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IMPROVEMENT OF EFFICIENCY
OF PUBLIC SECTOR INDUSTRIES

DP/SUD/79/010

SUDAN

Terminal Report*

Prepared for the Government of Sudan
by the United Nations Industrial Development Organization,
acting as executive agency for the United Nations Development Programme

Based on the work of S.C. Bhattacharjya, Food Industries Expert

United Nations Industrial Development Organization
Vienna

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INTRODUCTION

As my mission work was a varied one with practical approach to achieve results on my recommendations, and as I had to carry out a large number of ad_hoc assignments on the requests of the Ministry of Industry, the Senior Industrial Field Adviser of UNIDO posted at Cairo and Khartoum, and other concerned organizations connected with my field work, I have prepared this report in a different format, giving to some extent details of work done for each assignment. This will enable the concerned organizations to deal with the food factories' problems in future, more or less on the same lines. However, recommendations have been given separately in Chapter 14 of the report to assist the policy makers to consider them for implementation.

II. ACKNOWLEDGEMENT

While carrying out my mission work, I received full cooperation from all concerned officials, Scientists, Technologists and Engineers in the Ministry of Industry, Ministry of Finance and Economic Planning, Food Industries Corporation and other concerned industrial corporations, including the Duty Free Shop Corporation, Industrial Research and Consultancy Center (IRCC), Food Research Centre, food processing factories in the public sector, Horticultural Research Corporation, Director of Horticulture, Director-General of Agriculture and Natural Resources at Juba and Wau, United Nations Development Programme, Khartoum and the Senior Industrial Development Field Adviser (SIDFA) of UNIDO at Khartoum, our Project Office, Embassy of the Republic of India, and the Royal Netherlands Embassy at Khartoum. I also had the opportunity to meet and discuss with His Excellencies, three Ministers of Industry, problems of food processing factories in the public sector, particularly those at Wau and Kassala.

Without their active cooperation, it would not have been possible to achieve the positive results that have materialized through my mission work. I sincerely acknowledge their cooperation and assistance and thank them for the same.

A list of such persons with whom I have dealt during my mission work is given in annexure 42.

III. ASSIGNMENTS

My original assignment was as a Consultant for four months, with possibility of extension, for the Wau Fruits and Vegetables Canning Factory at Wau in Bahr El Ghazal Region in the Southern Sudan in the Project DP/SUD/74/041 Improvement of Efficiency of Public Sector Industries (First Phase). To improve the production and technological operational efficiency in this factory was the main task of my mission. I took up this assignment on 7 April 1970 and was briefed on the subject in UNIDO Headquarters in Vienna on 9 and 10 April 1979. I arrived at Khartoum, Sudan on 12 April 1979 to start my work. On arrival I met, along with the Project Manager of the Project DP/SUD/74/041, the Managing Director of the Food Industries Corporation (FIC) at Khartoum, under which the factory was working as a constituent unit, and discussed with him the problems of this factory and plan of my mission work in Wau. During discussions, he suggested that in addition to Wau Factory, I should work for three other food factories in his organization at Khartoum, Kassala and Babanousa to improve their overall performance, and the Manager of the project agreed to it and requested me to take up the additional assignments as desired by the Managing Director, FIC. My first assignment was therefore expanded as soon as I arrived at Khartoum.

During the second phase of the project, its number was changed to DP/SUD/79/010, its objectives expanded and the Project Manager's title was changed to Chief Technical Adviser, the Chief Technical Adviser recommended further expansion of my activities to include, in addition to four food factories, two sweets factories in the FIC and work relating to capacity utilization of four sugar factories under the Sugar Industries Corporation.

The expanded duties were as follows:

The expert assigned to the Efficiency Improvement Unit of the Ministry of Industry will be expected to carry out the following tasks under the supervision and general guidance of the Chief Technical Adviser and, in cooperation with the national counterparts, other national and international staff of the project team, in particular the following:

1. Assess and improve the operating efficiency of the existing corporations and production units, including applicable recommendations on and integration within agro-industrial food complexes.
2. Evaluate the processes and methods and improve them as required.
3. Evaluate the quality control, setting adequate standard procedures; check and improve the adequacy of control laboratory procedures.
4. Determine correct yield and establish yield control.
5. Train all managers and supervisory personnel involved in manufacturing processes.
6. Establish production planning and control.
7. Analyze the present product lines and recommend alteration and/or addition within commercial possibilities and availability.
8. Give technical advice to the management of the corporations and the units present and planned production facilities.
9. Study the feasibility of the project.

During the third phase of the project, as a result of the industrial policy change of the Government with regard to public sector industrial corporations, emphasis was shifted direct to production units in three sectors of the industry viz Food, Textile and Leather and my mission was to give overall assistance to the public sector food processing units to solve various problems faced by them and thereby improve their productivity and profitability. While doing so, I was also required to look into the rehabilitation aspects of these factories and work out such programmes and assist in their implementation. In addition, I was required to attend to various ad_hoc requests of the Ministry of Industry and the Industrial Research and Consultancy Center (IRCC) the counterpart organization of the project for these factories and also for other industrial activities. In view of all these developments in the project, I had to change my work plan from time to time to meet the requirements of these factories, Ministry of Industry and the IRCC.

IV. WORK PLAN

To begin with, my work plan was prepared in consultation with the Managing Director of the Food Industries Corporation (FIC). It was visits to the food factories first and preparation of preliminary reports for their improvement for consideration of the FIC and assistance in implementation of recommendations. In between, I was to assist the Managing Director of FIC to prepare proposals to get external assistance for development of the food industry in Sudan. The Managing Director and his Deputy were considered as my

counterpart National Officers at Khartoum, whereas at the factory level, the General Managers of the factories were my counterpart National Officers. During the second phase of the project, in addition to what I was doing, in consultation with the Managing Director of FIC, additional work plan was prepared to carry out work based on the expanded duties. In this additional work plan, emphasis was laid on determination of capacity utilization for food and sugar factories and analysis of difficulties that stand on the way to obtain designed capacity for each factory. It was also decided at this time that a Senior Officer of the FIC should be with me in the Project Office as a National Counterpart Officer so that he could be associated with day to day work of the Efficiency Improvement Unit (EIU) that was set up under a Ministerial Order from the Ministry of Industry that worked as a counterpart organization of the project. The Chief Engineer of the FIC who is also a Food Technologist, and who was the General Manager of Babanousa Milk Products Factory for ten years was therefore posted from January 1981 as my National Counterpart Officer. He worked with me up to September 1983.

During the third phase of the project, when the FIC was abolished along with other public sector industries corporations, emphasis in my work plan shifted to sectoral basis and direct assistance to food factories as recommended by the UNDP/Government Evaluation Mission in March 1982. At this stage, the Industrial Research and Consultancy Center (IRCC) was made the National Counterpart Organization of the project in place of EIU that was recommended to be abolished by the said Evaluation Mission. A senior officer (Chemical and Process Engineer) from IRCC was posted in the project office to work with me as a National Counterpart Officer in place of the previous counterpart officer from the FIC. However, it was decided that I should take from IRCC

Other concerned officials to work as my counterparts as and when necessary. It was also decided that in view of the new approach of the Project on sectoral basis, I should submit my plan of work for approval of the Minister of Industry. I therefore prepared and submitted my work plan accordingly and it was approved with some additional work given by the Minister of Industry. This work plan should be seen in annexure I of this report. Whenever I prepared a work plan in consultation with the concerned authorities, emphasis was given on practical approach for development and solution to problems.

V. FOOD INDUSTRIES CORPORATION

I started my mission work with the Food Industries Corporation (FIC). It came into existence along with other industries corporation after the Industrial Production Corporation was abolished in 1976. Besides the six food processing factories that were getting assistance from our project, the corporation had under its management one large scale wheat flour mill in Khartoum North that was nationalized and the Blue Nile Packing Corporation that was engaged in the manufacture of packages mainly for the factories under FIC.

The FIC was staffed with qualified and experienced technical personnel who interacted with me fully in implementing more of my recommendations to improve the conditions of food factories particularly that of the Wau Fruits and Vegetables Canning Factory. After its abolition, a small central marketing unit has been set up at Khartoum to assist the factories in marketing their products in and outside Sudan. This unit has also cooperated with me to a large extent while I did work to solve some marketing problems of Kassala Onion Dehydrating Factory and Kareima Fruits and Vegetables Canning Factory.

VI. WAU FRUITS AND VEGETABLES CANNING FACTORY

This factory is one of the four public sector food processing factories set up in early sixties in four regions of the country with technical and economic assistance from USSR. It is situated at Wau in Southern Sudan. Wau is connected with Khartoum by rail, road and air. The initial investment on factory buildings, staff quarters, machinery and equipment was of the order of Ls. 1.06 million. Eight hundred feddans of land were given free by the Government to establish the factory, buildings, staff quarters and develop a captive farm to grow raw materials for processing. Its construction started in 1963 and it was commissioned in 1968. During 1968 to 1984 a small additional capital investment of Ls. 0.01 million has been made. The total up-to-date investment is therefore Ls. 1.07 million.

The machinery and equipment of the factory have been designed mainly to manufacture tomato paste. However, utilizing some of these machinery and equipment, the factory can make on a small scale, a few products from pineapple, mango, citrus fruits, egyptian beans and meat. The capacity of the factory has been worked out by me as below:

a) Tomato paste (concentration 28° Brix)	6 tons/day
b) Various types of pineapple and mango products	3 tons/day
c) Canned vegetables including different types of beans	4.5 tons/day
d) Various types of jams	3 tons/day
e) Various types of syrups	3 tons/day
f) Canned meat	1 ton /day

This factory was an important agro-based food processing unit in the Southern Sudan and it can play a very good role in economic development of the area. If it is operated properly and efficiently then it will not only generate enough employment potential but will also bring adequate economic benefits to the farmers engaged in growing fruits and vegetables and rearing livestock. However, until now, it has not been possible for the factory to play any significant role in the economic development of the area because it could not be run properly right from the start due to many problems. During my first visit to the factory, I therefore identified these problems, discussed them with the Managing Director of FIC and on his request, initiated action to find solutions for some of them. The preliminary report that I submitted after my first visit to this factory should be seen in annexure 2.

Though this factory has been equipped on an automatic machinery line to process 50 tons of fresh ripe tomatoes into paste per day, yet it appears that no study was made before establishing this factory with regard to availability of tomatoes in Wau area to meet raw material requirement of the factory and as a result, it could not work, even for a single day, to make the main product (tomato paste) from tomatoes grown in Wau area until tomatoes were grown in the farm of the factory and processed into paste in 1981 through direct assistance from me. In the absence of the main raw material (tomatoes) the factory was depending on imported tomato concentrate to manufacture occasionally tomato paste through re-constitution but it did not work well because of the difficulty of foreign exchange to import tomato concentrate and of its spoilage during transportation from Port Sudan to Wau, a distance of more than 2,000 kilometers.

During my first visit to this factory, I found that due to nematode attack on tomato plants in Wau area, it had not been possible to grow tomatoes for

processing in the factory. I therefore thought that something must be done to solve this problem first, otherwise it will be very difficult to improve its condition. I found that previous attempts to solve this problem were mainly theoretical and of advisory nature and no practical approach was worked out except an attempt by the Horticultural Research Corporation at Wad Medani to grow tomatoes along with other vegetables on an experimental basis in Wau area in the early seventies. This attempt was also not successful due to some reasons beyond the control of the Corporation. I recommended growing of nematode resistant tomato varieties and on a request from the Managing Director of FIC, I agreed, based on my horticultural background, to carry out an experiment in this regard in Wau area by bringing nematode resistant tomato seeds. However, I thought that as it was a raw material growing problem, I should involve the Food and Agricultural Organization of the United Nations and accordingly, I requested the Resident Representative of FAO to get a small quantity of nematode resistant tomato seeds for the experiment, but the FAO Resident Representative, after taking advise of his Horticultural Expert and Soil and Crop Investigation Expert, both working in the South, had reservation carrying out such a practical experiment and therefore I had to look to other sources to get the required tomato seeds and that I could get through the Embassy of India at Khartoum.

As carrying out such a practical experiment to solve the main raw material problem of the Wau Factory was an important step in the right direction, the Resident Representative at UNDP in Khartoum, the Programme Officer for our project in UNDP, the Ministry of Planning of the Government, Horticultural Research Corporation, Horticultural Department of the Government and the Director General of Agricultural and Natural Resources of the Southern Region took great interest in the experiment and extended full cooperation to make it successful. The extent of interest generated on my approach can be seen from

the two letters written by the Resident Representative in UNDP Khartoum to the Under Secretary Ministry of Planning, Khartoum, with copy to all concerned in December 1979 and February 1980. They are annexures 3 and 4 respectively of this report.

I got one kilogramme of nematode resistant tomato seeds (variety S-120) from the National Seeds Corporation of India through the Embassy of India, Khartoum and organized an experiment in cooperation with the management of the factory, Food Industries Corporation, Director General of Agriculture and Natural Resources of the Southern Region, Commissioner of Agriculture of the Bahr El Ghazal Province, Halima Experiment Station near Wau and the Horticultural Research Corporation, Wad Medani. It was carried out in three places, one in the captive farm of the factory, one in the agricultural farm of the region at Bussen; situated at a distance of ten kilometers from the factory and one at Halima Experiment Station situated at a distance of 25 kilometers from the factory. The design of the factory, fertilizer doses, agricultural practices and reporting system that were worked out by me in the Wau factory, in consultation with all concerned, were identical in three places. A copy of the monthly reporting system for this experiment should be seen in annexure 5. The officials in charge of the experiments were guided properly after analysing their monthly reports of performance of the experiments. As a result of this joint efforts, the experiments in all the three places were successful. However, in the captive farm of the factory, the result was slightly better. The experiment was therefore repeated in the captive farm, on a request from the FIC, by bringing ten more kilos of the same seeds. It was also successful and some quantity of tomato paste was made from tomatoes grown under this experiment, and its quality evaluated in comparison with the imported tomato paste through consumers' reactions at Juba, Khartoum and Wau.

and the product was found to be good as the imported stuff. These two experiments indicated the following:

- a) The nematode resistant tomato variety S-120 can be grown in the Wau area and it is a prolonged yielder, and as a result, tomato paste manufacturing period of the Wau factory can be for a longer duration.
- b) Adequate irrigation is required for successful growing of this variety; during the two experiments, it was done manually, but to grow this variety on a commercial basis in the captive farm of the factory, proper irrigation facilities should be organized.

After making this break through, the factory wanted arrangements for seeds of this variety so that it can grow its main raw material for processing into paste. As it was difficult for the factory to arrange foreign exchange to import these seeds from India, I organized, in cooperation with the Embassy of India, Khartoum, FIC, and officials of the Government of India who came to attend the meeting during the UNIDO/Government Solidarity Meeting at Khartoum in March 1981, for the supply from India of 50 kilogrammes of tomato seeds of S-120 variety annually free of cost for five years from 1982 to 1986. Through these arrangements, 150 kilogrammes of S-120 variety seeds have already been received by the factory from the Government of India.

After coming to know the results of experiments to grow tomatoes for processing into paste in Wau Factory, the farmers of the area showed interest in growing this variety of tomato to meet the raw material requirement of the factory and they were supplied with some seeds by the factory management.

Realizing the fact that it is not desirable for the factory to depend on only one variety of nematode resistant tomato and on one source of supply to meet its main raw material requirements for processing, I brought in 1983 from the United States of America two more high yielding nematode resistant tomato seeds (one kilo of each variety) for this factory and got them to grow on an experimental basis in its captive farm. Both these varieties have been found successful in Wau area.

This positive contribution to the Wau factory has convinced its management and all others concerned that the factory can manufacture tomato paste of acceptable quality from nematode resistant tomatoes that can be grown in its captive farm and by the farmers in Wau area, and meet the demand of this essential product in the Southern and Western areas of the country, thereby assist in saving valuable foreign exchange through import substitution.

In order to assist the factory further in growing its main raw materials for processing in future, I brought in early 1985 free of cost, 2.5 kilogrammes of FURADAN, a nematicide from the Agricultural Chemicals Group in the FMC Corporation, USA and sent it to the factory for application in the soil on an experimental basis. This chemical can make the soil nematode free and after that any high yielding tomato variety suitable for processing can be grown by the factory and also by the farmers. If this experiment which has not yet been carried out is successful, then it will be a another break through for the factory to get its main raw material supply from the Wau area itself.

I identified that processing pineapples and mangoes has got a very good potential for Wau factory. However, pineapples are to be brought from source Yubu, Nzara, Yambio, Maridi, Ezo and Tambura in Equatorial Provinces far away from the factory. To get pineapples for processing from such distant places not only adds to transportation cost of raw materials, but there are possibilities that the Wau factory may not get enough pineapples from these places in future for processing in the event of setting up a processing factory in one of these places. (During my visit to these places in 1980, I was told by the concerned officials of the idea of setting up a fruit processing plant particularly to process pineapples in one of these places). I therefore organized on an experimental basis, growing of pineapples in the captive farm of the factory by bringing planting materials from Nzara and it was successful. The factory can therefore organize growing of pineapples also along with tomatoes for processing. This is essential, otherwise, it may face in future the same situation with regard to pineapple as it faced with tomatoes right from the start of the factory.

Realizing that it will be difficult for the factory to organize an irrigation system to grow tomatoes and pineapples on a commercial scale unless it is assisted in this regard, I collected from Dunlop Irrigation Services, Thame, Oxfordshire, England, adequate information for Sprinkle/Drip Irrigation System to irrigate 25 feddans of land in the captive farm of the factory. I also suggested to the Ministry of Industry that as it is a raw material growing problem, the FAO of the UN at Khartoum should be requested to take a project to assist in developing a suitable irrigation system to grow, on a commercial scale, nematode resistant tomato varieties that have been successfully introduced by

UNIDO/UNDP project in Wau area.

Taking into consideration potential of development of pineapple and mango processing in Wau factory, I suggested setting up of an independent semi-mechanized medium processing line in the same factory premises for these two fruits with capacity to handle ten tons of pineapples and ten tons of mangoes a day and to assist the factory. In this regard, I got for it a power driven pineapple slicing machine free of cost under TCDC Programme from India. I also got some pineapple punchers and corers that operate manually. Based on my recommendation, the Ministry of Industry has requested, through proper channels, the Government of India for a complete pineapple and mango processing line with appropriate boiler for this factory under its ECDC Programme. If it materializes then it is going to be another positive step for proper development of Wau factory in the right direction. Before creating such facilities, I standardized manual production and quality control procedures to enable the factory to manufacture on, on a small scale, different types of pineapple and mango products and based on them, the factory is continuing production of such products.

Training being essential for successful production operations, I gave practical training in the factory to the technical personnel in production, quality control and storage sections. In addition, I organized theoretical and practical training in India under TCDC Programme for six months for the Assistant Production Manager and the Horticultural Officer of the factory. Practical training for the Horticultural Officer in growing nematode resistant tomatoes was organized by me for six months in the Horticultural Research Corporation

at Medani and practical training for quality control was organized for three months for the Assistant Quality Control Manager of the factory in the food division of the Industrial Research and Consultancy Centre at Shambat.

The condition of the Nau factory started deteriorating in 1975-1976, and though the problems of the factory with suggested solutions were identified by me in 1979, its conditions became precarious in the beginning of 1980 and it was on the verge of closure. Therefore the Managing Director of FIC (now dissolved), in consultation with me and with the approval of the Minister of Industry, took a small rehabilitation programme for this factory for three years from 1980-1981 to 1982-1983. I assisted in the preparation of this programme that may be seen in annexure 6. Through implementation, with assistance from me and my national counterpart, the factory could revive production and made 159 tons of various products valued at 0.25 million Sudanese Pounds. However, due to diversification of funds for obligatory commitments for laid-off workers, the programme could not be successful and as a result, the Ministry of Industry and the Ministry of Finance and Economic Planning again wanted a comprehensive rehabilitation programme to be prepared for this factory with our assistance. This has now been prepared by me and my national counterpart for three years from 1984-1985 to 1986-1987. A copy of this programme has been enclosed separately as annexure 7 of this report. In order to implement this programme, the Ministry of Industry has formed one Monitoring Committee and one Implementation Team. I have been made an Advisor to the Monitoring Committee and Implementation Team, and my national counterpart has been made a member of the Implementation Team. the Monitoring

Committee, based on the Rehabilitation Programme, has taken a crash pilot programme for three months to find out whether the Rehabilitation Programme can be implemented under the prevailing conditions.

After getting positive results from my work as mentioned above, the factory management started taking comprehensive assistance from me and my national counterpart, and therefore we had to assist the factory Manager in preparation of his three years' investment plan and also annual production planning supported by budgetary requirements to be presented to the Ministry of Finance and Economic Planning through the Ministry of Industry for consideration and approval.

The crash pilot production programme taken by the Monitoring Committee, if properly implemented and evaluated, will indicate that this factory can be run at a profit and therefore it should be provided with inputs as indicated in the rehabilitation programme.

VII. KASSALA ONION DEHYDRATION FACTORY

This is one of the four food processing factories set up in early sixties with assistance from the USSR. It was established at Kassala in the Eastern Region, a traditional onion growing area of the country to produce dehydrated onions for export. The area being good for horticultural produces, the farmers here, besides onions, grow a number of other fruits and vegetables like citrus fruits (particularly grape fruits) bananas, guavas, tomatoes, ladies fingers, potatoes, sweet gourd, and eggplants, etc. The machinery and equipment have been supplied by M/S TECHNOEXPORT, Sofia, Bulgaria, with

designed capacity to dehydrate 50 tons of onions per day. Besides peeling and washing operations and packing of finished product that are carried out manually, other operations are automatic. However, bean driers had to be installed at a later stage of drying.

This factory has played an important role in economic development of Kassala area, particularly that of the onion growers and workers who work in the factory during production season, but its main contribution is earning of valuable foreign exchange for the country.

It started production in 1961-1967. In the initial stage it experienced difficulties in getting grown proper variety of white onion that gives a good yield and quality product. These were overcome by 1966-1969, when an indigenous variety of white onion, NASI was developed and introduced for the factory. When I visited the factory in May/June 1979, I found that it was sliding down and therefore, after analysing the problems faced by the factory, I suggested a 'Rejuvenation Plan' in my preliminary report that has been given as annexure 8 of this report. This plan had been considered at various stages by the FIC and it was thought that in order to implement it, it is better to examine the possibility of developing an agro-industrial food complex at Kassala. In this context, I was requested to prepare data sheet by the Senior Industrial Development Field Adviser. This was prepared and submitted for consideration and it may be seen in annexure 9. I was also requested to collect further information on the proposal which was done in a preliminary manner and submitted to the Chief Technical Adviser of the Project. This may be seen in annexure 10.

After the reorientation of the project on sectoral basis, I was requested by the Special Advisor to H.E. the Minister of Industry to give topmost priority to this factory to solve its problems relating to production, quality and marketing. It faced a serious problem in 1982 and 1983 with regard to quality and as a result, its production and market started dwindling, and there were frequent complaints on quality from buyers in Holland and West Germany. Therefore, my national counterpart and I gave full attention to this factory and made frequent visits to improve operations as far as possible with available inputs and facilities. Our visits resulted in the following:

- a) Proper production planning and operations and installation of a quality control system (annexure 11). The production increased from 110 tons to 410 tons and quality improved substantially.
- b) Introduction of monitoring system to oversee the progress and problems (annexure 12).
- c) Provision from the project, on cost sharing bases, essential critical spare parts such as stainless steel onion cutting knives, variator chains and steam traps to improve production quantity and quality.
- d) Adequate and enlarged marketing information in West Germany and Holland with assistance of the International Trade Centre at Geneva, through its project in the Ministry of Commerce, Supply and Cooperation at Khartoum, and sale of the dehydrated white onions in large quantity to traditional and new buyers in Holland.
- e) Introduction of handling and transport system in consultation and cooperation with Sudan Shipping Line so that dehydrated white onions for export leave Port Sudan within 72 hours from the time of despatch from the factory warehouse.

While carrying out intensive work in this factory at the request of the Ministry of Industry, it became clear that as its machinery and equipment had been in operation for near about 20 years, they need replacements and spare parts, and unless this is done it will be difficult to increase the production consistent with quality and costs. Therefore, proposals (annexure 13) were made to the Ministry to arrange essential critical spare parts on an urgent basis. However, due to foreign exchange difficulties, it could not so far be done. In view of this difficulty, attempt was made to involve some other organization to get economic and technical aid to improve the condition of Kassala factory and it was found that the Government of Netherlands was assisting in horticultural development in Kassala area and also in creating processing facilities for fruits and vegetables by way of assisting in establishment of a small fruit juice plant at Kassala. The Charge d'Affaires of the Royal Netherlands Embassy at Khartoum was therefore requested to consider giving technical and economic aid for the rehabilitation of this factory. The first letter written to him in this regard may be seen in annexure 16. The proposal was discussed at various levels and it resulted in fielding a mission by the Government of Holland in March/April 1985 to examine the possibility of rehabilitating Kassala Union Denydration Factory. The mission has submitted its report and it is under consideration of the Government of Holland. As this proposal was initiated by me, the Government of Holland requested my comments on the Mission Report and the Ministry of Industry wanted my coordination and follow-up in finalizing the proposal. My comments may be seen in annexure 17.

VIII. KAREIMA FRUITS AND VEGETABLES CANNING FACTORY

This is the first factory I was requested to visit by the Managing Director of the FIC. It is one of the four factories set up in early sixties with technical and economic assistance from USSR. It is situated at Kareima in the Northern Province of the northern region. The place is by the side of the River Nile and well connected with rail, road and air. The Kareima, like Kassala, is a good horticulture-produce growing area. However, in this area, in addition to fruits and vegetables, egyptian beans of good quality are grown on an extensive scale. The main fruits and vegetables of the area are citrus fruits, mangoes, dates, tomatoes, green peas, etc.

This factory was originally equipped to process into paste 50 tons of tomatoes per day. Later on, additional machinery and equipment were installed to process another 72 tons of tomatoes into paste. The present designed capacity of the factory is therefore to process 122 tons of tomatoes per day. Though tomato paste is the main product of the factory, yet it can make on a small scale by utilizing some of the equipment of tomato paste line, different types of products from citrus fruits, mango and egyptian beans. In addition to fruits and vegetables processing, there is a small dates processing factory at Kareima under the management of Kareima canning factory. The present annual capacity of Kareima factory for various products has been worked out by me as below:

- | | | |
|----|---|--------------|
| a) | Tomato Paste (made from tomatoes grown in Kareima and from assorted tomato concentrate) | - 3,240 tons |
| b) | Canned fruits and vegetables including beans | - 1,080 tons |

c)	Fruit juices	-	720 tons
d)	Fruit jams	-	60 tons
e)	Packed dates	-	1,700 tons

The maximum and minimum production so far of these products are as follows:

a)	Tomato paste	i) maximum	-	1,124 tons
		ii) minimum	-	39 tons
b)	Canned fruits and vegetables including beans			
		i) maximum	-	731 tons
		ii) minimum	-	27 tons
c)	Fruit juices	i) maximum	-	196 tons
		ii) minimum	-	1.5 tons
d)	Fruit jams	i) maximum	-	128 tons
		ii) minimum	-	0.6 tons
e)	Packed dates			190 ton average per year.

The preliminary report submitted by me after my first visit to the factory may be seen in annexure 18.

During my work in this factory, I have found that though Kareima is a good tomato growing area, yet, due to low financial return in comparison to other fruits and vegetables particularly beans, the farmers are hesitant to put more land under tomato cultivation. This may create problems for the factory in the future to get on a continuous basis enough tomatoes for processing. To assist the factory to avoid such a problem, one kilogramme each of twelve high yielding varieties of tomatoes suitable for processing into paste were brought by me from the United States of America on cost-sharing basis for carrying out experiments in Kareima to select suitable varieties so that from the same area

of land under tomato cultivation, the farmers can get at least double the present production.

Similarly, three kilos each of three high yielding tomato varieties from India, one kilogramme each from Bulgaria and Holland were brought. After carrying out the experiments, the best variety (ROMA VF) was identified and 250 kilogrammes of seeds of this variety have been brought from Holland under cost-sharing arrangement. Quality of tomato paste made from this variety has been found to be very good. The direct assistance from the project has put the factory on proper direction to achieve in the near future designed capacity to manufacture tomato paste. To assist the factory further in this regard, suggestion to introduce 'hydroponic' system to grow tomatoes for processing has been given and adequate information has been collected and given to the FIC for consideration. Yield of tomatoes under this system has been reported to be 120 tons/feddan and it is ideal for desert condition.

In addition to main raw material problem, I have found that in order to compete in the market, the factory needs improvement in packaging, particularly in labelling of tomato paste cans and packing of fruit juices, I have therefore suggested that the factory should lithograph its cans, particularly those used for packing tomato paste and it should introduce trigger top cans for packing fruit juices and nectars. In order to assist the factory in this regard, adequate information on lithographing has been collected and passed on to the management.

The personnel working in the production and quality control sections have been given practical training, and new products formulation, particularly from mangoes have been given for diversification of production. The new Production Manager has also been trained under ICDC programme in India for four months in processing of fruits and vegetables.

On the request of the Ministry of Industry, the factory has been assisted for the following:

- a) Selection of a power driven automatic jam filling machine.
- b) Assessment of the quality of mango products.
- c) Assessment of quality of tomato paste (annexure 20)
- d) Assessment of quality of imported tomato concentrate (annexure 21).
- e) Marketing of tomato paste (annexure 22).
- f) Preparation of a status report for consideration of the Northern Regional Government to examine the possibility of taking the management of the factory from the Central Government.
- g) Urgent requirement of tomato concentrate and tins (annex. 23).

In addition, in order to enable the factory to make its own tomato concentrate and pack it in large tin containers (3.2 kilos capacity) for use as raw material to make tomato paste through the year, an experiment was carried out in association with the Food Research Centre, Shambat, by bringing this type of containers from the project.

IX. BABANUSA MILK PRODUCTS FACTORY

This is one of the four food processing factories set up in the early sixties with technical and economic assistance from USSR to process milk in various forms. It is in the western part of the country where livestock population is high and milk availability was considered to be adequate. The factory was equipped to make milk powder (both whole and skimmed) butter, cheese, and butter oil by collecting milk from areas adjacent to Babancusa. It was set up

at an estimated cost of Ls. 1.5 million and commissioned in 1968-1969. In the beginning, it could collect sufficient milk and make the market products as intended, but after a few years it experienced difficulties in getting adequate milk because of the movement to the south in summer months of the nomads engaged in milk production in traditional milk producing areas near the factory.

As a result, milk products manufacturing activities of the factory slowed down and the factory had to examine the possibility of utilizing the machinery and equipment to manufacture some other products. This resulted in manufacturing Karkadeh powder by extracting, concentrating and drying rosella (*Hibiscus Sabdariffa*) calices and gum arabic powder. Rosella and gum arabic are available in the area in large quantities. Recently the factory has also started manufacturing 'Aradeb' powder from aradeb (local name) a plant of the tamarind family.

The following programme of work was suggested for the factory:

"As adequate quantity of milk is not available in the area, the factory is now manufacturing dehydrated karkadeh and gum arabic. A study therefore will be undertaken to find out whether the factory should completely switch on to dehydrate karkadeh and gum arabic and if so, what are the additional facilities required. In addition, study will be undertaken to improve processing techniques, particularly extraction and clarification of karkadeh solution to reduce hygroscopic nature of the final product, and also to make different types of karkadeh products. Assistance will also be given to create sustained export market for dehydrated karkadeh."

H.E. the Minister of Industry approved the above programme with the following remarks:

The study on Babanousa Milk Products Factory should include karkadeh growing in that region and find out a relationship with the farmers so that quality and quantity should improve."

While I was organizing the above study involving Sudanese officials as will be seen from the correspondences at annexure 24, the Evaluation Mission that evaluated the project in May 1984 deleted it from my programme of work for reasons best known to it and as a result, a very important and relevant study could not be carried out. However, realizing the importance and potential of Karkadeh powder, particularly in export markets, I initiated action to get clearance of this product from the Food and Drug Administration of USA. The correspondences in this regard are in annexures 25. Also, on the request of the Ministry of Industry, I prepared the fifth Three Years Investment Programme for this factory.

X. KRIKAB INDUSTRIES CORPORATION (Sweets Factory)

This factory which was started by a private organization in 1957 to manufacture hard boiled and soft boiled sweets was commissioned in 1958, and it was nationalized in June 1970. When the project was oriented to sectoral basis, this factory was included for assistance from the project. The following programme of work was suggested for this factory and it was approved by H.E. the Minister of Industry.

"Two Sweets Manufacturing Factories in Khartoum North

These two factories were nationalized in 1970. In order to work out a developmental plan for them, analysis of their present status and scope of development in the future will be undertaken. In addition, introduction of some new technology such as dehulling of sesame seeds that has already been undertaken on an experimental basis will be continued.

Accordingly, a report on this factory indicating its present status and future prospects has been prepared involving the Industrial Research and Consultancy Centre, the national counterpart organization of the project. This is in annexure 43.

XI. REA SWEETS FACTORY

This factory was established by a private company in 1952 and commissioned in 1959 to make 'Tahinia' an indigenous sweet based on sesame seeds and sugar. It was nationalized in 1970 and after orientation of the project to sectoral basis in 1982, this factory was included for assistance from the project on the request of the Ministry of Industry. When collection of information for analysis and preparation of developmental programme as done for the Krikab Sweet Factory was in progress, the Evaluation Mission that evaluated the project in May 1984 deleted it from my programme of work and as a result, I could not prepare the desired report for its development. However, experiment to decuticle sesame seeds with lye treatment has been completed by utilizing the pilot plant facilities of the Food Research Centre, Shambat. This will enable the factory to prepare sesame seeds for processing at a lower cost

than the costs now involved in the technological operations followed. But the new technology could not be introduced in the factory because by the time the experiment was completed and results obtained, this factory was deleted from the work of the project by the Evaluation Mission.

XII. FACTORY BY FACTORY ANALYSIS

When the project was oriented to sectoral basis, my work plan was to assist the food processing factories in all possible manner to solve all types of problems faced by them to increase productivity and profitability. To do this, I thought that first of all, a complete analysis of all operational activities should be done for these factories to identify properly their problems and then work out possible solutions. This idea, when presented to the Ministry of Industry, was appreciated and approved for plan of action. Accordingly, I, along with my national counterpart, designed 14 questionnaires covering all operational aspects of the factories and sent them with a forwarding letter (annexure 14) to their General Managers to fill and send them back to us for analysis, identification and suggested solutions. Fourteen questionnaires may be seen in annexure 15.

Based on the information given by the factories on these questionnaires (some of them had to be assisted by us to fill them properly) the following documents could be prepared by us:

1. Present Status and Future Prospects (1984-1998) for Krikab Industries Corporation (Sweets Factory)
2. A detailed Rehabilitation Programme (1984-1985 to 1986-1987) for the Wau Fruits and Vegetables Canning Factory.

3. A tentative rehabilitation programme for the Kassala Onion Dehydration factory giving emphasis on replacement/supply of spare parts for worn out machinery and equipment. This resulted in creating interest with the Royal Netherlands Embassy at Khartoum to get prepared, through a Dutch Mission, a rehabilitation programme for this factory to consider Dutch technical and economic aid in this regard.

The system of factory by factory analysis proposed by me has been adopted in other sectors of the project also, and the Evaluation Mission (May 1984) gave a lot of emphasis on this approach.

XIII. FOOD INDUSTRY IN SUDAN

Though my mission work was directly connected with the 6 food processing factories in the public sector out of which four are engaged in processing and preservation of fruits and vegetables in one form or the other and two are manufacturing hard boiled and soft boiled and indigenous sweets, yet on the basis of my knowledge and experience for other types of food industries, I was requested by the Director General of the IRCC to prepare a paper on Food Industry in Sudan showing its importance and relevance in economic, regional and rural development of the country. Accordingly, a paper was prepared for consideration and discussion. A copy of this paper may be seen as annexure 34. This gives an idea of the importance and need of development of the food industry in Sudan.

XIV. RECOMMENDATIONS

Based on my detailed mission work, the following observations and specific recommendations are made:

a) Observations

- 1) As present status of horticulture and its potential for future development is good, it is necessary to take appropriate action to develop further conservation, preservation and processing facilities that include development of cold storage, setting up of grading and packing stations and preservation and processing factories, including freezing and dehydration plants. Location of such facilities, either in growing areas or mass consumption areas should be determined after proper analysis of each proposition.

Such development will prevent spoilage of horticultural produces which is estimated to be 25 to 30% at present.

- 2) The present six food processing factories in the public sector are in 3 categories, namely export-oriented, import substitution oriented, and manufacturers and suppliers of some high-calorie low-priced products. They are therefore in a position to contribute further in achieving socio-economic goals of the country. In fact they are playing such a role since a long time.

- 3) The markets for the products of the 6 factories are good. In fact, they cannot at present meet fully market demands of their products. As success of any industrial venture ultimately depends on available markets, it is reasonably concluded that if necessary, inputs are given to these factories in time, they can be profitable ventures without much difficulty.
- 4) The 4 factories at Kassala, Kareima, Babanousa and Wau are earning directly and indirectly foreign exchange for the country. Further assistance to their development should be viewed, keeping this aspect in mind.

b) Recommendations

1) Kassala Onion Dehydration Factory

The joint efforts of the project and the Ministry of Industry have resulted in the preparation of a rehabilitation programme for this factory by a Dutch Mission. It is now under consideration of the Government of Holland to give technical and financial aid for its implementation. If it materializes, then there should not be much difficulty in rehabilitating this factory, otherwise, the following inputs are recommended to resume production consistent with high quality for export markets.

- a) Out of the four dehydrators in the factory, two should be fitted with new stainless steel drying belts and non-return valves. If this is done, then dehydration operations can successfully be carried out in them at least for another five

years. These spare parts are available from BIDINVEST, Sofia, Bulgaria at an estimated cost of US\$ 22,000 C.I.F. Port Sudan (cost of four drying belts and 30 non-return valves). The machinery and equipment for Kassala factory were supplied by M/S TECHNOEXPORT, Sofia, Bulgaria and at present M/S BIDINVEST, do the work of this organization.

Simultaneous action should be taken to select two new dehydrators that operate on modern technology to dehydrate white onions. It should be done through invitation of tenders. If this is done simultaneously in two stages in this manner then the factory can resume quality production in 1987 and the initial cost will be less. By the end of 1987, the factory can get two new dehydrators installed and use them from 1988 production season onwards. At that time, it can either use the old dehydrators to manufacture toasted onions or take action to replace them with new ones.

- b) The bin driers installed in the factory at a later stage on indigenous design to complete the last stage of drying operation need proper repairs that can be carried out locally without any difficulty.
- c) Either suitable magnets or electro-magnetic fields or metal detectors should be set up in suitable places in the inspection belts for the finished products; it will be better to fit one of the gadgets at the end of the inspection belt.

- d) At least one cleaning machine should be set up to remove non-metallic impurities such as pieces of dried stalks and peels of onions.
- e) Another weighing machine with circular weighing disc to weigh 50 kilos of materials should be arranged.
- f) At least 50 stainless steel onion cutting knives should be brought from Bulgaria.
- g) One simple moisture determination instrument should be arranged for the control laboratory.
- h) The boiler that is more than 20 years old should be repaired or replaced.
- i) All the compressors and pumps used for cooling the four finished products rooms should either be repaired or replaced.
- j) Though the factory has now got electric power from the mains in the town yet it is essential to keep at least one generator of the factory in good working condition so that it can be used in the event of power failure from the mains to supply power to the finished products rooms that need continuous cooling when the dehydrated onions are stored.

- k) A contingent programme for rehabilitation of the factory incorporating the inputs from a to j as indicated above, financial requirements, including working capital and income from export of the finished product should be prepared and kept ready for implementation urgently to catch the 1986-1987 season in the event of not getting technical and economic aid from the Dutch Government.

The Kassala Onion Dehydration factory has earned foreign exchange for the country right from the year it started production and it has a very good potential to do so for many years to come provided its twenty years old machinery and equipment are replaced/provided with adequate spare parts. Keeping this point in view, it is worthwhile to invest money in its rehabilitation.

- l) At present the factory sells its product in West Germany through an agent who gets 2% commission. The agent has not been found to be very effective during the last few years, and as a result, the Marketing Unit of the erstwhile FIC at Khartoum had to put during these years a lot of efforts with assistance from the project to sell its products to other parties after storing it for a long time.

As dehydrated white onions manufactured by Kassala factory is now known in West Germany and Holland markets, it is advisable to sell it direct in these and other markets. This will bring a little more bit more profit to the factory.

2) Kareima Fruits and Vegetables Canning Factory

This factory is now in a better position in comparison with the other food processing factories in the public sector. However, in order to maintain its present status and carry out further development, the following recommendations are made:

- a) The high yielding tomato varieties that have been successfully introduced in Kareima areas should be continued to be grown and for this purpose arrangement should be made in advance every year to get adequate quantity of seeds.
Two hundred and twenty-two kilogrammes of tomato seeds of high yielding varieties have been arranged for the factory from the project from the U.S.A., India, Bulgaria and Holland.
- b) A study should be made by the Department of Horticulture and the factory management to find out whether tomatoes can be grown in the islands of the River Nile within a radius of 50 kilometers from the factory and if so, such islands should be identified and adequate number of power driven small boats fitted with bergers (capacity at least 50 tons each) should be provided.
- c) Hydroponic system that has been preliminary investigated by the project to grow tomatoes for this factory should be examined further because if it is found feasible for installation the area, then there will not be any raw material problem for the factory in the future because yield per feddan in this system is extremely high (121 tons). However, a lot of socio-economic aspects is involved in the introduction of such a system, and therefore they need careful study.

d) In addition to tomato paste, the factory is now making, on a small scale, products from mango, citrus fruits and beans by utilizing some of the machinery and equipment of tomato paste line. As potential for processing these fruits and beans is good in Kareima area and as market for products made out of them is expanding, an independent processing line to process and preserve these materials should be set up in the same factory complex area. A study should be undertaken and a project prepared for implementation.

e) Kareima factory will have to compete with the private factories in the country to sell its products. It should therefore have attractive get-up for its products. Lithographing of tin containers, particularly for those used in packing tomato paste is therefore recommended. Some information has already been collected in this regard by the project. It should be followed for implementation.

3) Wau Fruits and Vegetables Canning Factory

a) Through the efforts of the Ministry of Industry, Ministry of Finance and Economic Planning, the Project, and the IRCC, a comprehensive Rehabilitation Programme for three years (1984-1985 to 1986-1987) has been prepared for the first time for this factory. Realizing the importance of implementing this programme, a Monitoring Committee and an Implementation Team have been set up by the Ministry of Industry and the

Ministry of Finance and Economic Planning to assist the management of the factory in its implementation. The Food Industries Expert of the project has been made Advisor to the Monitoring Committee and the Implementation Team to assist these two bodies in successful implementation of the Programme. To test the Programme before its full implementation, the Monitoring Committee has taken crash pilot programme for three months. The results of this crash pilot programme, after assessment, will indicate the directions in which the full programme is to be moved. The advisory guidance of the Food Industries Expert is therefore essential at least up to the completion of this crash pilot programme because he is the main author of the Rehabilitation Programme and for his knowledge of the problems of the factory.

- b) The project has successfully introduced three varieties of nematode resistant tomatoes in the Wau area to solve its main raw material problem. All of them need adequate irrigation facilities for successful growing. Such facilities should therefore be arranged in the following manner.

For Growing the Captive Farm of the Factory

Irrigation facilities can be either Sprinkler/Drip/Channel System. The source of water can either be from the River Jua near the factory or bore wells dugged in various places of the farm. Information collected by the project on Sprinkler/Drip irrigation should be useful in this regard.

Egg Growing by the Farmers

Farmers can grow in small plots that can be from quarter of a feddan to five feddans. Irrigation facilities in such plots can be arranged manually. However, digging wells will be necessary for the farmers whose lands are not near the river. UNICEF water project in Bahr-El Ghazal Region may assist the farmers in this regard.

The Regional Ministry of Agriculture and Animal Production, Bahr El Ghazal Region submitted a project to the Ministry of Industry to grow tomatoes for Wau factory. On a request from the Special Advisor to H.E. the Minister of Industry, the Food Industries Expert has commented on it. This comments may be seen in annexure 26. This project should be pursued with the Regional Ministry of Agriculture and Animal Production.

On a recommendation from the project to involve the Food and Agricultural Organization of the United Nations at Khartoum to assist in establishing irrigation facilities to grow tomatoes for processing in the captive farm of the Wau factory the Government has requested this organization to render such assistance. This should be followed. Correspondence in this regard may be seen in annexure 27.

- c) Potential for processing mango and pineapple in Wau factory is very good. Though the factory is now manufacturing products from these fruits on a small scale by utilizing some of the machinery and equipment of the tomato paste line, yet it is essential to set up a complete separate line in this factory

to process these two fruits to realize fully existing potential.

To assist the factory in implementing this recommendation, the following things have been done.:

- i) One power driven pineapple slicing machine has been brought from India free of cost under TCDC Programme.
- ii) On a recommendation of the Monitoring Committee, the Government has requested the Embassy of India at Khartoum to consider supplying a complete pineapple and mango processing line with appropriate boiler to process 10 tons of pineapples and 10 tons of mangoes per day under TCDC Programme. The request is now under consideration of the Government of India. This should be followed. In case it does not materialize the Ministry of Industry should find alternate sources to assist the factory in this regard.
- d) The factory can fabricate now in its tinshop only three sizes of cans (90 grammes, 350 grammes and 4 gallons capacity). In order to make other sizes of cans (500 grammes, 1000 grammes and 3,500 grammes capacity) that are essential to make its programme for pineapple and mango products successful, it needs semi-automatic reforming, flanging and seaming machine for A21/2, A10, one pound butter and one pound tall cans. This should be arranged for the factory. The tinshop in the factory can make flattened tin sheets for these sizes of cans.

e) The factory uses only two types of packaging materials, namely tin cans and jerry cans to pack various types of products made by it. Jerry cans are available from indigenous sources but to make tin cans, tinplates are required to be imported. The factory has very little quantities of tinplates in stock. Therefore at least 600 tons of tinplates (300 tons acid resistant and 300 tons sulphur resistant) should be imported for this factory for the next 3 years. This can be done at the rate of 200 tons (100 tons acid resistant and 100 tons sulphur resistant) per year. It is better to import differential electrolytic tinplates with one pound inside and 0.75 pound outside substance.

On a recommendation of the Monitoring Committee, the Ministry of Finance and Economic Planning (Planning) is examining the possibility of getting tinplates for Wau factory under some bi-lateral programme. This should be followed. If it succeeds, well and good, otherwise, required foreign exchange should be arranged to get this important packing material for the factory. Without its timely arrangement, the Rehabilitation Programme will not be fully successful.

f) The project has made arrangement for the supply of 250 kilogrammes of nematode resistant tomato seeds (variety S-120) free of cost from India for five years from 1981-1982 to 1985-1986. 150 kilogrammes of this seed has already been received by the factory. Supply of the balance quantity that is 100 kilogrammes should be pursued in time with the Embassy

of India at Khartoum. Simultaneously, arrangement should be made to import from USA at least 50 kilogrammes each of the other two high yielding nematode resistant tomato varieties introduced successfully in Wau area by the project.

4) Babanyusa Milk Products Factory

Potential for developing this factory as an export oriented one base on Karkadeh and Gum Arabic Powder is good. To explore and achieve this potential, the first step is to conduct a study on the following lines:

- a) Is there any possibility of reviving milk processing in this factory?
- b) If the answer to a) is yes, then how to organize it and how to integrate it with production of karkadeh and gum arabic powder.
- c) If the answer to a) is no, then what are the machinery and equipment that should be kept for manufacturing karkadeh and gum arabic powder and what facilities including availability of raw material are required to manufacture at least 200 tons of Karkadeh powder annually? Is there any possibility of manufacturing other food products utilizing available raw materials?
- d) Is the technology used by the factory now (spray drying) is adequate or drum-drying technology will be better and cheaper? To get an answer, experiment on drum-drying technique is necessary.
- e) Is hygroscopic nature of the product can be overcome by introducing packing under vacuum or inert gas or by putting moisture absorbent in present individual packs?
- f) Is it possible and economical to extract colour from karkadeh for export as natural colour to be added to food and pharmaceutical products?

In the plan of work of the Food Sector, this study was included and approved by the Minister of Industry but could not be carried out due to its deletion from the work plan by the Evaluation Mission for reasons best known to it. This should be carried on.

5) Krikab Industries Corporation (Sweets Factory)

The recommendations for improvement of this factory made in the report prepared by the project and the IRCC are under consideration of the Government now. If they are accepted and implemented, then this factory can develop on the recommended lines, otherwise, there is no other alternative but to dispose off this factory. If it is decided to dispose it off, then it is recommended that instead of setting it to a private party, the Ministry of Industry can consider giving it to a cooperative of the workers of the factory to run it, provided they are willing to form such a cooperative. The Ministry of Industry and Ministry of Commerce, Supply and Cooperation should assist the workers in this regard.

6) Rea Sweets Factory

A report showing the present status and future prospects should be prepared for this factory on the same lines as had been done for the Krikab Industries Corporation. The food sector of the project could do it but time did not permit.

If the Ministry decides to continue to run the two sweets factories, then the following recommendations should be considered:

- a) Both factories should be combined and run under one management.
- b) Besides the present products lines, additional new products lines, particularly ready-to-serve beverages based on fruit juices, including tomato juice, fruit jams and preserves (in the form of mango leather like imported apricot leather) should be included and detailed integration programme should be worked out indicating building requirements, addition and deletion of machinery and equipment, individual products capacity, packaging patterns and financial requirements.

7) Spare Parts

All the food processing factories in the public sector are more than 20 years old. They therefore need spare parts to run the machinery and equipment properly. In some cases, replacement of obsolete and worn out machinery and equipment is also necessary. Except in a few cases, this has not been done. It is also not known whether spare parts are at all available. The following recommendations are therefore made regarding spare parts:

- a) For factories at Kareima and Wau that are identical, a complete list of spare parts requirements should be prepared and presented to the suppliers in USSR (original supplier of the plant) through its Embassy at Khartoum to find out what they can supply from ready stock and what they can fabricate. Such a list in details has been prepared for Wau Factory and it is included in the Rehabilitation Programme. For Kareima, it is to be prepared.

- b) For Kassala factory, spare parts requirement have been identified, lists prepared and some cases proforma invoices obtained from the original supplier of the plant in Bulgaria through its Commercial Counsellor at Khartoum. In case technical and economic assistance from the Government of Holland to rehabilitate this factory does not materialize, then essential and critical spare parts should be obtained from Bulgaria to start production in this factory.

- c) In case of Babanousa factory, spare parts requirements should be identified and listed based on its findings during the study as recommended above and presented to the original supplier of the plant in USSR through its Embassy at Khartoum to take similar action as indicated for Kaneima and Wau factories above.

- d) For Krikab Industries Corporation (Sweets factory) spare parts requirements have been identified and incorporated in the report for development that is under consideration now. They are available from indigenous sources. In case it is decided to operate further the factory then the spare parts, particularly the vacuum pumps should be arranged immediately.

- e) For Rea Sweets Factory, spare parts requirements should be identified during the recommended study.

8) Training

Success of an industrial venture depends largely on trained personnel. Though in-plant training has been given from the project to the personnel working in planning production, production operations, packaging storage, marketing and quality control and

training in raw materials growing, production and quality control has been arranged under TCDC programme outside the country, yet it is necessary to further train selected persons are recommended below:

- a) Except in Kareima and Babanousa factories, there is nobody with a post graduate degree in Food Technology working in any of these factories. It is therefore necessary to train at least one such person for each factory. The United Nations University, in collaboration with the Food and Agriculture Organization of the United Nations and the Government of India, has set up a Post Graduate Food Technology Training Institute at Mysore, India, and it runs a two years course leading to M.Science. Food Technology degree. This Institute is meant for training personnel from countries in Asia and Africa to manage and develop all types of food industries. It takes students selected by the country governments and awards fellowships studies to selected candidates. The course starts from July each year and the country governments' nominations are received by April. The minimum entry qualification is graduate in Science or Agriculture. The Ministry of Industry should select the first candidate for this course for 1986-1987 to 1987-1988 session. The selection can be from qualified persons working in the factories or from outside in case such persons are not available in food factories. Information regarding this course and Institute is available from the Director, Food Technology/Training Institute, UN University, Cheluvamba Mansion, MYSORE 13, India.

- b) The University of Gezira at Wad Medani has started a graduate course in Food Technology. One person from each food processing factory in the public sector should be trained in this course or a graduate in Food Technology from this University should be appointed in each of the factories.
- c) Specific training for short duration in identified areas can be arranged by the Food Technology Division of the Industrial Research and Consultancy Centre as has been done in collaboration with the Food Industries Expert of the project in training one official of the Wau factory in quality control.

9) Management

With the abolition of the Food Industries Corporation, each food processing factory is to manage itself with assistance from the Ministry of Industry. To do so properly, some methodology should be evolved and the following recommendations are made in this regard:

- a) In the Ministry of Industry, a small cell should be created to look after the requirements of the food processing factories both in public and private sectors and for development of the food industry in the country. One qualified Food Technologist may be appointed in this cell.
- b) The Food Technology Division of the IRCC should be the Executive Agency for the Ministry of Industry to take care of the problems of the food factories. All such problems should first be dealt with this division and then referred to the Ministry, if need be, for further action.

- c) At the factory level there should be an in-house Executive Committee chaired by the General Manager of the factory and consisting of members representing all major operational divisions of the factory. This body will be the policy making body for the factory particularly for production planning in advance and for arranging inputs for such production. It will also be the forerunner of the Managing Board when a factory is converted into a company.

- d) The core-strength based on full capacity utilization should be worked out for each factory as has been done for the Wau Fruits and Vegetables Canning Factory with assistance from the Food Industries Expert of the project. This will enable the factories to find out direct personnel costs and costs that should be covered under social benefits. The IRCC can be entrusted to determine such core-strength for the remaining 5 factories.

- e) Proper costing of finished products is necessary for good management. Presently, it is not done on a systematic manner. The IRCC has evolved and introduced costing system in some public sector production units. It may therefore be entrusted to do so in all the food processing production units in a phased manner.

- e) The overall performance of each factory should be evaluated every quarter by the Food Technology cell in the Ministry of Industry. Through such evaluations, deficiencies and difficulties should come out and appropriate action taken to overcome them.

10) Marketing

At present there is a Central Marketing Unit for all the food processing factories in the public sector. It is supposed to assist them in marketing their products in and outside the country but in practice, it deals with three factories only namely factories at Kassala, Kareima and Babanousa. As all the factories except the two in Khartoum North are located far away from Khartoum, it is necessary that there should be a body at Khartoum to assist them in selling their products. The Central Marketing Unit can do this job and to do it effectively, the following recommendations are made:

- a) The relationship between the Central Marketing Unit, factories and the Ministry of Industry should be defined clearly and the assignment of the CMU should be made clear.
- b) The optimum personnel requirement of the CMU should be determined keeping in view the assignments.
- c) The CMU should take appropriate action to assess continuously the market requirements for products made by the factories and based on such assessment, guide the managements for proper annual production planning. It should also endeavour to create new markets for the products and suggest production of new products for the markets.

11) Finance

The annual financial requirements for each factory should be worked out each year based on production planning. The way it has been done for the Wau Fruits and Vegetables Canning Factory can be a

ideal in this regard. In addition, all the arrear debts of the factories should be assessed and decisions taken regarding their payment or write off. This will give a clear picture of financial requirements of each factory. After getting this information for each factory, the Ministry of Industry can decide the sources wherefrom the finance is to be arranged. The IRCC can be entrusted to do this exercise for the Ministry.

12) Tomato Concentrate Plant

The current annual demand of tomato paste in Sudan has been estimated as 4,000 tons. This will increase to 6,000 tons by the end of the century. This demand is met by indigenous production of tomato paste from fresh tomatoes and imported tomato concentrate and by importing tomato paste as such in consumers' packs. As tomato is a seasonal crop, it is difficult for the factories, both in public and private sectors engaged in the manufacture of tomato paste, to produce this quantity from fresh tomatoes to meet the demand of this product. Therefore, the factories will have to depend on tomato concentrate to make tomato paste. A tomato concentrate plant with adequate capacity should therefore be set up in a suitable place to make and supply concentrate to factories for production of paste. A feasibility study should be carried out in this regard.

13) Ready-to-serve Beverages Based on Fruit Juices

There is a good scope to introduce ready-to-serve beverages based on fruit juices and to begin with, it can be started with mango. Mango pulp in bulk can be packed with or without preservative in the Wau and Kareima Fruits and Vegetables Canning factories and

these can be brought and be used in one of the sweets factories in Khartoum North to make mango ready-to-serve beverage packed in bottles with 10-15% juice content. Mango pulp from Wau which will be dearer can give the body and color, and pulp from Kareima factory which will be dearer can give flavour to the product. To do so, both the pulps will be mixed in such a ratio that the cost of production is kept to the minimum and the product has acceptable color, flavour and taste. Development and introduction of such a product involving three public sector food processing factories will not only assist them in diversification, but will also introduce an essential product in the markets. A feasibility study in this regard can be carried out.

14) Survey and Preparation of a Master Plan for Development of Food Industry

The necessity and scope of development of food industries in Sudan have been given in chapter 13 of this report. A survey of food industries and related raw materials is required to be done to prepare a Master Plan for the development of this strategic industry. Information on the availability of fruits and vegetables in this regard is given in annexure 28. The IRCC in collaboration with the Food Research Centre can carry out this survey and prepare the Master Plan.

XV. INSTITUTIONAL LINK-UP

When I started my mission work, there was no institutional link up of the project because the Efficiency Improvement Unit in the Ministry of Industry was not yet set up. However, I involved the Food Research Centre at Shambat

right from the beginning of my work and the first thing that I did was to deliver a lecture in the Centre, on the request of the Director, where I explained as how research centres are involved in development activities and how results of research are taken to the users in the field and factories. The Project Manager and two other experts in the project also attended the lecture. Later on, when the EIU was set up in the beginning of the second phase of the project. I had to involve it along with the Food Research Centre in my activities and every fortnight my counterpart and I, along with other functional units of the project presented out activities to the EIU. During the third phase of the project when EIU was abolished, the IRCC became the National Counterpart Organization of the project and I had to involve the Food and Economic Divisions of the Centre in my work. However, I had to deal with the Director of the Centre for many other activities of the project. Though I continued to involve Food Research Centre in some of my mission work where I found that adequate facility did not exist in IRCC, yet I felt that there must be a link up between the Food Division of the IRCC and the Food Research Centre so that jointly they can tackle the problems of the food factories. When everybody agreed for such a link-up, no definite action could be taken. However, my suggestions for integrating the activities of the Food Division of IRCC and PRC are as below:

- a) Arab Industrial Development Organization has decided sometime back to set up a regional food research centre for Arab countries in Sudan. Some studies have been made to set up this centre but up to now nothing has materialized. This decision should be pursued by the IRCC and a project developed to set up the centre. Once it is set up, link-up between the PRC and Food Division of IRCC will be established automatically.

- b) So long as the Arab Regional Food Research Centre is not established, there should be a coordinating committee between the two centres so that efforts are not duplicated but integrated to solve the problems of the food factories.
- c) Possibility of transferring the Food Research Centre from the Ministry of Agriculture to the Ministry of Industry may be considered. If this is done then the problems of the food industry can be tackled in an integrated manner by the Ministry.

The Industrial Research and Consultancy Centre which is considered to be the Technical Wing of the Ministry of Industry is now the National Counterpart Organization of the project. By working with the project, it has geared itself to a major extent to solve the problems of the industrial production units. However, it will be strengthened further, if a Division of Consultancy and Extension is created in the Centre and housed in the premises where the project is located to enable the centre to do trouble-shooting work in a intensive manner.

XVI. MONITORING SYSTEM

In order to assist the IRCC and the Ministry of Industry to take appropriate action on the problems faced by the food processing factories, a simple Monitoring System was designed and introduced for reporting. It can be seen in annexure 29. The system worked quite well for Kassala and Kareima factories.

XVII. MISCELLANEOUS AD_HOC MISSIONS

On requests from time to time from the Food Industries Corporation, Senior Industrial Field Adviser, Regional Ministry of Agriculture and Natural Resources, Ministry of Industry, Efficiency Improvement Unit and the Industrial Research and Consultancy Centre, I had to do a lot of ad_hoc mission work. Though they were ad_hoc in nature, they had a bearing on my main mission work and therefore I had to carry them out. They are listed below:

1) Food Industries Corporation

On a request from the Managing Director of the Food Industries Corporation who was also the Managing Director of the Sugar Corporation for some time, I did the following:

- a) Preparation of proposals for consideration by the World Bank to allocate credit facilities for development and rehabilitation of some food processing industries in the public sector in the Democratic Republic of Sudan (annexure 30).
- b) Preparation of Development and Rehabilitation Plan of the Sugar Industry in Sudan for consideration of the World Bank to allocate credit facilities (annexure 31).
- c) Preparation of proposal for consideration by the Dutch Government to assist in the development of the food industry in Sudan.
- d) Determination of core-strength requirement for the Wau Fruits and Vegetables Canning Factory. A Committee with me as advisor was formed to do this work that was related to the rehabilitation programme of the factory.

2. Senior Industrial Development Field Adviser posted at Cairo looking after Sudan

In a request from the Managing Director, Duty Free Shops Corporation, the Senior Industrial Development Field Adviser posted at Cairo requested me to prepare a preliminary feasibility report to set up a fruit processing plant in the proposed duty free industrial zone near Juba in Southern Sudan. This was done after visiting Juba and other places in the equatorial provinces (annexure 32).

3. Regional Ministry of Agriculture and Natural Resources, Juba

The Director General of Agriculture and Natural Resources of the erstwhile southern region who extended cooperation in carrying out the experiments in Wau area to grow nematode resistant tomatoes for the Wau factory, requested me to visit pineapple plantations under his Ministry in different places in Equatorial Provinces and advise him regarding packing and marketing of fresh pineapples and also the possibility of creating facilities to process them.

I combined this work with the work given to me by the SIDFA for the Duty Free Shops Corporation as mentioned under 2 above and visited the Government pineapples plantations at Meridi, Kambio, Souce Yubu, Nzara and Tambara in the erstwhile Eastern and Western Equatorial Provinces and submitted a report to him.

I was also requested to pay a visit to Nzara agro-industrial complex and suggest ways and means for its improvement and further development. I did it while I was at Nzara and submitted a report to him.

4. Efficiency Improvement Unit (National Counterpart Organization of the Project during the second phase) in the Ministry of Industry
On a request from the Director of the Efficiency Improvement Unit,

I rendered the following assistance:

- a) In drafting the Ministerial Order to set up the Efficiency Improvement Unit in the Ministry of Industry.
- b) In preparing proposals for the Portfolio of the Solidarity Meeting with particular reference to food industries proposals.
- c) In preparation of texts for charts and graphs for all the public sector industrial corporations for the exhibition organized during the Solidarity Meeting. A few proposals have materialized.

5) Ministry of Industry

On requests from the Special Advisor to H.E. the Minister of Industry from time to time, I have carried out the following:

- a) As a member of the Rescue Team for the food industries in the public sector set up by the Ministry after the abolition of the Food Industries Corporation, I, along with my national counterpart, assisted the General Managers of the factories in preparation of their 'Rescue Programmes' and budgets for this purpose.
- b) 210 tons of imported tinplates brought for Kareima and Wau factories were lying in Port Sudan since 1977. I was requested to assess their quality and submit a report. My national counterpart and I therefore went to Port Sudan, identified the tinplates packages and assessed their quality and submitted our report.

Based on it, delivery of 190 tons of tinplates have been taken for use in wau factory.

- c) 500 tons of tomato concentrate packed in 5.2 kilogrammes capacity cans imported for Kareima factory could not be taken delivery of from Port Sudan for a long time and as a result, some of them are reported to be spoiled when they were ultimately received in the factory. I was therefore requested to examine them and submit a report. Accordingly, I went to Kareima factory, examined the tomato concentrate cans, evaluated them and submitted my report that can be seen in annexure 21.
- d) Ad_hoc assignments given to me as in a) and c) above prompted the Special Advisor to H.E. the Minister of Industry to ask for my suggestions for quick clearance and transportation of goods from Port Sudan to the public sector production units. Accordingly, I prepared a note and submitted it to him. This may be seen in annexure 35.
- e) The Minister of Industry examined the possibility of collaboration with a West German firm for better utilization of its beer manufacturing factory in Khartoum North. On a request from the Special Advisor, I assisted in the discussions and negotiations in this regard with particular view to utilize the plant for bottling soft drinks and drinking water for export.
- f) On a request from H.E. the Minister of Industry, my national counterpart and I accompanied the Hungarian Team to the factories at Nassala, Kareima and Babanousa and gave them relevant information for these factories and also for Wau

factory. This team came to extend technical and financial assistance to food factories in the public sector.

- g) On a request from the Special Advisor to H.E. the Minister of Industry, my national counterpart and I prepared proposals for Kassala, Kareima, and Wau factories for getting technical and economic assistance from the Government of Romania under Sudan-Romania Protocol. The proposals may be seen in annexure 36.

- h) On a request from the Under Secretary, I and the two other Sectoral Experts in the project prepared a note to improve the Industrial Research and Consultancy Centre which is the National Counterpart Organization of the project so that it can involve itself in a more intensive manner for industrial development in Sudan. copy of this note is in annexure 37.

- i) On requests from the Ministry of Industry, I assisted the concerned officer in the Ministry of Industry in the following:
 - i) Preparation of Three Years Investment Plan for food factories in the public sector.
 - ii) Preparation of project proposals for food factories for presentation to the Regional Investment Promotion Conference at Khartoum organized by UNIDO, Vienna. I was made Advisor to the team set up by the Ministry for discussion and negotiations for food industries, and in this capacity, I assisted the members of the team in negotiating with parties and organizations from various countries.

6) Senior Industrial Field Adviser posted at Khartoum

- a) On a request from the Special Advisor to H.E. the Minister of Industry to get a consultant for 4 months to assist the IRCC to prepare a techno-economic feasibility report to set up a wheat flour mill in the Northern Province of the northern region, the SIDFA requested me to take up the assignment as a special case. I took it up and assisted the team in designing and writing up the report. To do this mission, I had to visit the wheat flour mills in Port Sudan, Wad Medani, and others. I also had to visit Dongola, Kareima, Hudaiba and Dammar to discuss with the concerned officials and collect relevant information to prepare the report. As the concerned Government Organizations in the Northern Province has paid money to the IRCC for preparation of this report, it has become the property of this Organization and therefore, I cannot enclose it as an annexure with my report. However, I have given a copy to the SIDFA and shown it to the concerned officials in UNIDO Vienna.
- b) On a request from the SIDFA, I have prepared data sheet for Wau, Kassala, and Kareima factories. They are in annexure 33.
- c) On another request from the SIDFA, I have detailed information for publicity regarding the activities of the project to Ms. Deate Muller-Blattan, Journalistin, Kluffer Dachtan 6, 5300 Bonn 2, West Germany. I was told that she was engaged to give publicity for UNDP/UNIDO activities.

7) Industrial Research and Consultant Center, IRCC

- a) As mentioned under Chapter 17 of this report, I have prepared, on a request from the Director General of the IRCC, a paper on Food Industry in Sudan, its importance and relevance in economic, regional and rural development of the country.
- b) On getting another request, I prepared a note on the status of technology used by the food processing factories in the public sector in Sudan. A copy of this note is in annexure 39.

8) International Lepper Organization Cooperative Training Project at Khartoum

On a request from the project, possibility of setting up a tomato concentrate plant in Bahad Area Settlement Scheme by the Vegetables Growers Cooperative in the area, and supply of onions by the same Cooperative to the Kassala Union Dehydration Factory were discussed with the Food Industries Corporation and the concerned expert of the project. Correspondence is on annexure 40.

XVIII. TECHNICAL AND ECONOMIC COOPERATION AMONG DEVELOPING COUNTRIES

While carrying out my mission work, I paid particular attention to get assistance under TCCO and ECOC programme to implement some of my recommendations. The way I started it with regard to nematode resistant tomato seeds has been given earlier in detail in this report under the War Fruits and Vegetables Canning Factory. This was followed by the following:

- a) Getting free or cost a power driven pineapple slicing machine for the waq factory from India.
- b) Getting one dozen stainless steel onion cutting knives for Kassala factory from India.
- c) Practical training of three persons, two in production and one in raw material growing in India.
- d) Visit of the Director General of the IRCC to the various research and development institutes in India for three weeks.
- e) Identification of projects for assistance under TDDC Programme from India during Solidarity Meeting. (This was done on a request from a UNIDO official; annexure 41).
- f) Identification of consultants from India and Pakistan for the textile industry. (This was done as the coordinator of the project on a request from the Special Adviser to H.E. the Minister of Industry).

XIX. COORDINATION, ADMINISTRATION, FINANCIAL WORK

In addition to my mission work, I did the work of the CIA from October 1979 to September 1980 and October 1981 to October 1985. This work involved improvement of project office, premises and a lot of coordination and administrative work. In addition, I had to look after the financial work of the project since 1979. All these, on average, have taken 15% of my effective time.

XX. PERSONS ASSOCIATED WITH MISSION WORK

As indicated under Chapter 2 of this report, the names of persons associated with my mission work and with whom I met and discussed at various stages may be seen in annexure 42.

XX. LECTURES_GIVEN

In requests, the following lectures have been given:

- a) In the Food Research Centre, a lecture has been given to the scientists, technologists and engineers on 'Transfer of Technology from Research and Development Organizations to the Industries'.
- b) In the Seminar on Export Quality Development and Control organized by the International Trade Centre at Khartoum, a paper entitled 'Export Quality Control Measures in Public Sector Food Processing Factories in the Democratic Republic of Sudan', prepared by myself and my counterpart was presented.
- c) To the students of Food and Sugar Technology Discipline of Gezira University, a lecture on Scope of food Industries in Sudan was given.
- d) In the training course in Preparation, Evaluation and Investment Promotion of Industrial Projects organized for senior officials by the UNDP and UNIDO, a lecture on Investment opportunities in Food Industry in Sudan has been given.