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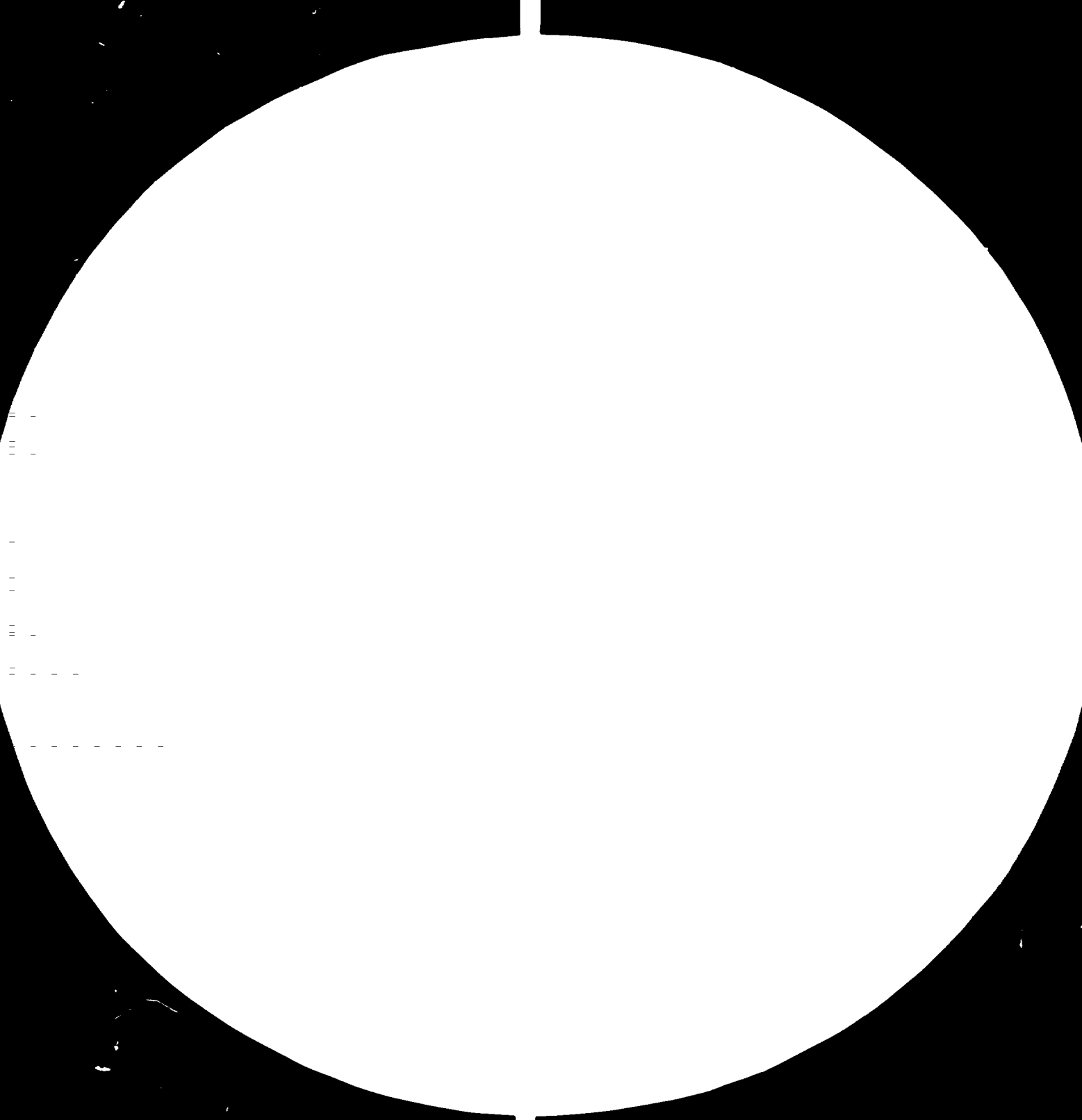

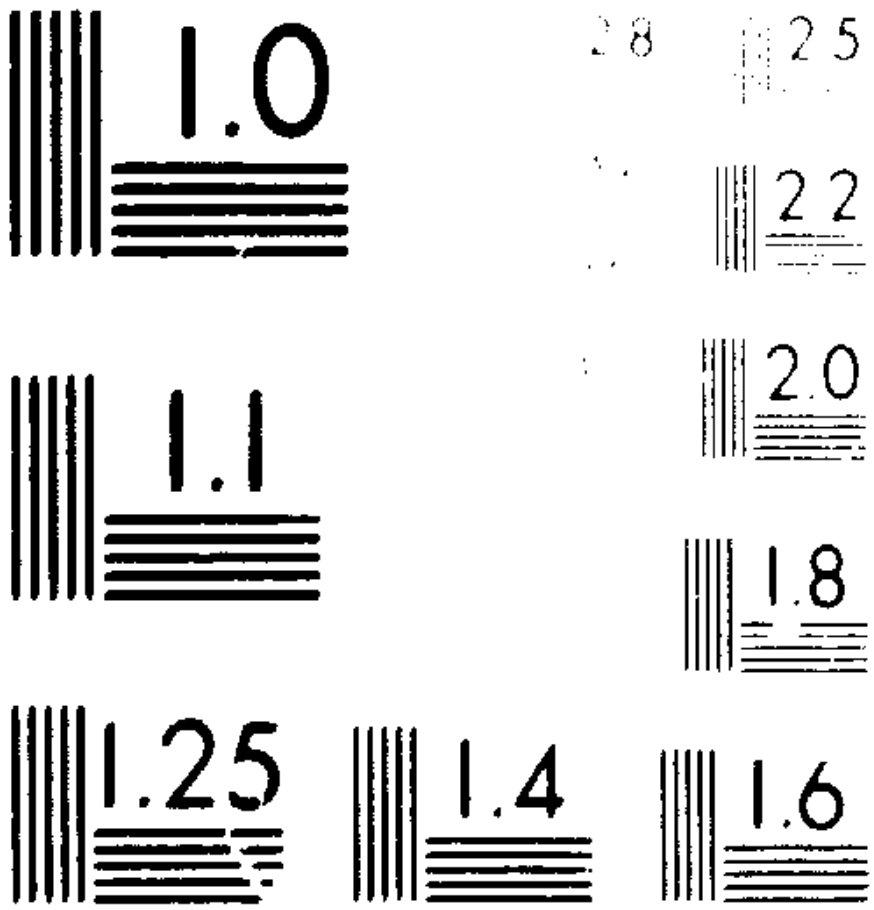
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TANZANIA INDUSTRIAL RESEARCH AND DEVELOPMENT ORGANIZATION
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REPORT ON
TANZANIA. DEVELOPMENT OF TIRDO'S ACTIVITY
IN FOOD SCIENCE AND TECHNOLOGY.
(DP/URT/78/019/11.08)

Prepared for
the Government of the United Republic of Tanzania

by

the United Nations Industrial Development Organization,
executing Agency for the United Nations Development Programme

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UNIDO - EXPERT IN FOOD TECHNOLOGY

NOVEMBER 30, 1981

This report has not been cleared with the United Nations Industrial Development Organization which does not, therefore, necessarily share the views presented.

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GLOSSARY OF ABBREVIATIONS

FAO	=	Food and Agricultural Organization of the United Nations
FYP	=	Five Year Plan
LIDA	=	Livestock Development Authority
NAFCO	=	National Agricultural and Food Corporation
NCCO	=	National Cold Chain Organization
NCI	=	National Chemical Industry
R&D	=	Research and Development
TFNC	=	Tanzania Food and Nutrition Centre
TBS	=	Tanzania Bureau of Standards
TIRDO	=	Tanzania Industrial Research and Development Organization
TISCO	=	Tanzania Industrial Studies and Consulting Organization
UN	=	United Nations
UNIDO	=	United Nations Industrial Development Organization
UNDP	=	United Nations Development Programme
UTAFITI	=	Tanzania National Research Council

SUMMARY

The expert made, according to his Job Description, a representative survey of the food industry. He has made widespread contacts and had discussions with responsible persons and authorities of the related organizations. In this way he attempted to get the most up-to-date information possible within the very short time of the assignment. Visits were made to all the institutions having a share in the development of food science and technology including those which are responsible for the education and training of the present and future staff of the food industry. The expert also made visits to various factories, plants and investigated:

- the supply of raw material, including the purchasing, delivery and storage.
- the applied technology in comparison with the practice of other countries and with those described in the up-to-date literature;
- the necessity and perceived demand for applied R&D concerning the increase of production and productivity, the improvement of nutritional value, variety and reliability of the products;
- the possibility to start new branches of the food industry for the country taking in consideration the possible supply sources, the necessity of the decrease of malnutrition of the population and the desire to increase the amount of exported processed food products, exporting work instead of raw agricultural products.

The greatest difficulty in the development of the food industry is caused by the lack of raw and accessory material; some branches are using only 30-40% of their capacity as a result. The deficiency of raw material results in the first place from low productivity, from the big self-consumption, from lack of the organization of

crop collection and the defects of storage.

On the other hand there are possibilities to amplify the product spectra in the existing branches, e.g. the increase of the varieties of processed meat products, of dairy products etc. may give an impulse to the progress of the food industry. Furthermore, the renewal of stopped factories or branches might be forced, e.g. the production of fish meal, of other animal feeds, of dried yeast etc.

Finally, taking in consideration the abundancy of carbohydrate based agricultural products within the country, the establishment of production of starch and glucose-fructose syrup, which is a big demand by the home industry as well as, on the world market might be suggested.

The expert understood, that technical assistance and advice to industrial enterprises of food industry must have a strong and fixed basis in TIRDO and support by the Ministry of Industry. This is essential, since the number of graduated and trained specialists in the food industry is extremely low. Furthermore, assistance is needed to accelerate the present very slow technical development of the industry and to advise industry on licences and know-how.

TIRDO's main tasks in the field of food technology might be summarized as follows:

a. elaboration of the pricrities for the development of the single branches in cooperation with other organizations.

b. to organize self training courses for the staff of TIRDO Food Department after having recruited the initial cadre.

c. to promote the education of a country wide staff in food technology and food science, furthermore to train TIRDO staff by study trips to foreign countries having developed branches of food industry.

d. to assist to the branches and single factories in the improvement of their technology, of the variety and quality of their products, to give advice for the establishment of new food industry either on an internal basis or by purchasing licences and know how,

e. to elaborate a detailed programme and to execute it upon installation of the laboratories,

f. to participate in the organization of adequate quality control for the different industry branches according to their specialities.

The food laboratories of TIRDO have to be equipped with all the facilities to accomplish the tasks designed above. The selection of equipment should consider the major instruments ordered already for other departments of TIRDO. The purchase of the equipment suggested in this report should begin one year before the expected laboratory completion. Finally, the necessity of at least one senior expert for 6-12 months at the initiation of laboratory work is suggested.

I. INTRODUCTION

A. The preparatory work and mission framework

The expert arrived in Tanzania on the 22nd of October, 1981 for a one and one half month mission based on the Job Description DP/URT/78/019/11.08 (see Annex 1). The most important objectives of the mission were:

- to make an in-depth survey of the food processing and food preservation industry and to assess their problems, plans and needs;
- to review TIRDO's staffing and training plans and recommend improvements thereto;
- to develop a five year TIRDO work programme in food technology services and research appropriate for support of Tanzanian food industry.
- to elaborate the specification of equipment, materials and supplies necessary to carry out the work programme and finally
- to present and discuss the TIRDO food technology plans with prospective donor agencies.

The report of the expert should set out the findings of the mission and present recommendations to the Government on further actions which might be taken.

The duration of the mission was extremely short taking in consideration that the period includes the briefing and debriefing in Vienna, travel and the preparation of the report.

The Final Report of the Preparatory Assistance to TIRDO prepared by C.J. Wilder, UNIDO Expert, I. Nagy, UNIDO Expert, F.J. Soede, UNIDO Senior Industrial Development Officer has given an overview of the situation of Tanzanian industry in May, 1979. The expert utilized the statements found in this Final Report, although the situation has changed in the intervening years.

Agricultural and food production have declined steadily since 1979. Weather, transportation, unavailability of inputs are among the reasons cited for the decrease. The Government of Tanzania currently places great emphasis on the restoration and increase of food production in the country. Reports by Tanzanian institutions and UN agencies were studied to gain insight into causes for production declines and the prospects for revitalization. These reports are listed in Annex 2.

The importance of the further development of the Tanzanian food industry is striking. The country possesses an enormous richness of various raw materials for the different branches of the food processing. On the other hand, the nutrition of the inhabitants is not sufficient, the daily calorie intake in the year 1977 was only 2089 Kilocalories/per capita (8726 KJ) and the increase compared with the year 1969 was only 28 Kilocalories (FAO data). The composition of the nutrition leaves much to be desired, the daily protein intake being 49,0 gram, growing from 47,8 gram during the mentioned period. The food industry has also the potential possibility of exporting processed food or semiproducts instead of exporting raw material.

Hon. C.D. Msuya, M.P., then the Minister of Industries emphasized: "Development objective in Tanzania is seen and justified if it serves the basic needs of human life such as food, shelter, clothing and the like. Based on this policy, food industries and the agricultural sector have a crucial role in our development effort in the provision of the basic items of food to our people in sufficient quantity and quality." Mr. Msuya emphasized at this time the importance of the establishment of an industrial research and development organization and of its role in the food industry. TIRDO was established by the Act No. 5 1979 and Hon. C.D. Msuya, Minister for Industries at that time made some statements at the initial meeting of the TIRDO Council, concerning tasks in the field of food production. "Under the strategy efforts will be made to produce the consumer goods required by our people using locally produced raw materials... TIRDO is visualized as a local technological base.... in the dynamic process of transfer and development

of technology...TIRDO will have laboratory facilities for the development of processes for the manufacture of goods and for analysis of local raw materials...Just as research institutions in the agricultural sector...to get better seeds...husbandry...TIRDO must do likewise in the industrial sector."

The studies, documents and an assessment of current food production indicate the general problems faced by the food industry. The main directions of TIRDO activities, research and development in food technology should be derived from the following:

- a basic need is an increase of agricultural production that is available to industry for processing;
- the organization and management of raw materials collection should be developed taking in consideration the very low level of infrastructure (storage, chilling, transportation) which has a special signification in processing perishable materials;
- given the difficulties caused by the missing infrastructure, the development of small-scale and medium size plants might be recommended near to the local supply sources;
- great emphasis should be given to the utilization of by-products and wastes;

the very conservative food production should be changed to a more flexible and multi-faceted industry establishing locally not traditional, but for Tanzania suitable branches;

- the limited variety of food products may and should be extended to a greater variety of consumer's goods, mainly taking in consideration the elevation of the quality of nutrition.

B. Outline of the Mission

A detailed Work Plan was prepared by the expert for the execution by he and his counterpart, Mr. J. Nyonyi.

The main goals of the Work Plan (Annex 3) might be summarized as follows:

- the expert should become familiar with the organization and activity of TIRDO, TFNC, TISCO, TBS, LIDA, etc., i.e. with all of those organizations which play a role in food science, food production and food quality, including normalization;
- the expert should obtain background informations about the food supply, type of nutrition, biological needs and economic conditions concerning food production;
- the expert will visit as many food producing factories and plants as possible selected in a representative way. The visits should be conducted to get information about all activities affecting food processing.
  - the sources and sufficiency of the supply of raw material,
  - the up-to-dateness or the lack in technology, techniques and equipment of the processes,
  - the hygiene of the technological courses,
  - the types, the variety and the quality of the products,
  - the organization and the execution of quality control,
  - the demand for the assistance of TIRDO,
  - the capacity of the plant and the rate of utilization,
  - the number of the workers and graduated technologists;

- examine studies and surveys concerning agricultural production as a basis of food processing, and the present situation of food industries.
- the existing Food Law Act. No. 10, 1978 should be studied and analysed for its implementation and effect on the development of food production;
- the analysis of the present situation of the food industry, to make suggestions including counterpart training and conclusions concerning the TIRDO research and development work and the assistance to food industry; including a specification of those instruments and equipments, which are indispensable to laboratory work supporting TIRDO's industrial assistance;
- a FINAL REPORT setting out the findings of the mission and putting the recommendations to the Government of the United Republic of Tanzania.

The expert visited 19 institutions and industries which have a relationship to food technology. Mr. Nyonyi, TIRDO Research Officer, participated in the majority of these visits. The list of organizations with the name of the persons contacted is given in Annex 4.

II. Findings

A. Background information

The statements and the data presented in the reports and documents together with the discussions with the persons in the visited organizations leads to a synthetized picture of the Tanzanian food industry.

The third Five Year Plan included some major priorities, which should be adapted to the agro-industries, to food and agricultural production summarized as follows:

- the basic commodities should be processed into final or semi finished products for local consumption and for export, using local materials wherever possible;
- the creation of an adequate infrastructure (water, electricity, storage, transport) is an indispensable input;

- the formation of a well-trained, indigenous staff specialized in food science and technology including university graduates as well as technicians;
- a practical need for increasing production and productivity is the improvement in organizing work in skilled management and the strengthening of discipline in production. For the latter technological discipline should be underlined as well as, that of the working system.

The third FYP projected the increase of the agricultural production, the basis of food processing. According to some reports, the main problem is at present time the lack of raw material. Here it should be mentioned, that the agricultural products may be considered as raw material for the food processing but also as raw food according to the Tanzanian Food Law. Generally the crops should be recognized as raw food or as raw material after their separation from the plant, or in the case of animals, after slaughtering. This statement was corrobarated by the managers of the various factories. Comments on the lack of raw materials are summarized below:

- the production of many agricultural goods has decreased e.g. that of different oil-seeds, the production of cashew nut (more than 50%), the coffee production is partially substituted by the production of bananas etc. The motive might be found in the lowered prices, but this report has not examined in depth the price policy.
- The losses of crops on account of the inadequate storage in some cereals may reach even 20-40% of the production.
- The self consumption of the farmers is very high and it should be taken in consideration, that nearly 90% of the nation is living in rural areas. For example, only 20% of the produced cereals are flowing through commercial channels and that 40% of all commercial maize flour is sold in Dar es Salaam.

- The agricultural productivity is very low in some cases, such as the utilization of the livestock considering meat as well as milk. A consequence of this fact should be mentioned; the meat consumption is 9,7 Kg per capita, which compared with the consumption of other countries is very low. The target is increased in 1990 to 12,1 Kg per capita. The milk consumption might be estimated at 22 liter per capita, which should be developed to 28 liters per capita by 1990. The present egg supply shows the figure 9,4 pieces per capita. This should increase very strongly to 16.9 in the year 1990. All the mentioned data are representing the yearly consumption.

Among the manifold consequences of the described situation must be stressed the under-utilization of the food processing capacity e.g. the dairy plant in Musoma is using only 30% of its capacity, the sugar mill in Kilombero makes use of 40% of capacity. It should be mentioned, that according to Tanzanian reports, the whole sugar industry utilized 74% of its capacity in 1980.

But on the other hand, the FYP contains expansion of productive capacity of food processing. The above mentioned sugar industry, having a domestic demand for 300,000 t of sugar per year for 1985, has the intention to increase the capacity. But even in this case would fall short by 74,000 t of sugar at full capacity. If capacity utilisation remains at the 1980 figure of 74% a deficit of 134,000 t of sugar would result.

The Country Survey of TISCO puts the question: Would it be reasonable to develop the capacity of cashew nut processing after the decrease of production from 145,000 t to 49,000 t.

B. Visits

The list of the licenced food producers may be found in Annex 5. The expert and his counterpart visited altogether 12 factories, half of which were in Dar es Salaam and the others in Arusha. The factories were selected to have small and large scale and different types of products and production technologies. Details of the visits are given in Annex 6.

GLORIA Bakery Ltd. is one of the small bakeries of Dar es Salaam. Production is down on account of lack of flour. They get more or less 270 t flour/month and their capacity is 35 t/day. The quality of the flour is not uniform which does cause technological problems. They would be very much interested on researches to find substituting cereals in the place of wheat flour e.g. sorghum or millet. The machinery is old and the hygienic circumstances are moderate. The quality of the bread is good. Of course, we could not see a big variety, but apart from bread, they produced some confectioneries. The Manager had some tests with flour mixes which were delivered by the National Milling Corporation, and according to his experience, there was no difficulty either in the production or in the quality of the products.

TANGOLD Products Co. Ltd. Dar es Salaam are producing bottled and canned fruit products; pulps, jams, sliced fruit, tomatoe paste. The main raw materials; mango, pine-apple, oranges, tomato and sometimes passion fruit. The capacity is not utilized since the supply of raw material is very uneven. The production period lasts for a longer time.but it is limited by the deterioration of the raw material. The greatest problem is the price policy; they pay 60 cents for 1 Kg of oranges. The farmer, if he can come to a market, can sell it for 1 shilling per piece. The factory is hiring trucks and purchasing raw material on the spot. There is no contract with any cooperatives or farmers. They have an interest in purchasing a farm to guarantee supply. The idea of vertical integration should be encouraged. The idea was raised by other managers also. The installation is not extremely old and was undergoing maintenance at the visit time. The expert proposed the production of concentrates, which could find export markets a great amount of water, when exporting juices. The need for TIRDO services was presented:

- to get help in the elaboration of new types of products,
- to training their staff by TIRDO, and to assist in obtaining fellowships in developed countries.

National Cold Chain Organization Mr. Musoma, General Manager, noted that NCCO presently emphasizes cold storage of fresh fish. Exapnsion to be able to handle other produce requiring chilling or freezing is needed and the long range plans for the Organization include growth and diversification.

Livestock Development Authourity. Mr. Kimati provided detailed informatic . concerning meat production and processing. The livestock in Tanzania are not efficient meat producers and therefore efforts are underway for the breeding of more productive types (F 1). The FAO Livestock Project and the FAO Dairy Project are playing an important role in this effort. It is also true that without concentrated animal feeding, the quantity and quality of meat will not change as much as desired. The farmer is not interested in the improvement of the quality of meat, since the same price is paid for any kind of meat. This statement was also made by the FAO Livestock Project Manager, Mr. Coles. At the moment meat processing is very limited. Not more than 3 or 4 types of canned meat products are produced at the Tanzania Packers Ltd., which has been visited. At the moment they produce only canned juices, mainly pineapple juice and squash. We were told that sliced pineapple used to be processed. The greater part of the factory is in reconstruction and at the present there is not any chilling capacity. Mr. Kimati also mentioned the establishment of small-scale poultry processing based on local resources in some centres of poultry breeding.

It was very clear that the development of various processed meat products could be a contribution by TIRDO to the meat industry. The elaboration of methods of packaging either for meat or for dairy products would also be valuable. The expert appreciates the valuable information provided by Mr. Coles, Mr. Kimati, Dr. Baluhi, the Director of Tanganyika Packers Ltd. and from the technologist, Mr. Saidi.

Rajani Oil Mill. The mill is in reconstruction and expansion. They obtain raw material from GAPEX and are transforming cotton-seed, sesame, sunflower seeds and ground-nut. The importance of a vertical

integration as a tool in the assurance of sufficient raw material supply was mentioned again. The technological level of the mill is not high, but the work is well organized taking into consideration the difficulties caused by the reconstruction. The oilcakes produced have a relatively high oil content and therefore must be used with caution for animal feeding. The refinery was not in operation due to a lack of raw materials. They are using the waste water with its oil content in the production of soap. The expert believes this to be an experiment, but the produced soap was presented. This very ambitious factory has no quality control and they would appreciate the help of TIRDO in the establishment of such an organization. Another need is the elaboration of more up-to-date oilprocessing technology with less waste and more yield as well as some comparative data of the productivity in this field. This is a country-wide problem, as stated by the Hon. Minister of Industries B. Mramba at the briefing for World Bank President, Mr. Clausen, saying that Tanzania loses millions of Shillings every year by exporting oil seed cake with a very high oil content (Daily News 24.11.1981.

EMCO Industries Ltd., Arusha. This factory was closed for 5 months lacking a licence for the import of glucose-syrup, which is not produced in Tanzania. They began production this month and have enough raw material until the end of January. Therefore the plant capacity is not fully utilised and they are employing 17 workers instead of 75. The main goods produced are small candies of nominal quality. The manual work is characteristic for this small factory. They had a graduated technologist, but he returned to India not having adequate work here. This enterprise has another factory which produces soap. It is worthwhile mentioning that it has not produced for some months even though they have a brand new soap production line. When asked about the need for TIRDO services it was declared that first they must have the raw material and the accessory goods such as colorants, aromas etc.

Tanzania Food Corporation Ltd., Arusha. This is a well organized, up-to-date factory with a graduate expatriate technologist who had 16 years experience with Cadburry, England. The plant is producing biscuits and pasta. The equipment of both production line is modern and in good condition. They are producing only one type of biscuits, but applying various forms of packaging such as cartons, roll-packs etc. The technology is adequate; the only quality failure is non-uniform colour of the biscuits. This is results from the slow response of electrical heating for the ovens. In all other respects the production and the factory itself is an up-to-date, hygienically acceptable plant. The capacity is underexploited on account of the lack of raw material, primarily flour. This also effects the other production line : the brand new installation for pasta. The factory has two Italian lines, one a Braibanti, the other a Pavan, both modern technology but out of production for five months on account of the lack of flour. The whole factory made a very good impression from all points of view; organization, equipment, technology, technological discipline and management.

Tanzania Dairies Ltd., Arusha. The capacity of the plant is 50,000 liters/day but actual production is about 33,000 liters i.e. 66% utilization. Milk is collected in two ways. Factory vehicles travel to various cooled centres and some farmers bring their milk directly to the plant. The raw milk is examined by the small laboratory which makes physical, chemical, bacteriological and sensorial tests. The control is applied to the processed goods as well. It should be mentioned, that this enterprise owns 7 dairy plants of which this is the largest. They pasteurize at 72-78 ^{o}C. The average fat content of the raw material is about 3.5%, which is normal. The end-product contains 2.0% fat and the skimmed fat is transformed to butter. The plant produces ice cream and sometimes ghee as well. The impression of the organization, production, equipment, work discipline, quality control and quality of the products was very good. The hygienic conditions were consistent with the demands posed by the delicate procedures carried out in a dairy plant.

Tanzania Breweries Ltd., Arusha. We were given very detailed and profound information about the organization, technology, microbiological aspects etc. from Mr. Mkolwe. He is not a graduate scientist nor has he had fellowship in a foreign country with a developed brewery industry but was very well informed, and skilled. Eighty five percent of the malt is imported and this limits the production. The target for 1981 was for 1,200,000 hecto-litres of beer. Until now they have produced 100,000 hecto-litres in only one month. They use 7% sorghum in the place of maize, 8% barley and some sugar. The grade of fermentation regulates the alcohol content and the extract. The production is limited not only by lack of raw and accessory materials but by the age of the machinery. It is a second hand installation brought from Canada. They are working on reconstruction with the intent to quintuple the production. The quality of the different types of beers produced here (Kilimanjaro, Safari, Pilsner) is acceptable and a good quality control system is working. The hygienic conditions might be better, but there is some excuse on account of the reconstruction. Possible services from TIRDO, included a request for some special theoretical and practical training of the staff and they would be very pleased with assistance in obtaining study trips.

KILIMA Bottlers Ltd., Arusha. Discussions were with Mr. Dalal. The bottlery was established in the year 1968, but in 1973 was rebuilt with completely new installation which is up-to-date equipment even today. The capacity is 550 cases (13,200 bottles) per hour. The variety of the products; Coca-Cola, Fanta Orange, Ginger, Soda Club, Tonic, Spright. They are importing the concentrates, some chemicals, sometimes the crown-corks, the green bottles (not the white ones) and until recently even the carbondioxide. Now they have CO_2 production sufficient for the plant capacity. Not being fully utilized, the surplus CO_2 is sold. The quality of the drinks, as well as, that of the CO_2 purity (99.9%) is sufficient. They have 110 workers but the number would be greater if the full capacity could be utilised. There was one graduate engineer from India. The factory is well equipped, the production is well organized, quality control is working and the quality as well as the variety of the products is considered acceptable.

Tanzania Food Production, Arusha. A privately owned firm with a very small-scale production which is more an import and sales activity than a food processing installation. They used to import curry, safran etc. from India, but now there is no import license. They are milling gram-seeds and packaging those spices for which an inventory remains.

Conclusions of the factory-visits.

1. The situation of the food industry is very delicate at the very moment and demands a manifold assistance. The greatest difficulties may be summarized as follows:

Many kinds of raw and accessory materials are missing either on account of the low agricultural production or the limitation on the import of such stuffs. As a consequence, the capacity of the factories is underutilized in most of the cases. The steps that should be taken to assure the increase of agricultural productivity and production are mainly the responsibility of organizations and authorities other than TIRDO. But by all means TIRDO can participate in the solution of such problems for example substitute materials in bakery flour or local production of malt.

2. The technical and technological level of the food factories varies. Some plants are installed with equipment of high technical level and, with sufficient supply, may function with relatively good productivity and with goods of acceptable quality. But in a number of cases the production line is outdated and there are missing spare parts as a consequence of having very old types of machinery. TIRDO could undertake the task of a detailed survey of the single factories or even of single production lines and advising on improvements. The conservativism found in some factories concerning the applied technology should be addressed by TIRDO in studies of the replacement with new, more productive and effective technologies. For example, more effective extraction of edible oils would increase production by the elevation of the yield and would improve the quality of cake used for animal feeding.

3. The number of products of the different branches of the food industry is very low and the variety is small. The improvements of the nutrition of the Tanzanian people gives the grounds to amplify the

the scale of food products, mainly with higher nutritional value and corresponding quality. This statement may be valid in meat processing, dairy production in the processing of canned vegetables and fruits and of canned meals etc. Variety could be achieved in some cases without large capital outlays.

4. There is a possibility of establishing new branches of the food industry in Tanzania. There are natural resources within the country, e.g. carbohydrate-based crops, among which are sorghum, millet, maize, cassava etc. The world market requires starch, glucose and fructose syrup. Production could form a basis for export and supply the home sweetening industry as well. The establishment of this production would require much effort but TIRDO's possible study of this subject could provide advice for buying licence or know-how and could lead to participation in the adaptation of technology.

5. Organized quality control is missing in many factories and cannot be explained away by the difficulties of production. Organized and working control systems in single factories or for several factories of one single enterprise should be developed. The elaboration of adequate food quality control systems, adapted in the programme of TIRDO. This task may include testing with physical, chemical, organoleptical (sensorial) and microbiological methods. Close collaboration with TBS in the area is needed. The importance of the control and assistance concerning the hygienic conditions of production emphasized in the Food Act No. 10, 1978 should also be a part of TIRDO's activities.

6. Nearly every place visited had a need for theoretical and practical training of the industrial staff. TIRDO's Food Department should assist to the industry with the arrangement of special courses for graduates as well as, for medium level technicians. This should be coordinated with the University of Dar es Salaam.

C. Visits to Tanzanian Organizations

The expert had the possibility to visit Mr. Mwobahe the Director of TBS and to exchange ideas. Mr. Mwobahe summarized the main objectives of TBS as follows:

- the preparation of standards,
- the certification of quality,
- assistance to the industry in the establishment of product control systems,
- to provide testing, calibration and other metorology services,
- to give consultative and training services.

The Tanzanian standards are either compulsory or voluntary. The standards for those commodities which have direct influence on the health and safety of the people have to be compulsory standards. The food products being commodities of this type have compulsory standards.

We discussed the importance of collaboration between TBS and TIRDO, these organizations having complementary tasks, aims and goals. TBS inspection of the standards implementation should identify difficulties in performance by industry. This information including the data on deviations could enable TIRDO to seek out the reasons for default. The feedback to TBS from TIRDO could present these reasons and make possible the review of proposal for the renewal or modification of standards. TIRDC might provide assistance to the factory to eliminate deficiences which cause the deviation from the standard values.

The expert and his counterpart made two visits to TFNC and were provided with booklets presenting the work, research and studies carried out by this organization. Visits to the laboratories resulted in an interchange of ideas with the leading biochemist Mr. Temalilwa. The expert concluded that close cooperation between TIRDO and TFNC is also indispensable. The tasks are different, but complementary.

The main objectives of TFNC are to plan and initiate food and nutrition programmes in Tanzania, provide training facilities, carry out research on food and nutrition, advise the Government on matters relating to food and food distribution and to disseminate nutrition research results. TFNC has the right, according to Food Act No. 10

1978, to check all aspects of any food product at any time. At regular intervals manufacturers would be asked to submit samples for analysis. TFNC has laboratory premises with some up-to-date instruments, e.g. there may be found GLC, AAS, spectrophotometers and an arrangement for microbiological work. The management of TFNC has the intention to further develop the laboratories and to build up facilities for developing small scale food processing equipment including a pilot plant. TFNC is cooperating with SIDO in establishing small scale food technologies. UN and Swedish aid is grated with the remark : "The TFNC has embarked on a concentrated R and D programme in food technology and food storage."

Taking these activities into consideration it is obvious that a close cooperation with TIRDO is indispensable. Mutual information exchange and the harmonizing of the research and development programmes of the two organizations should be implemented. TIRDO is oriented more to industrial problems and to their solution, furthermore to carry out those research which may assure "good industrial practice", i.e. to produce those products which respond to the nutritional goals planned by TFNC.

The coordinated collaboration with harmonizing programmes between TBS, TFNC and TIRDO is of vital importance! The material and intellectual resources of Tanzania in the field of food science and technology cannot support parallel programmes and research on the same subject at different institutions. The concentration of the available forces is logical and needs to be fulfilled. The expert suggests that the cooperation in this field might be promoted by the UTAFITI, the National Scientific Research Council. UTAFITI, established by the Act No.51 1968, has a duty to monitor, enhance and foster scientific and technological research for the development of the country. Furthermore, among the executive functions may be found: "(i) The coordination of all types of scientific research carried out within the country." The Council has a Food and Nutrition Research Committee which could assume the responsibility for coordination.

University of Dar es Salaam. The expert had the opportunity to interchange ideas with the Director of Postgraduate Courses Mr. Mshigeni. After an overview of the system of education and training at the University the possibility of specific degree programmes for food scientists and technologists was discussed.

The University includes the Faculty of Agriculture, Forestry and Veterinary Science in Morogoro. According to the prospectus presenting the studies for the Academic Year 1981/82, the expert understood that the Faculty offers courses leading to the degrees of B.Sc. Agriculture, among others. During this three year course the student may select subjects taught by the Department of Food Science and Technology as follows:

1st year	Agricultural Biochemistry
	Physical chemistry
2nd year	Human Nutrition
	Food Preservation and Processing
	Food Chemistry
	Food Manufacture
	Food Engineering
	Food Packaging
3rd year	Food Microbiology
	Food Enzymology
	Food Hygiene
	Food Economics

Thus there is the possibility for the training to students who are interested in the above mentioned subjects. But the subjects are not compulsory and the Faculty does not graduate food scientists or technologists.

The visits to the various factories and organizations and the discussions during the period of the mission have shown that in Tanzania there is great need for graduate food technologists. The number of such specialists is very low; according to a report of TFNC, there are 4 food technologists in the country and a few technicians.

The development of the food industry demands specialists not only at B.Sc. grade but also M.Sc. graduates. TIRDO has at the moment only one staff-member in the Food Division. He has the B.Sc. of botany and zoology and will receive the M.Sc. of biology. His self training has been effective and he has become very familiar with the food industry, food technology and food science. But it is obvious, that a single staff-member cannot solve all of the research and development problems of the food industry nor can he carry out the extensive training of the industry cadres that is needed. A basic survey and summing up of the needs of the different branches of the food industry concerning theoretical and practical training is recommended and might be executed by the present staff member.

Food science and industrial food technology have become demanding fields of activity requiring special education and extensive experience. One comes to the conclusion that the formation of specific university degrees for food technologists should begin at once in Tanzania. It would seem to be most effective to begin with the M.Sc. degree accepting candidates with first degrees in chemistry, agronomy, zoology, etc. This can be followed shortly by the establishment of the B.Sc. programme.

Meanwhile the recruitment for amplifying the TIRDO Food Department staff should emphasize selection of specialists from the Faculty of Agriculture. The present staff-member, Mr. Nyonyo, might assist with the training of new staff by giving seminars on food chemistry, food technology, food control systems and food analysis.

III. RECOMMENDATIONS

1. Inputs to the Food-Industry

The shortage of raw and accessory materials is the greatest obstacle of the progress of the food industry. The FYP forecasts the improvement of this situation. The development of the various branches of the food industry depends to a certain extent upon the production of agricultural products. The first step to establish a realistic development programme for the food industry should be the elaboration of the priorities of the different branches after

consultations with the Ministry of Agriculture and NAFCO. The elaboration of such a priority list is recommended as a cooperative effort by TIRDO, TISCO and TFNC.

The visits, discussions and consideration of existing agricultural materials together with the present food processing capability suggests that emphasis be given to the branches of the food industry which follow in an approximate priority order:

- meat processing, producing various types of canned meat commodities as well as different varieties of sausages, canned meals and eventually mixed types of meat and vegetable;
- fruit and vegetable processing, producing concentrates, canned fruits, jams, marmalade and a larger variety of juices;
- dairy industry, widening the product types such as fermented milk products like yoghurt, varietis of cheese etc.;
- tobacco industry, increasing the production of various types of cigarettes, mainly taken in consideration the export possibilities. In this relation it would be reasonable to produce for the demands and tastes of the importing countries;
- the establishment of a new branch would be justified using the carbohydrate resources of the country producing starch and glucose-fructose syrup for home consumption as well as for export;
- small-scale poultry processing located in centres of poultry breeding communities;
- the production of vegetable oil;
- the increase of alcohol production using the molasses presently not utilized;

2. Recruitment and training of TIRDO Food Department staff

- TIRDO can provide only limited assistance to Tanzania food industries with the existing staff. Degree courses in food science and technology are not now available in the country nor does the food industry have an excess of qualified technologists. It will therefore be necessary to provide both theoretical and practical training for persons recruited by the Food Technology Department. This training will require from 12 to 24 months to complete thus recruitment should begin well in advance of laboratory completion and the expansion of services to industry.

The nucleus of an effective Food Technology Department should be at least four and preferably five food scientists. Recruitment of the additional three or four persons should begin as soon as possible. Graduates from the Faculty of Agriculture, Forestry and Veterinary Sciences, Morogoro should be given preference and selected according to the study discipline and the number of subjects pursued under the Department of Food Sciences and Technology of the Faculty. Candidates who have worked in industry following graduation should be of special interest.

2.1. In-Country training

TIRDO should organise a three month course for the new Food Technology staff. Lectures by the existing staff and invited specialists should include:

- Food chemistry
- Food technology
- Food microbiology
- Food analysis
- Food control including organisation, methods and statistical sampling.

A work programme of service to industry should also be initiated both to assist industry and provide practical training. This programme is elaborated in 3.1 following.

2.2. Overseas training

Study trips abroad should be scheduled on an alternating basis

once the training course above is completed and practical experience has been gained. Suggested topics and countries include:

- Studies on meat and poultry processing - 9 months	Italy and Hungary
- Canning and food preservation - 1 year	Sweden
- Fish preservation and processing - 6 months	Soviet Union or German Democratic Republic
- Dairy products - 1 year	Netherlands and/or Denmark
- Starch and glucose - fructose production - 6 months	USA

2.3. National Training

It is recommended that Tanzania establish a two year postgraduate course and degree in Food Science and Technology at the Faculty of Agriculture, Forestry and Veterinary Science, Morogoro. TIRDO should support this effort and consult with the faculty on development of a syllabus. TIRDO staff should be considered for enrollment in the course when it is established.

It is further recommended that the Department of Food Science and Technology, Morogoro, move to establish a three year course leading to a B.Sc. Food Science and Technology as soon as practical. Both the undergraduate course and the postgraduate course should be a part of the country strategy to increase food production and to make food and food products available to the population. Trained personnel are essential to industrial development and to a continued supply of staff for the TIRDO Food Technology Department.

TIRDO should undertake the organisation and presentation of short courses for industrial employees. The details of such courses will be determined by the needs and problems of the industry branches but should include hygiene, preservation, quality control, testing, analysis and technologies for product development.

2.4. Future TIRDO staff levels.

The expert has reviewed the Policy Statement on the Mission of the Tanzania Industrial Research and Development Organization (UNIDO/IOD.287/Rev 1, 27 November, 1979) which proposed a staff of 4 senior officers, 8 research officers and 11 technicians. This staff level might be set as a target for 1990 if the Food Technology Department of TIRDO becomes functional in 1985. While some services to industry can be initiated without facilities, staff expansion and training should be coordinated with the availability of supporting laboratories and equipment.

2.5. Project Organization.

Food technology is best pursued as a collective effort of several research officers with a diversity of skills. Discussions and coordination of the work of single specialists is essential. Team work, cooperative attitudes and the advanced training of specialists can be aided by seminars where research results, problems and background information from the literature are presented to and discussed by the staff. Seminars could be scheduled on a bi-weekly or monthly basis and integrated with the review and extension activities of the Information Department.

A list of recommendations for books and periodicals covering food science and chemistry, food processing, analytical, evaluation and quality control techniques and miscellaneous topics is provided in Annex 7.

3. Research and Development Programme

The activities of the TIRDO Food Technology Department should be developed in a stepwise manner which corresponds to plans for the completion and equipping of the laboratory facilities. Some work can be initiated now but the extent will be limited by the availability of staff. The recommendations following address both the shorter term and longer range plans.

3.1. Direct assistance to Industry

This task could and should begin as soon as possible. The addition of one or two staff members would greatly facilitate this activity and broaden the base of persons with practical experience.

The method of assistance should be carried out by personal contact with the concerned factory or branch. After obtaining a full understanding of the existing problems of production the staff should:

- study the literature corresponding to the problem to be solved,
- analyse the production and the cause of failures e.g. low productivity, bad quality, low yield etc.,
- consult with the staff of the factory and other competent organization,
- elaborate the proposed changes in technology and techniques, and
- assist in carrying out the proposed actions and evaluate the results.

Over time the assistance can be extended to advise on the selection of possible licences and know-hows, and assist industry in the adaptation of technologies. This task may be combined with laboratory work and pilot plan experiments when the facilities are available. In the interim use might be made of factory laboratories or those of other organizations.

3.2. Laboratory programmes

The beginning of detailed laboratory work in support of research programmes is a function of the installation of the food laboratories and growth of the Food Technology Department staff. The first step is always the writing up of the specialized literature. Thus the research work should begin 3-6 months before the expected date of finishing the laboratory installation.

The main research themes might be suggested as follows:

- use of cereals existing in abundancy in the country to substitute for wheat in bakery flour and pasta production, the preparation of such mixtures, fixing of the recipes, experimental baking and product evaluation.
- Elaboration of technological methods to improve the yield of oil extraction and improvement of clarification techniques.
- Elaboration of methods for the production of essences and concentrates of domestic fruits, especially citrus varieties.
- Elaboration of new varieties of food products such as canned meat products and sausages, fermented milk drinks, cheese and ice-cream.
- Adaptation of know-how for the production of starch and glucose fructose syrup.+
- The elaboration of special treatments and flavours for tobacco mainly for export.
- The construction of a time table for fruit processing taking in consideration the ripening times of the different fruits and assure by such a time table the continuous exploitation of canning capacity.
- Utilization of fruit wastes to produce alcoholic beverages with an export possibility. The elaboration of fermentation procedures for a high quality beverage would be desirable.
- Methods for the utilization of molasses apart from the production of alcohol such as processing bakery yeast, dried yeast and feed yeast.

+ There is believed to exist a project plan for production of these products from cassava and maize by NCI with support from the Netherlands government.

- The utilization of bagasse for the production of acetic acid, of furfural and of paper.
- If adequate supplies of electricity can be forecast, research on quick freezing methods should be elaborated taking in account the special fruits and vegetables of the country in this relation.
- The elaboration of the utilization of cottonseed husk waste.
- Research on the utilization of the wastes of slaughtering e.g. intestines, hommones, glands, sweetbread etc.

- The natural energy sources of the country indicate a need to find out what branches of food industry could effectively apply the drying process to food products. TIRDO's Food Technology Department should elaborate a study on such food products and the technology of process drying.

The foregoing recommendations are the best judgements of the expert based upon conditions at the end of 1981. If the implementation of these suggestions must be deferred for two to three years, a review and adjustment of the research plan will be in order.

4. Laboratory Equipment

ANNEX 8 contains a list and specification of those instruments and equipment which are necessary to execute the tasks mentioned above and other research related to the field of food research. The specification does not include some major equipment which were already proposed by UNIDO experts for other departments of TIRDO. Such instruments are:

- UV-Visible Spectrophotometer
- Gas Chromatograph
- High Pressure Liquid Chromatograph
- Atom Absorbic Spectrophotometer
- IR Spectrophotometer

It would be superfulous to duplicate such big and expensive instruments because experience shows that utilisation of their capacity is generally low. It may be suggested that the use of such

instruments be coordinated. It is highly recommended that a control instrumental/analytical group giving services to all Departments be established. The advantages include higher utilization of instrument capacity and the possibility to concentrate the instrumental specialists.

5. Institutional relations, foreign assistance and experts

Taking in consideration all of the discussions, the very close cooperation between TIRDO, TBS and TFNC is indispensable. It is highly recommended that yearly coordination of the plans and programmes of the three institutions take place together with the establishment of mutual information exchange concerning activities and executed work. The information system should be elaborated by the TIRDO Information Department with the consensus of TBS and TFNC.

There is a great need for development and progress of the food industry in Tanzania. The aims and goals presented in this report, including the recommendations, requires relatively large financial support. The problem apart from the establishment of technological resources at TIRDO is the acquisition of industrial technology; licenses, know-how and the supply of processing machinery. It is recommended that TIRDO elaborate a detailed proposal of bilateral cooperation with countries such as:

- canning industry, food preservation, deep-freezing	Sweden
- wine cellary, wine production	Italy, Hungary
- dairy production	Denmark, Netherland
- starch, glucose, fructose syrup prod.	USA
- fish processing	Soviet Union, GDR
- vegetable oil production, bakery, pasta production	Italy
- meat processing	USA, Italy, Hungary

The execution of all the programmes above and of other indicates the need for food research and development experts for about 6-12 months when the laboratories are finished and the equipment is installed and operating.

ACKNOWLEDGEMENTS

The expert wishes to express his gratitude for the understanding and support of Mr. C.A. Stone, Chief Technical Adviser. Thanks should be given to the Director General of TIRDO Mr. C.L. Tarimu and to his kind and willing counterpart, Mr. J. L. Nyonyi. The expert enjoyed during his presence the cooperation and support of the Project staff.

The expert found the greatest cooperation in completing his assignment at all the organizations, institutions and factories visited and enumerated in ANNEX 4. A special expression of gratitude should be given to Mr. B.L. Mwobahe, Director of TBS, to Mr. J. P. Kimati, LIDA and to Dr. K. Mshigeni, University of Dar es Salaam.

Finally the expert would like to express his greatest satisfaction for the kind cooperation and assistance provided by Mr. D.H. Wozab, Representative of FAO, Mr. B.O. Coles FAO Project Manager, and to Mr. R. J. Donald FAO Dairy Economist.

ANNEX I

JOB DESCRIPTION

PROJECT IN THE UNITED REPUBLIC OF TANZANIA

26 December, 1980

Job Description
DP/URT/78/019/11.08

Post title	Expert in food technology
Duration	One and one half months
Date required	As soon as possible
Duty station	Dar es Salaam with possibility of travel within the country
Purpose of Project	To assist the Tanzania Industrial Research and Development Organization (TIRDO)
Duties	The expert will work under the general supervision and guidance of the Senior Technical Adviser to TIRDO and in close co-operation with TIRDO management and staff and in liason with the Ministry of Industries, and food processing industries and Tanzania Food and Nutrition Centre. The expert will specifically be expected to:

1.) Conduct an in depth survey of the food processing and food preservation industry to assess their problems, plans and needs.

2.) Review TIRDO staffing and training plans and recommend improvements thereto.

3.) Develop a five year TIRDO work programme in food technology services and research appropriate for support of Tanzanian industry.

4.) Prepare a detailed list with specifications of equipment, materials and supplies necessary to carry out the work programme.

5.) Present and discuss the TIRDO food technology plans with prospective donor agencies.

The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further action which might be taken.

Qualifications — University degree in biochemistry, biology or organic chemistry with extensive and broad experience in food processing and preservation. Background in small to medium scale industrial practice desirable. Experience in developing Countries an asset.

Language — English

ANNEX 2

LIST OF SURVEYS AND REPORTS STUDIED BY THE EXPERT:

1. Henein, S.K.: Reports of the I., II., III., Quartal 1981. UNIDO
2. Wilder, C.J., Nagy, I., Soede, F.J.: Final Report of Preparatory Assistance to the Tanzania Industrial Research and Development Organization, UNIDO/IOD, 17 August, 1979.
3. Policy Statement on the Mission of the Tanzania Industrial Research and Development Organization, Secretariat of UNIDO, UNIDO/IOD. 287/Rev.1. 27 November, 1979.
4. Mosha A.C.: Country Status Survey on Agro-Industries in Tanzania, February, 1980
5. Country Industrial Development Study, TISCO, 1981.
6. FOOD/Control of Quality/Act, No.10, 1978. The United Republic of Tanzania.
7. The Food Processing Industry in Tanzania, Food Manufacturers Workshop Proceedings, TFNC, 1978.
8. International Scheme for the Coordination of Dairy Development and International Meat Development Scheme, United Republic of Tanzania, Final Draft Report, FAO, 1979.
9. Report of the Task Force to Investigate and Recommend Viable Alternative Operations for the Mara Dairy Plants, FAO, 1981.
10. Study of the Livestock Feed Industry in Tanzania, TPI, 1980.
11. Hedley, B.R., Donald, R.: National Dairy Development Plan, Arusha, 1981.
12. Notes on Dairy Industry Policy/Draft for National Livestock Policy Document.
13. Extracts from National Dairy Development Plan/Vol. I./
14. Tanzania Bureau of Standards: Functions, Organization and Services.
15. Research Needs and Priorities in Relation to Certain Agricultural Commodities, Vol. I., TPT-FAO, DDR: IAR/75/20 June, 1975.
16. Academic Year 1981-82, Prospectus, University of Dar es Salaam.
17. B.A. Mwingira, Mndewa B.S.E.: Coffee Processing Research Unit, TIRDO, 1978.

18. Mwingira, B.A.: Modern Techniques of Coffee Processing EARO, 1977.

19. A Review of the Tanzania Sugar Industry in 1978/79, Marketing Development Bureau, FAU/UNDP Project SF TAN 27, 1980.

20. Survey of Industrial Co-operatives, UNIDO/SIDO, 1980.

21. Mwingira B.A.: Aspects which concern Tanzania Industrial Research and Development Organization, 1979.

22. J.L.M. Nyenyi: Reports on Industry Familiarization, 1981.

ANNEX 3

WORK PLAN

The main goal of the mission is to elaborate a plan and recommendations to the Government for further actions which might be taken to establish and operate a TIRDO programme of effective assistance to the Tanzanian food industry. This requires that the expert become familiar with the food industry and the activities of other organizations and institutions which provide services and support to this sector.

The main themes to be investigated are:

a. the agricultural production as raw material supply for the food industry,

b. the present level of food production, including the utilized capacity, the amount and regularity of raw material supply,

c. the level of applied technology, furthermore of the variety and quality of the products,

d. the possibilities for the formation of new branches of food industry, mainly making use of by-products and wastes, to elevate the level of nutrition of the Tanzania people, and to increase exported food products,

e. to understand the studies by Tanzania institutions and UN Agencies about the present food production and to review the existing Food Law as a means to promote the development of food processing and the quality of food,

f. to synthetize the findings to a comprehensive proposal.

According to the above enumerated aspects the following programme is proposed:

1. Information.

1.1 To become familiar with the organization and activity of TIRDO, furthermore of the related institutions: TBS, TFNC, TISCO, LIDA, NCCO.

Dead line : 05.11.1981

1.2 To get information about relevant projects of UN Agencies, primarily those of FAO.
Dead line : 02.11.1981

1.3 To make a survey over the various studies elaborated by Tanzanian organizations, institutions, authorities and by UN Agencies.
Dead line : 06.11.1981

2. Review of the actual situation of the food industry, according to different branches, different sizes and different ownerships, through a more or less representative survey.
Dead line : 13.11.1981

3. Discussions of the findings from the above mentioned activities with the Chief Technical Adviser, the Director General and the counterpart, returning to some organizations mentioned in 1.1 and 1.2 as necessary.
Dead line : continuously

4. To examine the present education system concerning those faculties which train cadres for the food industry, research and control.
Dead line : 20.11.1981

5. To synthesise the findings and discussions concerning the promotion of TIRDO's assistance to food industry and prepare a Final Report.

Dead line : 26.11.1981

ANNEX 4

Organizations, Institutions and Factories Visited

1. Tanzania Bureau of Standards - Dar es Salaam
   Mr. B.L. Mwobahe - Director

2. University of Dar es Salaam
   Dr. K. Mshigeni - Director Postgraduate Studies

3. GLORIA Bakeries Ltd. - Dar es Salaam
   Mr. C.G. Nikitas - Director

4. TANGOLD Products Co. Ltd. - Dar es Salaam
   Mr. R.B. Hoza - Manpower Development and Administrative Manager
   Mr. S. Heze - Food Technologist

5. National Cold Chain Operations Ltd - Dar es Salaam
   Mr. E.G. Musoma General Manager

6. Tanzania Food and Nutrition Centre - Dar es Salaam
   Mr. H.M. Lukoo AG. Director F.S.T. Department
   Mr. C. Temalilwa - Biochemist I/C of Laboratory

7. Livestock Development Authority - Dar es Salaam
   Mr. J.P. Kimati - Director of Planning and Operations

8. Rajani Oil Industries Ltd. - Dar es Salaam
   Mr. A. Sivanandam - General Manager

9. EMCO Industries Ltd - Arusha
   Mr. C. Patel - Ag. General Manager

10. Tanzania Food Corporation Ltd - Arusha
    Mr. A.R. Dallos - Ag. Managing Director
    Mr. K.A. Flavell - Production Manager

11. Tanzania Dairies Ltd. - Arusha
    Mr. E.J. Nguma - Insurance Officer
    Mr. P. Gabriel - Senior Factory Foreman

12. Tanzania Breweries Ltd. - Arusha
    Mr. K.F. Mmbaga - Manpower Development Officer
    Mr. G.J. Mkolwe - Senior Brewer

13. Kilima Bottlers Ltd. - Arusha
    Mr. S.A. Dalal - Ag. General Manager/Accountant

14. Tanzania Food Products Ltd. - Arusha
    Mr. M. Shah - Factory Owner

15. Tanzania Packers Ltd. - Dar es Salaam
    Dr. A.K. Baluhi - General Manager
    Mr. S. Saidi - Factory Manager

16. Tanzania Industrial Studies and Consulting Organization
Mr. F. J. Zanghira - Economist

17. Food and Agricultural Organization
Mr. D. H. Wozab - Representative

18. Food and Agricultural Organization Livestock Development Project
Mr. B. O. Coles - Livestock Industry Coordinator

19. Food and Agricultural Organization Dairy Development Services
Mr. R. J. Donald - Dairy Economist

ANNEX 5

LINCENCED FOOD INDUSTRIES

DAR ES SALAAM BASED FOOD INDUSTRIES

	NAME OF INDUSTRY	PRODUCT
1.	ABC Food (T) Ltd.	Bread; Sugar confectionery.
2.	C.B. Spices Ltd.	Turmeric; Curry, Chillies, Cinamon powder.
3.	City Bakeries Ltd.	Bread; Cakes.
4.	Coastal Dairy Industry	Evaporated and fresh milk
5.	Coca-Cola Industry (Tanzania Bottlers)	Soft drinks: Coca-Cola, Fanta.
6.	Dar-brew Ltd.	Chibuku
7.	Dar Food Products Ltd.	Spices. Gram flour
8.	Dar Oil Mill	Coconut and Simsim Oil
9.	E.A. Salt Works Ltd.	Salt
10.	Fahari Bottlers Ltd.	Soft drinks: Pepsi-cola, Mirinda.
11.	Gloria Bakeries Ltd.	Bread; Cakes.
12.	Kunduchi Salt Works	Salt
13.	Mafia Coconut Ltd.	Coconut oil. Coir fibre. Copra cake.
14.	Mwangaza Ghee Co. Ltd.	Ghee
15.	Nafco Coconut Oil Plant	Coconut oil
16.	National Cashew Co. Ltd.	Cashew nuts
17.	NMC Canning Division	Juices Squashes, Vinegar, Pickles.
18.	NMC Feeds Division	Animal and poultry feeds
19.	NMC Baby Food Plant	'Lisha' Baby Food.
20.	NMC Wheat Mills, Kurasini	Wheat flour
21.	NMC Rice/Maize Mills, Pugu Road.	Rice, Maize flour
22.	National Cold Chain Organization	Meat, Fish
23.	Popular Oil Mill Ltd.	Cooking oil
24.	Poultry Feeds Co. Ltd.	Poultry feeds
25.	Rajani Industries Ltd.	Sunflower oil and cake
26.	Tanganyika Packers Ltd.	Meat; canned meat; meat/beans; Bone/blood meals

	NAME OF INDUSTRY	PRODUCT
27.	Tanita Cashew Industry Ltd.	Cashew nuts.
28.	Tanzania Biscuits Co. Ltd.	Biscuits.
29.	Tanzania Breweries Ltd.	Beer
30.	Tanzania Cigarettes Co. Ltd.	Cigarettes
31.	Tanzania Dairy Farming Co. Ltd.	Fresh milk
32.	Tanzania Distilleries Ltd.	Whisky; Gin
33.	Tanzania Flour Mills	Maize/other cereal flour.
34.	Tomango Food Products	Tomato juice/Sauce
35.	Tropical Food Supplies Ltd.	Juices, Squashes, Canned beans.
36.	Vitamin Foods Ltd.	Juices, Tomato sauce, Squashes.

TANGA/ARUSHA/MOSHI BASED FOOD INDUSTRIES

1.	Anjari Soda Factory Ltd.	Soft drinks
2.	EMCO Industries Ltd.	Assorted sweets, Toffee
3.	Kilima Bottlers Ltd.	Soft drinks
4.	Kilimanjaro Sweets and Confectionery	Sweets
5.	Mvumoni Salt Mine	Salt
6.	NMC Canning Plant, Korogwe	Fruit Juices/& Sauces, Squashes.
7.	Tanzania Dairies Ltd. Arusha	Milk; Yoghourt; Butter.
8.	Pepsi-Cola Plant, Moshi	Soft drinks: Pepsi-cola.
9.	Saifi Soda Fountain, Arusha	Soft drinks. Distilled water.
10.	SIDO projects, Tanga	Carbonated fruit drinks.
11.	Surat Oil Mills, Arusha	Coconut, Groundnut, Simsim, Sunflower.
12.	Tanganyika Coffee Curing Co.Ltd.	Cured coffee
13.	Tanzania Breweries Ltd., Arusha	Beer
14.	Tanzania Food Corporation Ltd.	Biscuits, Spaghetti, Macaroni
15.	Tanzania Grain and Seed Processors Ltd.	Flour, Beans, other seeds
16.	Tanzania Food Products, Arusha	Spices. Grain flour
17.	Tanzania Tomato Industry Ltd.	Tomato juice, sauce.
18.	Umoja Bottlers Ltd., Moshi	Soft drinks.

IRINGA/MOROGORO BASED FOOD INDUSTRIES

	NAME OF INDUSTRY	PRODUCT
1.	Dabaga Fruit Products, Iringa	Fruit juices, Sauces; Squashes.
2.	Mtibwa Sugar Estates/factory, Morogoro	Sugar
3.	Kilombero Sugar Factory Ltd.	Sugar, Molasses
4.	Muhenda Sugar Factory Ltd.	Sugar.
5.	Tanzania Tobacco Processing Co. Ltd.	Cured tobacco
6.	Ulanga Cotton and Rice Industries	Rice, Maize, Milling Cotton Oil.

FOOD INDUSTRIES BASED IN OTHER TOWNS

1.	Ashok Oil Mill, Mwanza	Cotton seed oil/cake
2.	Bihawana Mission Wine, Dodoma	Wine
3.	Bizari Ltd., Bukoba	Curry powder/spices
4.	Bukoba Coffee Roasters and Packers	Coffee
5.	Hyderi Oil Mills, Lindi	Groundnut, Simsim Oils
6.	Kagera Sugar Factory Ltd., Bukoba	Sugar
7.	Kigoma Bottling Co. Ltd., Kigoma	Soft drinks.
8.	Lake side Dairy Ltd., Mwanza	Milk, dairy products
9.	Lunguru Oil Mill, Shinyanga	Cotton seed oil/cake
10.	Mafuta ya Ilulu Ltd., Nachingwea	Cooking oil
11.	Mara Dairies Ltd., Musoma	Milk, butter.
12.	Mbeya Sweet Confectioners	Sweets
13.	Mtwara Bottlers Ltd., Mtwara	Soft drinks
14.	Munna Bottlers Ltd., Mwanza	Soft drinks
15.	Mwanza Bottling Co. Ltd.	Soft drinks.
16.	Mwanza Fish Canning Ind. Ltd.	Canned fish
17.	NMC Dodoma Wine Co. Ltd.	Wine
18.	Nyakato Millers, Mwanza	Animal feeds.
19.	Nyanza Fishing and Processing Co. Ltd., Mwanza.	Fishmeal, fish oil
20.	Tanzania Dairies Ltd., Tabora	Milk
21.	Tabora Beekeepers Co-op. Society	Honey, beeswax
22.	Tanganyika Instant Coffee Ltd., Bukoba	Coffee
23.	Vegetable Oil Industries Mwanza	Cotton, groundnut oil/ghee

ANNEX 6

REPORT ON VISITS TO FOOD INDUSTRIES AND RELATED ORGANIZATIONS

by

J.L.M. NYONYI
Research and Development Officer, TIRDO

(25 October 1981 - 13 November 1981)

INTRODUCTORY REMARK

The main objective for the above mentioned visits was to enable Dr. O.I. Vajda, UNIDO Expert, to have an insight of food industrial activities so as to enable him to make recommendations for the development of the Food Division of TIRDO.

Nineteen industries/organizations were visited and interviewed (fifteen of them by both of us, and four by the expert alone). This report gives a summary of my major findings at fifteen places, a personal evaluation of the observations made and areas in which I think TIRDO could provide assistance.

ORGANIZATION: TANZANIA BUREAU OF STANDARDS (TBS)
DATE: 26 OCTOBER, 1981
PERSON CONTACTED: MR. B.L. MWOBAHE - DIRECTOR
VISITED BY: DR. O.I. VAJDA, J.L.M. NYONYI

OBJECTIVES: To discuss functions of TBS and possible working relationships between TIRDO and the former, especially in the field of Food Science and Technology.

FINDINGS: TBS principle objective is to prepare and establish standards for quality specifications and codes of practice on a national and international basis. The standards prepared are in the fields of: Agriculture and Food, Chemicals and Chemical products, Textiles, Engineering, Metrology and Quality assurance.

TBS is constructing five laboratories and these will be in operation early, 1982. The laboratories are for: Food and Microbiology, Chemical, Textile, Material testing and Metrology. The Laboratories will cater for product quality verification, precision measurements and calibration of instruments.

CO-OPERATION WITH TIRDO: It was agreed in principle that a co-ordination of activities between TIRDO and TBS be established. It was made very clear that TIRDO could find useful information from standardization activities and could incorporate some ideas in its R and D activities. Similarly, it would be very useful for TBS to be informed of TIRDO's research achievements as the latter would help in the review of standards.

It was further discussed that as most of the laboratory work at TBS will be conducted with a major objective of helping in the drafting, setting, and implementation of standards, activities of conducting applied research and providing technological assistance to industry should be carried out by TIRDO.

ORGANIZATION: UNIVERSITY OF DAR ES SALAAM

DATE: 28 OCTOBER, 1981

PERSON CONTACTED: DR. K. MSHIGENI - DIRECTOR POSTGRADUATE STUDIES

VISITED BY: DR. O.I. VAJDA, J.L.M. NYONYI

OBJECTIVES: To discuss and familiarize ourselves with the activities of the University of Dar es Salaam as regards the training offered in the field of Food Science and Technology.

FINDINGS: (1) We were informed of the existence of the Department of Food Science and Technology in the Agriculture Division of the Faculty of Agriculture, Forestry and Veterinary Science at Morogoro.

(2) We were given copies of University Prospectus for Academic year 1981-82 from where we could study the course structure given by the Department of Food Science and Technology.

(3) We noted that the Faculty at Morogoro does not offer a course leading to the Degree of Food Science and Technology (FST) as such. Studies in this discipline are a part of the courses leading to the degree of Bachelor of Science (Agriculture).

(4) The University welcomed our idea on the need of elevating the studies currently offered in the field of F.S.T. The biggest limiting factors being shortage of teaching personnel and equipment. The University promised however, to take up this issue with the relevant bodies so that the Faculty in Morogoro may eventually offer degree programmes in F.S.T. This idea was deemed necessary by all of us as an essential step towards the promotion of the badly needed expertise in F.S.T. in Tanzania.

FACTORY: GLORIA BAKERIES LTD - DSM

DATE: 28 OCTOBER, 1981

PERSON CONTACTED: MR. C.G. NIKITAS - DIRECTOR

VISITED BY: DR. O.I. VAJDA, J.L.M. NYONYI

OBJECTIVES+ : The visit to the factory was made to enable us gather the following information:

(1) Products produced: types, varieties, quality,
(2) Availability of raw materials/plant capacity.
(3) Technology level : processes and equipment
(4) Hygiene standards
(5) Organization and execution of quality control
(6) The demand on the assistance from TIRDO

FINDINGS: (1) The factory's main product is bread, although it produces some confectioneries on a small scale. The quality of bread is good.

(2) Availability of wheat flour which is the main raw material is not encouraging. The factory gets about 270 t flour/month. The plant capacity is 35 t/day, so that it is now operating at 25% capacity utilization.

(3) There are complaints on the quality of wheat flour received from the National Milling Corporation. It appears that at times the flour delivered has no improvert added to it, and at times doubt arises as to wether it is real wheat flour.

(4) The management expressed desire for research activities especially in finding substitutes for wheat flour e.g. by utilizing other cereal sources like sorghum and millet.

(5) The machinery used is a bit old and the level of hygiene is satisfactory.

(6) The management said it could not do much at present to elevate the quality/variety of its products due to the limited supply of raw materials.

+ The objectives listed here apply for all factory visits made and are not repeated in the reports following.

FACTORY: TANGOLD PRODUCTS CO. LTD. DSM

DATE: 29 OCTOBER, 1981

PEOPLE CONTACTED: MR. R.B. HOZA - MANPOWER DEVELOPMENT AND ADMINISTRATIVE MANAGER

MR. S. HEZE - FOOD TECHNOLOGIST

VISITED BY: DR. O.I. VAJDA, J.L.M. NYONYI

FINDINGS: (1) The factory is producing canned and bottled products thus: canned; Mango pickle, pulp and juice, Pineapple juice and slices, Passion fruit juice, Tomato juice, Orange juice, Tomato paste. Bottled; Squashes of orange, Lemon and Pineapple, syrups of Blackcurrant, Red rose, Grenadine, etc., Tomato sauce, Chilli sauce, and Fruit jams.

(2) The raw materials may be noted from the names of the products listed in (1) above. At present the factory is operating on a single shift basis of 8 hrs a day at approximately 40% capacity utilization. The daily full production capacity is not being utilized as the supply of raw materials is relatively low at the moment.

(3) The manufacturing process involves sorting out of the raw materials, weighing, boiling/pasteurizing, chemicalising, bottling or canning, packing and storing.

(4) The factory is facing a price competition for the purchasing of raw materials, as it pays only 60 cents for 1 Kg of oranges for example, whereas the farmers could fetch up to 1 shilling for one orange on the open market. As the factory does not own their own fruit farms, the problem of securing enough raw materials is bound to exist, unless they raise the buying prices of fruits.

(5) The machinery is in good working order, occassionally receiving renovations etc. The factory hires lorries for the transport of fruits but plans are underway to purchase factory-owned trucks for this purpose

(6) Suggestions were made to the management for the production of fruit concentrates, as these could easily and conveniently fetch an export market. This idea was received with pleasure, infact further requests were made for TIRDO to help the factory elaborate on new types of products, and also help the factory personnel acquire some training fellowships from overseas.

(7) The factory has got a laboratory for running quality control activities especially on finished products. It may be said however that the laboratory is not well equipped and is managed by a semi-skilled staff.

ORGANIZATION: NATIONAL COLD CHAIN OPERATIONS LTD DSM
DATE: 29 OCTOBER, 1981
PERSON CONTACTED: MR. E.G. MUSOMA - GENERAL MANAGER
VISITED BY: DR. O.I. VAJDA, MR. J.L.M. NYONYI

FINDINGS: (1) The main activities of NCCO are geared towards stimulating production, preservation, and distribution of food products locally and abroad.

(2) NCCO was primarily set up to carry out freezing operations for Zambian meat, fish, etc., from overseas before reaching their final destination. At present this is no longer the case and the Organization is currently supposed to be dealing in fish, livestock, and vegetable products for local use mainly.

(3) At present, NCCO handles fresh fish cold storage and, to a small extent, beef and pork cold storage. There is a big need for this Organization to be fully developed in various kinds of food processing including areas that have already been noted above plus other food perishables e.g. fruits and vegetables etc.

(4) The need for vertical integration between agriculture and the food industry was highlighted here again, as this would enable NCCO to collect enough agricultural products it requires for processing, preservation and distribution.

ORGANIZATION: TANZANIA FOOD AND NUTRITION CENTRE - DSM
DATE: 3 NOVEMBER, 1981
PEOPLE CONTACTED: MR. H.M. LUKOO AG. DIRECTOR (FSTD)
MR. C. TEMALILWA SENIOR BIOCHEMIST
VISITED BY: DR. O.I. VAJDA, MR. J.L.M. NYONYI

FINDINGS: (1) The TFNC runs four departments: Planning, FST, Manpower Development, and Medical Nutrition Departments which includes the Laboratory.

(2) The major activities of TFNC may be summarized as
(i) Drafting and implementing plant relating to food and nutrition (Review of National food policy, Initiation of the use of food and nutritional planning at national, regional, village levels, etc.)

(ii) Conducting research/survey on food and nutrition.

(iii) Provide staff training, run a documentation section, run a food/Nutritional laboratory and a Food Quality Control Laboratory.

(3) Taking TFNC activities in consideration it is obvious that a very close cooperation with TIRDO is necessary especially in R and D programmes.

ORGANIZATION: LIVESTOCK DEVELOPMENT AUTHORITY - DSM

DATE: 6 NOVEMBER, 1981

PERSON CONTACTED: MR. J.P. KIMATI - DIRECTOR OF PLANNING AND OPERATIONS

VISITED BY: DR. O.I. VAJDA, MR. J.L.M. NYONYI

FINDINGS: (1) The Livestock Development Authority operates the following sub-organizations: The National Cattle Ranching Companies, The National Dairy Farming Companies, Tanzania Livestock Marketing Company, Tanzania Dairy Companies, NCCO, and Tanganyika Packers Limited.

(2) Detailed information about the situation concerning cattle breeding and meat production and processing were given.

(3) The Livestock industry is undoubtedly not at its best at present and big efforts to raise its standard would be appreciated. The role played by FAO Livestock Project and that of the FAO Dairy Project in this endevour was appreciated.

(4) A suggestion was made that we visit Tanzania Packers Ltd. where we could hold further discussion of meat/meat products diversification programmes, etc. The visit was made and a separate report is given in Report 15.

FACTORY: RAJANI OIL MILL LTD. DSM
DATE: 6 NOVEMBER, 1981
PERSON CONTACTED: MR. A. SIVANANDAM - GENERAL MANAGER
VISITED BY: DR. O.I. VAJDA, MR. J.L.M. NYONYI

FINDINGS: (1) The factory produces cotton seed, groundnut, soya, simsim, and sunflower oils. The raw materials used may be deduced from the above mentioned products.

(2) The factory gets raw seeds from the General Agricultural Products for Export Co. (GAPEX), but to be able to get enough seeds for processing, the factory had plans for establishing its own farms.

(3) The mill is undergoing reconstruction at the moment, with a view of installing solvent extractors, to replace the currently used mechanical oil extractors.

(4) The final product is relatively of good quality and of high demand in the country. The oil cakes left behind however have a relatively high oil content, which in the first place is a loss to the factory, and secondly not quite suitable for animal feeds. The factory exports most of its oil cakes abroad for further processing.

(5) The management of the industry requested the following from TIRDO:-

(i) Provide new and more efficient technologies in oil processing by way of Research and by means of providing written literature on the subject.

(ii) Help organize a quality control laboratory at the mill, as currently they have none. The plan for the laboratory building is however in their new expasion programme.

(iii) To provide some comparative data on oil processing, marketing, etc. for various countries.

FACTORY: EMCO INDUSTRIES LTD ARUSHA

DATE: 9 NOVEMBER, 1981

PERSON CONTACTED: MR. C. PATEL Ag. GENERAL MANAGER

VISITED BY: DR. O.I. VAJDA; MR. J.L.M. NYONYI

FINDINGS: (1) The factory main products are sweets, toffees, laundry and toilet soap. For the last two years the factory had not been successful in securing an Import licence for raw materials (glucose, wrapping paper, soap ingredients etc.). This led to the closure of the plant for five months. They only resumed sweet production this month, with raw materials to last them for two months only. The soap mill is still closed for same reasons.

(2) The factory is currently employing only seventeen people instead of seventy five, operating only at 30% of its production capacity.

(3) The factory chemist left for India, having nothing much to do then, hopefully that he comes back when the situation goes back to normal.

(4) As for the demands for TIRDO's assistance it was made very clear that assuming that the factory resumes to its regular supplies of basic raw materials, R and D activities for the local production of glucose, sweet essences, flavours, and colours, would be very much welcome.

FACTORY: TANZANIA FOOD CORPORATION LTD - ARUSHA

DATE: 10 NOVEMBER, 1981

PEOPLE CONTACTED: MR. A.R. DALLOS - Ag. MANAGING DIRECTOR
MR. K.A. FLAVELL - PRODUCTION MANAGER

VISITED BY: DR. O.I. VAJDA; MR. J.L.M. NYONYI

FINDINGS: (1) This plant produces various types of biscuits; and pasta products-macaroni and spageti. The equipment for the production of both biscuits and pasta is quite up to date, and production is led by a well experienced technologist, Mr. Flavell.

(2) At present the factory is only producing biscuit. The production of pasta products has stopped due to the unavailability of samolina wheat flour required for this process.

(3) Apart from the unavailability of special wheat flour for pasta production the technology level at this factory seems adequate; and level of hygiene quite acceptable.

(4) On TIRDO's assistance, the management requested for a thorough study in the exploitation, improvement and utilization of locally available raw materials for the production of good quality products with less dependence on raw material supply from overseas. The factory uses several chemicals in the production of biscuits e.g. Sodium bicarbonate, Ammonium bicarbonate, Sodium meta Bisulphate, etc.; some food colours and essentials, all which are currently being imported from abroad.

FACTORY: TANZANIA DAIRIES LTD. - ARUSHA

DATE: 10 NOVEMBER, 1981

PEOPLE CONTACTED: MR. P. GABRIEL --FACTORY FOREMAN
MR. E. NGUMA

VISITED BY: DR. O.I. VAJDA; MR. J.L.M. NYONYI

FINDINGS:

(1) With a good supply of fresh milk, the factory usually produces the following products; Fresh standardised milk, fresh butter, super fine ghee, dairy cream, yoghurt, and ice cream.

(2) The capacity of the plant is 50,000 litres/day, but the present production is 33,000 litres/day (66% capacity utilization).

(3) Milk for processing is collected in two ways, where either the farmers delivers straight to the factory or the factory owned vehicles collect the staff from the 12 milk cooling stations in Arusha Region.

(4) The factory operates its Quality Control activities in small scale laboratory. Incoming milk and finished products undergo physical, chemical and bacterilogical examination in this laboratory.

(5) Milk is usually pasteurized at 72-78°C. The average fat content of the raw milk has approximately 3.5% fat, and the standardised milk has 2.0% fat. The skimmed fat is transformed into butter, ice cream, etc.

(6) Fresh standardised milk is usually packed and sold in tetra packages. At the moment these packs are not available (imported roll packs) and milk is distributed in cans and covered buckets.

(7) At the time of this visit, the milk technologist was away on a business trip, and thus what would be the demands of the dairy to TIRDO as regards assistance in technology etc. was not discussed.

FACTORY: TANZANIA BREWERIES LTD - ARUSHA

DATE: 10 NOVEMBER, 1981

PEOPLE CONTACTED: MR. K.F. MMBAGA, MANPOWER DEVELOPMENT OFFICER
MR. G.J. MKOLWE, SENIOR BREWER

VISITED BY: DR. O.I. VAJDA; MR. J.L.M. NYONYI

FINDINGS:

(1) The main product produced here is beer. The production target for 1981 was 1,200,000 hecta litres but until the time of our visit they were producing less than 100,000 HL month.

(2) The main raw materials used are: malt, water, sorghum and barley. Of the total cereal used in beer, malt accounts for 85%, while sorghum and barley accounts for 15%. Malt is an imported stuff, and therefore limits the production capacity when it is not readily available for one reason or another.

(3) Very detailed information on the brewing process were provided covering technological, quality control, and hygiene aspects. The factory carries out chemical and biological tests covering the whole products, ranging from malt grits to final products.

(4) The production is limited not only on account of lack of malt grits, but also due to other factors e.g. supply of yeast for fermentation process, shortages in crown cork supplies, water shortages, and breakdowns in machinery. The present machinery is a second hand installation and rather old.

(5) The quality of beer produced is very good. They produce four beer brands, the type produced being determined by the ratios of raw materials used, and consequently having variable amounts of alcohol. The beers they produce have an alcohol range of 2.7-4%.

(6) The management requested TIRDO to help the factory in all possible ways to raise its technological standards and if possible offer some training on some of its staff in the country and overseas.

FACTORY: KILIMA BOTTLERS LTD - ARUSHA

DATE: 11 NOVEMBER, 1981

PEOPLE CONTACTED: MR. S.A. DALA, Ag. GENERAL MANAGER
FACTORY ENGINER; et.

VISITED BY: DR. O.I. VAJDA; MR. J.L.M. NYONYI

FINDINGS:

(1) The factory bottles the following soft drinks; Coca-cola, Fanta Orange, Fanta Club Soda; Fanta Ginger Ale, Fanta Tonic water, and Sprite.

(2) The raw materials used are: concentrates, crown corks, bottles and chemicals including CO_2. All concentrates are imported, a proportion of crown corks is also imported, bottles are supplied locally and CO_2 generated at the factory by a self owned plant imported from Denmark. The chemicals are all imported.

(3) Detailed information on the bottling and quality control processes was provided. The quality of the drinks and that of CO_2 manufactured is very good. The machinery and equipment is quite up to date, with a capacity of producing 550 cases of the drinks in an hour = 13,200 bottles/hr.

(4) Of the carbon dioxide produced, 26% is utilized in the bottling process, while the rest is sold to outside customers within the country.

(5) At present no immediate demands on TIRDO's assistance could be brought up. All the same the factory management promised to contact TIRDO when such a need arises.

FACTORY: TANZANIA FOOD PRODUCTS LTD. ARUSHA

DATE: 11 NOVEMBER, 1981

PEOPLE CONTACTED: MR. M. SHAH - TEMPORARY FACTORY CARETAKER AS THE GENERAL MANAGER WAS ON A TRIP

VISITED BY: DR. O.I. VAJDA; MR. J.L.M. NYONYI

FINDINGS: (1) The factory is a small scale and privately owned enterprise; at present only packing only one type of spices - curry powder and producing gram-seed flour.

(2) The factory is in big shortages of raw materials for the production of spices at the moment, and are using the limited amounts of curry, safanin etc. they imported from India a year back for the production of curry powder.

(3) Gram-flour milling does not pose many problems to the factory as gram-seeds are readily available. We were not permitted to inspect the mill as the Manager was away and the only gentleman around was quite an old person and only a caretaker of the factory at that moment.

FACTORY: TANZANIA PACKERS LTD DSM

DATE: 13 NOVEMBER, 1981

PEOPLE CONTACTED: DR. A.K. BALUHI - GENERAL MANAGER
MR. S. SAIDI - FACTORY MANAGER

VISITED BY: DR. O.I. VAJDA; MR. J.L.M. NYONYI

FINDINGS: (i) The factory slaughters cattle, sells fresh meat, and processes the rest as: Corned beef, beef in beans, pet food, meat meal, bone meal, etc. The factory also produces other products thus: baked beans, canned fruits (slices, juices, squashes etc.)

(2) The factory has a capacity of slaughtering 1000 cattle/day, but at present handles only 250 cattle on a slaughter day. The factory is currently undergoing reconstruction and on our visiting day no cattle slaughtering or beef/beef-products processing was going on. Only fruit (pineapple) slicing and juice making was proceeding.

(3) It was clearly exposed that the development of various processed meat products would be a big contribution from TIRDO to the meat industry. R and D activities on meat/meat products' packaging would also be very useful.

(4) The factory has a good quality control system for the products it makes, running sensory (taste panels), chemical and microbiological tests especially on semi-processed and finished products.

ANNEX 7

LIST OF RECOMMENDED BOOKS AND PERIODICALS

1. Meyer, L.C.: Food Chemistry, Reinhold, New-York.
2. Stewart, G.F. Amerine, M.A.: Introduction to Food Science and Technology, Academic Press, London, New-York.
3. Borgstrom, G.: Principles of Food Science, 1-11., MacMillan, New-York.
4. Karlson, P.: Introduction to Modern Biochemistry, Academic Press, New-York, London.
5. Fox, B.A., Cameron, A.G.: Food Science, A Chemical Approach, Crane Russak Co., New-York.
6. Charm, S.E.: Fundamentals of Food Engineering, AVI, Westport, Connecticut
7. Desrosier, N.W.: Technology of Food Preservation, AVI, Westport, Connecticut
8. Gould, R.F.: Radiation Preservation of Foods, American Chemical Society, Washington, D.C.
9. Minifie, B.W. Ffst, F.: The Science and Technology of Chocolate, Cocoa and Confectionary, Churchil, Livingstone, London.
10. Williams, K.A.: Oils, Fats and Fatty Foods, Churchil, Livingstone, London.
11. Copley, M.J. Van Arsdel, W.B.: Food Dehydration, AVI, Publ. Co., Westport, Connecticut,
12. Hough, J.S., Briggs, D.E., Stevens, R.: Malting and Brewing Science, Chapman and Hall, Associated Book Publishers Ltd.
13. Amos, A.G. et al.: Food Industries Manual, Leonard Hill, London.
14. Reed, G.: Enzymes in Food Processing, Academic Press, New-York, London.
15. Kramlich, W.E. et al.: Processed Meats, AVI Publishing, Westport, Connecticuty.
16. Prescott, S.C., Dunn, C.G.: Industrial Microbiology, McGraw Hill, Book Co. Inc., New-York.
17. Harris, R., Von Loesecke, H.: Nutritional Evaluation of Food Processing, AVI Publ. Co., Westport, Connecticut.
18. Fox, A.: Hygiene and Food Production, Churchil Livingstone, London.
19. Schultz, H.S.: Food Enzymes, AVI Publ. Co., Westport, Connecticut
20. Altschul, A.M.: New Protein Foods, Academic Press, New-York, San Francisco, London

LIST OF RECOMMENDED BOOKS AND PERIODICALS Contd..../...

21. Food Chemicals Codex, Food Protection, National Acas. Print and Publ. Washington.

22. Pederson, C.S.: Microbiology of Food Fermentation, AVI Publ. Co., Westport, Connecticut.

23. Joslyn, Maynard, A.: Methods in Food Analysis, Academic, Press, New York, London.

24. Pomeranz, V., Meloan, C.E.: Food Analysis, Theory and Practice, AVI Publ. Co. Westport, Connecticut.

25. Hart, L.F.: Modern Food Analysis, New-York.

26. Jacons, M.B.: The Chemical Analysis of Foods and Food Products, Von Nostrand, Princeton, New Jersey.

27. Winton, A.L., Winton, K.B.: The Analysis of Foods, Wiley, New York.

28. Pearson, D.: Chemical Analysis of Foods, Churchil Livingstone, London.

29. Stahl, E.: Thin Layer Chromatography, Springer Verlag, Berlin, New York.

30. Macleod, A.J.: Instrumental Methods of Food Analysis, Halsted Press New York.

31. Pearson, D.: Laboratory Techniques in Food Analysis, Halsted Press New York.

32. Microbiological Methods, Butterworth, London.

33. Jay, J.M.: Modern Food Microbiology, New York, Van Nostrand Reinhold Co.

34. Speck, M.L.: Compendium of Methods for the Microbiological Examination of Foods, American Public Health Association, Weshington.

35. Frazier, W.C. Food Microbiology, McGraw Hill, New York.

36. Amarine, M.A., Pangborn, R.M., Roessler, E.B.: Principles of Sensory Evaluation, Academic Press, New-York, London.

37. ASTM, STP-434: Manual on Sensory Testing Methods, American Society for Testing and Materials, Philadelphia.

38. Kramer, A. Twigg, G.A.: Fundamentals of Quality Control for the Food Industry, AVI Publ. Co., Westport, Connecticut.

39. Herschdoerfer, S.M.et al: Quality Control in the Food Industry Vol. I.-III., Academic Press, London, New York.

40. Goodwin, R.W.L.: Chemical Additives in Foods, Churchil Livingstone, London

LIST OF RECOMMENDED BOOKS AND PERIODICALS Contd..../....

41. Ayres, J.C.: The Safety of Foods, AVI Publ. Westport Connecticut.

42. Ayres, J.C. et al: Chemical and Biological Hazards in Food, Hafner Press, McMillan Publ. Co., New York.

43. Ockerman, H.W. Source Book for Food Scientists, AVI Publ. Co. Westport Connecticut

44. Food Technology, Ed. John B. Klis, Institute of Food Technologists, 221 N. LaSalle Str., Chicago

45. Food Manufacture, Ed. Anthony Woollen, Morgan-Grampian Ltd., 30 Calderwood Str. Woolwich, London

46. British Food Journal, Ed. C.R.A. Martin, Peterson Publ. Co. Birmingham, U.K.

47. Association of Official Analytical Chemists, Journal, Ed. H. Reynolds, Washington, USA.

48. Food Science and Technological Abstracts, Ed. E.J. Mann, Farnham Royal, Bucks, U.K.

49. Canning and Packaging, Ed. P.J. Newman, Tim Publ. Ltd. 7 High Road, London, W42NE, U.K.

50. Cereal Chemistry, Publ. Association of Cereal Chemists, St. Paul, Minnesota, USA.

51. Food Processing and Packaging Publ. Tothil Press Ltd., London, UK

52. Food Preservation Quarterly, Commonwealth Scientific and Research Organization, Australia.

53. Journal of Dairy Science, American Dairy Science Association, White Plans, New York.

54. Soft Drinks, Ed. P. Mullins, Keller Publ. Corp., 10 Cutter Mill Road, Great Neck NY 11021

55. Microbiological Abstracts, Section A., Ed. E.S. Krudy, Information Retrieval Ltd., 1 Falconberg Court, London WIV TFG, U.K.

ANNEX 8

PROPOSED INSTRUMENTATION OF THE THREE MAIN SECTIONS OF FOOD DEPARTMENT

1. Fruits and Vegetables, Deep Frozen Goods, Beverages.

Analytical balance

Quick top-pan balance

Refractometer Abbe

Water bath

Sieves with shaker

Ultrathermostate

Mixer homogenizer

Refractometer

Hand refractometer

Fruit tester

Fruit tester needle

Insectofon(insect contamination tester)Fruit shatterprood tester

Refrigerator

Low temperature refrigerator

Sealing tester

Freeze drier

Immersion refractometer with thermostate

Alcoholmeter series

Aphrometer

Vacuum drying cabinet

CO_2 tester

Table computer

Pocket computer

Various laboratory equipments made of glass: beakers, test tubes, retorts, pipetts etc., of metal, porcelain, rubber and synthetic materials, furthermore of platinum.

2. Animal products.

Meat and meat products, poultry, eggs, fats and oils, milk and dairy products.

Analytical balance

Quick top-pan balance

Electric meat chopper

Mixer-homogenizer

Ultra X(for the determination of moisture and fat)

Refrigerator

Low temperature refrigerator

Universal kitchen machine

Hot plate

Electric grill toaster

Universal laboratory scaffold

Refractometer Abbe

Lactodensimeter

Melting point tester(melting, boiling and drop point)

Penetrometer Precision circular polarimeter

Gerber's butyrometer installation(+shaking box + centrifuge)
Refractometer with butter scale

Water bath Table Computer

Pocket computer

Various laboratory equipments made of glass of porcelain of metal, cups of platinum.

3. Cereals, and seeds.

Cereals, sugar, confectionary, sweetness, coffee, tea, spices, nuts.

Analytical balance

Quick top-pan balance

Polarimeter(saccharimter)

Polarimeter automatic

Polarimeter full circle

Sieves with shaker

Farinograph

Valorigraph

Amylograph
Penetrometer
Mixer homogenizer
Macaroni breaker
Dielectrometer (determination of moisture)
Gluten washer
Gluten elasticity tester
Micro-wave baking oven
Fermentometer
Table computer
Pocket computer
Laboratory mill, grinder
Soxketh extraction apparatus complete
Luminiscent tester
Various laboratory equipments made of glass, of metal, of plastics, of porcelain and cups of platinum etc.

It would be recommended to establish two further laboratories:

4. Chemical, chromatographical, instrumental laboratory
5. Microbiological laboratory

4. <u>Chemical, Chromatographical and instrumental laboratory</u>.

Moisture balance
Macro Kjeldahl apparatus complete
Micro Kjeldahl apparatus complete
Calorimeter
Hotplates
Muffle furnace
Mixers, homogenizers
Ultrathermostate,
Thermostate
Vacuum pump
Oil bath
Water bath
Dielectric apparatus with cells determination of moisture

Chemical, Chromatographical and instrumental laboratory. Contd.../..

Refractometer
pH meter
Rotadest (rotary distillation apparatus)
Vacuum frying cabinet
Water distiller
Flask shaker
Volatile oil tester
Paper chromatography set
Column chromatography set
Thin layer chromatography set
Chromatographic cabinet
Chromatography evaluation table
Universal laboratory scaffold
Polyacrilamid gel electrophoresis complete
High voltage electrophoresis apparatus
Analytical UV lamp
Polarograph
Polarograph with square waves
Turbidimeter
Lovibond tintometer
Fractions collector
Analytical balance
Quick top pan balance

5. Microbiological Laboratory

Autoclave
Thermostate cabinet (incubator)
Anaerobic incubator
Refrigerator
Water bath
Drying cabinet
Centrifuge
Ultracentrifuge
Colony counter

Microbiological laboratory. Contd...../....

Electronic cell counter
Microscope with all accessories
Stereo microscope with accessories
Membrane filter
Laminar flow box (inoculation)
Slide microtome
Germicide UV lamp
Mixer homogenizer

DETAILED SPECIFICATIONS

Equipment	Qty	Firm Catalogue number	Spec. No., Type
Anaerobic incubator	1	F 11-700B	National 6136-J10
Analytical UV lamp for chromatography with spare parts	1	Ga LCF-7502	-
Aphrometer	1	LM QE-103	-
Arcometer series	19	LM -	-
Autoclave	1	LM ST-174/2	Sterilex
Autoclave	2	LM ST-133	Sterilex
Bacterial incubator for coliforms with accessories	1	F 11-716-150	
Balance analytical, electronic	3	G BFE 660W	Mettler HK-160
Balance analytical, mechanical	3	G BFB-220U	Mettler H-80
Balance microanalytical	1	G BFB-100T	Mettler M5SA
Balance top-pan mechanical	3	G BFE-830E	Mettler E2000
Balance top-pan electronic	2	G BFH-340H	Mettler PC2000
Balance top-pan electronic	1	G BFH-360-2	Mettler PC4000
Balance weights	2	T 1403-D10	
Bactericid lamp	2	LM-MIM MB-6709	-
Centrifuge	1	LM-MIM LZ-425	-
CO_2 tester	1	E. Haffmans	-
Chromatography tank with accessories	1	Ga - Holland CJA-654	-
Chromatography columns	5	Gr QCA-300-E	Quickfit No. 2
Chromatogram drying cabinet with spare parts	1	Ga OVL-220-010-W	-
Chromatogram evaluation table	1	LM-MIM OE-401	-
Combined development chamber (electrophoresis)	1	LM-MIM OE-207	-
Calorimeter with O_2 bomb	1	Ga CBA-302-010H	Autobomb

Equipment	Qty	Firm Catalogue number	Spec. No., Type
Dielectrometer with measuring	2	K. 238-020, -030 or last model -036, -038	-
Electrophoresis, polyacrilamid-gel	1	LM OE-110	-
Electrophoresis, medium voltage	1	LM OE-204, 205, 405	-
Electronic microbiological cell counter with accessories	2	F 7-910-1,2,4,6	-
Fluorescence spectrophotometer	1	HITACHI	Model 204 or last model
Fruit tester	2	LM-MIM QB-129	-
Fruit testing needle	2	LM-MIM QB-131	-
Fruit shatterproof tester	2	LM-MIM QB-130	-
Freeze drier	1	LM OE-950	-
Farinograph (evaluation of flour)	1	Brabender, FRG	-
Fermentometer	1	LM-MIM QE-101	-
Fraction collector with	1	Ga FMC-330-010F FMC-330-010X	Volumetric and time
Gerber fat determination set	1	Ga BS 696	-
Gluten washer	1	LM-MIM QA-104/1	-
Gluten elasticity tester	1	LM-MIM QE-101	-
Hand-refractometer 0-32%	2	ATAGO No. 311 N	-
Hand refractometer 28-62%	2	ATAGO No. 312 N	-
Hand refractometer 0-10%	1	ATAGO No. 316	N 10
Hotplates with spare parts accessories	2	Gri HPL-300-U	
Hotplate with spare parts accessories	4	Gri HPL 500	
Immersion refractometer with thermostate	1	K 365-350, 177 or last model 800	-
Infrapid 31 with grinder determination of f[illegible] protein moisture	1	LM-MIM QA-261, KO-25Z	

Equipment	Qty	Firm catalogue number	Spec. No., Type
Insectofon insect contamination tests	1	LM-MIM SM005	-
Laboratory mill with accessories	1	Ga MPF-300-U	Pascall Model g
Laminar flow-box			
Lovibond Colorimeter with accessories	1	K. 217-140	
Luniniscent tester	1	LM-MIM QB-111/1	-
Macro-Kjeldahl digestion apparatus	1	A/S N. Foss DK-3400, Hillerod	Kjel-Foss Aut.
Micro-Kjeldahl distillation apparatus with spares	1	Ga NKT-670 L	-
Macaroni breaker	1	LM-MIM QA-225	-
Micro wave baking oven	1	LM-MIM QA-226	-
Microscopes binocular	3	6540-425	Bristol Model 3000A
with accessories		6585-D15-F50	6587-F10
Microscope stereoscopic		T.6540-M30	Bristoline Model 3065 A
Melting, boiling & drop point tester	1	Ga MFM-300X	Mettler FP-5
Milk cleanliness meter	1		
Membrane filter	1	LM-MIM OX-215	60mm dia.
Membrane filter holder with flask	1	(THOMAS Catalogue (Schleicher & (Schuell 4616-N10	47mm dia.
Moisture balance	1	MRX-270-H	OHAUS 601-OH
Mixer-homogenizer	3	Ga. MPR-240-S	1-4 liter
Mixer emulsifier	3	Ga. MPR-730-V	300mm depth
Polarimeter with accessories	1	K.3411-200	
Polarimeter, Mitcherlich, full circle with accessories	1	K. FRC 3400-270	-
Polarimeter, Lippich with accessories	1	K. 340-30	-
Polarograph	1	YANACO P8	P8-FRE
Polarograph square waved	1	RADELKISZ OH-104	

Equipment	Qty	Firm catalogue number	Spec. No., Type
Pocket computer	8	-	-
PH-meter, digital with glass & calomel electrodes	2	F	ORION 701 A
Polarizing microscope with accessories	1	K 280-650	Carl Zeiss
Refrigerator	4	Gr RFP-010V	LEC 115 litres
Refrigerator	2	Gr RFP-350-E	LEC 180 "
Penetrometer, automatic	2		AP 4/2
Refrigerator for low temperature	3	Gr RFP-700H	LEC 260 "
Refractometer, Abbe	2	Gr RFA-340-010U	Bellingham & Stanley
Refractometer, Abbe	2	Gr RFA-400-010R	Bellingham & Stanley 60.
Refractometer, with butter scale	1	K. 363-610	Zeiss 500305
Sacharimetor	1	K. 340-900	
Sand bath	2	Gr BLD-350-U	
Soxleth extractors	12	Ga EXP-600-050E	
Soxleth water bath	2	Ga EXP-300-010R	
Slide microtome, with accessories	1	Leitz-Wetzlar	Rotary 1510
Sieve shaker, with sieves and sieve brush	2	Ga SIH-400-020X through 330W	BS 410
Table computer	3		
Thermostat	2	LM-MIM LP-120	
Thermostat	1	Ga TM-920	80°C
Thermostate cabinet (incubator)	2	Sc. Co. 11-690	
Thin layer chromatograph kit	1	T. 2734-J30	
Ultrathermostat	1	K 177-930 or last model	-15°C +150°C
Ultra-x balance (for moisture)	1	K. Schroder, D-694, Weinheim FGR.	No. 071
Ultracentrifuge, testing	1	Hitachi AE-0010	Model 55 P-2S

Equipment	Qty	Firm catalogue number	Spec. No., Type
Universal laboratory scaffold	3	Ga STH-250S Fig. 5.	Model 55 P-2S
Vacuum drying cabinet	1	K. 333-420	
Vacuum pump	1	Gr. PYB-550-M	EDWARDS Sp.2.
Valorigraph	1	LM-MIM	QA-205
Volatile oil tester	1	LM-MIM QB-113	
Water-bath	1	LM-MIM LP-516	24 places
Water-bath	2	Gr BKM-250-010P	15 litres capacity
Water-bath shaking incabator	1	Gr BKS-300-010F	15 litres capacity
Water-still	1	LM-MIM LD-103/2	10 litres/hour
Warburg apparatus with glassware complete	1	K. 433-000	-
Fume hoods	3	THOMAS/5165-K12	LABCONCO Standard 47

Notes to ANNEX 8

+ The Catalogues used:

Gallenkamp 1981	- Ga
Thomas Scientific Apparatus 1979	- T
Griffin Science and Education 80/82	- Gr
LABOR-MIM Hungary 1980	- LM
K.Kolb Scientific Technical Supplies 1974	- K

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Estimated Total Cost US $ 267,500

The estimated cost not including freight and insurance is based largely upon prices from the catalogues listed above. Where specific cost information was not available, estimates were made. Individual prices are available in the TIRDO project file.

Inflation and model changes will, of course, alter actual costs over time. Recosting will need to be undertaken at the time of procurement.

General laboratory glassware and chemical supplies are not included in this recommended list. Provisions should be made to indent such items together with the equipment procurement.