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CO-OPERATIVE FOOD INDUSTRIES
ASSESSMENT OF THE PRESENT SITUATION AND FUTURE POTENTIAL

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ZAMBIA

Technical report: Food-processing activities in Zambia*

Prepared for the Government of Zambia
by the United Nations Industrial Development Organization

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SUMMARY

The co-operative food industry has hitherto been concerned only with flour milling and processing of oil-bearing seeds.

The processing plants are often underutilized due to frequent breakdowns, lack of spare parts, weak management, inadequate maintenance, insufficient quantities of raw materials, and transport problems.

The frequency of breakdown depends to a very large extent on the quality and standard of the mechanical and electrical installations in the plants. This, in combination with difficulty in obtaining spare parts and inadequate maintenance, reduces the productivity below what is acceptable.

The spare parts problems are to a great extent caused by the present foreign exchange situation.

Future measures to remedy the current shortcomings and provide a good basis for successful development of the co-operative food industry include the following:

- acquisition of funds for rehabilitation of existing plants through international agencies and bilateral aid
- technical assistance for preparation of an integrated program for each food industry subject to rehabilitation
- provision of management support and technical assistance during a transitionary period of time for operation and maintenance of food processing plants
- strengthening and expansion of the Research and Development Section within ZCF in order to provide qualified technical and economic services to the co-operative movement in the country
- development of a better understanding and awareness of the importance of food hygiene in the integrated chain of activities in food processing industries.

1.0 INTRODUCTION

1.0.1 This survey for an assessment of the food-processing co-operatives in Zambia was carried out 29 January to 19 February 1986.

1.0.2 Discussions were held with representatives for Zambia Co-operative Federation (ZCF) which is the apex organization for the co-operative unions.

1.0.3 Meetings have been held with representatives for authorities such as Ministry of Agriculture and Water Development, National Commission for Development Planning and ZAMHORT. Information on various issues has been obtained from a number of reports and studies pertinent to this survey.

1.0.4 In the course of the stay in Zambia plans were drawn up for visits to three provincial co-operative unions, viz. The Eastern Co-operative Union, The Northern Co-operative Union and The Southern Province Co-operative Marketing Union.

1.0.5 These all have experience from co-operative agro-industries and are from that point of view more advanced than the other unions.

1.0.6 Efforts have been made to identify the major problems. Some of these are fairly common, or sometimes general, but are not always repeated in the notes from the plant visits.

1.0.7 Taken as a whole, it is believed that most problems and shortcomings have been identified and discussed. It is hoped that this can form the basis for measures aiming at improving the existing food industrial ventures and serve as a guide to avoid pitfalls and earlier mistakes in future food industrial projects.

2.0 THE CO-OPERATIVE MOVEMENT

2.0.1 The co-operatives are key elements in the Party's and its Government's strategy for development.

2.0.2 The Zambia Co-operative Federation (ZCF) is the apex organization for the nine Provincial Co-operative Unions and co-operatives such as Commercial Farmers Bureau, Zambia Agriculture and Trading Co-operative, ZATCO, and National Marketeers Co-operative Union.

2.0.3 The principal function of ZCF is to undertake, on a co-operative basis, all kinds of business operations. The Federation also maintains direct contacts with sister apex national organizations in other countries and international bodies like ICA, COPAC, etc.

2.0.4 Each co-operative union is autonomous as far as internal decision-making is concerned, and has a General Manager and a Board of Directors.

2.0.5 Initially the unions were engaged in marketing and collection of, e.g, maize on behalf of the National Agricultural Marketing Board, NAMBOARD.

2.0.6 Other crops, like sunflower in some provinces, paddy rice in others, soyabeans and groundnuts, are increasingly adding to the crop mix handled by provincial co-operative unions. Handling of maize and fertilizer will, however, remain the backbone activity for a long time.

2.0.7 In 1985 the Government decided to withdraw subsidies from the co-operative unions and instead focus their efforts on market-controlled commodities like maize and fertilizer.

2.0.8 The unions were directed to re-orient their activities to income-generating operations and to strengthen their ideological principles of member participation and member promotion.

2.0.9 The diversification was to be geared towards involvement in food processing industries at both society and union levels. This is a drive to transform the unions from the status of being "middlemen" in commodity trade to that of processing entities.

2.0.10 According to available publications, three of the nine provincial unions are at present engaged in some kind of agro-industrial activity, either on their own, through subsidiary companies or through co-operatives within their area of jurisdiction. Two other provincial co-operative unions have stated as their objectives to "process any agricultural products collected from member societies".

2.0.11 Five of the provincial co-operative unions are more developed than the others, i.e. those on the line-of-rail – Southern, Lusaka, Central and Copperbelt Provincial Co-operative Unions plus Eastern Co-operative Union. The Northern, Luapula, North Western and Western Co-operative Unions are lagging behind in development and thus in line for more Government support in the future.

3.0 THE FRAMEWORK FOR CO-OPERATIVE ENGAGEMENT IN FOOD PROCESSING INDUSTRIES

3.1 General

3.1.0 In the following a brief account is given regarding the responsibilities of parastatal organizations to handle and process various agricultural commodities.

3.1.1 Some changes in the strict pattern of commodity trade and probably also processing are likely to take place after the liberalization of the grain trade in 1986.

3.1.2 The unions may now, for instance, compete with NAMBOARD and private firms in buying agricultural commodities for further processing. The details of the pricing system are not yet worked out but there is a floor-price to the producer with no limit upwards. In essence, availability and demand are likely to govern the prices, at least to some extent.

3.2 The Flour Milling Industry

3.2.1 The bulk of the grain is processed by the National Milling Corporation, NMC, and mills belonging to the Industrial Development Corporation, INDECO, which is a subsidiary to the Zambia Industrial and Mining Company, ZIMCO.

3.2.2 There are also some private interprises in the milling industry.

3.2.3 A transfer of parastatal maize mills to the provincial co-operative unions is being discussed at present and may be realized very soon.

3.3 The Oil Milling Industry

3.3.1 According to a recent study, the present cultivation of oilseeds, sunflower, groundnuts, soyabeans and cotton covers approximately 150 000 hectares with a total crop yield which is estimated at about 80 000 tons.

3.3.2 Increasing the production of oil-bearing seeds is aiming at realizing self-sufficiency in edible oils by 1990. A major part of the investments, which include seed production, research, extension, credit, marketing and processing, will be covered by the FAO/ADB Oilseeds Development Project.

3.3.3 The overall rated processing capacity in Zambia for sunflower seed and soyabeans is stated as 123 800 tons/year.

3.3.4 The major part of the oil mills are owned and operated by Refined Oil Products (1975) Ltd (ROP), a parastatal organization. Private industry is also involved, although on a smaller scale. A few plants, notably one in Katete and one in Choma, are owned by the co-operative.

3.3.5 In addition, two plants for processing of cotton seed are presently under construction, or have just commenced operations. Both have an installed crushing capacity of 12 000 tons/year, one located in Ndola (ROP) and one in Kabwe and owned by BPR Industries.

3.3.6 In total, the oil crushing industry appears to be under-utilized at present. It may also be that the capacity achieved, due to various constraints, is not capable of processing very much more than the current production of oilseeds. The investment in two new oil mills (3.3.5 above) may be interpreted as a sign of this.

3.4 The Dairy Processing Industry

3.4.1 Government policy

3.4.1.1 In previous National Development Plans (NDP) much emphasis was placed on the development of the state dairy sector to compensate for the departure of expatriate farmers. In the Third NDP (1979-83) renewed interest was directed to the potential of private farmers with less emphasis on the state sector.

3.4.1.2 The development was geared to both production of marketed milk from the traditional sector and the commercial sector for supplies to urban areas. Major programs for rural milk production and collection were formulated.

3.4.1.3 The strategy in the current investment plan is designed to reverse the decline in per capita consumption and reduce the disparities in consumption levels in the major urban markets. Milk production will expand from commercial, parastatal and smallholder dairy units.

3.4.1.4 Priority will be given to consumer milk, both fresh and recombined.

3.4.2 Consumption of milk and dairy products

3.4.2.1 The per capita consumption is generally low with significant differences between income groups in the urban areas, 42 l of milk or milk products (expressed in milk equivalents) for the high income group compared with 9 l for low income group people. Infants 1-5 years old in the high income bracket get about 0.25 l per day, whereas the low income children get only about 0.05 l per day.

3.4.2.2 In the rural areas the variations are notable, from 4.3 l per capita to 32 l depending on whether the region is a traditional cattle district or not.

3.4.3 Potential for increased milk production

3.4.3.1 All observers agree that there is a considerable potential for increasing the milk production in the commercial sector. Yield per cow can be increased, existing herds can be larger, and new dairy farms can be established.

3.4.3.2 Rapid improvements are difficult to attain. A number of dairy schemes, in particular settlement schemes, were launched in the 1970s. They have all faced difficulties and progress has been slow.

3.4.3.3 A Dairy Development Program (FAO/WB) was formulated at the beginning of the 1980s, including a total of 1 800 farm families in the Southern and Central Provinces. The farmers were divided into three categories — most advanced, emerging dairy farmers, and those who would start selling milk and marginally increase their level of production from indigenous cows.

3.4.3.4 The project was apparently too ambitious. The target of including 1 800 farm families now seems to be redesigned and focused on 150 farms in the Mazubuka and Monza areas in the Southern Province.

3.4.4 Major constraints to increased milk production

3.4.4.1 The reasons for the discouraging results from dairy development are likely to be rather complex. The time element necessary for transition to more advanced production patterns has obviously not been considered sufficiently.

3.4.4.2 The major constraints, however, may be summarized as follows:

- poor economic return from milk relative to that obtained from other livestock farming alternatives
- high investment costs in stock and equipment for medium to large scale dairy farms
- difficulty in obtaining required inputs for dairy farming, e.g. vaccines, drugs, spare parts
- uncertainty as to the long-term future of large scale private commercial farming
- the commercial dairy farms must have a high level of performance to be economically viable; this requires a high managerial standard which is difficult to find.

3.4.5 Government Role in Dairy Processing

3.4.5.1 The Dairy Produce Board (DPB) is a parastatal organization which has the monopoly of buying, manufacturing, processing and marketing milk and dairy products in certain selected areas. These are principally the peri-urban areas of the line-of-rail, that is along the railway from Livingstone in the South to Ndola in the Copperbelt.

3.4.5.2 With the exception of sales from the indigenous cattle herds, some dairy settlement schemes, authorized producers/retailers and the Zambezi Co-operative Dairies Ltd (Appendix 1:3, 3), all marketed milk and dairy products are officially supposed to be channeled through DPB.

3.4.5.3 DPB operates a number of dairy plants. The Lusaka plant was upgraded in 1973 and is equipped for processing of both fresh and recombined milk. Provision has been made for UHT packing of the milk but glass bottles were reintroduced in 1980. Capacity utilization in 1979 was stated at 22.5% of the rated capacity, 12 000 l/hour.

3.4.5.4 The Kitwe plant in the Copperbelt has a similar production pattern, a rated capacity of 8 000 l/h which was utilized to 60% in 1979.

3.4.5.5 No information has been obtained regarding the present degree of utilization of the two plants. Development of dairy farming in the past 5-6 years and the present difficulties with foreign exchange do not indicate any improvement.

3.4.5.6 In 1982/83 two small dairy processing plants were established in Chipata, Eastern Province and Mazabuka, Southern Province. The Chipata Dairy (Section 4.4, para. 4.4.6) has a rated capacity of 6 000 l/day. So far, 2 500 to 3 500 l of fresh milk has been processed per day and the balance has been made up from recombination of imported milk powder and butterfat.

3.4.5.7 DPB is suffering from heavy financial losses which are partly related to the repayment of losses from the past. This is expected to have serious repercussions on its ability to function as a processing and marketing organization. Continued, even though involuntary, neglect of plant, machinery and equipment maintenance will contribute significantly to this.

3.5 The Slaughtering and Meat Processing Sector

3.5.1 Number of livestock

3.5.1.1 The cattle population in Zambia is very unevenly distributed between the different parts of the country. The total number was estimated at some 1.8 million in 1979, with about 800 000 head in the Southern Province, 380 000 in the Western, 220 000 in the Eastern and about 200 000 in the Central Province. All other provinces have considerably less, in particular Luapula with barely 5 000 head.

3.5.1.2 The numbers of sheep and goats are insignificant in terms of slaughter potential, 32 000 and 325 000 head respectively.

3.5.1.3 Pig production has decreased during the 1970s and the total number of pigs in 1979 was some 120 000 head, with the majority or about 70 000 in the Eastern Province.

3.5.2 Cattle off-take

3.5.2.1 Calculated from the assumptions made in the Food Strategy Study, i.e. an annual off-take from the commercially oriented farms of 16.4% with an annual herd increase of 5% p.a., these cattle farms have today about 440 000 head with a production of 72 500 slaughtering animals.

3.5.2.2 The traditionally managed herds which use communal grazing, under either sedentary or transhumant systems, were assumed to increase by 2% p.a. and have a net off-take of 5.9%, 5.1% of which is marketed. The total number is thus calculated at 1.73 million head for 1986, about 88 000 being slaughtered. This may be an overestimation depending on the drought which has struck the country over a number of years.

3.5.3 The Slaughtering and Meat Processing Industry

3.5.3.1 The Cold Storage Board, CSB, which is a parastatal organization, operates slaughterhouses for cattle in the major producing areas, Lusaka, Mongu in the Western Province, Livingstone and Choma in the Southern Province. Depots are established in other places.

3.5.3.2 Municipal abattoirs exist in a number of towns, like Ndola, Luanshya, Kitwe and Chingola in the Copperbelt, Kafue in Lusaka Province and Mazabuka in the northern part of the Southern Province.

3.5.3.3 Large areas of the country thus lack organized slaughtering and the animals are presumably killed, handled and marketed in a traditional manner.

3.5.3.4 The total slaughtering capacity in CSB abattoirs is stated to be 142 500 head p.a. and the total national capacity about 240 000 head p.a. This should be compared with the present estimated off-take of about 160 000 head.

3.5.3.5 All CSB slaughterhouses were under-utilized in 1982; Lusaka 20% utilization, Mongu 30% and Livingstone 6% (1981). Whether the situation has improved in recent years is not known. It is concluded from available documents that the national slaughtering capacity is adequate until 1990.

3.5.3.6 A suggestion is apparently being discussed which may eventually lead to the Mongu slaughterhouse being taken over by the Western Provincial Co-operative Union.

3.5.3.7 It is worth mentioning that the hygienic conditions in the Municipal abattoirs, and certainly also the traditional slaughtering in the rural areas, leave much to be desired.

3.5.3.8 Zambia Pork Producer, also a parastatal organization, operates a pig slaughterhouse in Lusaka with a capacity of 400 pigs/day. 12% of this capacity was utilized in 1982 and with the decline of the pig industry as a whole the degree of utilization is not likely to have improved.

3.5.3.9 There is also a chicken slaughterhouse in Lusaka operated by the Poultry Development Company Ltd, PDC, a subsidiary to the Rural Development Corporation. The capacity is 1 000 birds/h and the capacity utilization in 1982 was 20%. Since there is a trend to fewer and larger producers, the position for PDC may look brighter today.

3.5.3.10 The prospects for future initiative by the Co-operative Movement in the slaughtering sector do not seem to be particularly good.

3.5.3.11 In time, depending on the future engagement by the Co-operative Movement in livestock co-operative societies, a platform may be created for an integrated co-operative involvement in the livestock sector including a viable co-operative slaughterhouse industry.

3.5.3.12 Meat processing is mainly carried out on a small scale by the private sector. The plants are all located in Lusaka or in the Copperbelt and use each only about 0.5 to 3.5 tons carcass weight per day as raw materials.

3.5.3.13 An exception as far as the capacity is concerned is Brooke Bond/ Lyons, a multinational company in Ndola. They produce pork luncheon meat and corned beef, apart from many other tinned products such as peas, pineapple, jams, etc,. in total 32 products.

3.5.3.14 Meat processing for local supply is likely to be a sound project idea in many urban areas when the need arises. It may thus be combined with small sized hygienic slaughtering facilities which can supply meat and meat products to the co-operative stores. Such development should then be integrated and cover the whole chain of activities from the Investment Co-operative Societies to establishment of suitably planned and managed meat shops with adequate chilling facilities.

3.6 Vegetables and Fruit

3.6.1 No statistical figures have been obtained for production or marketing of vegetables and fruits. The large volumes are handled by small merchants on the local markets.

3.6.2 In the Western Province tomatoes and mangoes are grown quite extensively and there is a mango processing plant in Mongu with a capacity of 400 tons/year. The potential for increased production is reportedly quite high.

3.6.3 In the North Western Province large quantities of pineapple are grown in the Ikelange area. The fruit is transported to Mwinilunga Cannery Factory operated by the District Council.

3.6.4 The factory has reportedly encountered several problems including transport difficulties, erratic electrical supply and sub-standard quality, causing marketing problems.

3.6.5 Brooke Bond, mentioned previously under 3.5.3.13 above, produces a variety of juices and fruit preserves and there are also several private firms in the Copperbelt and Lusaka which are engaged in vegetable and fruit processing, some on quite a large scale, e.g. Farm House brand tomato ketchup.

3.6.6 Okra, eggplants, avocado, papaya and guava do well in many areas but production is not properly organized. They are all highly valued products on the European market.

3.6.7 Taking into account the present airfreight costs, 8 Negwee/kg (at present rate of exchange US$ 0.012) with Zambia Airways, the viability of organizing the growers and establishing a vegetable and fruit collecting, sorting/grading and packing plant, with the appropriate chilled storage facilities, may be worth investigating by the Lusaka Provincial Co-operative Union.

3.7 Coffee

3.7.1 The coffee industry is for all practical purposes a Government business for which the Zambia Coffee Company is responsible. They manage the coffee estates which produce the bulk of the coffee and they also process the beans.

3.7.2 Limited quantities of coffee are produced by smallholders and there is only one coffee co-operative society with comparatively few members.

4.0 EASTERN CO-OPERATIVE UNION LIMITED, ECU

4.1 History

4.1.1 The formation of co-operatives in the region dates back to 1948. There was a transition in 1963, when the small co-operative unions in districts like Chipata, Katete, etc., formed Eastern Province Co-operative Marketing Association, EPCMA. At this time the associated member societies were only producers' co-operatives.

4.1.2 In 1973 the need for multipurpose co-operative societies became apparent, and there was a transformation of EPCMA into ECU. The by-laws were changed, both for the Union and for the co-operative societies. Any viable activity of interest to the member societies could be taken up, such as production of crops, marketing of crops, supply of farm inputs, establishment of consumer shops at society

level, operation of hammermills at society level. Later on, co-operative credit schemes came into the picture. Education and training of co-operative members and employees at primary level is another important task.

4.1.3 Of late interest has also been focused on agro-industrial development on a modest scale.

4.1.4 The number of member societies is approaching 90, one of them, the Eastern Livestock Co-operative Society Limited, becoming a member in 1982. From an organizational point of view ECU is divided into six districts and operates in all ten depots.

4.2 The Eastern Livestock Co-operative Society Limited

4.2.1 This society has members scattered all over the region, and is of some particular interest for diversified and extended activities within the ECU.

4.2.2 The short and long term program, as spelt out by the Society itself, includes the following:

" - Poultry

This would allow members to borrow finance from the Society to re-establish their projects which stopped as a result of non-availability of feeds and scarcity of day-old chicks.

- Piggery

To re-establish the industry after it stopped for disorganized marketing, poor producers' price and scarcity of feeds. Members would borrow from the Society finance, for renovation of pig houses, breeding stock and feeds, to start projects.

- Dairy

Milk is short of supply by between 65% and 70% to meet the demand in the area. It is intended that members would fill up the shortfall by establishing dairies in their localities. The system would be the same to provide finance to the members. This project would include a beef fattening scheme to facilitate a liquidity element to the farmer/member for his financial obligations to the Society. "

Other points the Society has raised are concerned with draft-oxen and suitable implements for these, and veterinary services. Financing and internal resources are also discussed.

4.3 Agricultural production

4.3.1 There are no actual figures stating the area under cultivation. However, from an agro-industrial development point of view the production figures are of considerable interest, and also some aspects of possible future changes.

4.3.2 The following table gives the purchases by ECU for the 1984/85 and 1985/86 seasons:

Crop	tons 1984/85	1985/86
Maize	166 670	161 680
Sorghum	2	5
Millet	-	1
Wheat	-	692
Paddy rice	355	402
Beans	9	34
Cow peas	26	64
Sunflower	12 977	7 394
Soyabeans	57	54
Groundnuts, shelled	468	386
unshelled	1 073	3 309
Makuru Red, shelled	2	5
unshelled	3	1
Cotton	4 769	4 700

4.3.3 A notable change in the overall picture is the introduction of wheat into the area, initiated by the local demand for wheat by the ECU milling industry.

4.3.4 The new pricing system with floor prices, and the increased cost of fertilizer, are believed to reduce the interest in growing maize, with increased production of other cash crops, in particular groundnuts, sunflower and cotton.

4.3.5 Lintco, which is responsible not only for cotton but also for soyabeans, have registered a small decline in cotton production in recent years. Increase in cotton production is promoted primarily by extension activities. The target for the 1986/87 cropping season is to increase the area from 5 500 hectares in the previous season to 10 000 hectares.

4.3.6 There is an increasing interest in growing soyabeans and efforts are being made to recruit more farmers to grow this crop. Extension services are provided and credit facilities including seed and fertilizer. Lintco also buy the soyabeans, and production has increased dramatically from 84 tons in 1983/84 to approximately 400 tons last season and 1 000 tons in 1985/86.

4.3.7 It was understood from the discussions with Lintco that there would be no objection to ECU oil milling industry processing the oilbearing seed at present dispatched by Lintco for oil extraction elsewhere.

4.4 Food Processing Industries

4.4.1 So far, the engagement by ECU in agro-industries has been focused to a large extent on flour milling and the Union currently owns and operates the following:

Chipata	1 Wheat mill
	1 Maize mill
	1 Groundnut shelling plant
	1 Groundnut grading plant
Lundazi	1 Maize mill
Petauke	1 Maize mill

The milling industry in Chipata also includes a stockfeed plant.

4.4.2 In Katete there is an ECU oil mill, processing mainly sunflower seed and groundnuts.

4.4.3 Some of these industries have been visited and brief accounts are given in Appendix 1:1.

4.4.4 Small hammermills, primarily for maize milling, are operated by 50 primary societies.

4.4.5 Lintco, which is responsible for the purchase, handling and processing of cotton, has a cotton ginnery in the Eastern Province with a capacity of 6 000 tons per year. Maximum amount processed in a year has so far been 4 700 tons, giving roughly 1 500 tons of lint and 3 200 tons of cotton seed.

4.4.6 The Dairy Produce Board operates a small dairy plant in Chipata supplied in 1982 by Danish Turnkey Dairies. The rated capacity is 6 000 l/day of consumer milk. The milk is received, weighed, pasteurized, chilled and packed in Pre-Pac half-liter or quarter-liter plastic bags. There is also equipment for recombination of skim milk powder, butter oil and water.

4.4.7 So far, 2 500 to 3 500 liters of fresh milk are received from six producers, supplying approximately 1 400 l, 1 100 l, 500 l, 100 l, 80 l and 15 l respectively at the moment. The remaining processing capacity is utilized for recombined milk.

4.4.8 There is no proper slaughterhouse in Chipata but CSB has a depot and butcher's shop.

4.5 Future Plans for Food Industries

4.5.1 ECU has gained a certain amount of experience from the establishment and operation of industrial ventures. Agro-industrial expansion both horizontally and vertically has been discussed within the Union and includes the following:

- Bakery/Confectionary for manufacturing of biscuits and groundnut cake products.
- Complementing the existing groundnut shelling and grading plant in Chipata with a roasting line for (salted) groundnuts including a packing line (sealed tins).
- Processing equipment at society level including
  - additional hammermills
  - small vegetable oil crushing units
  - juice pressing equipment for masuku fruit; the juice would be used for wine-making for sale in the co-operative shops and, in the long term perspective, marketed in other areas; job opportunities would be created
  - sugar cane presses for local utilization on a household level of sun-evaporated sugar sirup.

4.6 Potential for other Food Industries

4.6.1 Depending on the future development of the Eastern Livestock Co-operative Society, dairy processing plants may be considered in Lundazi, Katete and Petauke to cater for local needs. The urban population for the three is projected at 10 400, 14 000, and 27 500 respectively by 1990.

4.6.2 This suggests that Petauke would have first priority, considering the size of the potential market.

4.6.3 Whether or not it will be justified to establish small dairy processing plants depends entirely on the vitality and expansion of dairy farming in each one of these districts.

4.6.4 Meat processing for local supply, primarily to the co-operative stores in line with the discussion in para. 3.5.3.14, is another possible future venture.

5.0 NORTHERN CO-OPERATIVE UNION LTD, NCU

5.1 General

5.1.1 The Union was registered in 1954 and has today 57 affiliated rural societies. Agriculture in the region is predominantly focused on cultivation of crops and so far little interest has been shown in animal husbandry.

5.1.2 The following compilation shows the crops predominantly grown and the change in production since 1970 reflected in the purchases made by NCU.

	tons per year			
	1970	1975	1980	1985
Maize	60 000	10 200	14 300	61 600
Millet	-	-	200	16
Paddy rice	90	370	900	4 100
Beans	20	40	1 900	200
Sunflower	-	80	100	150
Groundnuts	20	1	10	-

The figures show clearly a rapid growth of maize production, a steady increase in the paddy rice purchases and a moderate improvement in marketed quantities of sunflower seed.

5.2 Food Processing Industries

5.2.1 The policy of NCU is to expand and eventually diversify their engagement in the food industrial sector.

Milling of maize is carried out on a small scale at society level and a number of hammermills are operated in the villages. Vegetable oil crushing is also carried out at society level in Mpika and Chinsali.

5.2.2 The co-operative food industries are owned through the NCU subsidiary company, Northern Milling (1977) Limited, which operates the following mills:

	capacity tons/24 h	year of construction
- Rice mill	36	1981
- Maize mill	48	1980
- Maize mill	48	1948(bought 1977)

5.2.3 All three plants are located on the same premises, the rice mill in one building and the two flour mills in another. A small batch-mixer for animal feeds is also located in the latter building.

5.2.4 The overall layout has not considered the handling of either the raw materials, maize and paddy, or the processed products. Efficient handling and transport is not possible at present. Appendix 1:2 gives an account of the present status of the installations.

5.2.5 The rice mill will be subject to some modifications to improve the performance of the plant, in view of the type and quality of paddy produced in the region. The appropriate storage facilities will also be added to allow for an acceptable overall product flow (App. 1:2, sect. 1.3 and 1.4).

5.2.6 Plans are being made to modify the location of the intake to the new maize mill. This will considerably improve the situation, with less transport and direct handling of the maize bags from place of storage to the mill intake.

5.3 Northern Milling (1977) Limited

5.3.1 Details concerning the mills operated by the company are presented in Appendix 1:2. The annual capacity of the two maize mills is 21 000 tons, according to a report from NCU dated 30 October 1985.

5.3.2 The present constraints are related to the limited allocation of maize, for 1985 only 9 720 tons, and also the technical faults and lack of spare parts. This level of production, or in other terms under-utilization of available capacity and investments, makes the venture non-viable.

5.3.3 It should be noted, however, that according to the findings, the total processed quantity of maize was about 8 600 tons during 1985, or some 1 000 tons less than was allocated. This suggests that, for 1985 at least, the basic constraint has been the technical condition of the Roncaglia Mill in particular.

5.3.4 The financial position of Northern Milling is very weak. The company has reportedly been running at a loss since it was bought by NCU in 1977. This is to some extent surprising, since the old mill actually contributed almost 70% of total output in 1985.

5.3.5 The big problem is, no doubt, the Roncaglia Mill installed in 1980, which must be rehabilitated as soon as possible. The plan of action proposed by NCU incluces

1) Apply for loans in foreign exchange to buy spare parts.

2) Arrange for a study to be made to recommend the most adequate replacements and work-out plan for the mill.

3) Find a sponsor to finance the purchase of two trucks for transport of the milled products to the districts.

5.3.6 Point 2) is strongly supported, but the terms of reference should be geared towards a complete techno-economic study of Northern Milling (1977) Ltd, aiming at a plan of action for rehabilitation of the maize milling section.

5.4 Future Plans for Food Industries

5.4.1 It is pointed out clearly that the NCU has an ambition to expand and diversify its agro-industrial sector. It appears to be equally clear that development in a foreseeable future will be concentrated on the milling sector only, with the exception of small oil mills on a semi-industrial scale at society level.

5.4.2 The current program includes the following:

- Increase in the number of hammermills at society level.
- Establishment of small oil crushing units at society level.
- Acquisition of a maize mill in Chinsali from INDECO.
- In a longer term perspective establishment of a maize mill in Isoka, subject to decision by the NCU Board of Directors.
- In the future NCU may enter into the fish processing sector since Lake Tanganyika is within the Union's area. So far, fish processing is carried out by Government-owned companies and private enterprise.

6.0 SOUTHERN PROVINCE CO-OPERATIVE MARKETING UNION LIMITED, SPCMU

6.1 History

6.1.1 The SPCMU was registered in 1960 as a Union of Primary Producers Co-operatives in two districts. In the 1970s further districts were added and by 1981 SPCMU covered the entire Southern Province.

6.1.2 At present 97 primary societies are affiliated to the Union, 20 of which are multi-purpose societies.

6.2 Agricultural Production

6.2.1 By far the most important crop is maize. Sunflower has a tendency to increase slowly, whereas the three other crops purchased by the Union, soyabeans, wheat and sorghum, tend to be quite stable with small variations from one year to another.

6.2.2 The table below shows the quantities purchased in the last five years. Soyabeans, wheat and sorghum are given in one figure.

Year	tons		
	Maize	Sunflower	Soyabeans, wheat, sorghum
1981	273 478	6 192	2 563
1982	146 300	3 636	1 985
1983	86 474	5 812	2 402
1984	94 545	14 732	1 481
1985	130 086	7 232	2 482

6.3 Agro Industries

6.3.1 Considering the size of the Union, comparatively little attention has been paid to agro-industrial development. The Union has recently taken over the Monze Stockfeed Plant, which is not in operation at present.

6.3.2 A scheme to establish society level hammermills started some years ago and may in this connection be termed small scale semi-industrial units. There are at present 7 of them in operation and the total number by 1987 is expected to be 35.

6.3.3 ZATCO Stockfeed Limited, which is a subsidiary to Zambia Agriculture Trading Co-operative Limited, has an oil mill and a feed plant in Choma.

6.3.4 A third co-operative agro-industry in the Province is the dairy plant in Livingstone, owned and operated by Zambezi Co-operative Dairies Limited.

6.4 Future Plans for Food Industries

6.4.1 The program to provide additional societies with hammermills is in progress and will be followed by the establishment of society level oil mills in a similar manner, initially six units.

6.4.2 In the 4th Five Year Diversification Plan provisions have been made for 8 food processing units, each at an estimated cost of K 30 000 (1985 cost level). No information has been obtained regarding the type of food industries planned, but the funds allocated indicate that it is a society level scheme.

6.4.3 The largest single project is a Union oil mill to be located in Choma for processing of sunflower seed, soyabeans, groundnuts and cotton seed. The oil cakes are intended to be supplied to the Monze Stockfeed Plant, som 60 km from Choma.

7.0 COMMENTS AND CONCLUSIONS

7.0.1 It is apparent from the many interviews with Union and plant management representatives that the proper project preparations in terms of qualified studies to establish the detailed requirements, the plant specifications including capacities, process performance, standard of workmanship, quality issues, norms for the electrical supplies, etc., have been grossly overlooked. This is also documented by estimates made regarding process capacities available in comparison with present availability of raw materials and reasonable expectations for the future.

7.0.2 Efforts were made to procure an opportunity of reviewing some project specifications which normally form part of a project contract agreement. This would have shown the merits and shortcomings in more detail. Unfortunately these efforts were not successful.

7.0.3 It is thus concluded that co-operative agro-industries are generally not procured on the basis of adequate specifications.

7.0.4 To what extent the supplier is liable for deficiencies in the plants, and what guarantees are provided as an assurance of good performance, have not been clarified.

7.0.5 It follows that commissioning procedures with detailed technical inspection of the plants, capacity trials, performance tests of the individual machine units and the plant as a whole and the issue of take-over certificates do not seem to be common practice.

7.0.6 In summary, the corner-stones in implementing food processing industries are very fragile, ample evidence of which may be obtained from the results in existing plants.

7.0.7 The building is invariably an integral part of a food processing industry, at least as far as the hygienic considerations are concerned. It is important that the building is easy to clean, that the proper arrangements are made for carrying out the cleaning, etc. The importance of increased awareness of these issues for future food processing industries must be stressed very strongly.

7.0.8 With limited or no funds available for investment in agro-industrial projects, the negotiating position for the recipient country is weak. This, in combination with inadequate technical know-how and experience from procurement of food industrial projects, appears to be the reason why the co-operative food industry has so many installations which are not up to standard.

7.0.9 Technically inferior plants may function satisfactorily under very good management supported by well qualified and experienced personnel for maintenance and repairs, who have a reasonably well equipped workshop at their disposal. Availability of spare parts must also be good.

7.0.10 The food industry plants which have been inspected are frequently inferior in one or several respects. Capacities are based on the wrong assumptions, inadequate penetration of the bases for determination of plant criteria which formulate the project, inadequate or no technical specifications for procurement, no guarantees of standard and performance.

7.0.11 When a plant of this quality is run by a management which is weak in one or several of the important disciplines organization and personnel, production planning, production routines and financial planning and follow-up, the pre-conditions for a viable enterprise do not exist.

7.0.12 If other constraints are added, such as substantial scarcity of spare parts due to lack of funds and difficulty in obtaining foreign exchange, lack of transport and sometimes restrictions in supply of raw materials, the problems become insurmountable.

7.0.13 It is vital to the future development of the co-operative food industry that the present processing plants are rehabilitated to the extent necessary from a technical, economic and administrative point of view in its broader sense, in order to ensure that future operations result in an economic surplus — generate funds for later investment, either to expand the enterprise or to establish new ventures. If this is not done, the Zambian co-operative food industry will always have to rely on foreign grants, aid, or other means of foreign financing. Future internal financing of new food industries within the co-operative movement is essential in order to fulfil the strategy of development.

8.0 SUGGESTIONS FOR MEASURES TO BE TAKEN

8.1 Any initiative to assist the co-operative food industry in Zambia must aim at (1) rehabilitation of existing operations, (2) establishment of project implementation routines designed to ensure that future food processing plants are up to standard, and (3) elaboration of the appropriate training programs and managerial support.

8.2 The overall plan would have to include:

8.2.1 Acquisition of funds for rehabilitation of existing plants through international agencies and/or bilateral aid.

8.2.2 Technical assistance for preparation of an integrated program for each food industry subjected to rehabilitation, including

- technical specifications for the necessary repairs, modifications and additional equipment
- recommendations for management support, organizational changes, complementary training of personnel, financial and economic planning.

8.2.3 Provision of managerial support and technical assistance in line with the requirements identified (under 8.2.2).

8.2.4 Substantial strengthening of the Research and Development Section within ZCF including establishment of a Technical Department. The personnel resources should be capable of providing the following main services to the co-operative movement and take full responsibility for

- qualified techno-economic pre-investment and feasibility studies including project formulation

- elaboration of technical specifications to form the basis for procurement of food industrial projects, regardless of mode of procurement
- assistance in contractual matters and negotiations with suppliers, donors, etc.
- provision of technical expertise capable of supervising and controlling the commissioning procedure and taking part in guarantee inspections and tests.

8.3 A strengthened Research and Development Section would be a key element for the future successful development of the co-operative food industry. The responsibilities of the Section must be linked to adequate professional competence and integrity. The recruitment of well qualified staff members with suitable personal character is essential and will largely determine if the targets set are to be reached.

8.4 In order that the Research and Development Section may gain sufficient knowledge and experience, substantial multi-discipline technical assistance will be necessary over a number of years.

NOTES AND COMMENTS FROM ECU AGRO-INDUSTRIAL PLANTS VISITED

1. ECU Plants in Chipata

On the site in Chipata ECU owns and operates the following:

	Stated capacity per 24 hours	Approx.capacity per 8 h-shift
- Maize mill	120 tons	40 tons
- Wheat mill	45 tons	12 tons
- Rice mill	-	2 tons
- Stock feed plant	100 tons	30 tons
- Groundnut sheller	120 tons	40 tons
- Groundnut grader	10 tons	3 tons

Regrettably, although requested during the visit and also later, no information was received on production figures or achieved capacities of the plants. Consequently no assessment of the performance of the Chipata plants has been possible.

Judging from the findings and impressions from the inspection of the plants, it is concluded that the management is not aware of the importance of ensuring that reasonable hygienic considerations are applied in both food and animal feed industries.

1.1 Maize mill

1.1.1 Process flow

The mill is provided with three Simplex steel silos each holding 100 tons. The mill is designed with basement for conveying equipment, one milling floor and one sifter floor.

After weighing of the maize on a Howe Richardson automatic scale it is cleaned on a Simon Ripple Sifter, elevated to a horizontal damper paddle conveyor taking the maize to a half-ton conditioning bin. The holding time is short, reportedly about 5 minutes. After the damping procedure the maize passes through decorticators (2), is sifted and milled on 3 Simon double roller mills, sifted, after which the three fractions, Roller Meal, Breakfast Meal and Maize Bran, are conveyed to simple manual bagging-off outlets. The meal is packed in 25 kg bags.

The mill is of a fairly compact design and appeared to operate satisfactorily.

1.1.2 Comments, present state of the mill

In view of the fact that insecticide powder is frequently used in the maize stores, it would have been reasonable to suppose that a maize washing plant had been included in the line to improve the food hygiene. It is argued that the insecticide is inactivated by the time it is supplied to the mill and would do no harm.

At the time of the visit two sections of the horizontal dampener were patched in numerous places, but still leaked. These sections ought to be replaced as soon as possible. Spares were available in the spare parts store.

The screens in both decorticators were worn out and sacking had been secured around them. Only about one-third of the screens were still open. Spare screens were reportedly available from the spare parts store.

No major problems had been experienced in operating the plant, and an adequate supply of spare parts was reportedly still in the spare parts store.

In the past the mill has been in operation 3 x 8 hours during October through March, less during the rest of the year.

1.2 Wheat mill

This is a compact horizontal Roncaglia mill installed in an existing warehouse 1975/76.

1.2.1 Process flow

All mechanical transport of the wheat is carried out by means of screw conveyors. From the intake hopper the wheat is lifted and dropped on a pre-cleaner, conveyed to a trieur/drum cleaner, lifted and fed into a Roncaglia Original Pneumatic Washer and stored in one of six conditioning bins, rectangular concrete structures on the floor level. After conditioning, the wheat passes through a horizontal cylinder cleaner to the milling unit. This includes one crusher and five double roller mills. The three fractions, flour, "filter powder", and bran, are conveyed pneumatically to manual bagging. The whole installation is provided with pneumatic sieves and tube filters.

1.2.2 General information and comments

At the time of the visit one roller mill was out of operation on account of a burnt motor.

Spare parts are said to be generally not a problem. Eight spare motors are available centrally in Chipata for all ECU units. Transport of, e.g., electrical motors creates difficulties, since rewinding is done in Lusaka only. With transport both ways, and sometimes from the Lundazi mill, it may take a month or two.

The spare parts are replenished every 2-3 years, and apart from occasional temporary stops of one roller mill due to lack of spare motors, the spare parts situation is said to be well under control.

Re-fluting of the rollers is carried out at the NMC workshop in Lusaka.

The overall impression of the installation is favourable, although the intake - cleaning - washing - conditioning section was in need of thorough cleaning. The use of vertical screw conveyors is questionable – a cheap solution.

The mill operates only 1 x 8 hours per day, reportedly because of shortage of wheat.

1.2.3 Conclusions regarding the viability of the mill

The present production of wheat in the region is about 700 tons per year. Assuming that the average plant performance is about 75% of nominal capacity or 90 tons/24 hours, if operated on a 3-shift basis the total harvest would be processed in a little more than a week, or with one shift per day in about a month.

To reach an acceptable degree of utilization, to ensure the viability of the mill, the total wheat harvest in the region would have to increase about 30 times. Not even a ten-fold increase appears realistic.

It is thus concluded that the necessary initial project studies have either not been carried out or been handled in an unacceptable and unprofessional manner.

1.3 Rice milling unit

This is a small Japanese huller/polisher manufactured by Yanmar.

The unit, which is placed in a warehouse about 5 x 10 m, has been used for four years. After dehulling, the rice is screened and the hulls removed through aspiration/cyclone separation, and bagged. The dehulled paddy rice passes through a conical screw polisher.

The capacity is reportedly 2 tons/8 hours which, however, appears to be rather high.

The steel plate housing of the dehulling section was badly worn and repaired by welding numerous times.

Lack of spare parts has apparently caused no great difficulties and the unit operates satisfactorily.

The quality of the processed rice is low, with a very high percentage of broken kernels.

Another Yanmar rice milling unit has been purchased and will be installed in Chama, which is a major rice producing area further north in the Province. It is believed that these two units are capable of processing all paddy currently grown in the Province.

1.4 Stock feed plant

1.4.1 General

The plant is located in a spacious warehouse about 20 x 65 m.

It was commissioned in 1984 and supplied by Kumar Metal Industries, Bombay, India.

1.4.2 Process flow

The process flow is simple and straightforward with three floors. After being weighed on a platform scale, the bags of maize and other ingredients are dumped into the intake hopper from which the intake elevator lifts the material. A manually operated two-way valve directs the ingredients either to the mixer pre-bin or to the hammermill. This is fed by a vibrator-feeder with magnetic separator, and is powered by a 55 kW electric motor. The milled produce passes a cyclone and is lifted to the mixer pre-bin. Each batch is emptied into the horizontal mixer, which is designed with an open type screw mixer device. The mixer has a volume of approximately 2 m^3 and would thus handle 1-ton batches. After mixing, the compound feed is conveyed to the manual bagging-out unit which has an automatic scale and one bag-holder.

1.4.3 Comments, production, quality of products

The plant gives a good overall impression but appeared to be inadequately painted for rust protection.

At present the product list includes four types of poultry rations and one pig ration. So far there has been no demand for ruminant feeds. As a consequence the routine operation of the plant is to empty all ingredients included in a batch into the intake hopper for hammermilling.

It was noted in the warehouse that some of the ingredients used were of inferior quality. The maize, for instance, was heavily contaminated by foreign matter, including small stones, sand, cob fragments, etc. This suggests that the plant should have been equipped with an air-screen cleaner to ensure satisfactory feed quality, and to avoid excessive wear of the whole plant, but the hammermill in particular.

Chunks of moldy maize and oil cakes were not uncommon and even oil cake bags steaming warm from decomposition. Moldy, caked maize and expeller cakes are sorted out, but there is an obvious risk that certain quantities of deteriorated ingredients are unintentionally used, resulting in unhealthy feeds of reduced nutritive value and containing toxic substances.

The feed plant operates one 8-hour shift or less, depending on the demand for feeds.

1.5 Groundnut shelling unit

The plant is placed in a warehouse adjacent to the groundnut grading plant. It has been in operation for a couple of years and was delivered by Les Fils de Louise (SAMAT), Marseilles, France. It is a one-unit plant with intake hopper, elevator, two sheller drums, aspiration to remove the shells and a vibrating separation table with a number of screens. The unit was said to have operated satisfactorily. However, the performance did not appear to be first class, since the sorted groundnut bags contained approximately 20% shells. This was explained as being caused by the varying sizes of the groundnuts. The shelled and screened groundnuts are thus cleaned once more by about 40 people using the traditional trays.

One way to rationalize the procedure is to add a reasonably long sorting conveyor with space for about ten people.

1.6 Groundnut grading plant

The plant is approximately 25 years old and supplied by Carter-Day Company, Minneapolis, Minn., USA. The nucleus of the plant is six Carter Precision Graders placed two on each of three floors.

The groundnuts are sorted into six grades determined by the size of the nuts.

The plant reportedly works well with comparatively few problems. It is reported that very few spare parts remain.

1.7 General workshop

1.7.1 Equipment, personnel

The workshop is equipped with a Colchester Triumph 2000 lathe, a standard drill, a small rather simple bench lathe, gas and arc welders, a small bench grinder for sharpening tools and an assortment of hand-tools.

The maintenance of all ECU plants in Chipata, Lundazi, Katete and Petauke is centralized to the general workshop.

The Chief Mechanic is head of the maintenance organization which includes about 12 mechanics and 3 electricians. Only the 3 electricians and 2 of the mechanics are qualified. One or two of the mechanics are assigned to each plant on the site. In addition there is one mechanic on each of the plants in Lundazi, Katete and Petauke. Thus all major repairs or maintenance work on these locations will have to be requested from Chipata. The spare parts are also largely centralized to Chipata.

1.7.2 Comments

The centralization of spare parts and essential maintenance functions is bound to have a detrimental effect on the performance of the plants in Lundazi, Katete and Petauke. Not only is it a question of substantial delays from time to time with spare parts and assistance, particularly now with the severe transport problems, but equally important is the division of responsibility for keeping the plants running. There will always be reasons for inadequate performance which cannot be curbed if the present system is maintained.

2 Katete Oil Mill

2.1 General

The oil mill was started up in March 1984 and commissioned in June the same year. It was supplied by Kumar Metal Industries, Bombay, India, and has a rated capacity of 100 tons of seed per 24 hours.

According to the contract document, the plant is reportedly capable of processing sunflower seed, groundnuts, soyabeans and cotton seed. Apparently only sunflower seed was used during the commissioning trials.

Information regarding the commissioning procedure was not available. The commissioning procedure may have included a superficial inspection of the plant and the trials may have been confined to determining the input of sunflower seed. Thus detailed technical and performance tests of each unit in the plant may not have been carried out, e.g. performance of the decorticator and the extruder presses to establish the quantity of residue fat in the expellers.

2.2 Process flow

The process flow is briefly as follows:

The bags of produce are emptied into an intake hopper. A chain conveyor lifts the oil seed and feeds a decorticator, equipped with a two-screen vibrating table and pneumatic sucking-off of the husks, which are transported to a cyclone with bagging-off attachment. The decorticated seed is lifted by elevator No.2 and fed onto a horizontal conveyor above the expeller section. This consists of four cookers, each feeding one expeller press. The oil cakes are transported to elevator No.3 and lifted to the bagging-out pre-bin. The extracted oil is piped to an under-floor crude oil tank, pumped through filter No.1, collected and piped to a second under-floor tank, pumped through filter No.2 and collected in a third under-floor buffer tank for double-filtered oil. From here the cooking oil is pumped to one of two overhead 16 m^3 storage tanks located in an adjacent part of the building, where the oil-cakes are bagged and stored intermediately.

Filling of consumer oil containers is carried out along a bench. The oil runs by gravity from the storage tanks through a pipe provided with a number of taps.

The steam required for the cookers is supplied from a boiler installed in a nearby building.

2.3 Comments to the overall planning

The layout of the plant does not take into account the need for efficient handling of appreciable quantities of products both before and after the expeller press process. For instance, at full capacity some 4 tons, 80 bags of seed, will have to be transported from a seed storage, in this case a stack, and handled in the entrance to the process building where there is no room for even half-an-hour's supply of bags.

In the same general area the hulls are bagged and then dumped in a heap while waiting to be carted away. Loading takes place in the same entrance as the seed intake.

Some 2.5 to 3 tons of expellers would be sacked per hour. At this end of the building, where the storage and filling of the cooking oil also takes place, there is floor space for a few hundred bags. The bags will then be transported by tractor to a warehouse some 40 m away from the intake end of the building. The same tractor is also used to transport bags of oil seeds to the intake and bags of hulls from the plant.

2.4 Present condition of the plant

At the time of visiting the plant the following was noted:

- The two screens on the decorticating unit were covered with caked dirt-sand-hull-seed mix; top screen about 25% of surface, bottom screen about 85%. It was explained that this was due to recent flooding of all three elevator pits.

- Extruder press 1. New extruder screw was being put in; unit presently out of operation.

- Extruder press 2. Broken extruder screw shaft; unit dismantled and out of operation.

- Extruder press 3. Top drive out of order, dismantled, no spare part; unit out of order.

- Extruder press 4. Electric starter out of order, reportedly to be replaced; unit out of order.

- Pressure gauges to three oil pumps out of order.

- Boiler plant dismantled, cracks in the end sections being welded; plant out of order.

It is also noteworthy that the process line does not include an initial seed cleaner. This is a vital piece of equipment for removal of sand, stones and other inert material which may damage, and under any circumstances substantially increase the wear on the decorticator and extruder presses in particular, and cause more frequent breakdowns.

The civil structural work, and especially the finishing of concrete foundations for the extruder presses and all floors, leaves much to be desired. This, in combination with the placing of process piping, makes the plant extremely difficult to keep reasonably clean. The recent flooding of all elevator pits is also a result of improperly executed civil works.

There are no proper arrangements for cleaning of the filter cloth, nor is there anywhere to store those not in use.

It would also have been appropriate, from a food hygiene point of view, to have the cooking oil packing department completely separated from the rest of the plant.

In summary, the hygienic conditions of the plant are entirely unsatisfactory and do not meet the basic requirements of a food industry.

2.5 Personnel

The plant manager is assisted in operating the plant by 1 mechanic, 2 welders, 1 boiler plant operator, 4 clerks and 32 general workers.

The mechanic is not qualified. He participated in erection of the plant and has been employed ever since. The 2 welders have received training on the job but are not qualified. As a result, welding of for instance expeller screws, due to wear, is not carried out in Katete. Instead the screws have to be sent to the ECU general workshop in Chipata for welding, a distance of about 80 km, an elaborate and time-consuming procedure, especially considering the prevailing transport difficulties.

The qualifications of the boiler plant operator are not known.

2.6 Operational experiences

The boiler plant reportedly never functioned satisfactorily from the very beginning. There have been numerous breakdowns, all for the same reason, namely cracks in the gable ends between the tube weldings. Replacement of the boiler plant is at present being discussed and may be implemented very soon.

There have been numerous unspecified faults in the extruder presses. All four units have never been in operation at the same time, at least not during the previous and current seasons. The extruder presses which have been operable have never been used on 3 shifts. Normally the plant is run on 1 shift only. 2-shift operation has been tried but has not proved possible because of accumulation of expeller bags and hull bags which have to be carted away.

The production records from March through December show a total processed quantity of sunflower seed of 1 579 tons. The plant has been run 5 days a week or about 210 days during this period. Since one shift of 8 hours per day is normal, the plant has been in operation approximately 1 680 hours and thus processed on an average approximately 0.9 tons per hour or 20% of rated capacity (4.16 tons/hour).

The fat content in decorticated sunflower seed is about 34%. A first crushing yields about 17%, leaving 17% in the expellers. A second processing yields another 10% vegetable crude oil, leaving 7% in the oil cake. This would be considered acceptable.

It is very likely that the contract with the supplier only stated the input capacity and not any performance requirements.

As a normal procedure it seems as if the sunflower seed is processed only once. This means considerable losses of cooking oil and consequently revenues to the plant. Moreover, oil cakes with as much as 17% fat content are no advantage and are apt to cause various complications to the feed industry.

2.7 Suggestions for improvements, Comments

In the short term, efforts should be made to eliminate the present basic problems and bottlenecks. One necessary measure is the installation of a pre-cleaner to remove sand and small stones from the oil seeds.

It is also suggested that the existing forklift truck, which has a capacity of 3 200 kg, is used for transport of oil cake bags. Initially about one hundred standard wooden pallets would have to be acquired. The dimensions should allow four bags in one layer. Stacking 8 bags in height, each pallet would take 1.6 tons. A reasonably even road would have to be prepared alongside the processing building and to the oil cake warehouse. The pallets of oil cake bags can probably be stacked two in height in the warehouse. This would significantly reduce the handling of the cake bags and allow use of the tractor for transport of seed bags.

Bagging of the hulls does not appear to be practical, apart from being a bottleneck in the routines of the plant. The cyclone could favourably be moved outside the building and placed with the outlet 2.5 to 3 m high. The hulls could be dropped on the ground and removed from time to time, or a box-type waggon could be placed under the cyclone and emptied when full.

A better solution would be to install a pellet machine or cuber to press the hulls for use as fuel to the boiler, thus saving the expense of fuel oil and wood. The necessary modification for removal and handling of the comparatively large quantities of ashes would have to be made.

The present arrangement for maintenance is inadequate. A qualified maintenance crew must be stationed at the Katete plant and be given the entire responsibility for keeping the oil mill in operation. It is not believed that a plant of this complexity can operate successfully without technical assistance, initially on a continuous basis, but in time reduced to periodic technical support tailored to the actual needs.

A qualified workshop with adequate spare parts store is also a prerequisite for keeping the plant going.

The economic and financial issues attached to successful management do not seem to have been taken sufficiently seriously. Strengthening of these resources is essential for revitalization of the enterprise.

Although only a few years old, the plant is in urgent need of rehabilitation to rectify its shortcomings. Investigations should also be carried out to identify the reasons for the poor extraction performance of the expeller presses. It may prove necessary to modify the process flow to allow for a second extraction of the oil seed in order to obtain an acceptable degree of oil extraction. The plant capacity would then be reduced to about 50% of that at present, i.e. 50 tons of seed per 24 hours or 10 000 to 12 000 tons per year.

It is felt to be important that the appropriate expertise is engaged for this task to elaborate detail specifications with quality requirements.

The problems related to the oil mill have been elaborated at some length. It is a new venture, the plant and the experience of the operation are depressing, and yet the oil mill is very important for future food industrial development in the region. The total present quantity of oil-bearing seeds produced in the region is about 14 000 tons per annum and there are indications that this will increase. If the plant is rehabilitated completely, supplied with qualified personnel of all categories and receives technical assistance, the target of having an efficient oil mill with adequate capacity and performance can be achieved.

3 Petauke maize mill

3.1 General

The plant was installed in 1975 by Roncaglia, Italy. It has a rated capacity of about 30 tons per 8-hour shift.

3.2 Process flow

The process flow in brief is as follows:
The maize is lifted from the intake hopper by means of a vertical screw conveyor and fed to a cleaner, lifted by a second vertical screw conveyor to a horizontal screw distributing the maize into five holding bins, each with a capacity of approx. 5.5 tons.

A second horizontal screw conveyor takes the maize from the holding bins to either the line for breakfast meal or to the line for roller meal. The breakfast meal line has two mills of older design. The roller meal line includes three double roller mills. Each line is provided with bagging-out facilities.

3.3 Present condition of the plant, Some operational problems

The plant is in a poor state of repair and the following main points are of particular importance.

- Screw conveyors from intake hopper to cleaner and from cleaner to top horizontal bin distributing conveyor have been out of operation for not less than three years; they have now been removed. Instead, the bags are taken from floor level to the holding bins by means of a bag conveyor and emptied into the bins.

- Several aspiration filters are either damaged or without the filter tubes.

- The two mills in the breakfast meal line have no electric motors and have not been operable for about two years.

- One sifter has no motor and has not been used for the past six months.

- The motor has been missing from one side of roller mill No.1 for six months; the other side was working.

- Roller mill No. 3: one side not in operation due to excessively worn roller.

The breakdowns are reportedly frequent. One example worth mentioning is the burning of the same electric motor not less than 15 times in one year. This is a clear indication that the reason for a breakdown is not established, but a spare motor is just put in. It also shows that the motors are not adequately protected against overloading. Protection devices around belts and pulleys were missing.

3.4 Performance

The production records for 1985 show that 917.1 tons of maize had been milled. The mill is reportedly operated in 3 shifts November through February and 1 or 2 shifts during the other eight months of the year, to some extent depending on the demand. Supply of maize was said not to be a limiting factor for operation continuously 3 shifts the year round.

On the assumption that a practical annual processing capacity of the plant ought to be about 75% of rated capacity, the capacity utilization is only between 5 and 6%. With reference to the number of shifts during different periods of the year, a rough calculation shows that the production performance is less than 10% of rated plant capacity, 30 tons/8-hour shift. Extraction rate for roller meal is about 84%.

The plant is in urgent need of rehabilitation. The fact that the maize is not cleaned before milling has not only a detrimental effect on the mill. The hygienic quality of the flour is very likely to be low and would probably not pass a test.

3.5 Comments

The frequent breakdowns in the plant are attributed to insufficient maintenance and weak management which is not capable of obtaining sufficient technical support from the general workshop in Chipata. It is recognized, however, that it is difficult for a subordinate to get any response. On the other hand, it has not been established to what extent pressure has been exerted on the central maintenance organization to provide assistance.

It may be concluded that the present maintenance and repair organization does not function satisfactorily and this has a devastating effect on the state of repair of the periferal plants (Petauke, Katete and presumably also Lundazi). The entire responsibility for keeping the plants in shape, operating them properly and running the enterprise in a business-like manner must rest with the Managing Director of the plant, supported by a competent Board of Directors.

This means that each plant located on its own must have adequate and capable personnel resources, all categories, and with reference to maintenance and repair adequate workshop facilities and spare parts.

NOTES AND COMMENTS FROM NCU FOOD INDUSTRIAL PLANTS VISITED

1 Rice Mill

1.1 Supplier

The plant, which has a rated capacity of 1.5 tons per hour, was installed in 1981 by Schule, Hamburg, West Germany.

1.2 Process flow

The paddy bags are emptied into an intake hopper. A bucket elevator lifts the paddy to a screen/aspiration cleaner, it passes over a scale to a second bucket elevator which lifts the cleaned and weighed paddy to a double rubber roller dehuller. The paddy now passes through a paddy separator, the hulls are removed by means of aspiration, the dehulled rice is sorted out and the remainder is returned to the dehuller. The rice is elevated to a small buffer bin before passing through a Unimatic rice peeler and further for a second polishing in a peeling cone. The polished rice is graded and finally weighed and bagged.

1.3 Planned modifications

The plant operates without breakdowns, but some modifications are planned based on past experience. The electrical installations are of a high standard and very few disturbances have occurred. Two electric motors have burnt since start-up of the plant.

The current problems and the modifications which will be made are as follows:

- Provision of a 1 000 ton paddy storage.
- Exchange of the double rubber roller dehuller for a disc sheller, also of German manufacture. The replacement of the worn rubber rollers is difficult in the present economic situation. The standard of the local rice is also such that the friction between the rubber rollers tends to increase the breakage of the rice.
- Exchange of the Unimatic rice peeler for a peeler cone machine of the same type as the second polisher.
- Replacement of the grader.
- Installation of a packing machine for 1 to 5 kg consumer packs.

1.4 Problems experienced, remedies

A major problem is related to the type of rice that has to be processed. This is invariably very uneven in length and shape,

depending on the mixture of varieties. It is reasonable that pressure is exerted on the rice producers through extension efforts and the pricing system to deliver uniform rice of the same variety. Premium price for high grade produce is likely to be quite effective in promoting higher quality.

The very low moisture content is also part of the same problem. This is evident from compilation of the production results from the plant. The percentage figures are calculated from the total processed quantity of paddy January through December 1985.

Head rice	(1st grade)	7.4%
Mixed rice	(2nd grade)	58.9%
Gross broken	(3rd grade)	7.4%
Fine broken	(4th grade)	9.9%
Rice bran		16.4%

This is not entirely satisfactory and has a negative influence on the economy of the operation.

Discussions have been initiated to install a parboiling plant to improve the situation. Another alternative is to improve the storage of the paddy to avoid excessive drying of the kernels. Pre-process conditioning may also be considered in addition to improved storage. Improved storage conditions to avoid lowering of the paddy moisture content will only be effective providing the time from harvesting to storage in the mill's store does not permit excessive drying on the farms and/or in stores at society level.

The supplies and financing associated with the additions and modifications under consideration are presently being discussed with EEC countries.

2 Maize mill, Roncaglia

2.1 General description

The mill is a Roncaglia Pneumatic Original installed in 1980, and the rated capacity is stated at 2 tons per hour.

The basic set-up does not diverge to any large extent from the plant briefly described in Petauke, Appendix 1:1, 3. This plant, however, is equipped with a degerminator and rotary sieving machine at the beginning of the processing line after the holding bins.

2.2 Present condition

The plant is not up to standard quality-wise and exhibits too many defects considering that it has been in operation for only five years. The list of defects includes:

- aspiration system to the cleaner out of order (no motor) and the tube filters are lacking; the dust goes with the maize for milling

- vertical screw conveyors have inadequate performance and will be replaced by bucket elevators

- air filter tubes and joints to the horizontal filter dust screw leak badly, resulting in difficulty in keeping the plant clean; insect problems

- the two purifiers in the breakfast meal line out of operation for about a year; no motor

- vertical flour screw to weighing and bagging-out unit collapsed and now partly dismantled; temporary arrangement with manual weighing.

The electrical system causes problems, primarily due to lack of sufficient devices for motor protection. 2 - 3 motors burn on an average every month. The frequent disturbances in the operation of the plant are clearly shown in the production records.

2.3 Plant operation and performance

Efforts are made to operate all mills on the site 3 shifts per day. Assuming that this is successful for some 70% of the days and that the plant operates 250 days a year; assuming further that 75% of rated capacity can be achieved; this would give 4 200 hours of operation, including breakdown time, and a total annual processed quantity of 6 300 tons.

The actual total amount for 1985 was approaching 2 700 tons or roughly 40% of what could reasonably be expected.

Rehabilitation of the plant is vital for continued operation. A first step is taken by the Plant Engineer in replacing the vertical screw conveyors. The electrical system must be remedied as soon as possible, including the appropriate protection devices for all motors.

3 Maize Mill, Robertson

3.1 General description

This is an old mill purchased in 1977 by NCU. It was supplied in 1948 by Robertson (manufactured in South Africa). The mill has three floors:

- basement; electric motor and central shaft with pulleys for the roller mills

- milling floor; three roller mills driven by flat belts
- sifter floor; three double rotary screen sifters, each unit powered by an electric motor.

The intake hopper is located on the milling floor level, but in a separate compartment. A bucket elevator lifts the maize to the sifter floor where a Robertson screen/air cleaner is placed.

The capacity is stated to be 2 tons/hour.

3.2 Operational experiences, present condition

Although the design of the mill is old it appears to have comparatively few breakdowns. The roller mills need normal maintenance, refluting of the rollers and overhaul of the bushings to the roller shafts.

Two of the six rotary filter sections are out of operation, one being without the motor and one due to broken sieve screens. Difficulties are experienced in obtaining mesh of the right gauge made from sufficiently heavy material.

3.3 Performance

The Robertson mill operates according to the same general shift pattern as the Roncaglia mill.

The total quantity of maize processed during 1985 was approaching 5 900 tons. Using the same assumptions for assessing the performance as for the Roncaglia mill, the capacity utilization is estimated at about 90%.

4 Central Workshop, Maintenance

4.1 Equipment, tools, spare parts

The workshop is very inadequately equipped considering the requirements to keep the three mills running.

Arc and gas welding equipment, a compressor, a bench vice and a bench grinder for tool sharpening are the only major items. The numbers and types of hand-tools and instruments are also completely inadequate.

Orders have been placed for a radial drill, a 60-ton hydraulic press and a substantial number and assortment of hand-tools. This will be financed through Norwegian funds.

The spare parts store is small but well organized. There are plans to increase the workshop floor space and extend the spare parts store, partly by rearrangement.

4.2 Personnel

Maintenance and repair of the plants is the responsibility of the Plant Engineer and his staff, which includes

1 workshop foreman, qualified
1 electrician, qualified
1 fitter/welder, qualified
1 fitter, on-the-job trained
1 helper

There are at present two vacancies, both fitters, required to hold a National Crafts Certificate. The vacancies will be filled as soon as possible.

Technical assistance is provided by NORAD.

Of the complete maintenance crew, three fitters are assigned one to each shift to ensure continuous supervision and casual repairs.

Electric motors for rewinding are sent to an electrical workshop in the Copperbelt, some 800 km away.

Refluting of worn rollers is carried out in Mufulira, also in the Copperbelt, by Olympic Milling (private).

NOTES AND COMMENTS FROM AGRO-INDUSTRIAL PLANTS VISITED IN THE SPCMU AREA

1 ZATCO Stockfeeds Limited

This is a subsidiary to Zambia Agriculture and Trading Co-operative Limited.

The plant, which started operations on 1 April 1982, includes an oil mill and a feed plant and is located in Choma.

1.1 The oil mill, general description

The oil mill comprises a seed decortication unit, two cooker/extruder press units, a conveying system for oil expellers and a system for storing of crude vegetable oil, pumping, filtering and buffer-storing of the single-filtered cooking oil before filling the oil in 210 l drums.

The equipment was supplied and installed by Kumar Metal Industries, Bombay, India.

It is a plant with low technical standard. It has very simple arrangements for adjusting and monitoring of the process. This applies to the decortication unit and to the cooker/extruder press units.

The decortication unit has an unacceptable performance and there is a compromise between losing oil-seed with the hulls and having excess amounts of hulls with the seed.

The cooker/extruder press units are intended for continuous operation. However, the design of the cooker without a steam jacket and only a number of layers of steam piping between steel sheet protection covers with a limited capacity for heating the produce, is inadequate. There is no forced feeding of cooked oil-seed to the extruder press. This is fed by gravity and adjustments can be made by increasing or decreasing the outlet opening from the cooker by means of a shute. A system has been adopted by experience whereby the cooker/expeller is operated in a semi-continuous manner.

The rated capacity of the plant was not known. The through-put as the units are operated is reportedly 25 tons/24 hours for sunflower seed and 16.2 tons/24 hours for soyabeans.

The expellers are analyzed once a month as routine. On an average the residue fat content is reportedly 12.5%, crude protein 41.5% and fiber 15%, which indicates the presence of hulls. No information is available regarding the ash content, but this is likely to be rather high since the process line has no cleaner. However, preparations are being made to install a cylinder type cleaning machine.

In the course of the years a number of modifications have been made to the plant to make it function better and to reduce the reliance on imported spare parts. Nevertheless, the lack of spare parts is a problem and the present stock of spares is very low.

The cooker/expeller units are partly dismantled once a week for cleaning of the cookers and welding of the expeller screws, which are subject to considerable wear.

The decorticating unit is also attended to from time to time as a matter of routine, since the sandy particles in the seed act like emery on all moving parts and the pneumatic conveying system for hulls.

1.1.1 Operation, performance

As a rule the oil mill operates 7 days a week and 3 shifts of 8 hours. From April 1984 to March 1985 a total of 3 780 tons of oil seed was processed, 76% of which was sunflower seed and 24% soyabeans. Assuming that 75% of maximum plant capacity is realistic as top performance and that the plant is operated 300 days a year with stops for public holidays, employees' annual leave and annual general overhaul of the plant, the plant utilization is estimated at about 65% on an average.

During the same period 565 tons of cooking oil was produced, which means an average of about 15% extraction of single filtered cooking oil.

1.2 The feed plant, general description

This was installed and started operations at the same time as the oil mill, on 1 April 1982.

The plant was supplied by Kumar Metal Industries, Bombay, India, and comprises two main parts, the milling section and the mixing section.

The ingredients to be milled are emptied into a hopper, lifted by a bucket elevator to a pre-bin which feeds the hammermill by means of gravity. There is no magnet separator.

The original Kumar hammermill has been replaced by a locally manufactured machine which in part is designed by the Manager. The screen width is 300 mm and the mill is powered by an 80 hp electric motor.

The milled produce is pneumatically conveyed to a cyclone equipped with filter and bagging-out attachment. The bagged produce is weighed and eventually dumped with other feed ingredients into another hopper, lifted by a bucket elevator to a mixer pre-bin. From here the batch of ingredients is emptied into the mixer, mixed and conveyed to a bagging-out hopper provided with a scale and bagging-out attachment.

As in the case of the oil mill, technical modifications have been made to reduce the reliance on imported spare parts.

Routines have been elaborated and adopted for weighing and handling of the feed ingredients which makes the operation rather efficient.

Although the plant normally operates on a 3-shift basis, the production of feeds is governed by the demand, which is less than the production capacity. This is reportedly about 30 tons/shift but if the operators are sufficiently motivated as much as 40 tons/shift have been obtained. It is not known whether this has been achieved at the expense of, for instance, an adequate period of time for the mixing of each batch.

The plant is not provided with any cleaning facilities for the grain which is used in the feed formulas.

All ingredients are reportedly analyzed once a month in a local laboratory and every three months overseas. An agreement is in force with the overseas firm to analyze the feed ingredients and computerize the formulas accordingly for all formula feeds produced by the plant, at present 6 poultry rations, 3 for pigs, 5 for cattle, and horse meal.

Certain premixes, trace minerals and vitamins are imported.

1.2.1 Operation performance

Since the number of shifts the plant has been in operation in a year is not known, the capacity utilization can only be assessed in relation to the maximum possible per year. This is estimated at about 20 000 tons, assuming 300 days per year and 75% utilization.

The total production in a year is of the order of 8 000 tons or 40%. This figure is rather low but appears to be caused, to some extent, by insufficient market demand.

1.3 Maintenance

The oil mill and the feed plant are operated as one unit as far as maintenance is concerned.

The workshop facilities are poor and the equipment consists of only basic tools plus gas and arc welding machines.

The Manager supervises the maintenance and repair work and shows a personal interest in keeping the plants in an operable condition. He is assisted by 4 qualified mechanics, 1 electrician holding a crafts certificate and 2 helpers.

One of the mechanics is assigned to each shift with responsibility to repair minor faults and call for assistance in case of major difficulties. The two helpers are on-the-job trained and are expected to be sufficiently trained for assignment as shift mechanics in about one year.

1.4 General comments

It should be mentioned initially that the plants were never commissioned. No tests were carried out and consequently there are no handing over certificates as documentation of performance.

The plant as a whole gives a dirty and patched-up impression, but is operating quite successfully due to good standards of management, which also makes the employees motivated. Initiative has been taken to improve the situation with regard to both plant performance and problems with spare parts.

The co-operation with competent feed formula expertise provides a certain guarantee for the buyers that the feed is acceptable from a nutritional point of view.

The economic performance of ZATCO Stockfeeds Ltd has improved in recent years, with an increase in the turnover from K 1.2 million in 1982 to K 5 million for the fiscal year 1984/85. The target for the current year is K 7.5 million. More important, a loss in 1983 of K 521 000 has been turned into a profit of K 400 400 in 1984 and K 629 000 in 1985.

2 SPCMU Stockfeed Plant Monze

2.1 History

At the time of the visit to the plant there was no-one available who could answer any questions related to operational experience or future plans.

Built in 1973 or 1974, the plant had been in operation presumably until 1981. The owner at the time, the Southern Provincial Pig Producing Co-operative, stopped production and the plant was quite recently acquired by SPCMU.

The new owner has reportedly plans to rehabilitate the plant and purchase equipment for adding molasses to the feed formulas. It was also stated that the plant had been inspected by expertise from a manufacturing company which had submitted, or was going to submit a quotation.

2.2 General description

The plant has a capacity of 20 tons/8 hours and is installed in a multi-floor steel structure about 12 m high. Closely attached are 3 steel silos, each with a storage capacity of about 140 tons. A roofed concrete slab of approximately 750 m^2 extends from the line of the feed plant-steel silos.

The plant is from the Federal Republic of Germany, with the steel silos manufactured by Gebrüder Achenbach, while the equipment in the feed plant was supplied by Ernst Heitling Machinen Fabrik.

The silos have inclined concrete floors. A screw conveyor from the centre pit in each silo is used for discharge from the silo into a horizontal 200 mm screw conveyor along the silos to the feed plant's main elevator. The same horizontal screw conveyor is also used for intake of grain to the silos and is thus provided with a very small intake hopper for emptying bags. A screw conveyor on top of the silos distributes the grain, mostly maize, to the different bins.

The main elevator is of double unit design, permitting intake of maize and running of the feed plant simultaneously. The feed plant has a milling pre-bin and 3-4 bins for ready feeds, an automatic scale in the process line, an intake hopper for ingredients, a hammermill equipped with cyclone and a tube filter, mixer pre-bin for milled produce provided with weighing facilities, an elevator for meal products and the necessary horizontal screw conveyors, spouts, distributors and pneumatic conveying tubes from the hammermill. A screw conveyor under the bins for ready products feeds the weighing/bagging-out unit. The bagging-out pre-bin is equipped with level indicators, monitoring the operation of the feeder screw conveyor.

The process is monitored from a control panel with push-button controls and indicator lamp showing if the individual machines or conveying lines are in operation or subject to some fault. The operational features of the plant are quite simple. However, all two-way distributors are operated manually with no indicators on the panel. This is no drawback, but requires the necessary operational routines with check-lists.

The plant requires thorough checking of all components, cleaning, overhaul, replacement of parts, e.g. filter tubes, spouts, bearings to the silo discharge screw conveyor, test of the electrical system including the necessary remedies, etc. Improvement of the anti-corrosion paintwork should also be carried out in places, both on the processing equipment and the steel cladding of the processing building.

2.3 Comments

The rehabilitation of the plant should not be too difficult or require substantial investment. It is suggested, however, that a sieve/air cleaner is purchased and attached to the intake hopper with the appropriate conveying equipment. This would reduce the wear on the plant as a whole and improve the hygienic standard of the feed.

The installation of equipment for adding molasses to the feed should be looked into in more detail. The ZATCO feed plant in Choma, for instance, which may service a similar farmer/consumer group, processes only about 20% cattle feed out of the total. If a similar proportion is relevant for the Monze plant the justification for investment in molasses equipment would have to be reconsidered. This is even more important if there are any doubts that the market demand permits the plant to operate att full capacity.

The utilization of molasses for cattle feeding can be accomplished by supplying the farmer with simple steel troughs provided with covers and either lick bolls or lick cylinders. This solution is comparatively cheap; the lick troughs can be made by small local workshops. The molasses can probably be marketed to a wider group of farmers and the molasses may be fortified by, e.g. NPN (non-protein-nitrogen) to improve the nutritional status of range cattle during certain parts of the year.

Needless to say, before start of production the necessary preparations would have to be made regarding organization, personnel including technical assistance which is likely to be an asset for some time, purchases and marketing. The assurance that managerial and technical capability can be recruited is a precondition for acceptable performance.

3 Zambezi Co-operative Dairies Ltd

3.1 History

The Co-operative was established in 1956 for processing of locally produced milk and marketing pasteurized milk and milk products to the population of Livingstone.

After Zambia obtained Independence the Co-operative lost several members but managed to survive. It has now ten members, six of them currently supplying the dairy plant with milk.

3.2 General description

The plant has a capacity of 4 000 to 5 000 l of milk per day working 8 hours/day. The process flow is simple, with weighing of the milk which is emptied through a strainer into a holding vat, piped to an APV head-exchanger and finally pumped to a cooling tank. After cooling the milk is packed on a Pre-Pac machine in half-liter plastic bags at a rate of 500/hour. At present some of the milk is bottled in half-liter glass bottles. This line is equipped with an old FRAU (Italy) bottle-washer and FORD (UK) bottle-filler.

An additional Pre-Pac unit has been acquired but is not yet installed.

Surplus milk is separated on a small Westphalia separator with a top-mounted milk vessel of about 15 l.

A 50 l butter churn and an 80 l/hour homogenizer complete the list of processing equipment.

Butter is stored in two freeze-boxes. A cold room, about 12 m^2, is used for storage of cream before butter-making and consumer milk if not dispatched directly from the packing machine.

The utilities include electricity, refrigeration, compressed air, and steam. 380 V electricity is supplied to the dairy from the main powerline. The refrigeration system, both to the cooling tank and to the refrigerated store, has two compressors, one of which as a stand-by unit. One compressor unit provides compressed air to the Pre-Pac machine.

A boiler plant provides steam for can and bottle washing and for general cleaning of the dairy. The stand-by boiler is identical to the main boiler. Both are subject to control once a year by the relevant Government Authority.

3.3 Personnel

The dairy has a General Manager who has been employed since 1978, and a Production Manager who has been working on the plant since 1966, except for a short training period at one of the dairy plants operated by the Dairy Produce Board. Thus the major part of his experience has been gained in the course of the years at different positions in the Co-operative.

The operational personnel are all on-the-job trained.

There is no maintenance personnel permanently employed. An arrangement was made in the past with a small local company which has a qualified electrician-cum-refrigeration technician. He may be called at any time, week-day or not, and is presumably very familiar with the installations.

Considering the size of the plant, this solution is probably the cheapest and most practical and should work satisfactorily as long as the personal relations with the dairy plant personnel are good.

3.4 Present status

The building is in a reasonably good condition but the floors bear the signs of many years wear.

The head exchanger is in a poor state of repair, with water leaking out of the couplings, and seemingly also from a few cracks. The bottling line reportedly has frequent operational disturbances. The bottle-washer leaks in several places inside. There are no spare parts in stock and the manufacturing company does not exist any more. Severe problems are also encountered with spare parts to the Ford bottle-filler due to the current economic situation in Zambia with regard to foreign exchange. With installation of the new Pre-Pac machine the problem should be solved.

The hygienic conditions in the plant could be improved, especially the cream separation procedure, where a more appropriate system should be considered on future rehabilitation of the plant.

It appears, however, that the routine cleaning of the dairy is satisfactory.

3.5 Milk testing

At present the milk delivered to the dairy is not subject to any tests for quality or fat content. This may work out when there are only six suppliers, but there is always a risk involved which it is rather unnecessary to take. With an increasing number of suppliers in the future, some of them probably inexperienced, there are good reasons to start testing all milk for quality properties.

The fat content is reportedly 3.8% on an average. The farmers are paid a fixed price of K 1.25/l regardless of the quality and fat content of their milk. The dairy herds vary from one farm to another – some have Jersey and Jersey crosses, some have Friesian-type cattle and some have animals more of the traditional type.

It would thus seem reasonable to pay the farmer according to fat content of the milk and with a deduction for milk which is not up to standard. The importance of using this as an incentive to the dairy farmers to supply good quality milk should not be neglected. The matter becomes even more important when the product list is increased in the future.

3.6 Marketing problems encountered, alternative remedies

The intake of milk varies according to the season and so does the sale of consumer milk. There is a peak in production from the end of November to approximately mid-February. The sale of milk, on the other hand, is low during this period. From mid-March there is normally an increased demand with good sales March through September, when it drops again.

At present level of intake, about 4 000 l/day, approximately 25% of the milk is "surplus". This is made into sour milk and sold at K 1.20/l instead of the Government set retail price of K 1.52/l or wholesale price of K 1.40/l for consumer milk. The ratio between sales of retail and wholesale milk is about 50:50. The monthly losses may thus be estimated at some K 7 800.

The alternative of processing yoghurt is now under consideration by the management and a quotation has been received for the necessary equipment and installations for yoghurt-making, and also for replacement of the pasteurizer.

It is expected that the Asian population in the Livingstone urban area are potential buyers. No far-reaching investigations have hitherto been carried out to quantify the demand.

An alternative would be to start cheese manufacturing, which is deemed to be less of a gamble, since the cheese can always be marketed elsewhere, providing the type and quality of cheese is in conformity with the demand.

Assuming that 1 000 l of milk would be available for cheese-making, and that a low-fat type of cheese is to be made, the gross income per month would approach K 40 000 if the wholesale price of butter is K 12/kg and of cheese K 15/kg.

The economy of producing full fat cheese should also be looked into.

The difference in comparison with the present situation, when the milk is sold sour, would be about K 4 000 in favour of the cheese alternative, but still a much poorer result than when the milk can be sold as consumer milk.

This is only a suggestion, but it shows that different alternatives should be contemplated and weighed against the investment requirements, and certainly also the prospects of funding the project.

The sour milk alternative requires no investment, whereas the cheese alternative would need investment in vats and some installations and equipment which could presumably be located in the butter-making room. If the market preference is for hard type cheese which has to mature over a certain period, a storage room with controlled climate would also have to be arranged.

To avoid mistakes being made, a comprehensive study must be carried out, where all parameters are considered including training of personnel and possible need for technical assistance.

3.7 Guide lines for the future

There is reportedly a trend towards increased production of milk in the area. This is also shown in the intake figures which have been presented for the past four years, and an intake between 7 000 and 8 000 l/day has been set as a target. A few potential suppliers have expressed their interest and the target may be reached in the early 1990s.

This suggests that the plant should be rehabilitated without increasing the capacity. A detailed study should be made regarding the alternatives for utilization of excess milk, where the overall merits and demerits are compared in order to ensure that future investments are not wasted.

A note of warning for the future is the economic situation of the Co-operative. Expansion and development will be difficult as long as the liquidity of the enterprise is fragile. Efforts must be made by the management, and not least by the Board of Directors, to consolidate the economy without undue delay.

Bonuses for milk delivered will have to be cut out and a stringent economic plan worked out, aiming at financial strength to give the Managing Director and the Board better scope to develop the Co-operative.

In contrast with many other co-operative ventures, the Zambezi Co-operative Dairies appear to have the current overall potential to succeed.

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