA NATIONAL WHOLESALE AND MARKETING LIMITED
- MWAISENI STORES LIMITED
- NIEC STORES LIMITED
- CONSUMER BUYING CORPORATION OF ZAMBIA LIMITED
- INDECO ESTATE DEVELOPMENT COMPANY LIMITED

The following companies were visited under the present project, DP/ZAM/90/010 (1991):

- ZAMBIA AGRICULTURAL DEVELOPMENT LIMITED (cf. Technical Report "A" for details)
- ZAMBIA COLD STORAGE CORPORATION LIMITED (see details below)
- DAIRY PRODUCE BOARD (see details below)
- INDECO MILLING COMPANY (cf. Technical Report "A")
- NATIONAL MILLING COMPANY (see details below and also in Technical Report "A")
- NATIONAL BREWERIES LIMITED (see data below)
- ZAMBIA BREWERIES LIMITED (see data below)
- PREMIUM OIL LIMITED (see data below and also in Technical Reports "A" and "C")
- SUPA BAKING COMPANY LIMITED (see data below)
- POULTRY PROCESSING LIMITED (see details below)
- ZAMBIA SUGAR Co. (see data below and in Technical Report "A")
- NAKAMBALA SUGAR ESTATE (see data below and in Technical Report "A")

- ZAPP ZAMBIA PORK PRODUCTS (see details below)
- ZAMBIA MALTING LIMITED (see Technical Report "A")
- NATIONAL HOTEL DEVELOPMENT CORPORATION LIMITED
- ICS (INTERNATIONAL CATERING SERVICES)
- NIEC STORES LIMITED.

A brief review of technology audits in food processing subsidiaries of ZIMCO follows.

**DAIRY PRODUCE BOARD.** The present problems are first of all those of plant rehabilitation and transportation. In the forthcoming 2-3 years the major production and transportation bottlenecks should be removed by a set of rehabilitation, renewal and expansion actions and projects (installation of a stand-boiler at the Lusaka plant, purchase of chill fridges, ice cream vending machines, butter churns, spare parts for milk separators, transport vehicles, construction of cold rooms and mini-dairies). Due to higher prices of milk it is expected that milk production will increase. With the improvement in milk collection the milk intake will increase as well. It is therefore necessary that the rehabilitation projects be really implemented.

Purchase of butter churns and cream separators will make it possible to reduce the contents of fat from 3.6 to 3% and to produce butter of better quality. Similarly, with the rehabilitation of the ice cream tunnel the quality of ice cream would increase.

Plant and transport rehabilitation are major factors of improving the quality of products and widening the breadth of production. Simultaneously, R & D should be carried out on new product development (new varieties of cheese, flavored yoghurt, fruit yoghurt etc.). Development of new dairy products must be accompanied and guided by marketing research.

Technology audit indicated that R & D should also work on waste reduction and waste utilization (whey). Other fields of RDI activities can be suggested as follows: Analysis of local potential to produce some spare parts; analysis of local potential to produce and substitute carrier materials and ingredients (adjuvants) imported from abroad.

ECBA should be undertaken whenever alternative technical solutions are available.

**MWAISENI STORES LIMITED.** Major problems are easily identifiable and can be readily alleviated if funds are available (improving the equipment, repairing the trucks etc.) or if deliveries of



goods develop in terms of quantity, regularity, and quality. However, even now there are several lines for potential R & D activities:

- Improving the service to customers (such as better arrangements of goods, more balanced stock of individual items in the sales room, removal of inconvenient sales outlets, separation of outlets for incompatible products, etc.).
- Specifying product development requirements to be feedbacked to manufactures (analysis of reasons for slow movements of some commodities, identifying consumer requirements, etc.).
- Improving the economy of distribution and sales processes (regularity of supplies, improving stock control, reducing losses, increasing space utilization etc.).

These activities could be organized either at the ZIMCO/INDECO or at NIEC level.

NIEC Agencies Ltd. NIEC operates under conditions of a seller's market. Its potential R & D activities thus depend mostly on the solution of the principal Zambian retail market difficulties, which are insufficiency of numerous items of goods, irregularity of deliveries, and quality of goods. The volume of these problems calls for a general economic research exercise, which should be undertaken at the level of the Government or ZIMCO Headquarters.

The immediate development effort could be above all aimed at the technical improvement of distributional relations among individual NIECA branches and with retailers (e.g., transportation and communication facilities). This effort could be made either at the company or at NIEC level.

ZAMBIA AGRICULTURAL DEVELOPMENT LIMITED (ZADL). The company management are well aware of the need to develop. The following potential improvements should be paid particular attention:

- \* Improvement of the cropping system of malt barley.
- \* Testing new formulations of stockfeeds for dairy cattle.
- \* Marketing research for production of selected fruits, vegetables, and other crops like mango, garlic, ginger etc.

**ZAMBIA BREWERIES LIMITED (ZB).** The following recommendations were made under DP/ZAM/88/028:

- (a) Continue in rehabilitation of hardware.
- (b) Accelerate the regular training of manpower.
- (c) Disseminate know-how in malt barley cropping.
- (d) Prepare the transfer of technology in malt production by INDECO.
- (e) Conduct market research of beer to assist the management in introducing new sorts of beer by identifying quality properties required by various market segments. Establish the willingness to pay for the new product.

**ZAMBIA COLD STORAGE CORPORATION Ltd.** The equipment in some abattoirs needs rehabilitation. It is necessary to repair cold rooms at Kitwe Cold Storage and to enlarge storage, freezing, and chilling facilities in all company abattoirs (mainly at Mongu).

As the transport facilities are quite insufficient, the purchase of further refrigerated trucks is advisable.

A well organized central shop for repairs and production of spare parts can improve substantially the productivity and efficiency of over-all production.

There is only one in-house laboratory (Lusaka abattoir) - it will be useful to provide also the other abattoirs with adequate laboratory equipment for chemical analyses.

Manpower qualification is relatively low; the situation could be solved by giving adequate local and foreign training and by increasing the number of university graduates. It would be useful to establish R & D at the company. The following problems should be solved preferentially: equipment replacement, hygienic monitoring, waste water treatment.

**ZAMBIA NATIONAL WHOLESALE AND MARKETING COMPANY Ltd.**

The constraints which ZNWMC faces are mainly of "vis major" nature: shortages of goods supplies, lack of forex to purchase new trucks and spare parts, controlled prices with very low profit margin, obligation to take over goods from a parastatal manufacturer even if it is not needed or if it is of unsatisfactory quality... In fact, considerable deterioration of services has been witnessed (abolition of credit schemes for retailers, irregularity of deliveries, etc.).

Improvements depend very much on factors outside the company.

There is, however, at least one area in which development work with impact on cost reduction could be carried out: reduction of empty return trips by establishing or joining an information system interlinking transport facilities (taking into consideration the type of cargo and the suitability of the trucks to carry it). In view of the number of trucks operated by individual transporters it would be more rational if the system is established and operated by the Contract Haulage Company which is the biggest truck operator in the country.

### 2.3 Companies and institutions outside ZIMCO

While the aforementioned institutions are important to the food industry and take part in its development and decision-making, the real food processing, outside ZIMCO/INDECO, takes place at a number of mostly small to medium companies of which the major ones are listed below, and also at hotels and restaurants:

- Mulungushi Investment (Mulungushi farms, formerly ZIMCO)
- Cadbury Schweppes (Z) Ltd.
- Eastern Province Marketing Union
- Specialist Foods
- Liberty Biscuits Sunquick
- Duzi Sweets Super Sweets
- Cooper Harvest
- Sunrise Biscuits
- Breakfast Food
- Twikatane Farm Products (cf. details below)
- Lusaka Cold Storage (1964) (cf. details below)
- Kyindu Ranch (cf. details below)
- Buccaneer Products (cf. details below)
- King Farm Products (cf. details below)
- Lendor Agricultural Holdings (cf. details below)
- Lyons Brooke Bond (cf. details below)
- Mushina Ltd. (cf. details below)
- Modern Meat Products (cf. details below)
- B.C.M. Products (cf. details below)
- Chibote Farm (cf. details below)
- Mupilo Farm Ltd. (cf. details below).

More information on some of the above companies is given below, with a view for ZIMCO/INDECO to be able to form an opinion as to whether some sort of business and/or RDI interaction is advisable.

**Twikatane Farm Products.** Twikatane Farm Products is a religious organization which has taken advantage of the cheap labor offered by its members to go into the production of meat products. As a religious organization they are also exempt from all taxes, which places them in a very favorable and competitive market position. They realized early on that ZAPP was unable to satisfy the market because of the poor quality of its specialty, smoked sausages, and decided to introduce the European sausage. They succeeded in taking over a big share of the fast foods market, until ZAPP's Kariba sausage came on the market last two years. Twikatane supplies supermarkets and uses a personal selling method which includes free deliveries, enabling it to have continuous contact with its customers. Twikatane transport system is considered very good. Apart from Euro sausages, they also produce very high quality beef sausages, which ZAPP has been unable to do until now. Like all other Lusaka based companies, Twikatane operates from Lusaka to Kabwe, Ndola, and Kitwe. They now intend to expand by establishing factory in the Copperbelt. Their own piggery supplies about 10 per cent of their pigs requirements. To meet the demand for their products they must buy certain products from ZAPP. Twikatane also exports a part of their production, mainly to Zaire. Twikatane's weakness is the high prices it charges for its products. On the other hand, it offers discounts ranging from 5 to 15 per cent to cushion its high price.

**Lusaka Cold Storage (1961) Ltd. (Luscold).** At variance with Zambia Cold Storage which is a ZIMCO subsidiary, Luscold is a subsidiary of the privately owned Galaun Holding company which runs a number of concerns and farms. It operates a processing factory dealing in beef, pork, sheep, chicken and has established forward linkages by operating two butcheries in Lusaka.

Luscold dominates the institutional market, having taken over from ZAPP some 7 years ago. The fact that Luscold has a sound financial position and produces a substantial part of its raw materials from its own farms enables it to sell its products - whether processed or fresh meats - to Government institutions such as prisons and hospitals. These institutions take a long time to settle their bills which makes them an undesirable proposition to firms who do not have a sound financial base with a very diversified investment portfolio.

The company produces a large number of low-priced items to keep their market share. Luscold has easy access to foreign exchange due to its 50 per cent retention earned from agricultural export. With this it is able to acquire machinery, transport, and other necessary inputs. A good fleet of vehicles allows it to deliver its products cost-effectively. It also supplies a few hotels and

supermarkets, and systematically replaces perished products in the supermarkets as an after sales service. Most of its products are in strong competition with ZAPP's but by any means superior in quality. Luscold operates almost like ZAPP in that it engages in personal selling in the south as well as in the Copperbelt.

**Kyindu Ranch - Meat Factory - Lusaka.** This ranch, situated about 30 km from the city center, has established a Meat Factory, Abattoir, and processing section. Its excellent cooked ham has the approval of several hotels and supermarkets in Lusaka. It also produces sausages, polonies, and ready to cook products. Generally the quality of their products is very good and packing is excellent. This has enabled it to capture expatriate and diplomatic markets. Kyindu Ranch has recently opened a butchery in Avondale Shopping Center where their products are for sale. Kabwata butchery is selling meat and sausages from Kyindu Ranch. They also offer quantity discounts ranging from 15-20 per cent.

**Buccaneer Products.** Buccaneer operates a processing plant on its farm situated some 30 km from Lusaka. They produce high-quality sausages which have captured a large share of the market comprised of hotels, some embassies, and higher-income groups. Although their prices are slightly higher than ZAPP's, the quality of their products along with better packaging materials stimulates demand for their products.

**King Farm Products.** King Farm produces meat of the lines ZAPP produces but of very low quality. They too supply supermarkets, and take-away shops (fast foods). They are competitive in the market because they can afford to offer low prices due to their small size and low overhead. Their operations are concentrated in Lusaka, with very little activity in other towns. King Farms is not considered a threat to ZAPP.

**Lendor Agricultural Holdings.** Lendor operates a number of cattle-raising or fattening farms. They produce high quality beef, like Luscold, and plan to eventually sell to institutions or abroad. The organization has a very sound cash position. Recently Lendor acquired some meat-processing machines and will soon go into sausage manufacturing. Until then, the only competition they pose is in fresh beef, and exporting beef to Angola and Zaire. Lendor sells meat and meat products in Kabulonga supermarket in Lusaka.

**Lyons Brooke Bond.** Its meat-processing activity specializes in canned products and it sells fresh beef and sausages to hotels and supermarkets in Copperbelt.

**Mushina.** This company operates in Kitwe. It manufactures beef

sausages and cutting meat. Market sales and slaughtering rate are low.

**Modern Meat Products.** This is a Chingola based company whose operations cover the entire Copperbelt and extend to Kapiri Mposhi, Kabwe, and Lusaka. They sell their beef sausages, pork sausages, and polonies.

**B.C.M. Products.** Very little is known about this company. It produces and sells the following products: Beef sausages, pork sausages, French polonies, and garlic sausages. This company operates in Copperbelt. They also offer quantity discounts ranging from 15 to 25 per cent. Their prices are generally marginally higher than those of Cold Storage (Luscold).

**Chibote Farm.** Chibote farm operates a number of cattle raising (fattening) farms, producing high quality beef. Chibote acquired abattoir and some meat processing (to start operations very soon). Chibote farm is exporting beef (frozen meat of high quality) to Angola. Chibote farm manufactures cheese and butter and it sells to hotels and supermarkets.

## 2.4 Performance trends and industrial policy

The Government's emphasis on food processing is evident in the FNDP allocations for the subsector, accounting for 13 % of the total priority A project finance, 58.6 % of priority B project finance, and 2.7 % of priority C project finance. These percentages correspond to ZMK 21.9 mln, ZMK 23.5 mln, and ZMK 2.8 mln, respectively.

### 2.4.1 Subsector

Policies more specific to the food-processing industries are as follows:

- 1 As regards access to foreign exchange, the so-called priority activities, including stockfeeds, vegetable oils, and fats are given preference.
- 2 "Sensitive" branches such as stockfeeds and edible oils receive a five-year tax holiday.

- 3 Total embargo exists on imports of competing processed foodstuffs. Imports of such inputs as sausage casings and spice are allowed.
- 4 A number of products from the food processing sub-sector are subject to price control (prices can be raised by producers).

The average capacity utilization for the Food, beverage, and tobacco subsector<sup>e</sup> was 52 per cent in 1990 compared to 56 per cent achieved 1989. In this subsector the production of mealie-meal was 318,748 tons in 1990 compared to the planned production of 320,293 tons. However, mealie-meal production increased by 1.4 percent in 1990 from 314,415 tons produced in 1989. The main reasons for the small increase in production was due to production constraints and lower demand of roller meal. The production of cooking oil dropped by 16 per cent in 1990. In 1989, production was 19,306 tons as against 16,187 tons, in 1990. Shortages of raw materials and low price increases affected the output of cooking oil thereby failing to meet the planned target by 32 per cent in 1990.

The total production of stockfeed by EC Milling Ltd., Indeco Milling and National Milling was 80,895 tons in 1990 compared to 81,153 tons achieved in 1989. The output achieved this year was 16 per cent below the projected production of 95,912 tons. The production of sugar increased by 3 per cent to 127,132 tons in 1990. However, this production was below the target by 8 per cent. The beer production at Zambia Breweries increased to 930,000 hectoliters in 1990 compared to 832,00 hectoliters in 1989. The increased production of beer by 12 per cent is mainly due to the rehabilitation program completed during the period. Production of opaque beer (chibuku) decreased by 15 per cent in 1990 from 2454 hectoliters achieved in 1989. The reduction was mainly due to boiler problems and lack of delivery vehicles.

#### 2.4.2 Selected companies

The meat processing industry has a number of backward linkages but the forward linkages in Zambia are few, and not very well developed. The pork products branch is concentrated in the large population centers along the line of rail with three model plants around the Copperbelt, in Lusaka, and in Livingstone. These are

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<sup>e</sup>Zambia Country Report, 1990.

Zambia Pork Products (ZAPP), Twikatane Farm, Lusaka Cold Storage Ltd., Kyindu Ranch-Meat Factory, Galaun Holdings Ltd. Galaun's slaughtering capacity is used by other significant producers: Buccaneer Products Ltd., Lusaka; Ngwerere, Lusaka Rural; King Farms Products Ltd., Lumumba Rd., Lusaka; Lendor Agricultural Holdings, Lusaka.

In summary, as much as 90% of Zambia's current output of pork products comes from Lusaka and its environs. This figure is quite consistent with ZAPP's market structure which shows that 70% of its output is marketed in the Southern area, with the remainder going to the relatively densely-populated Copperbelt. Poultry Processing increased production by 10 %.

Ninety-two per cent of the meat processing branch is privately owned and the remaining 8 per cent is controlled by INDECO (percentages based on estimated output per employee). It has not been possible to obtain a breakdown of private ownership.

Quality control and general standards of hygiene can certainly be improved. Although ZAPP has procured the services of Quality Control Superintendent, there are no laboratory facilities for determining the quality control of raw materials and products. Quality Control therefore consists of visually inspecting the quality of beef. From Lusaka Cold Storage, quality control ought to be ensured for the other ZIMCO companies in the area of raw materials and products.

#### Milk processing:

Milk processing is on a downward trend or remains level at best. Capacities are underutilized. A major priority is to develop milk supplies beyond the present level of 65,000 liters per day. In order to achieve increased milk production, the Board has embarked on the establishment of the following:

- (i) Milk quality penalty/bonus
- (ii) Butterfat payments
- (iii) Growth bonus.

In addition, the Board will in the not too distant future consider:

- (a) Milk transport charges
- (b) Dry season bonus.

The development of milk supplies poses particular problems in



Zambia where the tradition and therefore management experience of producing fresh milk suitable for processing is scarce and in the particular climate, preservation is expensive (refrigerated cooling).

Existing supplies come in the main from commercial farmers, i.e., large farms where management expertise and investment capital are available for what is an expensive even if lucrative enterprise.

The generation of milk supplies from peasant farmers in Zambia would be slow and difficult because of the need for initial heavy investment in an environment where credit is difficult to obtain.

The best possibilities rest with the expansion of supplies by existing suppliers or commercial farmers not presently involved. With milk, there is great attraction in monthly paycheck all the year round.

An increase in milk supplies, apart from simply making more of an ideal food available, would also lower its price due to greater throughput in the plants and would generate substantial and badly needed economic activity with its spin off-benefits.

#### Edible oil processing:

This has a steady trend but depends on inputs and pricing. Soya continues to be in short supply. Edible oil processing being essentially chemical processing, more on this can be found in the Technical Report "C".

#### Bakery production:

Bakeries are dependent on the inputs of flour. The production volume remains level on the whole, while the quality trends is on the rise.

#### Breweries:

Over-all performance in beer making is fair. There was a lack of reinvestment in the last ten years. Reliability of the process is good.

Inputs:	(a) malt	10.000 tpy
	(b) maize	5.000 tpy
	(c) sugar	5.000 tpy
	(d) Hop extracts	25.000 tpy.

Malt and hops extracts are imported from Europe and Zimbabwe. The annual capacity is 800,000 hectoliters. Specific potential R & D projects will concentrate on

- uses of local raw materials (malt, barley)
- market research of beer
- introducing new sorts of beer by identifying quality properties required by various market segments.

#### Sugar processing:

There is a MILLING FACTORY with two independent rolls; BOILER PLANT of three sections (36, 78 and 91 tph of bagasse); refinery producing white sugar (45,000 tons). More details can be found in Technical Report "A".

#### 2.5 RDI

The situation is RDI in Zambia in the food sector is rather poor. There is some R & D under NCSR and Mount Makulu coordination. Company R & D nuclei exist at National Milling Co. Cold Storage Board, Dairy Produce Board, ZAPP, and several others focusing on laboratory testing (microbial contamination etc.). That much for "technological" research.

Market research is pursued e.g., by NIEC, Kawambwa Tea Co., Supa Baking, Dairy Produce Board, and ZNWMC.

Product innovation is probably best represented and almost all companies make some, however rudimentary and unconcerted efforts to upgrade and/or innovate their products.

Information however on what is going on in any particular line of business elsewhere is mostly lacking. Of course, there is UNZA, Bureau of Standards etc. which are also active in R & D bordering on food processing.

### 3 INPUTS AND OUTPUTS

Inputs and outputs in the food business have very much to do with the contents of various components in food.

Food is anything possessing either energy, protein, vitamin or minerals. Water is not a food but rather a substance absolutely necessary for the biochemical processes of life. Foods vary in their chemical composition and levels of protein and energy, see the indicative composition of common foods of Zambia (FOOD VALUES):

Food	Moisture	Fat	Carbo- hydrate	Energy Cal/100 g
Cooking Oil	0	100	0	884
Sugar	3	0	96	370
Syrup	25	0	74	286
Jam	28	0	71	278
Maize	12	3	74	362
Rice	12	0	79	362
Wheat	12	1	76	364
Millet	11	1	78	329
Potato	78	0	18	83
Sweet Potato	68	1	28	123
Cassava	62	0	36	149
Soybean	8	18	30	392
Beans	12	2	62	338
Groundnut	3	44	24	559
Bambara	10	6	61	367
Cowpea	11	1	61	342
Milk	87	4	5	68
Eggs	74	12	1	162
Beef	59	13	0	239

The next table shows the cholesterol contents of common foods in Zambia:

Food	Cholesterol mg/g
Soybean	0
Groundnut	0
Maize	0
Sunflower	0
Chicken	60
Fish	70
Pork	70
Beef	70
Butter	250
Egg (whole)	550
Egg yolk	1500

Vegetable fats are better for health reasons than animal fats. According to a WHO (1985) study, lysine is the limiting amino acid that occurs most frequently in low-cost diets on a worldwide basis. Cereals, such as maize, have low lysine contents. With meat being too expensive, beans and soybeans become valuable sources of lysine. Methionine, which is somewhat limited in beans and soybean, is available in maize and rice in sufficient quantities to provide for human needs. Combining different foods, such as maize and beans or maize and soybean, makes high value foods because the amino acids supplement each other, producing a balanced intake.

### 3.1 Major inputs of subsector

Indicative checklist:

Poultry, cattle, pigs, goats, sheep, fish, fruits, milk, eggs, flours, sugar, salt (NaCl), yeast, spices, casings, ingredients, chemicals ( $\text{NaNO}_2$ ,  $\text{NaNO}_3$ , phosphate, acid ascorbate, etc.), plastics, cartons, raw material, gas, wood, electricity, water, equipment, seed, and vitamins.

### 3.2 Major outputs of subsector

Only those commercially important outputs of the food industry which are usually passed for further processing are listed:

#### Meat

Beef, pork, lamb, veal, chicken, fish, sausages, hides, blood, wastes, offals, tins, cans.

#### Milk

Yoghurt, butter, milk, ice cream, cheese.

#### Bakery

Bread, biscuits, rolls.

#### Breweries

Beer, Chibuku, molasses, cooking oil.

#### Fruits & vegetables

Potatoes, salads, apples, onions, garlic, etc.

#### Soft drinks

Fanta, Sprite, juices, Coca cola.

#### Flour

Mealie meal, soya flour, wheat flour, white flour.

#### Other

Cooking oil, sugar, coffee, tea, salt, and spices.

#### 4 LINKS

The backward and forward linkages in the food processing subsector are quite extensive. The stockfeed processing branch, for example, must have strong and reliable links to a number of branches, including oilseed processing, grain milling, meat processing, dairy processing, sugar processing, and beverages. The inputs from these branches determine to a great extent whether the stockfeed industry is capable of supplying the livestock subsector with qualified formula feeds. The absence of linkages, or poor performance in other branches, implies dependence on imported ingredients. The oil seed processing branch and the meat processing branch have fewer linkages, but are of crucial importance with respect to supplying byproducts to the stockfeed industry and various foodstuffs to the market.

Examples of common links are given below.

##### 4.1 Process flow and other in-house links

###### Production:

Poultry Farms	----->	Poultry Processing
Coffee Company	----->	Market
Kawambwa Tea	----->	Market

##### 4.2 Company-to-company input-output links

###### Commercial farmers:

Breweries - Malting	----->	Breweries - Retail
Hatchery - Poultry Farms	---->	Poultry Process - Retail
Com. Farmers	----->	Dairy Board - Retail
National Milling	----->	Supa Baking - Retail (Market)
Farms - Small Scale Farmers	----->	Retail - Market

##### 4.3 Links between subsectors

National Milling (NaCl)	---->	Supa Baking Cold Storage Board
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Nakambala Sugar -----> Breweries

#### 4.4 Links to other sectors of national economy

Farms	----->	ZAPP
Chibote Farms	----->	Kyiundu Ranch
Galaun Holdings	----->	Cold Storage

#### 4.5 Links to Government and non-ZIMCO institutions

GRZ and the public sector obviously have a role to play in human resource development through formal education, training and skills development programs. They have a regulatory function and should ensure that the policy and political environment is such that technology can be developed, transferred and adapted. It is essential that the private sector is able to operate profitably but not exploitively, and that both national and international companies are encouraged to invest in training, infrastructure, and research. However, the public sector should recognize its limitations in certain activities such as marketing and commercial operation of agro-business.

Also see Technical Report "A" (the same Chapter).

## 5 FORMULATION OF RDU IN FOOD PROCESSING

### 5.1 RDU objectives

The objective of the RDU is common for all groups and professions: to assist ZIMCO/INDECO to define a strategy of management and operation in RDI to raise the level of operating competence of research, development and innovation activities, and provide the basis for long term performance. The general objectives to be pursued by RDU in the food industry sector include:

- improvement of products (diversification of cattle, etc.);
- utilization of wastes (blood, bones, offals);
- applicability of special products or wastes for specific use (byproducts);
- sharing of laboratory and testing equipment (standardization of inputs/outputs);
- sharing of know-how (technology of mixing and blending: sausages, cheese, ice cream, bread).

### 5.2 RDU activities

The RDU specialist in food processing research and technology will undertake the following activities in RDI:

- RDI consulting on food processing problems in subsidiaries;
- mediation of intra-sectorial and inter-sectorial contacts and links in agro-industry;
- collection and dissemination of scientific and RDI information from/to all subsidiaries (cf. Annex F-1);
- technology auditing within the food industry;
- preparation and startup of RDU data banks;
- acquisition, verification, recording, and updating of data for data banks;
- organization of training, meetings, and ad hoc teams addressing food industry problems.



### 5.3 RDU outputs

Those include

- RDI promotion
- RDI coordination
- cooperation & planning
- R & D proper
- information services.

#### 5.3.1 RDI promotion

RDI promotion should be done by the RDU through

- positive examples
- advertizing
- pointing to comprehensive packages of innovated products
- high quality performance of RDU itself.

#### 5.3.2 RDI coordination within the RDU group

The coordination strategy emphasizes consistency and cooperation to lay the foundation for rationalizing the various food processing activities.

Coordination of the RDI activities within the ZIMCO group in food processing should include:

- Setting up ad hoc teams to solve specific problems
- Controlling the subsidiaries' RDI through redistribution of R & D funding and of RDI derived benefits
- Providing feedback between corporate and company level RDI.

#### 5.3.3 RDI cooperation and planning at nationwide level

ZIMCO/INDECO are not very strong in the food business. Much food processing takes place at non-ZIMCO companies. Memaco is in the lead with the new idea of diversifying into ranching. This is an

example which, if successful, could be followed by other ZIMCO/INDECO subsidiaries.

RDI cooperation and RDI planning in relation to non-ZIMCO/INDECO entities operating at the Government level, the University level, and the company level should include

- establishing and maintaining linkage between the research and development activities of the NCSR, the UNZA, and the proposed RDI activities of the ZIMCO/INDECO subsidiaries.
- information services supporting the RDI activities.
- gathering, sorting, analyzing, and disseminating information on
  - RDI activities (results)
  - products and their properties
  - wastes
  - technical and scientific instruments available in the country
  - advising on the choice of food processing technology.

#### 5.3.4 RDI conducted by the RDU

It is recommended that a post for RDI - FOOD RESEARCH in technology be established in the RDU.

Food research is logical from the standpoint of the relationships with agricultural production. Zambian food must be available to feed the nation, and this requires technology and management.

In the Zambian food system, certainly, agriculture and food processing have manifested manifold ties. For example, breeding of specific varieties is needed as much as improvements in processing, to upgrade the quality attributes of food. Food processing also incorporates integrated handling, conversion, fabrication, preservation, and storage.

"A food technology is practitioner who deals with the design and development of new products and processes, strategies for quality assurance and food safety, and process management in a food plant."

In the area of information, the RDU FOOD RESEARCH should in the short term engage in

- acquiring basic and applied knowledge through practical research of food in cooperation with ZIMCO agencies and food companies;
- supporting the food industry by organizing consultations, short in-service courses, and workshops.

In the long term the RDU FOOD RESEARCH should perform, or engage in, additional roles:

- quality control and assurance
- product development and improvement
- process development and modification
- food plant management
- food service management
- food marketing and marketing strategy
- food plant design
- nutritional evaluation
- food plant inspection and sanitation
- food safety and hygiene
- food research.

Design of RDI pilot projects:

- objectives and kind of different technology and marketing;
- requirements and conditions;
- cooperation;
- what kind of criteria must be evaluated;
- methods of evaluation, statistics;
- identification of forms of utilization of results of RDI activity.

### 5.3.5 RDU information services

The types of information which should be kept on file, analyzed, and/or distributed by the RDU can be illustrated on the example of meat processing (see Annex F-3).

#### 5.3.5.1 Data acquisition

An example is given for the area of meat processing:

- Weekly information<sup>7</sup> on slaughtering quantity and D. W.
  - (a) Cattle
  - (b) Pigs
  - (c) Chickens
- Weekly information on condemned animals/meat (kg)
  - (a) Carcass
  - (b) Offals
  - (c) Fat
  - (d) bones
- Monthly information on the consumption of blood (liters).

#### 5.3.5.2 RDI surveying

Can involve the following elements:

- general;
- identification of production constraints;
- identification of technology related losses;
- data dissemination;
- data dissemination techniques;
- recipients of information.

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<sup>7</sup>This information is collected daily by abattoirs. Weekly data provides inputs on the quantities of wastes available for processing to byproducts, and central filekeeping substantially increases accountability.

## 6 RDU OPERATION IN FOOD PROCESSING

### 6.1 Schedule of operations

The RDU's specialist in food processing should be available from the very beginning. In Phase II (up-scaling) he should coordinate his work with all other specialists but again, the link with agriculture should be pursued most thoroughly from the very beginning.

### 6.2 RDU staff

The specialist should be well qualified to participate in the activities listed in Chapter 5.3.4. His orientative job description can be found in Annex F-2.

### 6.3 RDU methodology

The method to be adopted in daily work is

- to start by gathering available information
- to build appropriate banks of data
- to share instrumentation proposed in Technical Report "A" with the agriculture specialist
- to build up contacts, links, and liaisons with manufacturers, farmers, processors, traders, and researchers
- to pay attention to the standards of hygiene in processing, selling, and storage (incl. shelf life).

### 6.4 RDU premises and facilities

See Technical Report "A" for shared facilities.

## 7.0 R & D PRIORITIES

Zambia Government priorities: To feed the nation is the Government's first priority. In pursuance of this policy, great stress should be paid on strengthening the link between the agro- and food sector on the one hand and the bulk of the manufacturing sectors, to provide adequate technology for the food production processes.

ZIMCO priorities: Greater involvement in the food sector should be regarded as one of the priorities of ZIMCO/INDECO.

## 8.0 RDI POTENTIAL

The RDI potential consists in

- potential new projects
- potential technology transfers
- innovations with little or no demand on investment.

Of course, subsectorial specifics of the food industry and food business must be paid proper attention. A considerable share of the potential projects focuses on new food varieties and brands.

Nine different specific projects are described in this Chapter. New projects which should be considered by the RDU (together with the EEU) include:

### (1) ANIMAL BYPRODUCTS PROCESSING PLANT

The stockfeed industry is dependent upon imports of certain ingredients of which animal protein comes high on the list. Such imports necessitate foreign exchange and make the industry extremely vulnerable.

The substitution of imported ingredients with domestic supplies is therefore a high priority requirement. The domestic processing of slaughterhouse byproducts such as bones, inside fat from cattle, pigs and chicken, also intestines and pork skins, blood, offals, and condemned meat and carcasses will provide the stockfeed with considerable quantities of ingredients to cover the requirements of the stockfeed industry with considerable quantities of ingredients to cover the requirements of minerals and protein.

The processing of condemned meats, bones, blood, offals, and pork skins as well as technical fat, should be investigated by the RDU in cooperation with the meat processing plants, and should be given an opportunity because this is a promising business. It can expand rapidly and will bring increased sales turnover.

### (2) PROPOSAL FOR THE PROCESSING OF CHICKEN TO SAUSAGES, POLONY, AND HAM

This proposal concerns a processing plant for the production of chicken sausages. This can operate in an existing factory (Poultry Processing Co.). The structure of the meat products

is proportional to the respective capacities of the warm processing units, smoking chambers, and boiling kettles. The meat processing section needs one mixer, cutter, mincer, and sausage filler for the processing. A typical characteristic of this group of chicken sausages is its heat treatment by cooking: you cook the main raw materials as well as the final products which is an important aspect because of killing germs.

This is a group of products which has a special role to play in fighting malnutrition in Zambia. For the production to be as cost effective as possible, the proposal is to mix chicken meat with beef and pork. There is no doubt that the new products will be popular in Zambia. The plant being proposed will directly increase sales turnover. However, the detailed planning will require some research.

All raw material inputs will be obtained locally. Only spices and additives may have to be imported. Based on the UNIDO team's personal experience from the plant at Poultry Processing Company, eight-hour shift operation would be possible and just adequate for the new workshop. The products can be attractively priced and there will be no problem selling them. Also, de-boning of the chicken requires lots of labor but that is only for the good because recruitment presents no problems.

### (3) APPLICATION OF GELATINE

Gelatine is a natural product, obtained by partial hydrolysis of collagen, an existing protein, mainly on the skin and bones of animals. Gelatine is a foodstuff. Due to its chemical composition as a protein, gelatine has been considered by the World Health Organization as a food stuff, because it is an important contribution of aminoacids for the human body. Gelatine is a gelifer - with cold water, gelatine swells and absorbs up to 12 times its weight in water. Heated at 50°C, it dissolves, giving a clean and transparent solution which, by cooling, forms a gel. This sol-gel transformation is reversible. The hardness of the gel depends on the gelatine water concentration and on the gelating power of the gelatine used: this property of gelatine to form gels is one the main applications that gelatine has, as well as the increase in viscosity in the mode of sol.

Colloidal properties: Gelatine has a high colloidal power



and as such facilitates the formation of emulsions or suspensions, that confers to gelatine numerous applications as a protective and indispensable colloid in multiple uses.

Applications of gelatine: Confectionery, bonbons (soft caramels, gum pills, marshmallows). Biscuitery and pastry-gelatine is perfectly compatible with various flours, starches, sugars, etc. Condiments and sauces - gelatine may be used as an emulsifier and thickener in numerous formulae of sauces and condiments as, besides being a foodstuff, it does not show any incompatibility with other classical constituents, such as vinegar, salt, spices, starch, etc.

Some useful advice for the use of gelatine: To dissolve the gelatine in water, pour the gelatine in the adequate quantity of water to obtain the final concentration desired, stir gently to avoid the formation of clats, humidify well all grains and allow the gelatine to expand well; the time of this maceration in cold water depends on the size of the grain, and may take from 1/2 hour to 4 hours. When the gelatine is well expanded, progressively raise the temperature of the Bain Marie (double boiler) in a recipient with a double bottom, stirring to facilitate the dissolution and obtain a homogeneous temperature in the whole mass; set the temperature at 30-60°C. Use easy-to-clean material, preferably stainless steel (do not use iron or copper).

Applications of gelatine for foodstuffs: Ice creams and frozen creams - gelatine is universally considered as stabilizer, indispensable to set the viscosity of the mix and avoid the formation of water crystals; likewise, gelatine improves the gustative properties, providing an elongation to the melting point. For the Meat preservers, sausages, gelatine as a pure protein is perfectly integrated in all meat preparations.

Oenology: gelatine is used with very satisfactory results in the clarification of wine, as with tannic acid it forms a group insoluble to the gelatine tannate, which aids in the flocculation and clarification of wine. In milk products the gelatine offers a great compatibility with the milky proteins, its aid is important in the manufacture of yoghurt, gelificating milks, cheese, etc.

Caution: use water of a good bacteriological quality.

## (4) INNOVATIONS WITH SOYA - MORE VARIEGATED FOOD PRODUCTS

A number of examples can be found where there is unused potential to be investigated.

- Supa Baking did make experiments with bread prepared from mixtures of wheat and soybean flour (3-4 %). But the soybean contents were too high. No more than 3% should be used.
- The RDU of ZIMCO/INDECO should induce the Zambia Cold Storage Board to start making sausages from a mixture of meat and soybean flour (2-3 %). The following types of sausages can benefit from this innovation: Barbecue, Breakfast sausage, American sausage, Vienna, Hot Dogs, Beef sausages, and so on...
- Introduce Hamburger as a food in Zambia. This can be hamburgers prepared from a mixture of beef and soybean flour (again, 3-4 % soybean flour). There are no Hamburgers to be had in Lusaka from Cold Storage Board.

The background is that soybeans not only have their nutritional value but also are valuable economically: for example,

- for 1 kg soybean the price is 60 Kwacha;
- for 1 kg beef without bores the price is 145 Kwacha.

Now it is high time to reduce the price of sausages, bread and so on while increasing the food value of protein.

The next aspect is the position of this UNIDO mission concerning already known proposals for new projects which however have not yet been launched. As an example, there is the

## (5) TANNERY PROPOSAL

This refers to the plans for setting up a new tannery. No details need be said here because this is a proposal known to INDECO since it originated with INDECO.

The UNIDO team have studied this, and recommend to go ahead with it, because

- the price of 1 kg of hide, raw and salted, that is, not processed, can very much differ:
  - the world price as at April, 1991 is about US\$ 1 per 1 kg of hide;
  - the price in Zambia is different: Bata pays one hide only 300 Kwacha.

One hide weighs about 25 kg and this means 1 kg divided by 300 equals 12 Kwacha per kilogram, which is US\$ 0.20, just 20 cents. INDECO just by doing nothing, loses 80 cents of earnings per each kilogram of hide they could get hold of.

In 1990, according to statistics by Ministry of Agriculture, 90,000 heads of cattle were slaughtered, so the difference of \$ 20 per hide amounts to a net sum of US\$ 1,800,000 lost. This also concerns the Lusaka, Mongu, and Livingstone abattoirs.

All this relates to the next problem (and next project) which is

#### (6) LEATHER INDUSTRY DEVELOPMENT

Zambia is exploiting only 30% of her leather industry<sup>a</sup> but could reach 70% within the next three years if the potential of the industry was developed. Zambia could then stop importing expensive leather goods (especially shoes) as quality finished products could be manufactured locally.

Cattle skins, hooves, bones, heels and other materials regarded as wastes could be exploited. More training for farmers is necessary together with a proper pricing mechanism for these raw materials to ensure that high quality hides are collected.

About 30% of hides are now rejected by tanneries because of defects (scars, holes, and marks), including those originating from traditional treatment of animal diseases.

Abattoirs should have proper skin preservative facilities. The skins must be collected without delay.

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<sup>a</sup>"Hides not fully exploited", Times of Zambia, 13 April 1991; interview of Dr. E. Taylor, UNIDO Country Director.

There are four tanneries in Zambia:

- Bata the only one which collects hides and skins and manufactures finished products
- Asaria of Lusaka producing half-processed materials for export but being assisted by UNIDO to produce finished products
- Kembwe of Kabwe (half-processed exports)
- Sido of Lusaka (also needs improving)

Small tanneries could be established where skins of smaller animals like snakes and lizards would be processed for handbags and handbands.

#### (7) THE CANNING INDUSTRY PROJECT

Neither ZIMCO nor INDECO is active in making canned meat products. There is potential for meat cans of various kinds: beef, pork, sausages, luncheon meat. These are produced by private companies like Cooper Harvest and Lyons in Ndola but the same can be done for instance by Cold Storage Board.

#### (8) THE BLOOD PROCESSING PROJECT

If it is true that 90,000 heads of cattle were slaughtered in 1990, this would have given 250 m<sup>3</sup> of blood. For this quantity what can be recommended is to purchase equipment for drying the blood. The product obtained can be used

- as feed, to be used for enrichment of stockfeeds (3-5%)
- as addition to fertilizers.

The extraordinarily valuable properties of blood need not be mentioned. An introduction of the production of dried blood would improve stockfeeds substantially and, on the other hand, would cut stockfeed production costs.

#### (9) MEAT EXPORTS

Zambia presently exports her beef, without bones, refrigerated, through private companies Chibote Farm and Lendor Agriculture. Cold Storage Board is not exporting. There is a market in Angola, Mozambique,

Zaire. What appears necessary is to rehabilitate the processing equipment at Cold Storage so as to make the cold rooms and blast freezers to operate properly, and the other equipment needed at the abattoir would have to be upgraded so as to meet veterinary standards. By exporting choice beef INDECO would contribute to the generation of forex.

## 9 FINAL RECOMMENDATIONS IN THE FOOD PROCESSING SUBSECTOR

There are essentially three topics worth researching, as identified by the UNIDO mission, also making use of the UNIDO team's past experience in Zambia. The three topics are three aspects of the food industry which have (or should have) strong ties with Research, Development, and Innovations:

- innovation of products
- projects already planned by ZIMCO or INDECO but not yet implemented
- recommendations of new projects to be investigated by the Research and Development Unit of ZIMCO/INDECO.

The priority projects to be investigated within the food subsector are recapitulated below:

- INNOVATIONS WITH SOYA - MORE VARIEGATED FOOD PRODUCTS
- MEAT EXPORTS
- PROPOSAL FOR THE PROCESSING OF CHICKEN TO SAUSAGES, POLONY, AND HAM
- THE BLOOD PROCESSING PROJECT
- ANIMAL BYPRODUCTS PROCESSING PLANT
- TANNERY PROPOSAL
- LEATHER INDUSTRY DEVELOPMENT
- THE CANNING INDUSTRY PROJECT
- APPLICATION OF GELATINE.

Examination and implementation of above recommendations with strengthen cooperative linkages between RDU and ZIMCO/INDECO subsidiaries as well as between RDU and non-ZIMCO institutions and companies.

Since all these projects cannot be implemented (not even reviewed) simultaneously, it is recommended that they be tackled in the order shown (with the Soya project given the highest priority).

## 10 CONCLUSION

This Technical Report is part of an effort involving four disciplines (agriculture, chemistry, and transport/systems together with food processing) which aims at upgrading research, development, and technology at ZIMCO/INDECO and in Zambia.

It has been concluded that

- a specialist in food processing should be appointed to work at the R & D Unit of ZIMCO/INDECO;
- nine different potential projects should be examined and possibly implemented by ZIMCO/INDECO in the area of food industry; and
- the link between agriculture and food processing on the one hand and manufacturing on the other hand should be strengthened for the benefit of the food subsector.

## ANNEX F-1

ZIMCO subsidiaries and associate companies  
involved in the food processing subsector

Company	Bordering on sector(s)	Principal products/services
Consumer Buying Corp. of Zambia Ltd.	T	food & consumer goods (retail)
Dairy Produce Board Duncan, Gilbey and Matheson Ltd.	T	milk & products
Industrial Development Corp. Ltd.	T	liquors
Memaco Farms Ltd.	A,C,T	mixed
Mulungushi Investments Ltd.	T	livestock, pigs, poultry
	A,F,T	mixed (bus services; farms; milling & stock- feeds; poultry)
Mwaiseni Stores Ltd.	T	food & consumer goods (retail)
Mwinilunga Cannery Ltd.	A	canned pinneaples
National Breweries Ltd.	A	opaque beer
National Fisheries Co. Ltd.		fish
National Import and Export Corp. Ltd.	T	international trading
Nchanga Farms Ltd.	A	crops & livestock
NIEC Agencies Ltd.		food, consumer goods & pharmaceuticals (wholesale)
NIEC Stores Ltd.		food & consumer goods (retail)
Poultry Processing Co. Ltd.	A,C	processed broilers
Premium Oil Industries Ltd.	A,C	hard soaps & detergents, edible oils & fats
ROP (1975) Ltd.	C	hard soaps & detergents, edible oils & fats
Supa Baking Co. Ltd.	A	baker's products
Zambia Agricultural Development Ltd.	A	cattle, milk, special crops & vegetables
Zambia Breweries Ltd.	A,C	beer
Zambia Cold Storage Corp.Ltd.	A	beef



Zambia Horticultural Products Ltd.	A	processed rice; canned foods; jams; vegetables (retail)
Zambia National Wholesale & Marketing Co. Ltd.	A,C	food & consumer goods (wholesale)
Zambia Pork Products Ltd.		pork & meat products
Zimco Institute of Management	A,C,T	training

Note:     A = agronomy subsector  
           C = chemical technology subsector  
           T = transport and systems sector

## ANNEX F-2

## Job description for the Food &amp; Food Processing specialist

Post title: Food & Food Processing specialist

Qualifications: Specialist in food and food products (university graduate).  
Experience in food processing problems, analysis of raw materials, application of innovations to food products, hygiene of food, safety and hygiene.

## Duties:

- To participate, under the general direction of the RDU Head and in close cooperation with the other staff members, in the startup and routine work of the RDU.
- To closely monitor all RDI activities in food processing.
- To assist the RDU Head in the execution of liaising & coordinating activities.

The specialist will be expected to perform the following activities:

- review the results of the "ZIMCO Technology Audit" in given professional area
- introduce a methodical approach to evaluation of existing and future food processing requirements in the country
- extract relevant data from the technology audit activity
- generate and update a list of all inputs and outputs (incl. wastes) of all subsidiaries and associate companies within the food processing subsector
- generate and update a list of all food processing in all other sectors, mainly in agronomy and agriculture, transport and systems sector, and the chemical industry

## subsector

- assist companies in accelerating existing R & D projects
- review new projects proposed by the 1991 UNIDO mission
- identify other RDI problems to be analyzed and potential new RDI projects to be launched
- make efforts to initiate the utilization of wastes from the food processing and look for economical, effective, and environmentally harmless waste disposal methods
- advise companies on food processing problems
- take an active part in the dissemination of information on food processing
- write a list of R & D contact persons at the companies who can maintain links in R & D to other sectors; mediate company-to-company links in food processing
- advise RDU Head on participation by professionals from his sector in the work of ad hoc teams on cross-sectorial or multi-sectorial RDI projects
- provide help to subsidiaries in their efforts to establish, expand, or re-orient their R & D departments
- establish and maintain linkage between NCSR, UNZA, Ministry of Agriculture, and the RDU in the area of food processing
- look for natural species which can be used in food processing
- advise on the rehabilitation of existing food processing installations and suggest alternative systems with regard to their potential in Zambia
- advise on development of disciplines related to the general food processing problems and transport, e.g. packaging, storage, information handling, manipulation, maintenance planning, and quality control
- train companies' RDI staff in methods of effective work with professional food processing literature.

## ANNEX F-3

Flow of information and liaisons  
in the meat processing branch