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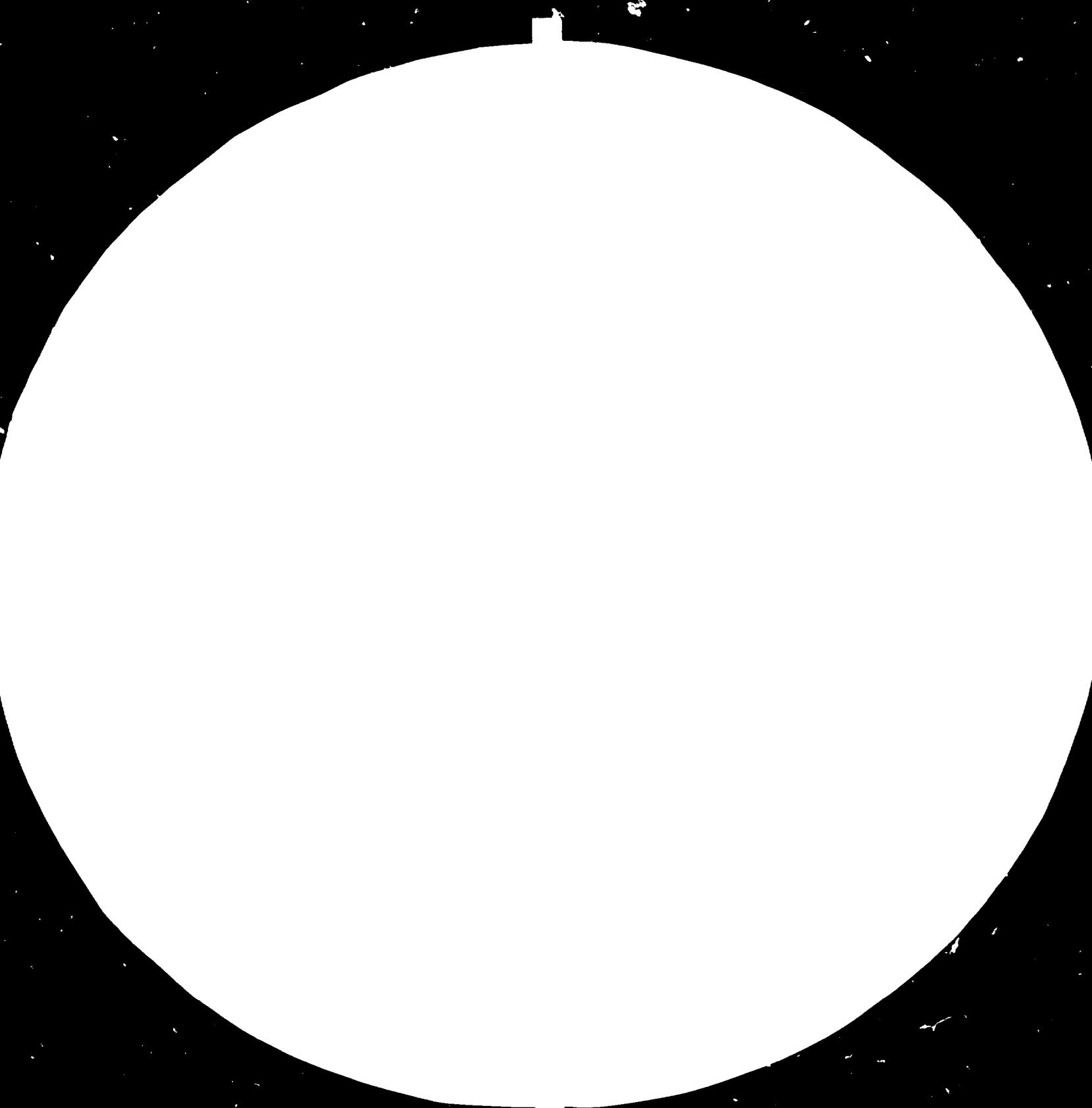

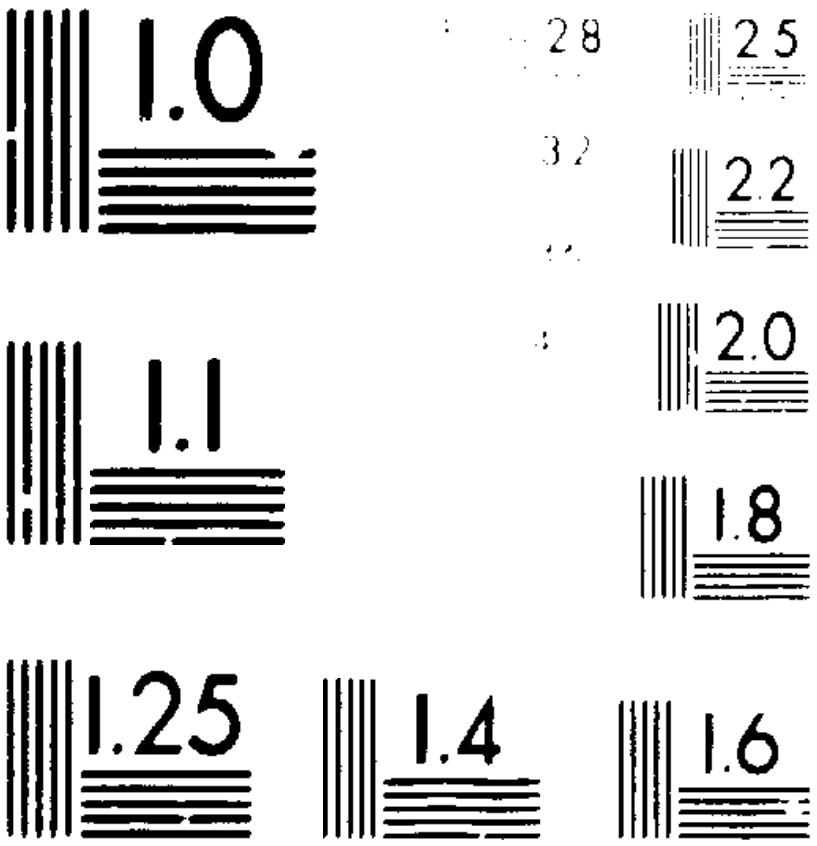

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DP/ID/SER.B/452
30 April 1984
English

Zambia.

ASSISTANCE TO ROP (EDIBLE OILS)

DP/ZAM/82/017

ZAMBIA

Terminal report *

Prepared for the Government of the Republic of Zambia
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Joseph R. Santhiapillai,
expert in industrial management

United Nations Industrial Development Organization

Vienna

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ACKNOWLEDGEMENT

My thanks are due to the following for all the help and guidance I received during my assignment.

1) Management and Staff of National Commission for Development Planning.

2) Management and Staff of Industrial Development Corporation.

3) Management and Staff of Refined Oil Products.

4) Resident Representative and Staff of United Nations Development Programme.

I would also like to make special mention of all the help, guidance and co-operation I received from everyone at R.O.P. during my assignment not only regarding my work but also in various other ways. For this my thanks are due to Mr. C. B. Chimanja, General Manager, Mr. A. E. W. M'bewe, Works Manager, Mr. P. Lyondo, General Production Manager, Mr. R. S. Rajan, Chief Engineer and all other Managers, Supervisors, Staff and Workers.

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Project Background

In accordance with Zambia's policy of import substitution and the achievement of self-sufficiency in essential consumer items the government intends to raise the production capacity of existing plants for edible oils in order to meet the fast growing national demand.

The need to foster domestic industry for edible oils has been made all the more acute by the shortage of foreign exchange reserves, which, in the past was used for the importation of this commodity. The shortage of the foreign exchange reserves resulted mainly from the decline of copper prices on the international market.

In 1981 the capacity of the seed crushing plant was increased by 300T/day and in November 1982 the new solvent plant with a capacity of 180T cake per day was commissioned. In November 1983 the cake pelletising plant, hulls pelletising plant and new storage silos for seeds were commissioned.

The development objectives of the project are to increase the production of edible oils and the further utilization of the by-products.

The immediate objectives of the project are:

1. Assist in project development and factory establishment including coordination of the financial, technical and managerial aspects of the project.
2. Assist in putting into operation the solvent plant and other new items of equipment and in increasing the efficiency of existing items of equipment.
3. Organise and streamline the production process

4. Assist in the development of appropriate policies and implement them as directed.
5. Assist in the planning and implementing of training programmes as required.
6. Assist in the development of the edible oil industry.

Introduction

ROP (1975) Ltd. emerged on 1st January 1975 as a result of nationalisation and merger of the then Refined Oil Products Limited at Lusaka and Lever Bros. Ltd. at Ndola to become the country's leading manufacturers of Edible Oils Fats, Soaps, Washing powders and Toiletries.

R.O.P. (1975) Ltd. with its head office at Ndola, runs two factories one each at Ndola (concentrates on production of washing powders, soaps and toiletries) and Lusaka (concentrates on seed crushing, solvent entraction and production of edible oils and fats. See Table 1 for production tonnages at Lusaka and Ndola.

R.O.P. had inherited very old technology hence had embarked on various expansion programmes to make use of available indigenious raw materials.

i) Lusaka Expansion Project

Expansion Project was started in 1978 and finally completed in end 1983 at a total cost of about K11 million. The different stages of the project were:

a) In end 1981 the seed crushing capacity was increased to 100,000 M.T. per annum.

b) In end 1982 the solvent entraction plant was commissioned. This plant is capable of handling 180 tons of cake per day.

c) In mid 1983 the oil degumming plant was commissioned

d) In end 1983 the cake pelletising plant, hull pelletising plant and the new storage silos for seeds were commissioned.

ii) Ndola Expansion Project

a) Cottonseed crushing plant is being put up at Ndola to

increase the crushing capacity to 21,000 M.T. at a cost of about K1.5 million.

b) Soap and Glycerine Recovery being set up at Ndola at a cost of about K5 million.

Since oil extraction is mainly at Lusaka, expert was based in Lusaka and concentrated his efforts on the Solvent Extraction plant and the Seed Crushing plant.

SOLVENT EXTRACTION PLANT

This plant was commissioned in November 1982. In a solvent plant one of the most important aspects is to monitor and minimise solvent losses not only because of its expense but also because of safety considerations. The other important factors for efficient running are correct rations of cake: solvent, operating temperatures and pressures.

1) Solvent Loss

Management were unable to monitor solvent usage weekly (as the tanks were not calibrated when it was installed).

The solvent tanks were calibrated and method established to determine weekly solvent losses per ton of cake processed. Solvent loss was brought down from 11 Kgs/ton of cake to about 5.5 Kgs/ton of cake resulting in savings and more important better safety of the plant.

Technical report was submitted.

2) Training

a) Training Course for Operators and Supervisors

A short refresher training course was undertaken for the existing operators and supervisors to explain aspects of safety, solvent losses, rates of solvent needed etc. for efficient running of the plant.

b) Three months Training Course (July-September 1983) for Tanzanian Staff and New R.O.P. operator recruits

The Tanzanian Government had requested R.O.P. to train 3 Tanzanian supervisors on the operation and maintenance of the Solvent Extraction plant as a similar plant was being installed in Tanzania. A detailed training course was conducted covering both theoretical and practical classes and also trainees were given an In-plant training. In the final weeks the trainees were starting-up, running and shutting-down the plants on their own.

This opportunity was taken to train 2 additional operators from R.O.P.

3) Solvent Plant Operating Manual

At the request of ROP Management an Operating Manual for the Solvent Plant was compiled and handed over in December 1983. This would be used by the Operators and Staff and would also be the basis for any further Training Courses.

The Operating Manual (16 Pages) consisted of the following:

4) Efficiency of Oil Extraction

Before the installation of the Solvent extraction plant oil left in cake was very high which resulted not only in

loss of oil but alsoproduced an inferior cake. The oil yield has now increased from 24% to 31% in the case of sunflower seed and from 13% to 20% in the case of Soyabeans.

There has been a marked increase in oil produced from local seeds (Refer Table 3). In 1980 oil produced from local sunflower seeds/soyabeans was 548 MT per quarter as compared to 2351 M.T. per quarter in 1983 i.e. an increase of about 425% in 3 years.

This has enabled R.O.P. Lusaka to increase refined oil production (Refer Table 4) and also reduce the quantity of oil imported. In 1981 the quantity of imported oil used was 6158 MT and accounted for about 75% of the total oil consumed in the Refinery, while in 1983 the quantity of imported oil used was 4758 MT and accounted for only 40% of the total oil consumed in the Refinery.

Hence ROP is advancing steadily towards the objective of reducing imports and using locally available raw materials, while at the same time increasing its total production. In order to maintain this trend of import substitution ROP would need the active support from Government departments like the agricultural department and also assistance from International Institutions like the UNDP and UNIDO.

SEED CRUSHING PLANT

The present seed crushing capacity of R.O.P. - Lusaka is 100,000 tons per annum and in 1983 the actual production was about 30,000 tons/annum i.e. only 30 .

This utilisation of only 30% capacity has to be looked from the following different angles.

A) Improving Operational Efficiency.

B) Increase local cultivation of seeds.

C) Possible utilisation of other oil bearing seeds.

D) Investigate feasibility of importing seeds from neighbouring countries, instead of importing crude oil.

A) Improving Operational Efficiency

The following is an analysis of Stoppages/Repairs for March Quarter, June Quarter and September Quarter 1983 in the Seed Crushing and Solvent Plant.

Stoppages/Repairs in Hours

	March Qr.	June Qr.	Sept. Qr.
1. Shortage of Seeds	268	6	-
2. Hulls/Cake Space	190	13	14
3. Shift Transport	16	-	8
4. Rain Water in Pits	53	-	-
5. Boiler Breakdowns	53	156	141
6. Seed Silos/Conveyors	52	53	117
7. Solvent Plant	204	67	369
8. Expellers	202	838	931
9. Conditioners	84	2	162
10. Conveyors/Elevators	115	56	16
11. Others - Seed Crushing	33	243	210
12. Cake Bagging Plant	-	19	45

Observations

1) General problems like shortage of seeds and lack of space for hulls and cake were high in the March Quarter but had been virtually eliminated in the subsequent quarters.

2) Owing to the fact that Expellers Breakdowns were frequently a bottleneck in production, the system of using all four available expellers for production was stopped in mid-June and the expellers changed to Pre-pressing thereby enabling 3 Expellers only to be used at any one time to achieve normal throughput. This made it possible to carry out repairs on any one expeller or conditioner without causing reduction in production. This explains the high repair hours in June and September quarters. If the new system had not been started production would have been much less.

3) Stoppages due to Boiler breakdowns are quite high. The R.O.P management have decided to install new Boilers and are in the process of evaluating tenders.

4) The Solvent Plant stoppages in September quarter are very high and has been mainly due to the Desolventiser developing steam leaks.

5) Planned Maintenance

A proper system of Planned Maintenance has to be established. At present only breakdown repairs is being done. A systematic inspection, cleaning and repairs is essential for all equipment in the factory. This will perhaps only be possible if a Planning Department is established. This is discussed below.

Management/Quality Aspects

1) Planning

The management should consider establishing a Planning

Department as the absence of planning is a serious drawback in the Operations of the factory. The function of the Planning Department should be:

a) Monitor stocks of raw materials and for packaging materials.

b) Make weekly and monthly production plans based on availability of materials.

c) Allocate number of workers required in each section based on approved labour standards and thereby determine number of casual workers needed on a daily and weekly basis.

d) Establish labour standards for each department in conjunction with the Production Departments.

e) Depending on production plans, arrange for periodic planned maintenance.

f) Coordinate Production, Purchasing and Sales.

g) Highlight anticipated production problems at an early date so that decisions can be made early thereby reducing crisis situations.

A planning unit of such a nature will help to increase operating efficiency and also enable Managers to plan ahead rather than devote too much time and energy sorting out crisis situations.

2) Quality Control and Weight Control

System of Quality Control and Weight Control needs considerable improvement.

Weight Control is entremely poor in that there is no record of the weights of products packed. The lab should weigh the products packed say few samples every one or 2 hours and use the average weight for the day as its daily output, only then the input-output statements made by the Cost Accountant are meaningful. At present the input-output statements assume

that the packed weight is the standard weight.

The weigh scales used should be checked and zeroed daily.

Quality control of incoming raw materials and packing materials should be done systematically and regularly. For this purpose specification sheets should be drawn up for every single item and these specifications should be used for ordering purposes as well. These specifications should give all details and their tolerances. e.g. Plastic containers - dimensions, volumetric capacity, type of material; labels - dimensions, type of paper, g.s.m. of paper, type of inks - alkali resistance or soap jelly resistance, colour standards, varnish if any, size of lettering etc.

As regards raw materials quality should be measured and these figures used, if applicable, in the imput-outnut statements and also claims made from suppliers if quality is inferior to standard.

Quality of Cake

The quality of sunflower cake could be controlled by:

a) Oil content.

b) Fibre content.

The oil content is effectively controlled by the Lab and is about 1%.

The Fibre content can only be controlled by controlling the hull content in the meat from the seperators. On the basis of the Lab. specification of 10% maximum hull content in the meat from seperators and the average composition of sunflower seeds (Dust and scrap 1.5%, Hulls 39.0%, Oil 31.0% and Moisture 6.0%) the theoretical maximum yields obtainable were calculated

as follows:

		%
Oil	=	30.0
Cake	=	35.5
Hulls	=	32.5
Dust and Scrap	=	1.5
Unavoidable Loss	=	0.5
		100.0

A report on the above was submitted to Manangement.

The hull content in the meat from seperators should be kept low (not greater than 10%) not only for good quality cake but since hulls are abrasive, a high hull content tends to shorten the life of the worms and liver bars.

Hulls

When crushing sunflower seeds, the hulls produced is 32.5%, which is a very high quantity. Till November 1983 these hulls were being disposed of by dumping in the bush. This entailed considerable expenditure and also led to the plant at times being stopped, owing to the hulls removal being a bottleneck.

In November 1983 a hull pelletising plant has been commissioned, as such the pelletised hulls can now be used in the boilers in conjunction with coal. At present it would appear that the boilers could use the hulls with coal in the proportion of about 40% hulls. This usage of hulls will lead to savings in coal costs.

Since the quantity of the hulls produced is large, R.O.P.

would not be able to consume the whole amount, hence management should actively persue the following:

1) Continue promoting usage of hulls by other industries who have large coal fired boilers.

2) Investigate the feasibility of making board with the hulls.

B) Increasing Local Cultivation

'ith the increased capacity of R.O.P. for crushing seeds the stocks of sunflower seeds and soyabeans in the country are being exhausted rapidly, as the actual rate of crushing is higher than the local production.

ee Table 5 for marketable surplus in Zambia during the last 10 years.

In 1982 - quantity of sunflower and soyabean crushed was 28,000 tons while quantity available was only 23,500 M.T.. In 1983 quantity crushed in the first 9 months was 23,600 tons while estimated availability for the year was only 25,000 tons. This therefore means that the plant will not have sufficient seeds for crushing in the near future unless local production is increased.

The Government is certainly persuing its policy of encouraging farmers to increase local cultivation by paying higher prices for the seeds, but this will only pay dividends if the other aspects like agricultural extension services, purchasing of seeds from the farmers etc. are improved. This needs urgent attention by the authorities concerned. Perhaps a coordinating committee of R.O.P., Agriculture Department, Planning Ministry and Purchasing bodies like Namboard and Cooperative Unions might help to coordinate the various activities and resolve any problems.

C) Importation of Sunflower Seeds/Soyabeans

The production expenses for producing crude oil is K405 per ton of oil or K122 per ton of seed. The expenses are very high as the quantity produced is much below capacity (See Table 6). If the total expenses are taken into account importation of seeds might not be feasible. If only the variable expenses are taken into account importation might be feasible.

Table 7 gives the maximum price (delivered factory) payable for sunflowe seeds/soyabeans as compared to importation of crude oil. These prices are based on the assumption stated, and R.O.P. could consider the feasibility of importing seeds if the imported price is less, and the assumptions made investigated in detail.

D) Utilisation of Other Oil-bearing seeds

The other oil-bearing seeds available in appreciable quantities in Zambia are groundnuts, cottonseed and maize. See Table 5.

Groundnuts

This can be easily crushed in R.O.P. but unfortunately this crop has reduced drastically during the last few years and not available for crushing as it appears to be directly consumed.

Cottonseeds

R.O.P. is in the process of installing machinery in Ndola for crushing 20,000 T. This is perhaps unfortunate as installation of Delinting and decorticating machinery only in Lusaka would be sufficient to handle cottonseeds as R.O.P. Lusaka works has excess crushing and solvent extraction capacity.

In fact depending on future estimates of cotton production ROP Lusaka may have to seriously consider installation of such machinery.

Maize

Maize has good potential as a source of edible oil, from the maize germ.

Maize germ is about 10% of the maize, and the oil content of the maize germ is about 35%. Hence theoretically the maize germ oil available is 3.5% of the maize. But due to losses during seperation, extraction refining etc. we shall assume the yield of refined oil as 2%.

This means for the annual production of 600,000 M.T. of maize the oil potential is 12,000 M.T.

At present the maize mills do not seperate the maize germs, as such maize germ cannot be used in R.O.P.

The feasibility of extracting maize germ oil should be studied in greater depth and detail before embarking on this project.

The following factors should also be investigated:

1) Since maize germ could deteriorate on storage, the transport logistics should be determined.

2) Since mealie-meal is the staple diet in Zambia, and since maize germ is not seperated at present, the mealie-meal contains oil, but if the maize germ is removed there will be no fat in the mealie-meal. Of course it could be argued that even at present the fat is lost through natural degradation. In any event this dietary aspect should be looked at and clearance obtained from the Health Department.

3) Also protein content of the mealie-meal would be reduced if the maize germ is removed. This can be remedied by adding back the solvent extracted cake of the maize germ. It is suggested that a Feasibility Study be conducted on extraction of oil from Maize germ.

Expert helped INDECO in preparing the terms of reference such a study.

Findings and Recommendations

1. R.O.P. (Lusaka) has a capacity to crush 100,000 M.T. of seed per annum and solvent extract about 40,000 M.T. of cake per annum and refine about 30,000 M.T. of oil per annum.

In 1983 the capacity utilisation of the plants has been about 30-40%.

The capacities of both Ndola and Lusaka works has been estimated as follows:

Edible Oils	37,000
Margarine/Edible Fats	15,000
Soaps	16,000
N.S.D. Powders	20,000

It is estimated that the above tonnages will satisfy the National Demand. Hence any further installation of oil crushing plants/refinery should not be necessary at present.

2. ROP has steadily increased oil production from local seeds. In Lusakas local oil consumed in the Refinery has increased from 2000 M.T. in 1981 to 7000 M.T. in 1983. In 1981 the quantity of imported oil used was 6158 M.T. and accounted for about 75% of the total oil while in 1983 the quantity of imported oil used was 4758 M.T. and accounted for only 40% of the total oil.

Hence ROP is progressing steadily towards the objective of reducing imports and using oil produced from locally produced seeds. In order to maintain this trend of import substitution ROP deserves the active support of the Government and of the International bodies like the UNDP, UNIDO etc.

3. The agricultural production of oil seeds is far below the capacity of the plants, and also below the actual crushing rate achieved. To supplement the demand ROP has been importing crude oil. Hence all efforts must be made to increase local cultivation of oil seeds.

It is suggested that an Edible Oil Committee comprising of members from Agriculture Department, ROP, Namboard, Cooperative Unions and NCDP be established to coordinate all aspects of Edible Oil Production.

4. A detailed feasibility study of extracting oil from the maize germ should be carried out.

5. Cottonseed delinting and decorticating machinery might have to be erected in R.O.P. Lusaka if the cotton production increases at the present rate.

6. R.O.P. Lusaka should establish a Planning Department as this will help to reduce costs and help to coordinate the various functions - Production, Engineering, Purchasing and Sales.

7. A proper system of Planned Maintenance is absolutely essential, for plants of this nature.

8. The system of Weight Control and Quality Control needs considerable improvement.

9. Operating Manuals should be prepared (similar to the one prepared for the Solvent plant) for all plants. These

manuals will also help in training the staff and workers.

10. The disposal of hulls can be a major problem as the Boilers at ROP cannot cope with the hulls produced. Hence ROP has to:

a) Actively promote usage of hulls instead of coal in boilers by other industries in Lusaka.

b) Investigate the feasibility of making board with the hulls.

R.O.P. (1975) Limited

Production in M.T. for Year April to March

Table 1

	R.O.P. - Lusaka					P.O.P. - Ndola					R.O.P. - TOTAL			
	1980	1981	1982	1983	1984 April-Sept. 1983	1980	1981	1982	1983	1984 April-Sept. 1983	1980	1981	1982	1983
Cooking Oils	5895	6485	7379	10113	6514	5510	3213	4501	6509		11395	9698	11880	16622
Edible Fats	1443	1601	600	1392	194	615	531	453	773		2058	2132	1053	2165
Total Oils and Fats	7328	8086	7979	11505	6708	6125	3744	4954	7282		13453	11830	12933	18787
Washing Powders	-	-	-	-	-	5786	4042	5446	4186		5786	4042	5446	4186
Hard Soaps	1086	1555	1085	1246	5	667	856	491	555		1753	2411	1576	1801
Toilet Soaps	427	147	32	-	-	1405	1603	1249	1708		1832	1750	1281	1708
Other Deter-gents	107	103	91	44	18	454	233	480	667		561	336	571	711
Tooth Pastes	-	-	-	-	-	34	42	48	68		34	42	48	68
Shampoos	-	-	-	-	-	9	13	15	2		9	13	15	2
Oil Cake	3265	3111	7621	12131	6712	4106	4517	2800	2587		7371	7628	10421	14718

Table 7

R.O.P. (1975) Limited
Turnover and Profit/Loss - K'000
for Year April-March

	1976	1980	1981	1982	1983
Lusaka Turnover			16,177	19,447	29,806
Ndola Turnover			18,173	20,577	25,871
TOTAL TURNOVER	34,058	30,426	34,350	40,024	55,677
TOTAL PROFIT/(LOSS) Before Tax	612	(2,938)	(172)	760	1,095

Table 3

R.O.P. - Lusaka Works
SEED CRUSHING AND SOLVENT PLANT
PRODUCTION IN M.T.

	Production during Period				Average Production per Quarter			
	1980 April-Dec.	1981 Jan.-Dec.	1982 Jan.-Dec	1983 Jan.-Sept.	1980	1981	1982	1983
Sunflower/Soyabean Crushed	6,667	11,559	28,164	23,629	2,222	2,890	7,041	7,876
Oil Produced	1,645	2,662	6,806	7,053	548	666	1,702	2,351
Cake Produced	2,956	4,638	12,327	9,655	985	1,160	3,082	3,218
Hulls Produced	1,984	3,927	10,024	6,564	661	982	2,506	2,188

Table 4

R.O.P. - Lusaka Works
Oil Consumed in Refinery - M.T.
Year April-March

		1981	1982	1983
TOTAL OIL	M.T.	8084	7986	11788
LOCAL OIL	M.T.	1926	3915	7030
	%	23 8	49.0	59.6
IMPORTED OILS AND FATS	M.T.	6158	4071	4758
	%	76.2	51.0	40.4

Table 5

Marketable Surplus in Zambia of Oil Bearing Seeds - M.T.

YEAR	Sunflower	Soya bean	Groundnuts	Cotton Seed	Maize
1972	163	-	6480	5635	
1973	1050	173	2950	5578	399,200
1974	3519	400	3435	2576	588,100
1975	8243	683	6099	1735	559,300
1976	15965	944	8637	2590	750,200
1977	13320	1274	7662	5952	696,700
1978	7551	1187	2216	5620	585,400
1979	11735	731	2737	10095	333,000
1980	16547	2035	2057	13333	382,300
1981	18740	1750	1310	12440	693,200
1982	20210	3320	650	13170	511,600
Est. 1983*	19400	5760	1450	13800'	596,100

* 1983 Estimates as per Planning Division, Ministry of Agriculture and Water Development May 1983.

The actual quantity in 1983 is estimated to be 21,000 M.T.

Table 6

R.O.P. - Lusaka Works
Budgeted Expenses - 1983/1984 - Kwacha

	Crude Oil Seed Crushing and Solvent Plant	Cooking Oil New Refinery
Salaries and Wages	513,000	272,000
Depreciation	1,092,000	165,000
Factory Maintenance	385,000	55,000
Admin. Overheads	491,000	732,000
Factory Power	292,000	435,000
Other Factory Overheads	148,000	219,000
Selling and Distribution Exp.	-	395,000
Finance Charges	-	20,000
Total	2,921,000	2,299,000
Budgeted Production M.T.	7,220	10,000
Expenses/ton of oil	405	230
Expenses/ton Sunseed	122	
Variable Expenses/ton Sunseed	35	

Table 7

Maximum Price (delivered factory) payable for Imported seeds against Imported Crude Oil Price

Basis

1) Selling price of sunflower cake = K300 per M.T.
2) Selling price of soyabean cake = K450 per M.T.
3) All cake produced can be sold at above prices.
4) For Sunflower Seed, oil yield = 30% cake yield = 35.5%.
5) For Soya beans, oil yield = 18% cake yield = 80%
6) Marginal costing for imported seeds i.e. total expenses (K405) not charged but only variable expenses of K35/ton of seed charged to crush imported seeds.
7) Quantity imported will depend on actual achievable crushing capacity after allowing for local seeds.

Imported Crude Oil Price K	Maximum Imported Seed Price (K)	
	Sunflower	Soya bean
600	250	433
700	280	451
800	310	469
900	340	487
1000	370	505
1100	400	523