Socialist Republic of the Union of Burma

Ministry of Cooperatives

Oilseed Processing and Edible Oil Distribution in Burma

Recommendations for Future Investment Potentials

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I. EXECUTIVE SUMMARY

The Socialist Republic of the Union of Burma must increase the current level of production of edible oils by 214 percent in order to meet the 1993/94 goal of raising per capita edible oil consumption to minimum recommended levels. The production of oilseeds is increasing. Therefore, the task is to improve the edible oil processing and distribution system. The present study was conducted to offer viable improvement options to the Ministry of Cooperatives so as to enable the achievement of the goal.

The Study Team recommends that the Ministry of Cooperatives adopt a time-phased edible oil processing and distribution improvement plan that will allow the Cooperative Sector to improve the efficiency of existing facilities, implement new solvent extraction plants, improve the distribution of the edible oil and, at the same time produce a higher quality, more hygienic edible oil for the consumer. The improvements will permit the Cooperative Sector to produce an increased quantity of edible oil more efficiently. Consequently, the Cooperative Sector will be able to increase the purchase price of raw materials to their farmer-members and capture a larger portion of the ever increasing oilseed production.

The Study Team recommends that new oil extraction facilities be of the solvent extraction type. The first solvent extraction plant should be located in an area of surplus edible oil production and should be a model, pilot operation including a refinery and bottling capacity. The new, small facility will serve as a training unit for consecutive solvent extraction plants as well as a pilot plant for future expansion.

The Study Team recommends that existing facilities improve their level of efficiency and quality by adoption of inexpensive improvements, such as hardfacing of internal expeller parts and barrel cleaning.

The Study Team recommends that the distribution system for edible oil be improved in order to assure the delivery of the high quality edible oil to the consumer. A distribution plan for bottled edible oil and improvements in barreled edible oil distribution are presented.

The Study Team recommends that the Ministry of Cooperatives improve the method of raw material price determination. Upon implementation of the oil processing and distribution plan, the more efficient extraction of edible oil will allow for increased purchase price to the oilseed producers for the raw materials and thereby will increase the portion of the oilseed production it purchases.

The Study Team recommends that the Ministry of Cooperatives implement an institutional strengthening plan to assure the safe, efficient operation of the new facilities; to develop an improved data collection, analysis and project design capacity; to strengthen the technical support services in the areas of chemical analysis, quality control, and facility design, operation and management; and, to increase the management skills within the Ministry of Cooperatives as a whole. The institutional strengthening plan will involve long- and short-term training both in Burma and abroad.

Finally, the Study Team recommends that the Ministry of Cooperatives develop an implementation plan for the new edible oil processing and distribution system in light of the foreign donor interests. Such a plan would optimize the potential foreign investments and would help assure the meeting of the edible oil goal by the target date of 1993/94.

II. INTRODUCTION

The Socialist Republic of the Union of Burma encompasses an area of approximately 261,288 square miles and ranges from 9 degrees 58 minutes to 28 degrees 21 minutes North Latitude. The Union is divided into seven states and seven divisions (provinces) namely Kachin, Karen, Chin, Kayah, Arakan, Mon, and Shan States and Sagaing, Tenasserim, Pagu, Magwe, Mandalay, Rangoon, and Irrawaddy Divisions with the Capital located in Rangoon.

In 1981, the population of Burma was estimated to be 34,900,000 with an annual growth rate of 2.23 percent. On a land area basis, there are 134 inhabitants per square mile. However only 28 percent of the land base is arable which increases the population pressure on arable land to 485 inhabitants per arable square mile. Of the total land area of Burma, only 48 percent of the arable land is planted to agronomic crops and only 41 percent of the arable land is harvested. The two major oilseed crops, groundnuts and sesamum, account for 20 percent of the planted area and 15 percent of the harvested area.

Edible oils play a major role in the nutrition of the Burmese citizen. In most Western cultures, edible oils are used in the preparation of foods, but direct consumption of edible oils is limited to that utilized in salad oils and dressings. In Burma, edible oils are consumed as a food and comprise a major source of calories, and essential fatty acids, as well as being a carrier for oil soluble vitamins. Consequently, the edible oils also contribute to the taste and smell of Burmese cuisine and the highly aromatic and flavorful groundnut oil is the edible oil of preference.

III. PURPOSE OF THE EDIBLE OIL EXTRACTION, REFINING, AND UTILIZATION STUDY

The Socialist Republic of the Union of Burma has received inquiries of potential investments in the area of edible oil from several donors. The Cottage Industries Department of the Ministry of Cooperatives was given the task of developing a study to assist the government in the wise utilization of the potential investments. The Agency for International Development of the United States of America was asked to assist the Cottage Industries Department in the preparation of the study which will be used as a guide for future investments and initiatives in the edible oil area.

The purpose of the study is:

a. to describe the current status of edible oil processing from procurement to consumption

b. to identify the future needs for edible oils

c. to recommend improvements to be made in the edible oil production process, and

d. to propose necessary actions required by the Socialist Republic of the Union of Burma and donor agencies to improve the edible oil situation.

The methodology used in the preparation of the study was private discussions with officials of the Ministry of Cooperatives, a two-week field trip to the major oilseed producing and processing regions, visits to edible oil related facilities in the Rangoon area, and visits and discussions with other ministries where applicable. The schedule for the Study Team for the period 17 January 1983 to 23 February 1983 is presented in Annex A.

IV. HISTORICAL BACKGROUND

A. Cooperative Movement in Burma in Regard to Edible Oils

The economy of the Socialist Republic of the Union of Burma has been divided into the State, Cooperative and Private Sectors. As the second pillar of the Burmese economy, the Cooperative Movement of Burma is presented in Annex B and references to the Cooperative Movement of Burma to follow will deal with the involvement of the movement only in the context of edible oils.

Oilseeds, in comparison to rice, are not a controlled commodity in Burma. As a controlled commodity, all production is purchased by the Agricultural and Farm Produce, Trade Corporation of the Ministry of Agriculture and Forestry and, following dehulling and polishing, the rice is sold to the public for consumption. In contrast, oilseeds may be sold to private buyers for processing for edible oil, confectionary purposes, and seed as well as to the cooperatives. An explanation of the ratio of oilseeds purchased by the Private Sector and the Cooperative Sector will be presented in a subsequent subsection. The following discussion will address only the involvement of the Cooperative Movement of Burma in the oilseed production, procurement, and processing progression.

The first initiative to the production of oilseeds comes from the Four-Year Plan which is part of the Twenty-Year Plan through Fiscal Year 1993/94. These production goals are passed from the Central Cooperative Society through the Township Cooperative Societies to the Primary Cooperative Societies by means of the Cooperative Department. Individual members of the Primary Cooperative Societies, namely the Village Tract Cooperative Societies and the Agricultural

Producers Cooperative Societies receive inputs for their oilseed production, such as credit, seed, fertilizer, and machinery services, from the local Primary Cooperative Society or through its efforts from other sources, such as the Agriculture Corporation of the Ministry of Agriculture and Forests. Upon harvest, the individual oilseed producer is obligated to sell at least the proportion of his/her production to the cooperative to account for repayment for the goods and services received for the oilseed production. The decision as to the fate of the additional production beyond that owned by the Primary Cooperative Society is generally a function of the purchasing price offered by the cooperative and the private buyer.

The decision as to the purchasing price offered by the Cooperative Movement to the producer for raw materials is based on the edible oil price to the consumer. The process of price determination is explained in Subsection G, Pricing of Oilseeds and Products. Suffice to state that the purchase price of raw materials offered by the Cooperative Sector is generally lower than the price offered by private buyers. The Cooperative Movement, however, increases the sales of the raw materials to the Primary Cooperative Societies by providing incentives to the Cooperatives member, as stated above.

Oilseeds purchased by the Primary Cooperative Society are transported in bagged form to the appropriate cooperative edible oil extraction plant. Such an edible oil extraction plant may be administered by a Primary Cooperative Syndicate, Township Cooperative Society or a Township Cooperative Syndicate. Transportation is supplied by the Primary Cooperative Society, or in its absence, contracted private truckers. Given the cost of fuel, the condition of the roads, and

the condition of the transport vehicles, the distance between collection and processing is generally minimized.

The edible oil extraction plants in operation by the cooperatives are, for the most part, old, inefficient, and unsanitary, and have been purchased from private operators who may have been in operation for 20 to 30 years before the swing toward a growth in the Cooperative Sector. The present status of facilities will be described in Subsection D. Regardless of their condition, two products are produced, namely edible oil and oil cake.

Edible oil is packaged in barrels at the edible oil extraction plant. The quality of the edible oil can only be described as that achieved through standard filtering. The condition of the barrels may be from new to very old and the sanitary condition of the barrel is generally unknown. Barrels are transported back to the Primary Cooperative Societies (Village Tract and Consumer Cooperative Societies) for distribution to cooperative members, mainly through the transport of the respective societies. At the local cooperative store, consumers bring their own containers, usually used bottles, and purchase their desired amount of edible oil. The purchased amounts usually acquired by one purchase are 10 to 20 ticals (6 - 12 fluid oz.). The oil is poured from the barrel into a pan and dipped from the pan into the consumer's container.

Oilcake is also transported back to the Village Tract and Consumer Cooperative Societies as is the edible oil, with the exception that the oilcake is bagged in 100 lb. bags. Oilcake can be purchased by cooperative members only and is purchased for the purpose of livestock feed, generally for bullocks.

The purchase price to the consumer for edible oil and oilcake is determined at the township level. Consequently, edible oil and oilcake prices may differ from township to township.

The Socialist Republic of the Union of Burma, in its desire to acquire foreign exchange currency, has selected oilcake as one of the target commodities for foreign exchange generation. The Agricultural and Farm Produce Trade Corporation purchases the oilcake from the individual edible oil extraction plant and transports the oilcake to Rangoon where it is accumulated for shipment. For that reason, there generally is no excess oilcake for the edible oil extraction plants to dispose.

Excess edible oil is purchased by those States and Divisions which are deficient in edible oil production for their own needs. Purchases may be of the form of a direct purchase from one township in a deficit area directly to a township with excess edible oil. The edible oil is transported to the consumption area by truck in barrels. The transportation is by the consuming township, the selling township by contract, or by a private trucker. At the point of receiving, the Township Cooperative Society then sells the edible oil to the consuming ward or village. The Consumer Cooperative Society of the ward or village receives the edible oil from the Township Cooperative Society in its own barrels and distributes the oil to the consumer as explained above.

In all cases, the consuming cooperative has the opportunity to inspect the edible oil before purchase. The inspection consists of the following: color - the buyer looks at the color of the edible oil,

smell - the buyer smells the edible oil, and taste - the buyer tastes the edible oil. No analytical tests are made as to the acid content, the rancidity, the moisture content, the amount of impurities, or the sanitary condition of the edible oil. The consumer purchases edible oil and does not have the opportunity to question the above.

In every step of the edible oil processing and distribution process the Department of Cooperatives of the Ministry of Cooperatives completes the functions as described in Annex B. —— Not attached

B. Production of Oilseeds

Oilseed production in Burma is composed of the crops of groundnut, sesamum, sunflower, soybeans and cotton. The largest amount of land area planted to oilseeds is devoted to groundnut and sesamum, some 88 percent.

Although oilseed crops in Burma (principally groundnuts and sesamum) comprise some 20 percent of the total acreage planted to crops, these crops receive only five to seven percent of the present fertilizer allocation. Pesticide use is also low. Modern pest management practices are applied to less than five percent of the oilseed crop acreage.

Groundnuts are grown primarily for use as an oilseed crop, but are also used as a food for humans and as fodder for cattle. Less than five percent of the groundnut acreage is irrigated. Groundnuts, both spreading and erect types are planted after the first spring rains. Monsoon groundnut acreage exceeds winter groundnut acreage by approximately ten percent.

Historical Union groundnut acreage, yields and production information are detailed in Annex C, Table 1. During the 1970s, acreage

planted to groundnuts declined. A recent reverse in this trend occurred during 1981/82.[1/] Acreage harvested is approximately 96 percent of acreage planted (range of 93 to 99 percent). Groundnut yields are particularly sensitive to time of planting, seed inoculation, and choice of variety as well as to seed quality, insects and disease. Historical yields have therefore been quite erratic, yet showing an overall slightly upward trend. Production, in spite of the declining trend in acreage, has maintained a flat trend due to the upward trend in yields.

Sesamum is the most widely planted oilseed crop and second only to paddy rice in area cultivated. Sesamum is regarded by producers as a risk crop. Over two-thirds of sesamum is planted during the monsoon season. Almost all sesamum is grown under rainfed conditions without inputs once land has been prepared.[2/]

1/ The rational for the declining acreage planted to groundnuts can be assumed to be a result of the High Yielding Variety Rice Improvement Program initiated by the Agriculture Corporation of the Ministry of Agriculture and Forests. The Program provides high yield varieties and necessary production inputs to producers. The whole township program was launched in 1978/79. Prices of paddy were raised 150 percent between 1971/72 and 1974/75. Thereafter, prices of quality paddy were increased by 10 percent or more per year whereas prices for ordinary grades of paddy were held constant. The subsidized inputs directed toward paddy production has resulted in a very favorable ratio of inputs to paddy price and the ratio in 1980 was 0.85, the lowest in South and Southeast Asia. Therefore, given the production margins involved, one would expect a shift from groundnuts to paddy.

2/ Land preparation generally consists of turning the soil with a bullock-drawn steel-tipped plow. Sesamum is then sown by hand without incorporation into the soil.

Historical Union sesamum acreage, yields, and production are shown in Annex C, Table 2. Changes in acreage planted illustrates a strong upward trend, however acreage harvested ranges from 54 to 78 percent, with an average of 64 percent. Yields have generally tended to increase, but show extreme swings from year to year. The instability of harvested acreage and yield are reflections of the weather, crop management, and the lack of inputs. Production, however, is gradually increasing.

Sunflower was only recently introduced as a source of edible oil in Burma. Historical Union acreage, yield, and production are detailed in Annex C, Table 3. Planted acreage is not currently significant but it is increasing steadily. Acreage harvested is approximately 86 percent of planted acreage with a range of 64 to 100 percent. This is the consequence of weather conditions. Yields show a slight upward trend which together with increasing acreage have resulted in a significant increase in production.

Soybeans are a traditional, but small scale crop in the Shan State where they are cultivated exclusively for direct human consumption. Soybean Union acreage, yield, and production are given in Annex C, Table 4.

Cotton Union acreage, yield and production are shown in Annex C, Table 5. The possible resulting yield of cotton seed from cotton production is not large enough to be considered a viable option for edible oil extraction.[1/]

Neither soybeans nor cotton seed are currently viewed by Ministry of Cooperatives authorities as sources of edible oil. Soybeans are

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1/ Available oil in cotton seed is less than 10 percent of available oil in groundnuts and sesamum, calculated on total area of production.

a regional indigenous food crop. Cotton seeds are of insignificant volume, cotton seed oil is used as an inedible oil for soap stock, and the fact that cotton is the responsibility of the Ministry of Industry I.

The major oilseeds (groundnut, sesamum, and sunflower) are grown in five Divisions: Sagaing, Pegu, Magwe, Mandalay and Irrawaddy Divisions. These divisions produce 88 percent of the groundnut production, 95 percent of the sesamum production, and 87 percent of the sunflower production. Historical Union acreage, yield, and production by State and Division are shown in Annex C, Tables 6, 7 and 8. Groundnut production is rather evenly distributed among the five divisions. However, Magwe Division produces more than a third of the Union production of sesamum followed by Mandalay Division, Sagaing Division, Irrawaddy Division, and finally Pegu Division with only seven percent of the Union production. Irrawaddy Division leads in sunflower production among the five divisions followed by Sagaing, Mandalay, Pegu and Magwe Divisions.

For all practical purposes, historical production of oilseeds indicates that only groundnuts, sesamum, and sunflower are viable for consideration in edible oil extraction. Historical production data also indicate that only the five divisions of Sagaing, Pegu, Magwe, Mandalay, and Irrawaddy Divisions contain the potential for the improvement of oilseed extraction methods.

C. Cooperative Sector Edible Oilseed Purchasing

Purchasing of oilseeds (groundnut, sesamum, and sunflower) by the Cooperative Sector has ranged from 1.2 to 13.7 percent of production depending upon the crop and year. Annex D, Table 1, details the volume

of purchases and the percentages of production purchased on a Union level and by the five major producing regions. The following percentages of production purchased by the Cooperative Sector reveal an erratic but upward trend in the percentage of the groundnut crop purchased. The trend for sesamum purchases is essentially flat and sunflower purchases are negligible.

PERCENTAGE OF PRODUCTION PURCHASED BY THE COOPERATIVE SECTOR

(UNION)

	Groundnut	Sesamum	Sunflower
1978/79	7.6	13.5	1.2
1979/80	8.4	7.0	1.3
1980/81	12.1	13.7	1.3
1981/82	10.0	11.3	1.5
1982/83[1/]	11.6	13.3	1.8

As a result of the above trends in Cooperative Sector oilseed purchasing, it is calculated that the private oilseed processing sector purchases the following approximate percentages of oilseed production.

1/ These are preliminary estimates based on nine months activity, 4-1-82 to 12-31-82 (Annex D) and production estimates (Annex C).

APPROXIMATE PERCENTAGE OF OILSEED PRODUCTION PURCHASED BY PRIVATE EDIBLE OIL PLANTS[1/]

	Groundnut	Sesamum	Sunflower
1978/79	38.9	32.0	97.5
1979/80	32.7	36.2	98.8
1980/81	30.8	30.6	95.8
1981/82	35.1	33.6	97.8

Cooperative Sector groundnut purchases, when compared to the revised yearly procurement plan of the Cooperative Societies (Annex D, Table 3), reveal that actual purchases of groundnuts are from 33 to 48 percent of planned procurement.[2/,3/] However, purchases of groundnut among the five major producing divisions reveal that Sagaing and Mandalay Divisions have been able in recent years to purchase over one half of the planned procurement targets (Yearly Revised Procurement Plan).

1/ Calculations are based upon production less seed use, food use, amount processed by hsi-zone and cooperative purchases (Annexes C and F).

2/ This statement is not meant in any way as a criticism of performance of the Cooperative Sector, but to determine in the following sections what level of cooperative purchases can be expected and, therefore, to enable project planners to determine the correct capacity of extraction facilities and to ensure their placement in the proper location.

3/ The differences in percentages of cooperative purchase compared to planned purchases from year to year reveal the impact of production levels upon the ability of the Cooperative Societies to procure oilseeds. This is as it would be expected.

In the case of sesamum, Cooperative Sector purchases, when compared to the revised yearly procurement plan, reveal that in years of high production levels of sesamum the Cooperative Sector has been able to achieve from 67 to 107 percent of procurement goals. Again,the ability of the Cooperative Societies to reach procurement goals is directly affected by the level of production which is, in the case of sesamum, weather-related. The Third Four-Year Cooperative Sector Procurement Plan for 1978/79 through 1981/82 is presented in Annex D[1/], Table 4.

D. Edible Oil Extraction and By-Products

1. General Description of Oil Extraction Facilities

There are two methods of groundnut and sesamum oil extraction in use in Burma: the traditional method and the mechanized expeller method. The Ministry of Cooperatives estimates that there are 59 Cooperative Sector edible oil expeller plants and 1,861 Private Sector edible oil expeller plants now in operation in Burma.[2/] The number of traditional oil extraction operations is unknown.

The traditional method is called hsi-zone, literally oil-machine. The method consists of a mortar made of wood, a pestle also made of wood and a drive arm attached to the pestle which is driven in a circle by a bullock. Small amounts of oilseeds are placed in the mortar and, by pressure of the bullock-driven pestle, the edible oil from the oil-seeds drains to a receptacle through a hole in the bottom side of the mortar. Being a very crude method of edible oil extraction, the amount

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1/ It must be realized that production output differences from year to year will affect the ability of the Cooperative Sector to reach such long range goals.

2/ A listing of the Cooperative Sector and Private Sector edible oil expeller plants is found in Annex E, Tables 2 and 3, respectively.

of edible oil that can be extracted from the oilseeds is limited and the resulting oilcake is high in residual edible oil.

The hsi-zones are generally located under an enclosed structure and adjacent to a private residence. The level of sanitary conditions is quite dubious and the dust from the circular path of the bullock easily enters the mortar and receptacle. Edible oil is filtered through cloth to remove large solid impurities and is readily accepted by the consumer.

The hsi-zones are located in the rural and small village regions of the oilseed producing areas of Burma and the edible oil produced is consumed by the immediate and extended families of the owner of the hsi-zone with any surplus sold to others wishing to purchase edible oil. The oilcake is fed to the bullocks and any excess is sold to other bullock owners in the immediate area. Although the system is quite rudimentary and inefficient, it fulfills a demand for both edible oil and oilcake which, due to the remote locations and difficult transportation conditions, would normally not be filled.

The Study Team visited 13 Cooperative and Private Sector edible oil mechanical expeller plants in the Rangoon area and upcountry during the field trip. An observation sheet on the 10 edible oil plants studied during the field trip is presented in Annex D, Table 1. The following comments concerning the edible oil mechanical expeller plants will be general in nature and will be based on the edible oil expeller plants visited. As a general rule, there is no need to differentiate between Cooperative and Private Sector edible oil mechanical extraction plants given that the status of edible oil plants of both sectors is quite similar.

The mechanical expellers now in use are from many countries. Most common among the plants are the Krupp from Germany, the Skoda from Czechoslovakia, the Rosedown from England, the Baby from India and locally produced copies of the above. The only relatively new mechanical expellers seen were the two mechanical expellers owned and operated by the Mandalay Township Cooperative Syndicate. The mechanical expellers were purchased from the People's Republic of China in 1981 and are of a 10 MT per day capacity. Most mechanical expellers owned by the Cooperative Sector have been purchased or expropriated from the Private Sector since the 1962 Revolution. Dates on the name plates of most of the mechanical expellers are from the 1920 to 1950 period. Many have been rebuilt over the years and a mix of locally constructed parts on old mechanical expeller bodies is common.

As a general rule, the raw materials are passed through the mechanical expellers four to five times to reduce the edible oil content of the resulting oilcake to seven to eight percent. The three to four additional pressings are a result of the state of repair of the internal workings of the mechanical expellers. Normal wear on the screw, the plates, and the cage bars inside the mechanical expeller during processing requires periodic repair and maintenance. Working parts must be rebuilt so as to assure the maximum efficiency of the pressing action. Many mechanical expeller plants have their own metal working facilities to rebuild expeller parts and the rest contract the work from local Industrial Producers Cooperative Societies or metal shops. In either cases, the repair work and the locally produced mechanical expellers are of mild steel and cast iron which wear very readily. No hard-facing is done in Burma. To complicate the already deficient situation, the repaired

parts are replaced in the mechanical expellers by eye and accurate placement with gauging tools is not practiced. Add to the above the fact that processing of raw materials high in sand content, and the time period between mechanical expeller part rebuilding is shortened even more.

The power source to drive the mechanical expellers varies from plant to plant, and is electric, diesel or steam power. The edible oil plants operating on electric power have made special arrangements to accommodate the local power supply. For example, the Pegu Division Cooperative Syndicate Oil Plant at Prome cannot operate during a three-hour period from 1800 to 2100 hours, the hours of peak electrical use in the urban area surrounding the plant. In contrast, the Mandalay Township Cooperative Syndicate has received special permission from utility officials to operate around the clock. Even during off-peak periods, the Prome Oil Plant operates at below optimum power conditions. During the visit at 1400 hours, the actual voltage was at 410 volts when full power should have been at 440 volts. The electrical power reaching the electric motors in Mayaung Cooperative Society's edible oil mechanical expeller plant was reading at 190 volts instead of the desired 220 volts. Operating electrical motors on below optimum voltage will not only shorten the operating life of the motor but will affect the working capacity of the expellers.

The diesel engines and steam engines driving the remaining edible oil plants are turn of the century museum pieces. They are very well maintained and serve their purposes. However, the inefficient system of drive shafts, pulleys and power belts decreases the power to the mechanical expellers. Steam is generated by burning an array of available materials ranging from oil and sawdust but generally groundnut hulls are used. Regardless of the power source, the other processes,

such as dehulling, pumping of edible oil and transporting cake and edible oil from level to level in the plant also add to the demand for power.

The raw materials arrive at the edible oil plant in jute bags. Sun drying facilities are available at most edible oil plants for additional drying, if necessary. The raw materials are poured into a hopper and, if available, an elevator leg carries the raw materials to a second level for feeding into the cooker, and, consequently, into the mechanical expeller. Those edible oil plants without an elevator leg feed the cooker by carrying baskets of oilseeds up to the cooker using hand labor. Steam is applied to the oilseeds in the cooker to increase the extraction efficiency of the expellers. Steam is generated by a boiler using materials as described above for fuels. However, not all plants steam cook the oilseeds and edible oil yields of those plants which dry-press their oilseeds are generally lower.

The two products of the mechanical expeller process are then transferred from the mechanical expeller for further processing. The edible oil passes from the expeller into a gutter and flows to a receiving tank. Usually the gutter and receiving tank are both uncovered and open to the environment. A piston pump forces the edible oil from the receiving tank through a standard plate-type filter press and the edible oil passes to a storage tank. Two possible areas for contamination during this step exist, namely the filter press and the oil that has passed through the filter are exposed to the environment.

The oilcake which passes through the mechanical expeller is elevated to a second level for additional pressings. Additional pressings may be totally oilcake or a mixture of pre-pressed oilcake and raw materials. After the final pressing, the oilcake is accumulated in a pile for bagging, weighing, and transport to either a distribution area for livestock feed or collection by the Agricultural and Farm Produce Trade Corporation of the Ministry of Trade.

The stored edible oil is barreled in 110 viss barrels for transport to the consumer. Actual sanitary condition of the barrels was not tested, however, most plants did not have barrel cleaning facilities. Barrels are not handled with care and in the absence of loading docks or ramps barrels are often unloaded by dropping the barrel on an old tire. Consequently, the barrels used upcountry for edible oil containers are often more six- to eight-sided than round. Barrels are filled, weighed and loaded onto the truck by rolling the barrel up a series of planks. If a leak in a barrel is noticed at this stage, soap, tar, or some other substance is used to plug the leak. Contamination of the oil from the substance is also possible.

As can be expected, the process is labor intensive and working conditions in most edible oil plants are hot and dusty. Regardless, labor is in ample supply and the present edible oil plants employ a considerable amount of the rural labor force.

2. Edible Oil Extraction Efficiency

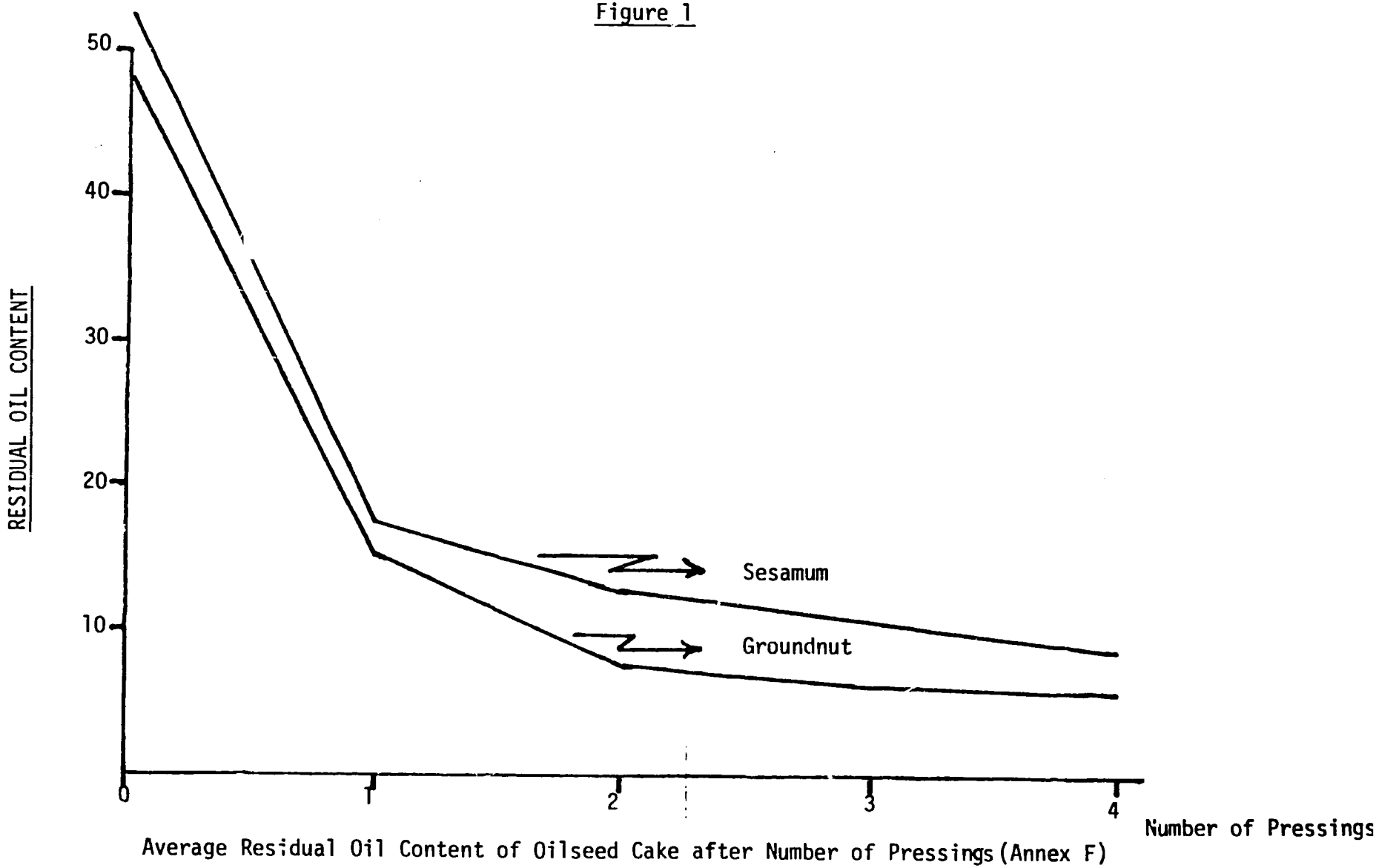
As a result of the conditions existing in edible oil processing in Burma, the recovery rate of edible oil from oilseeds

is low when compared to the percentage of oil in oilseeds, Annex F.[1/] The mechanical expeller plants which were visited by the Study Team press the raw materials an average of four times. The raw material is fed through the first mechanical expeller in a series and then repressed through the next mechanical expeller. In many cases, additional raw material is added to oilcake in preparation for additional pressings.

Samples collected from mechanical expeller plants reveal that the third and fourth pressings do not yield enough extra edible oil from groundnut cakes to be an economically efficient method of compensating for mechanical expeller inefficiency. The same holds true for sesamum after the third pressing, as illustrated in Figure 1. The additional pressings not only consume additional power but also reduce the effective capacity of the machinery. To further complicate the situation, the quality of what little additional edible gained through progressive pressings is lower than the edible oil obtained from the first pressing. Edible oil from the last pressing, for example, will be darker, will have sharp, pungent smell and will have a sharp taste. These are the three main physical qualities which distinguish edible oil quality. Furthermore, such edible oil has a shorter shelf life.

1/ The collected samples have a wide range of residual edible oil content in the oilcake even when taking the number of pressings into consideration. This again is a reflection of the condition of the mechanical expellers.

Figure 1



Average Residual Oil Content of Oilseed Cake after Number of Pressings (Annex F)

3. Edible Oil Extraction Plant Capacities and Utilization Rates

Based upon a limited survey of edible oil processing facilities (Annex E, Table 1), it is estimated that the effective capacity of all edible oil processing facilities in Burma is 37 percent of the original design capacity. The basic reason for this is as previously described: age of equipment, level of maintenance, use of parts made from mild steel, quality of rehabilitation of equipment, and power source limitations.

The effective capacities for edible oil processing facilities for the Cooperative and Private Sectors by Union and major producing areas are shown below.

Effective Capacity

Cooperative Sector[1/]

(Metric Tons of Oil)

	Number of Facilities	Capacity of Extraction 8 Hours/day
Union Total	59	42.68
Sagaing	10	3.88
Pegu	5	4.43
Magwe	14	21.40
Mandalay	8	8.10
Irrawaddy	2	9.53
Total 5 Divisions	39	38.34

1/ Source: Annex E, Table 1.

EFFECTIVE CAPACITY

Private Sector[1/]

(Metric Tons of Groundnut Oil)

	Number of Facilities	Capacity of Extraction 8 Hours/day
Union Total	1861	590.832
Sagaing	624	170.827
Pegu	251	62.106
Magwe	129	47.502
Mandalay	563	188.055
Irrawaddy	66	22.190
Total 5 Divisions	1633	490.680

Capacity utilization of the edible oil mechanical expeller surveyed (Annex E, Table 1) is approximately 45 percent.[2/] Capacity utilization for Cooperative Sector edible oil utilization for both Cooperative and Private Sector edible oil processing facilities Unionwide is approximately 28 percent.

The basic constraints that leads to low capacity utilization are old mechanical expellers, the lack of proper parts which cause excessive down time for repair, and the lack of electric power at certain times of the day. In addition, for Cooperative Sector facilities, the other major constraint is lack of raw materials due to low levels of procurement.

1/ Source: Annex E, Table 3.

2/ Capacity utilization based upon effective capacity per 8 hour day x 3 shifts a day x 260 days per year as related to either raw material inputs or edible oil outputs.

4. Edible Oil Production

Available edible oils for consumption must be determined by calculation based upon certain assumptions.[1/] The calculations are presented in Annex G.[2/] Total available edible oils consumed in Burma since 1969/70 are as follows:

	1000 M.T.
1969/70	116.2
1970/71	147.6
1971/72	138.2
1972/73	90.9
1973/74	128.3
1974/75	123.0
1975/76	126.4
1976/77	116.7
1977/78	145.9
1978/79	161.2
1979/80	112.1
1980/81	153.8
1981/82	199.3

1/ Data do not exist that detail the amount of groundnut, sesamum, or sunflower edible oil output of privately owned expellers nor are there any statistically sound estimates of the amount of groundnut and sesamum edible oil produced by the traditional hsi-zone method.

2/ Calculated available edible oil is within an error range of ± 10 percent.

The above available edible oils are composed of groundnut, sesamum, sunflower, rice bran and other minor domestically produced oilseed crops.[1/] Also included are imported edible oils, primarily palm oil.

The rate of increase in available edible oils has been 2.49 percent annually, due in large part to the increasing production levels of groundnut, sesamum, and sunflower. This rate is slightly higher than the annualized population growth rate of 2.23 percent.

The amount of edible oil (groundnut, sesamum, and sunflower) produced by the Cooperative Sector for 1978/79 through 1981/82 is presented below

	Quantity	Percentage of Domestically Produced edible oils[2/]
	Metric Ton	(groundnut, sesamum, sunflower)
1978/79	15305.6	10.2
1979/80	11722.6	11.3
1980/81	14715.2	10.3
1981/82	20189.0[3/]	10.7

Oilseed processing by the Cooperative Sector is performed by Cooperative owned edible oil mechanical extraction plants and by

[1/] Available rice bran edible oil produced by Agricultural and Farm Produce Trade Corporation, Ministry of Trade, is less than two percent of the domestically produced total available edible oils. Inedible rice bran oil produced is directed toward industrial use. While a large potential exists for the production of rice bran edible oil, the small amount of rice bran edible oil currently produced and the fact that production of rice bran edible oil is the responsibility of the Ministry of Agriculture and Forests, no further consideration is given to rice bran edible oil as a potential source of edible oil. This decision will be further discussed in Subsection F.

[2/] Source: Annex 2, Table 2.

3/ Preliminary Estimate.

hiring private edible oil mechanical extraction plants to process Cooperative Sector owned oilseeds. As the Cooperative Sector increased its amount of oilseed purchases during the last Four-Year Plan, the amount of Cooperative Sector oilseeds processed by private expeller plants has increased from 2.4 to 3.2 times the amount of oilseeds processed by the Cooperative Sector expeller plants.[1/] This further emphasizes the low rate of capacity of utilization and the constraints that cause the low rate of utilization as previously discussed.

Based upon the calculated domestically produced available edible oils in Burma, Private Sector edible oil extraction plants produced the following output of edible oil for 1978/79 through 1981/82.

	Quantity	Percentage of Domestically Produced Edible Oils
1978/79	82624.4	52.9
1979/80	52757.4	51.0
1980/81	76534.8	53.4
1981/82	103881.0	55.0

1/ Source: Annex D, Table 2. If the Cooperative Sector had been able to achieve either set of procurement goals (Annex D) it would have inundated the Cooperative Sector's edible oil processing facilities and caused an even higher level of processing through privately owned mechanical expeller plants.

The remaining balance of domestically produced edible oils was produced by the traditional hsi-zone method. The calculated output is as follows for 1978/79 through 1981/82.

	Quality	Percentage of Domestically Produced Edible Oils
	Metric Ton	(ground, sesamum, sunflower)
1978/79	58300	36.9
1979/80	38500	37.7
1980/81	52200	36.3
1981/82	64800	34.3

The Cooperative Sector production trend has been flat, with the Private Sector showing an increasing trend in percentage of domestically produced oil with a decrease in the traditional method.

5. Oilseed Cake Production

Oilseed cake produced in the processing of oilseeds in Burma is considered a by-product because of the essential requirement for edible oil in the diet. The primary use of oilseed cake is for animal feed with a small percentage being exported. A more detailed description of the exportation process is described in Annex H.

Union production of oilseed cake (groundnut, sesamum, and sunflower[1/]) is calculated to be as follows:[2/]

	1000 Metric Tons
1969/70	179.4
1970/71	224.1
1971/72	209.9
1972/73	140.4
1973/74	197.6
1974/75	220.3
1975/76	192.2
1976/77	176.4
1977/78	217.7
1978/79	251.5
1979/80	165.9
1980/81	238.0
1981/82	326.7

The exports of groundnut and sesamum oilseed cake have declined since the mid 1970s as shown in the following table.[3/]

1/ Sunflower is processed for edible oil with the hull intact. As a consequence, the resulting cake is generally of very low quality.

2/ Based on Annex G, Tables 1, 2, and 3 with a five percent loss factor.(Loss factor is a result of survey information at plants listed in Annex E.)

3/ Refer to the exportation process in Annex H.

Exports of Groundnut and Sesamum Oilseed Cake[1/]

	1000 M.T.	Percentage of Production
1969	49.0	27.3
1970	53.0	23.7
1971	66.0	31.4
1972	93.0	66.2
1973	43.0	21.8
1974	56.0	25.4
1975	36.0	18.7
1976	11.0	6.2
1977	12.0	5.5
1978	39.5	15.7
1979	11.8	7.1
1980	7.2	4.3
1981	8.5	2.6

Of the calculated Union production of oilseed cake (groundnut, sesamum, and sunflower), the three sectors involved in edible oil processing have produced the following quantities and percentages:

	Cooperative[1/]	Private Sector[2/]	Hsi-zone[2/]	Total
		(100 M.T.)		
1979/80	15.7 (9.5)[3/]	80.3 (48.5)	69.7 (42.0)	165.7
1980/81	17.9 (7.5)	125.6 (52.8)	94.5 (39.7)	238.0
1981/82	26.8 (8.2)	180.0 (55.1)	119.9 (36.7)	326.7

1/ Source: Annex H plus calculated sunflower cake.

2/ Calculated.

3/ Percentage of total.

6. Losses in Edible Oil

Because of the traditional hsi-zone method of extraction and low extraction efficiency rates of mechanical expellers, the amount of residual edible oil in groundnut, sesamum, and sunflower oilseed cake is quite high. The resulting loss of edible oil on a Union level amount to many thousands of tons each year as described below:[1/]

	Total Quantity (1000 M.T.)	Per Capita (Pounds)	Total[2/] Value of Loss	Expeller Plants (1000 M.T.)	Expeller Plant Value of Loss[2/]
			(Million Kyat)		(Million Kyat)
1969/70	29.80	2.42	-	22.3	-
1970/71	36.3	2.86	-	17.9	-
1971/72	34.0	2.64	-	16.6	-
1972/73	23.1	1.76	-	10.5	-
1973/74	32.9	2.42	-	14.4	-
1974/75	30.4	2.20	328.6	14.6	157.8
1975/76	31.7	2.20	560.9	14.6	258.3
1976/77	29.1	1.98	737.3	14.9	377.5
1977/78	34.3	2.20	873.0	17.8	453.1
1978/79	40.6	2.64	676.8	19.1	318.4
1979/80	26.8	1.76	477.6	14.3	254.8
1980/81	37.8	2.42	839.5	17.1	379.8
1981/82	50.1	3.06	861.9	26.6	457.6
	436.9		5,355.5	220.7	2,657.3

1/ Calculations based upon average percentage of edible oil in oilseeds multiplied by calculated quantities available for edible oil extraction less calculated edible oils produced (Annex G).

2/ Based on average retail price of edible oils, Annex M, Table 4. Prices available only since 1974. This average price contains a conservative

As production increases, losses will become even dramatically larger than the loss calculated for 1981/82, especially if production levels of the fourth Four-Year Production Plan for oilseeds is achieved.

E. Distribution of Edible Oils

1. Edible methods

Edible oils are distributed from the mechanical expeller plants to two consumer destinations: the member Primary Cooperative Societies for distribution to the area immediately surrounding the edible oil plant and, if any surplus edible oil exists in the area, the Primary Cooperative Societies of edible oil deficit areas. The largest edible oil deficit area is the urban area of Rangoon.

Regardless of the destination, edible oil is packaged for transport in steel barrels. Since barrels are not made in Burma, barrels are used and reused many times. One common source of edible oil barrels is the reuse of the barrel in which palm edible oil has been imported. As explained in a previous section, frequent use of the barrels under existing handling conditions results in damage to the barrels. Old barrels, however, are patched and reused past the normal life of a normal barrel. Sanitary conditions of the barrels are not checked before filling and barrels could be assumed to be quite contaminated. No barrel cleaning facilities were observed during the Study Tour.

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bias since the Private Sector sells the vast majority of edible oils at a price higher than the Cooperative Sector (this differential cannot be calculated prior to 1977/78). The average prices are then weighted by the amounts of available groundnut and sesamum oil (Annex G). Since groundnut and sesamum oil make up the bulk of available oils, the resulting weighted price is then multiplied times the quantity of loss to determine the value of unreclaimed edible oil.

The edible oil is stored in bulk tanks at the edible oil plant and, when a unit of edible oil is purchased by the Primary Cooperative Societies in the area or by a Township Cooperative Society of an edible oil deficient area, the buyer's barrels are transported by the buyer to the edible oil plant for filling. Barrels are filled to 110 viss by weight and loaded on a truck. If the purchased volume is large, barrels are stacked one on top of the other for transporting to the consumer.

Due to the physical condition of most barrels, the barrels that have been filled with edible oil are kept for a period of time at the plant before loading on the truck. The barrels are placed in a tipped position, one against the other, to allow for any evidence of leaks. If a leak is noticed, it is stopped and the barrel refilled and reweighed. A story is told of the number of occasions that a barrel on the lower level of a two-layer load of edible oil barrels springs a leak and the driver continues to the destination without being able to unload the barrels to stop the leak. Accepting this as a possibility, rural Primary Cooperative Society shops without barrel scales have wooden dip-sticks to assure themselves that delivered quantities are the same as purchased quantities.

Barrels are transported to a distribution point for the edible oil to the various Consumer and Village Tract Cooperatives. At that point, the edible oil is tested by the method described earlier by the receiving Cooperative Society and rebarrelled in the receiving Cooperative Society's barrels. The final point of sale is at the Village Tract or Consumer Cooperative Society's retail facility. These shops, as a general rule, are retail outlets for controlled products, such as rice,

kerosene, sugar and soap, and decontrolled items, such as foodstuffs, including edible oil.

A small amount of edible oil (four to five gallons) is pumped by a small mechanical lift-pump into an open aluminum pan for display., The consumer can then easily see the color, and by dipping a finger into the pan, check the taste and smell. Edible oil is dipped from the open pan into the consumer's own container, such as a bottle or jar, in the desired quantity. Dippers of 5, 10, 20, and 50 tical sizes are dipped into the pan and the quantity is funneled into the bottle.

2. Market Flows

Market flows of edible oils cannot be directly traced due to the lack of knowledge about edible oil sales by private mechanical extraction plants.[1/] Inter-divisional transfers of edible oils by the Cooperative Sector for 1978/79 through 1981/82 are described in Annex J. Table 1. Over this time period market movements indicate that the surp[illegible] Divisions of Magwe, Pegu, Mandalay, and Sagaing shipped edible oil to the Rangoon Division, Kachin State, Mon State, Shan State, Tennaserrim Division, Irrawaddy Division, Chin State, and Kayah State.

Based upon the above, together with a surplus-deficit analysis, the market flows for edible oil are described as illustrated in Figure 2.[2/]

3. Transportation Costs

Transportation of edible oils is constrained by the condition of roads, age of transport equipment, and the type of containers used for shipment. Transportation costs shown in Annex K, reveal that transport

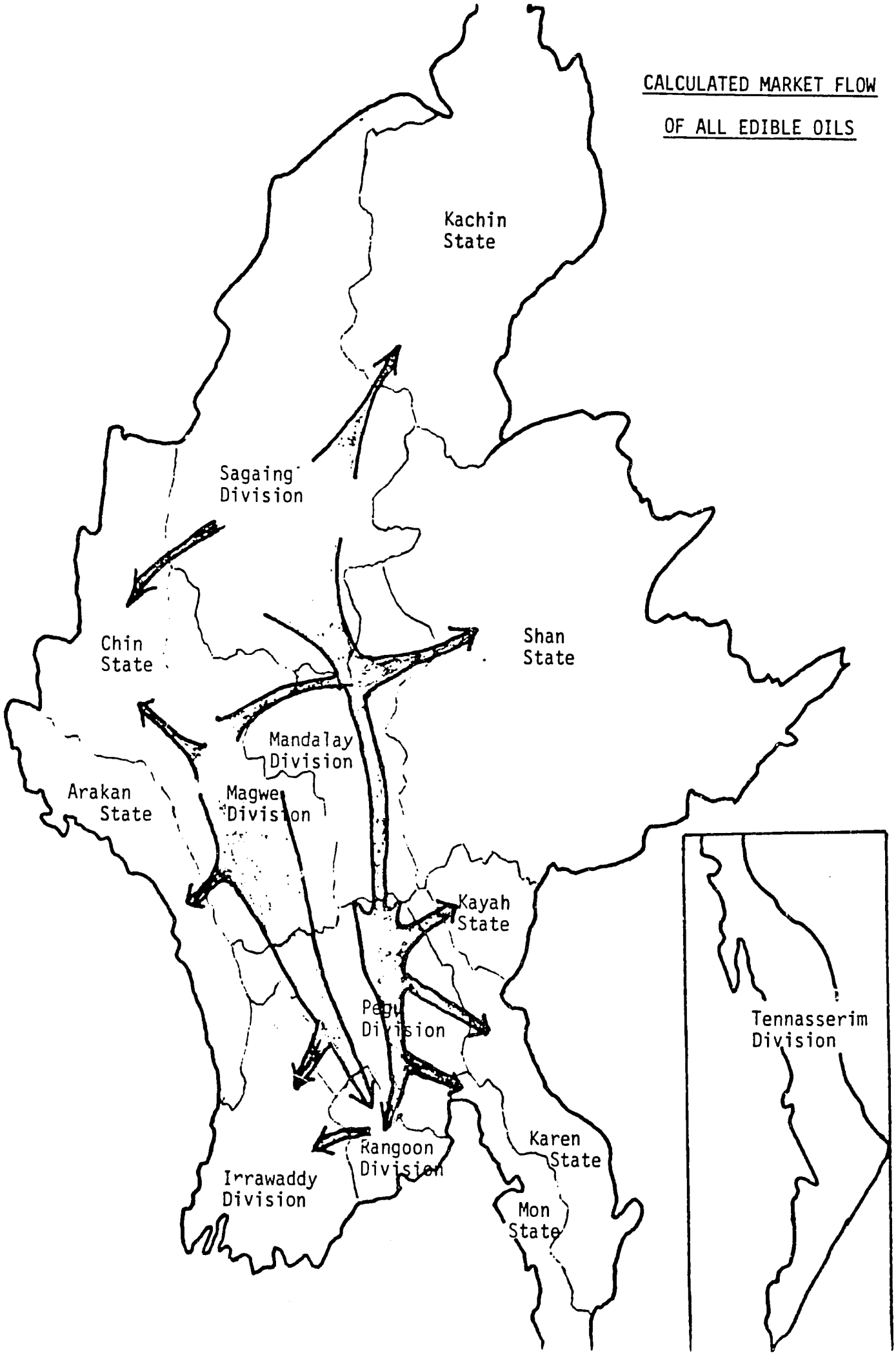
1/ Information relating to how much volume is produced by the Private Sector and what volume of Private Sector edible oil is sold to the merchant system in other States and Divisions is not known.

2/ Surplus-deficit analyses reveals that the Divisions of Magwe, Pegu and Sagaing most generally have a surplus of edible oils. Mandalay Division may not have a slight surplus depending upon the year in question. All other Divisions and States are deficit in edible oils, especially the metro-

CALCULATED MARKET FLOW

OF ALL EDIBLE OILS

Figure 2



costs are not only a function of miles traveled but also a function of road conditions.1/

The resulting costs of transport of edible oils add approximately one-fourth to one-half Kyat per viss to the wholesale cost of edible oil delivered within a fifty mile radius of an edible oil extraction plant.2/ Costs of transport for edible oil transported from surplus Divisions to Rangoon add from 0.8 to 1.2 Kyats per viss to the wholesale cost depending upon the surplus Division from which the edible oil is shipped.

F. Edible Oil Consumption

As stated in the introduction, edible oils comprise a major source of calories, essential fatty acids, and vitamins in the Burmese cuisine. There are five major edible oils available for consumption in Burma: groundnut, sesamum, sunflower, palm and rice bran oil, but strong preferences for the type of oil do exist.

Groundnut oil is the edible oil of preference. Groundnut oil has a strong pleasant taste and smell, and, as edible oils are served in greater quantities in Burma than in many other countries, the taste and smell of the groundnut oil contribute to the taste and smell of the prepared food. Furthermore, groundnut oil has a higher smokepoint than the other edible oils. This physical characteristic is extremely important when considering the usual method of Burmese food preparation. The great majority of Burmese homes prepares the food outside utilizing a charcoal fire and a vessel similar to an iron or brass wok. Given the high smokepoint of the groundnut oil, there is little loss from splattering and groundnut oil does not burn nor blacken. Consequently,

1/ Preliminary calculation of transport functions reveal that mileage is not the the prime prerequisite in determining transport costs. The irregular fit of the transportation function indicates that there is a strong influence on costs due to the inadequate road system.

2/ All transportation costs are based upon trucking costs (Annex K).

a series of foods may be cooked in the same groundnut oil without the need for additional edible oil. Furthermore, the groundnut oil does not absorb the flavor of the food being prepared. Other edible oils in comparison, lack the preferred groundnut flavor and smell.

Household experience with sunflower oil is limited. However, lower smoke points of the remaining available edible oils results in more splattering and more sesamum oil is required to prepare a meal than groundnut oil. Palm and rice bran edible oils have a lower smoke point yet and very rapidly turn black with frying. In addition, these oils have a sharp taste. Therefore, the preferred order of edible oil preference is groundnut, sesamum, and palm and rice bran oils.1/

Consumer purchasing patterns reveal that approximately 75 percent of urban consumers ask for groundnut oil while, because of the low price of palm oil, only a very small percentage will request palm oil. Approximately 70 percent of urban consumers purchase edible oil daily while 30 percent keep some undetermined amount of edible oil stored at home and purchase on an infrequent basis. The average size sale is estimated to be 10 ticals (approximately 6 ounces) with no more than 20 ticals (approximately 12 ounces) generally being sold at one time.

1/ Consumer preference as to taste and smell must be considered in any developmental process. Such an abrupt change in the traditional food habit of a country has, on many occasions, led to the rejection of an otherwise successful developmental action. Because of current consumer preferences in edible oils, no further consideration will be given to rice bran oil in the domestic production of edible oils. Consideration will be strictly limited to groundnut, sesamum, and sunflower edible oils.

Calculated available per capita consumption of edible oils in Burma is as follows:

Year	Calculated Available Per Capita Consumption of Edible Oil per year 1/ Pounds
1969/70	9.47
1970/71	11.77
1971/72	10.78
1972/73	6.94
1973/74	9.58
1974/75	9.08
1975/76	9.13
1976/77	8.25
1977/78	10.09
1978/79	10.91
1979/80	7.42
1980/81	9.95
1981/82	12.59

The above table reveals that in the past intake of edible oils per capita per annum has ranged from 38 to 70 percent of the calculated recommended level of edible oil requirement. 2/

1/ Source: Annex L, Table 1.

2/ Source: Annex L, Table 2.

The intake of oilseeds (groundnuts and sesamum) as food raises the per capita level of edible oil intake some one and three fourths pounds. While this increases the intake of edible oil by 17 percent it does not substantially alter the large deficiency of edible oil in the diet.

This historical deficiency is shown in Figures 3 and 4. Figure 3 illustrates the large total deficit in metric tons and the volume levels that need to be achieved for future consumption. Figure 4 charts per capita consumption against per capita requirements. The growth trend of per capita consumption is less than half percent annually. It is evident then to achieve recommendation levels of consumption that two things must occur; first, an increase in the level of production and secondly, more efficient edible oil extraction methods.

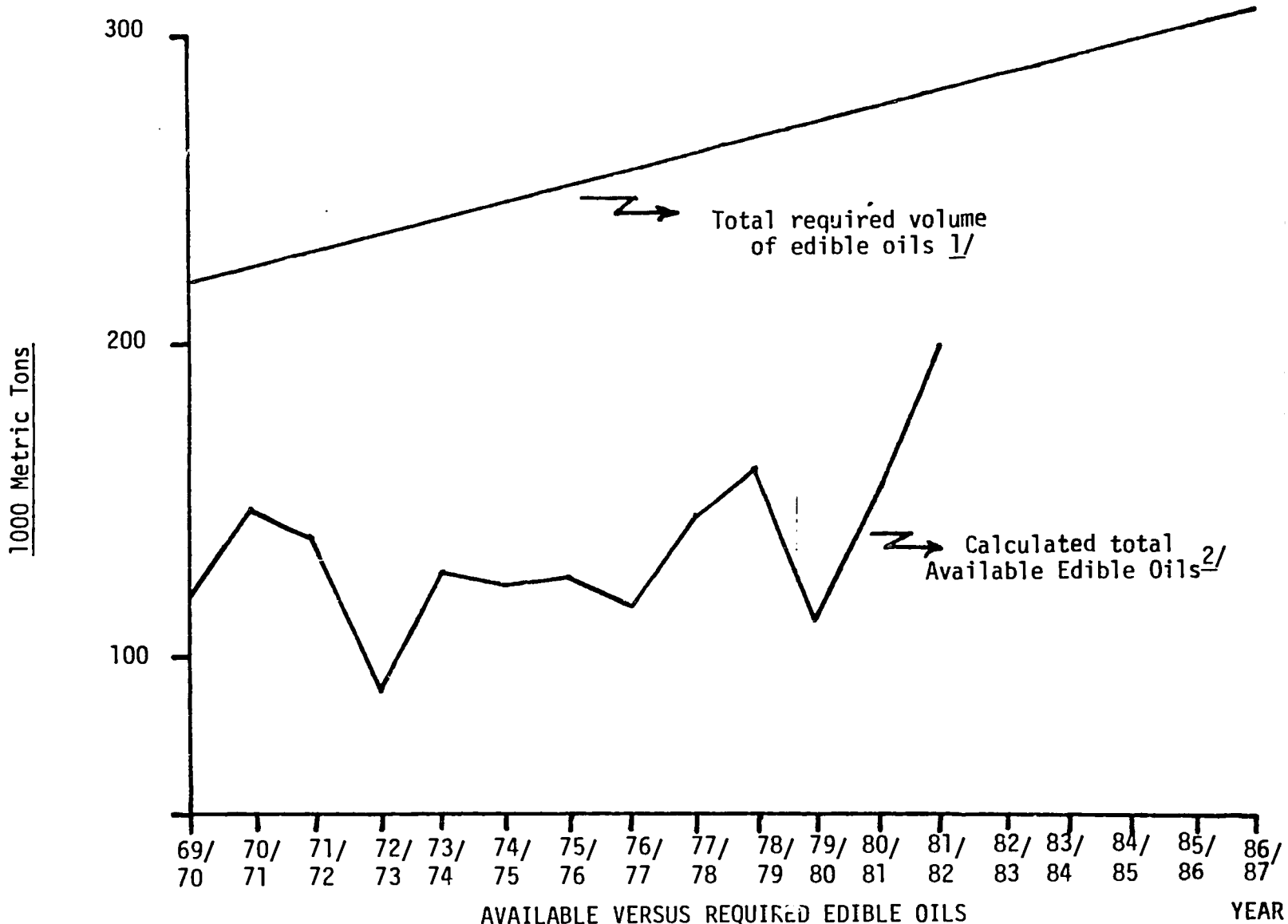
G. Pricing of Oilseeds and Products

1. Description of Price Determination by the Cooperative Sector

The determination of the price to be paid to the farmer member of a Cooperative Society for raw materials and the consumer purchase price for edible oil and oilcake were briefly described in Subsection A. Purchase price of raw materials is based on the edible oil price of purchase to the consumer.[1/] The price is fixed slightly below the price of the edible oil to the consumer. The price to the consumer is worked back through the oil processing system, taking into consideration the costs of transportation, distribution and handling, extraction and collection. Consequently, rough costs of production

1/ Of interest, the population of Burma is approximately 75 percent rural (Annex G, Population) and therefore, the farmer member of the Cooperative society is both a consumer of edible oil and producer of raw materials.

Figure 3

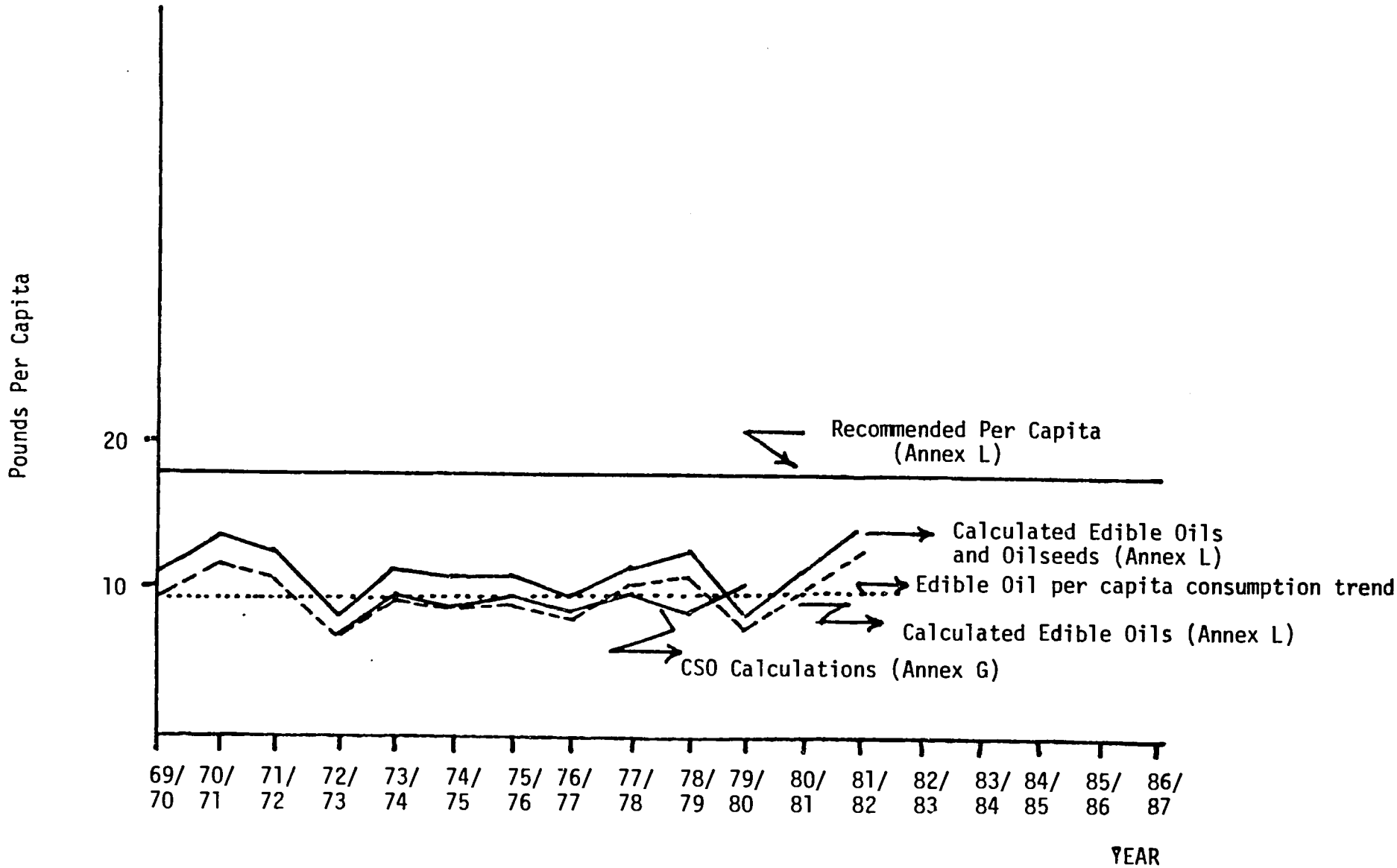


AVAILABLE VERSUS REQUIRED EDIBLE OILS

1/ Minimum Recommended Per Capita Consumption (Annex L) times Population (Annex I)

2/ Source: Annex G, Table 7.

Figure 4



UNION TOTAL PER CAPITA CONSUMPTION OF EDIBLE OILS

figures are supplied by the Primary Cooperative Societies to the Township Cooperative Society.[2/] At the township level, the price which was worked back from the consumer and the rough cost of production data are taken into consideration by the township decision-makers. Such a price determination is made twice a year, namely on the 15th of February and September of each year. As this price is a fixed price and does not change during a six-month period, it remains unchanged regardless of the changes in purchase price offered by private buyers, the weather, crop hazards, such as drought, pests, or diseases, or by supply and demand. Consequently, the purchase price offered by the Primary Cooperative Societies to member farmers is generally below the price offered by the private buyers and the Cooperative Societies don't purchase much more than that obligated to the Cooperative Societies for incentives received, such as credit, seeds, or fertilizer. Once these obligations are met, the remaining production may be sold to the Cooperative Sector or to the private buyers.

2. Prices of Edible Oils

Available price data concerning wholesale and retail prices of edible oils are listed in Annex K. While these data are minimal and short-run, the following inferences can be drawn.

First, as exhibited in Figure 5, average retail prices of groundnut and sesamum oil show very erratic price movements from year to year. Prices within each year apparently are very volatile, especially in 1978 and 1979. When these average prices in Figure 5 are plotted against the

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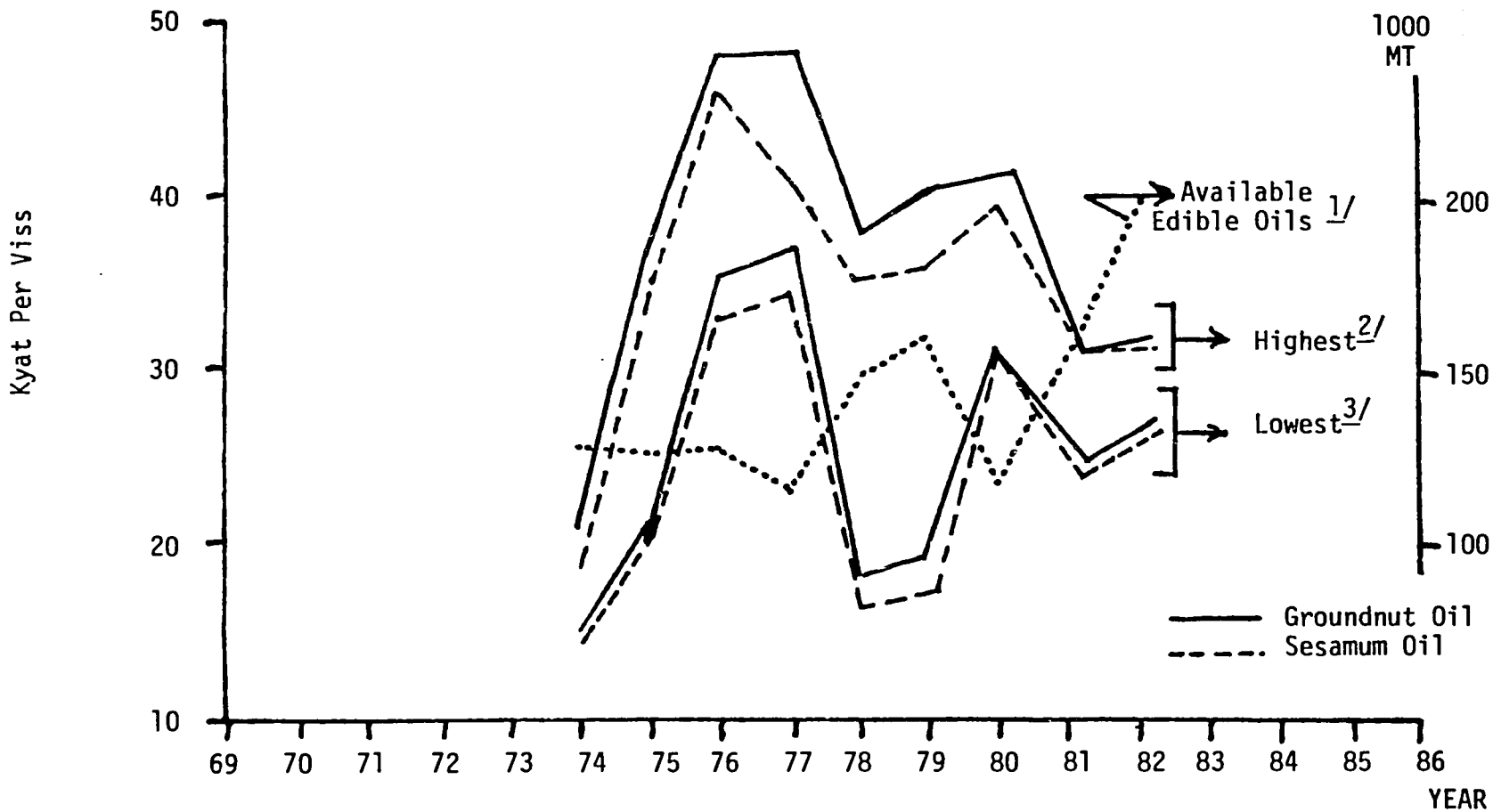
2/ Annex L.

Figure 5



AVERAGE RETAIL PRICES OF GROUNDNUT AND SESAMUM OIL

1/ Annex G

2/ Annex M

3/ Annex M

available edible oil quantity, the indication is that small shifts in supplies of edible oils cause very large price movements. The basic underlying reason for this is, as Burma is deficient in edible oils, a small decline in edible oil supply induces a large increase in price and vice versa. Until such a time as per capita consumption nears the recommended requirement, such price distortions will continue to occur.

In economic terms, edible oils are inelastic as to price affecting quantity consumed. In other words, no matter how much prices increase, the available quantity of edible oil will be consumed because it is a necessary part of the Burmese diet.

Secondly, when the availability of groundnut oil increases in relationship to the availability of sesamum oil, the price spread between the retail price of groundnut and sesamum oil increases. Throughout the price time series illustrated in Figure 5, this price reaction holds to a consistent pattern. The same pattern is evident in the differences between wholesale prices and retail prices of groundnut and sesamum oil. This pattern also holds true for the maximum differences between the lowest wholesale price and the highest retail price for groundnut and sesamum oil.

Thirdly, while it is the intention of the Cooperative Sector to attempt to stabilize the market price of edible oil, it has been unable to mitigate large price increases during declines in available edible oil supply. The basic reason is that the Cooperative Sector has never had more than a 11.3 percent share of domestically produced groundnut, sesamum and sunflower edible oils, which is not a large enough percentage

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1/ Annex G.

of available edible oils to achieve some level of retail price stabilization.[1/] Therefore, edible oil prices respond solely to shifts in the available supply of edible oils.

Prices of oilcake and any corresponding relationship to demand for oilcake or available supply of oilcake cannot be addressed due to the lack of price information.

3. Prices paid to producers for raw materials

It can be assumed that there is currently a small supply price response by producers because of the lack of fertilizer, quality seed, and management inputs.

Prices paid to producers for groundnuts by the Cooperative Sector as compared to production is illustrated in Figure 6.[2/] This reveals that the Cooperative Sector has practiced a pricing policy based on an insufficient data base. Prices paid to producers for groundnuts declined during periods of production declines and increased during periods of increased production. As a result, the Cooperative Sector has never been able to purchase more than 12.1 percent of total production of groundnuts.[3/]

Prices paid to producers for sesamum by the Cooperative Sector as compared to production is shown in Fugure 7.[4/] This reveals again the lack of price policy. While prices compared to production for 1977/78

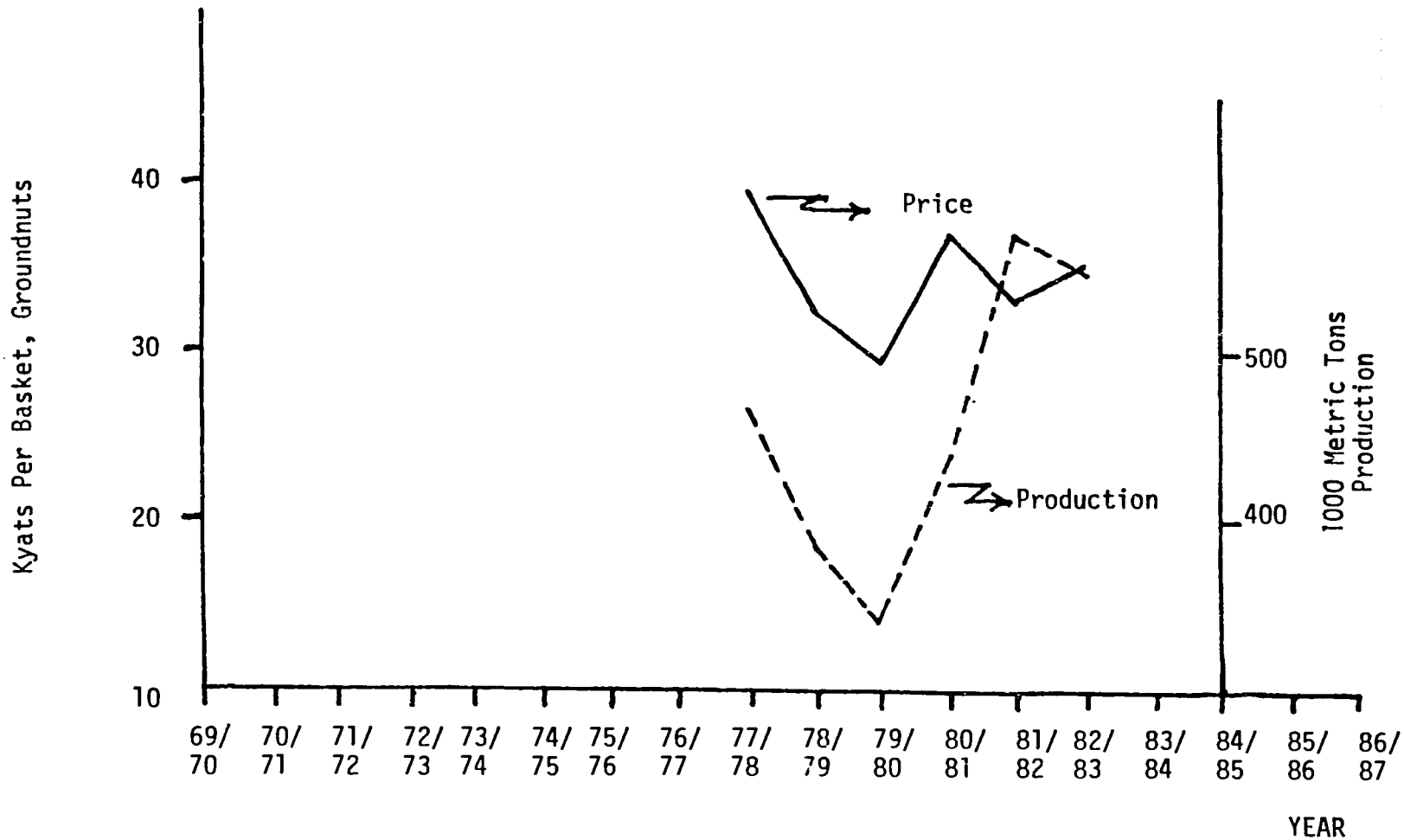
1/ Section IV. D4

2/ The importation of palm oil has also been an attempt of the State to stabilize edible oil prices. The imported quantities have not been sufficiently large enough to assist in dampening edible oil prices. In addition, palm oil ranks very low in consumer preference.

3/ Annex M, Tables 6A-6F and Annex C, Table 1.

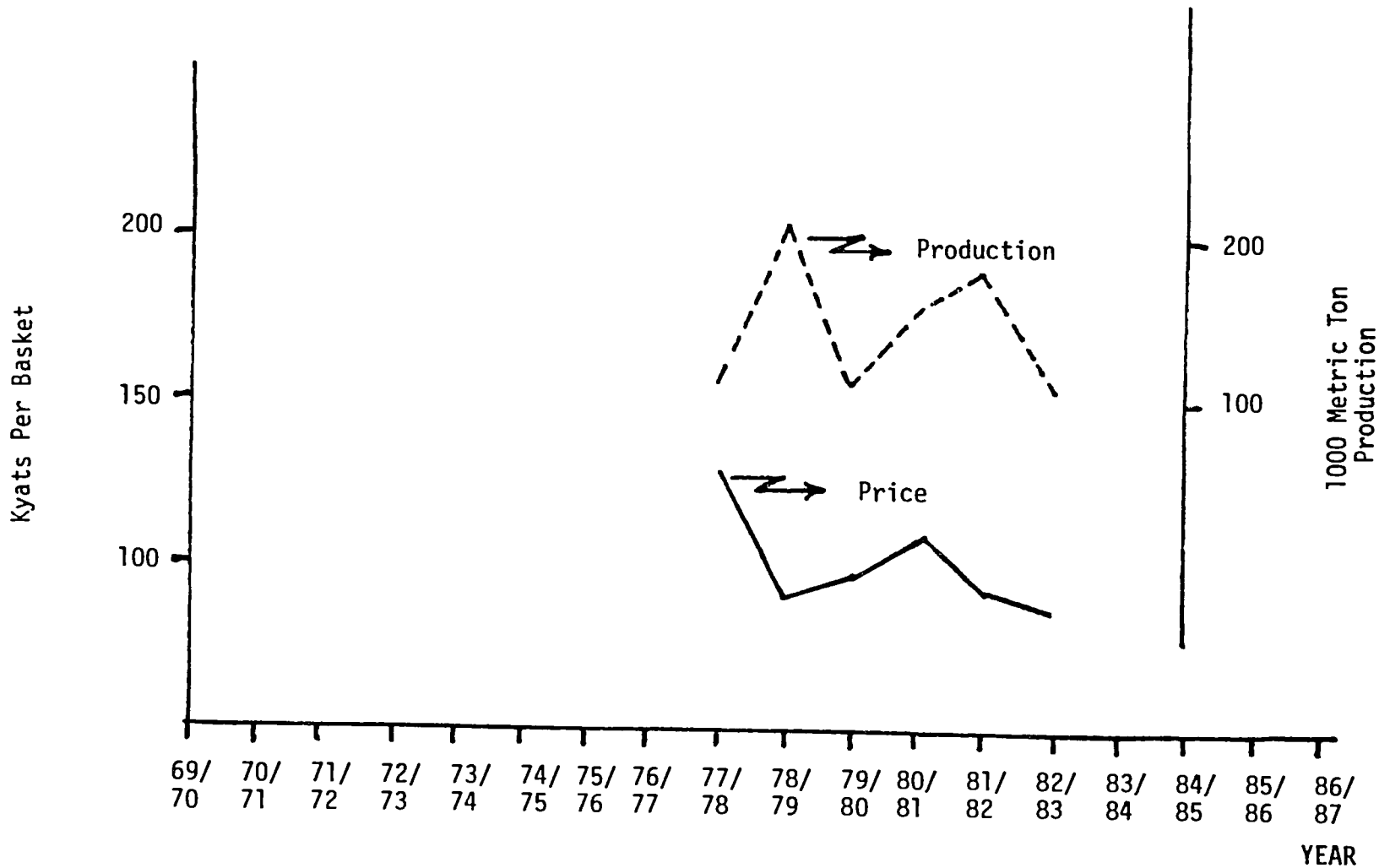
4/ Annex D, Table 1.

Figure 6



Average Prices Paid PRODUCERS FOR GROUNDNUTS BY THE COOPERATIVE SECTOR

Figure 7



AVERAGE PRICES PAID PRODUCERS FOR SESAMUM BY THE COOPERATIVE SECTOR

and 1978/79 reflect a coherency of price to production, after this time period, the relationship of prices to production are the same as in groundnuts. While the Cooperative Sector has been able to procure a high percentage level of the sesamum production, the percentage of production procured when compared to percentage of groundnut production is not significant.

The level of Cooperative Sector procurement of sunflowers make a realistic discussion of prices impossible to develop.

Prices paid to producers by the Private Sector are undetermined due to the lack of price information. However, informal surveys reveal that Private Sector prices range from nine to ten percent and three to 33 percent above the prices paid to producers by the Cooperative Sector for groundnuts and sesamum, respectively. As a result, the private sector captures the vast majority of the production available for marketing.

Limited cost of production data for groundnuts and sesamum are listed in Annex N. The extraction costs listed in these data are much higher than the extraction costs developed by the Study Team survey in Annex E, Table 4. Considering that the survey probably consists of the best Cooperative Sector edible oil processing plant in terms of physical condition and efficiency, it is felt that the cost data in Annex N are strongly biased upwards.

Even with the high cost of extraction stated in Annex N. the cost for producing one viss of groundnut oil ranges from 16.59 to 20.60 kyats.[1/] For sesamum oil, the range of total production cost is from

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1/ Total production cost is the cost of producing oilseeds plus the cost of the extraction of the edible oil.

9.88 to 17.00 kyats per viss. When compared to wholesale prices at Cooperative Sector edible oil processing plants in Annex M, Table 5, there is an average difference between wholesale price and cost of production of 3.45 and 6.21 kyats per viss of oil produced for groundnut and sesamum, respectively.

The Study Team has been repeatedly informed that the producers of groundnut and sesamum that sell their output to the Cooperative Sector receive rebates after the edible oil is extracted and sold. However, no explicit examples were ever presented and what the amount, is, if any, is unknown. The basic question that this leaves unanswered is what is the true price paid to producers by the Cooperative Sector for groundnuts and sesamum. In other words, where does the difference between the total cost of production of edible oil and the wholesale edible oil price received by the processing plant go?

V. FUTURE POTENTIALS

A. Future Oilseed Production Potentials

Past historical trends indicate that Burma can expect a slow growth in oilseed production in the future unless development projects are utilized to assist in increasing the potential for production.[1/]

The USAID financed Maize and Oilseeds Production Project (MOPP) began implementation in 1982/83 by the Agriculture Corporation is projected to achieve the following Union production results by 1986/87.

	Metric Tons
Groundnuts	814,000
Sesamum	221,000
Sunflower	105,000

The Four-Year Plan (1982/83-1985/86) for Union production and production in the five major divisions producing oilseed crops, are shown in Annex O. The resulting targets are as follows:

Four-Year Plan for Oilseed Production

(1000 Metric Tons)

	Groundnuts				Sesamum				Sunflower			
	82/83	83/84	84/85	85/86	82/83	83/84	84/85	85/86	82/83	83/84	84/85	85/86
Sagaing	124.0	129.4	132.8	138.1	53.3	58.7	62.0	61.3	13.7	14.5	16.7	18.6
Pegu	112.5	113.9	116.9	120.5	13.5	18.6	24.3	33.0	12.2	17.7	23.4	28.2
Magwe	168.5	171.4	175.4	177.9	55.6	60.9	64.4	67.5	5.3	7.0	8.1	8.4
Mandalay	147.2	153.0	160.7	160.6	85.1	91.2	96.1	103.1	17.6	21.5	26.7	30.0
Irrawaddy	58.8	60.0	61.4	62.4	21.3	33.8	49.6	64.4	12.7	16.3	20.3	24.6
Total for five divisions	611.0	627.7	647.2	659.5	228.8	263.2	296.4	329.3	61.5	77.0	95.2	109.8
UNION TOTAL	677	695	716	731	240	276	314	357	71	88	108	127

A graphic analysis of historical acreages, yields, and production with historical trends is located in Annex O. Also plotted onto the graphic analysis are the Four-Year Plan and the Maize and Oilseeds Production Project projections.

With the exception of groundnut acreage, the rationale for the plotted trends of the four years planned is understood and accepted by the Study Team.[1/] Based upon this and other qualifications, Study Team is willing to accept the four year plan as the basis for future production potentials.[2/], [3/], [4/]

1/ Plotted trends indicate that short-run time series were used as the basis for tre ' projections with adjustments for specific production projects which would intensify production. The Maize and Oilseeds Production Project target for groundnut production is 13 percent higher than the projection of the Four-Year Plan. However, the Four-Year Plan for sesamum production exceeds the MOPP target by 81 percent. The Study Team believes that the Four-Year Plan is excessively optimistic in its sesamum production projections because of the nature of sesamum productions. (Refer to Production of oilseeds Subsection, Section 4,B). Projections of the Four-Year Plan for sunflower are 39 percent higher than the Maize and Oilseeds Production Project. The recent significant increase in production of sunflower would indicate that the Four-Year Plan could be achieved.

2/ First, an approximate loss factor (a ratio of harvested acreage to planted acreage) has been used. While it is believed that the loss factor for sesamum is set rather low, the level of harvested acreage as related to planted acreage in this case is strongly influenced by weather conditions. Secondly, the breakdown of Union production projection into State and Division projections closely parallels past historical production trends by State and Division.

3/ Given that only 48 percent of the Union arable land base is cultivated, there is no major current constraint of land area availability. The low level of arable land under cultivation is primarily an effect of rainfall restrictions.

4/ Comparison of yields to other Southeast Asian countries indicates that with good weather, available inputs, and crop management assistance the projected yields in the Fourth Four-Year Plan could be achieved.

B. Future Cooperative Sector Edible Oil Extraction Potentials

Improvements in the edible oil extraction process in Burma will have little, if any, effect on the traditional method and, as long as the hsi-zones continue operating with inexpensive family labor and, by nature of their rural locations, removed from the formal commercial flow of edible oil, the hsi-zone method will continue to meet a very limited, local demand for edible oil and oilcake. There does not appear to be sufficient edible oil or oilcake produced from hsi-zones to merit collection of either product for sale or reprocessing in other areas.1/

In the context of this study, the Private Sector cannot be addressed. While it currently plays a major role in the processing of oilseeds, the task is to develop the system as a whole. To accomplish this task one must begin with only a portion of the total system and start the process of development by phasing in needed improvements to that portion of the system. One can therefore expect a diffusion of improvements throughout the whole system. The Study Team strongly believes that the initial starting point for improvement in the edible oil industry should be with the Cooperative Sector. The organizational strength of the Cooperative Sector should well lend itself to the adoption of improved technology and necessary practices.

1/ Annex G, Section 4,D.

Based upon the four Four-Year Procurement Plan, it is forecasted that the Cooperative Sector procurement of groundnuts, sesamum, and sunflower is as follows:

Four-Year Plan for Oilseed Production

(1000 Metric Tons)

	Groundnuts				Sesamum				Sunflower			
	82/83	83/84	84/85	85/86	82/83	83/84	84/85	85/86	82/83	83/84	84/85	85/86
Union Total	185.2	228.3	269.4	306.7	60.8	81.2	99.7	123.9	15.0	21.5	28.1	35.3
Kgaing	30.5	39.2	42.9	46.5	13.2	16.2	17.5	18.8	1.5	2.3	3.0	3.5
Pegu	57.9	59.6	63.3	67.2	6.0	7.6	9.7	14.3	6.2	9.2	12.3	15.4
Magwe	41.8	59.6	78.5	93.6	17.7	23.8	28.4	36.0	1.4	2.4	3.5	4.7
Mandalay	32.9	46.8	60.5	74.2	19.7	28.5	37.8	47.4	3.4	4.9	6.6	9.(
Irrawaddy	11.3	11.5	11.7	11.9	2.0	3.7	4.7	5.7	2.4	2.5	2.5	2.!

The past performance of the Cooperative Sector has been less than optimal when a comparison is made between actual procurement and planned procurement. However, with implementation of improved technology and practices[1/], it is predicted, that beginning in 1984/85, the Cooperative Sector should be procuring and processing the following quantities of oilseeds.[2/]

COOPERATIVE SECTOR - FORECASTED PURCHASES

(1000 Metric Tons)

	Percentage Available for Processing			Quantity				Edible Oil Potential			
	Gn.	Ses.	Sun.	Gn.	Ses.	Sun.	Total	Gn.	Ses.	Sun.	Total
1984/85	25.0	25.0	10.0	100	68	11	179	36	34	3	73
1985/86	30.0	30.0	15.0	124	93	19	236	45	46	5	96

1/ Refer to Section VI.

VI. RECOMMENDATIONS

A. Introduction Statement of Long-Term Edible Oil Requirement

The population of the Socialist Republic of the Union of Burma is increasing at a rate of 2.23 percent per annum. By the end of the Twenty-Year Plan in 1993/94, there will be approximately 9.9 million more mouths to feed than today.

One of the goals of the State is to increase the per capita edible oil consumption which at present is less than 70 percent of the recommended minimum requirement of 18.1 pounds of edible oil per year. At the same time, a concurrent goal is to be self-sufficient in edible oils thereby decreasing the Union's dependency upon imported edible oil. Therefore, by the end of the Twenty-Year Plan, edible oil production must increase 214 percent from the approximate present level of 175,000 metric tons per year to a required 374,000 metric tons per year.

Meeting the long-term edible oil requirement may appear in itself an ominous task. However, the present Section will detail an edible oil plan of improvement which will permit the Ministry of Cooperatives to meet the aforementioned goal. The improvement plan will be as specific as present data and information allow and will permit the Ministry of Cooperatives to prepare a time-phased implementation plan for the recommended improvements.

Recommendations to follow will focus on the five major edible oil regions of Burma. Success or failure of reaching the goal stated above will be dependent upon the Sagaing, Pegu, Magwe, Mandalay and Irrawaddy Divisions. Based upon the historical production data, the Fourth Four-Year Production Plan, and the expected surplus of edible oils based on

Divisional production levels, the Study Team recommends the order of investment to be as follows: Magwe, Pegu, Sagaing, Mandalay, and Irrawaddy Divisions. The rationale for the present prioritization is based upon existing surplus edible oil production which is available to be transported to Divisions which are deficient in edible oil.

B. Improvement of Oilseed Processing

The Study Team recommends a two-way approach to the task of improving oilseed processing in Burma. First, in order to absorb the projected oilseed production, the recommendations will address the construction and operation of new facilities which will produce high quality edible oil for shipment to oil deficient areas, primarily Rangoon. Second, the recommendations will address improvements to be made in existing facilities. These are low-cost improvements that will enable the current facilities to operate more efficiently and, at the same time, will enable the existing facilities to produce a higher quality edible oil for the areas immediately surrounding the facilities.

1. Recommended improvements for edible oil processing through new facilities

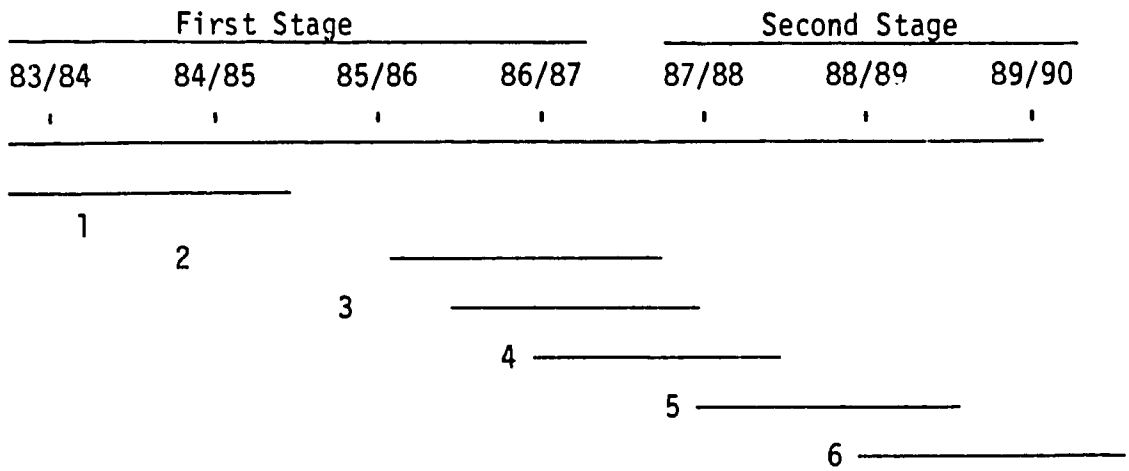
As the Cooperative Sector captures a higher percentage of the oilseeds produced and when a larger quantity of oilseeds are produced by the farmer members of the Primary Cooperative Societies, a decision must be made as to how and in what way the Cooperative Sector will expand their edible oil processing facilities. The Study Team recommends that new facilities of large capacity be of the solvent extraction type.

Solvent extraction of edible oil is the major type of edible oil extraction being used in the world today. In general terms, the process

consists of bathing the oilseeds or prepressed oilseeds in a solvent so as to extract the oil in the solvent and then later removing the edible oil from the solvent and recycling the solvent over more oilseeds. A technical explanation of the solvent extraction process is found in Annex Q. Advantages and disadvantages of the solvent extraction process are also found in Annex Q.

Implementation of solvent extraction plants would entail the building of new facilities with special requirements. A schematic drawing of the layout and the functions of the components of such a facility are presented in Annex Q. Of primary importance, is the location of the facilities and the processing capacities of the facilities. Further consideration must be given to the sequence of implementation of successive plants.

The Study Team recommends that a new pilot solvent extraction plant be installed in the Magwe area with the capacity of 25 metric tons per day (7500 metric tons per year) and expandable to 50 metric tons per day (15000 metric tons per year). The reasons for such a decision are that a small extraction plant would easily fit the short range procurement goals of the Cooperative Sector for the Magwe area, a small facility would be used as a training facility for personnel for additional solvent extraction plants, and a small model facility would serve as a learning base for the managing Township Cooperative Syndicate as well as for a Ministry of Cooperatives as a whole. Furthermore, a small, well managed, efficient operation would turn a positive internal rate of return given the present low levels of production, Section VII. The Study Team recommends the following time-phased sequence for installation.



The time gap in the sequence between the first and second solvent extraction plant would allow for modifications in the specifications of the subsequent plants based on operating experience of the first plant. The size of the second through the sixth plant is to be dictated by the ability of the Cooperative Sector ~~of~~ to procure enough oilseeds to continuously operate a plant.[1/] Therefore, all plants, both 25 and 50 metric tons per day, should be built to allow for expansion to double the original capacity. The Study Team further recommends that once the Magwe solvent extraction plant is in operation that the order of the additional plants be as follows: Pegu Division, Sagaing Division, Mandalay Division, Magwe Division, Irrawaddy Division.

The construction of a new solvent extraction plant in a particular area does not imply that all other expeller plants in the area should cease to function. The Study Team recommends that existing facilities focus on producing edible oils for the township or division that they serve and that the new facilities be directed toward the production of edible oils of high quality to be shipped in an economical and hygienic form to edible oil deficient areas, particularly Rangoon.

1/ Refer to Preliminary Internal Rate of Return results in Section VII

The implementation of a new solvent expeller plant requires careful and complete study. Many components are required for a solvent extraction plant that are not required for an expeller plant. Of primary importance, an ample and continuous supply of raw materials must be available to sustain the facility without a break in operation. Not only is the choice of the location critical for such a requirement but the facility must have ample storage capability to carry the plant from one harvest period to another. The electrical conditions must be dependable and consistent. An adequate supply of water must be available. Solvent must be available and of high quality.[2/] And most importantly, a highly trained and qualified labor force must be in place to assure professional and safe operation of the solvent extraction plant.

In regard to the physical plant, the solvent extraction process will be a prepressed oilcake solvent extraction process. Therefore, there will be two sources of edible oil. The prepress expeller will remove the edible oil from the raw material to a level of 15 percent. The oil from the expeller will be the best quality raw oil of the two processes. The solvent extraction process will produce an oilcake with an oil content of less than one percent. The oil from the solvent extraction process will, by necessity, have to be refined. The refining process removes suspended impurities, colloidal impurities, and free fatty acids. Refined oil has an improved color, is bland in taste, and will tolerate long-term storage better than unrefined oil.[3/]

The Study Team recommends that a refining unit be installed with the new pilot solvent extraction plant. The refining unit will be of

2/ Refer to Annex S

3/ Refer to Annex T

the physical refining type which is less expensive and easier to operate. The decision whether to refine the edible oil from the prepress expeller will be made by each solvent extraction plant; however, the new solvent extraction plant will be constructed so that the oil from the prepress expeller may be refined, if so desired. The decision as to inclusion and location of an expanded refining capacity will depend upon consumer acceptance of refined oil and the locations and capacities of future solvent extraction plants.

Once the edible oil passes through the refinery, the next task is to assure the delivery of the high quality,hygienic edible oil to the consumer. The present method of handling edible oil in 110 viss barrels, transferring of the edible oil from barrel to barrel as it passes from the edible oil extraction plant to the Consumer or Village Tract Cooperative and displaying the edible oil in bulk form for transfer to the consumer's container not only is unhygienic, but also wasteful and allows many possible opportunities for adulteration.

The Study Team recommends that the blowing of plastic bottles, filling them with edible oil, labelling and packaging for distribution be part of the refinery operation. The only way to determine proper bottle size is to conduct a survey of a large number of Consumer and Village Tract Cooperative Societies as to the most common purchase size. The container size should be as large as possible to increase the edible oil quantity to package cost ratio but also keeping in mind the available cash of the average household to be spent on edible oil at one purchase. Probable sizes for the bottles would be 25 to 50 ticals (0.25 and 0.50 viss, respectively). The estimated cost of a 0.50 viss bottle would be approximately one Kyat per bottle.

There are several advantages of clear plastic bottles over opaque or translucent containers. Most importantly, the consumer can see the color, a very important indicator of quality. Second, the clear container allows for labelling on the bottle without covering up the color of the contents.

In order to assure the smooth operation of the solvent extraction plant and refinery, an important additional component is necessary. The solvent extraction plant and refinery must conduct routine chemical analyses on moisture in oilseed cake, free fatty acids, residual oil content in the oilcake, as well as other analyses.

The Study Team recommends that small inexpensive laboratories be installed at each solvent extraction plant site to conduct routine analyses. The presence of a functioning laboratory at each solvent plant will not only facilitate the necessary analyses, but other presently neglected determinations, such as moisture content of raw materials will also be able to be conducted.

In summary, by beginning in the development of new solvent extraction of oilseeds in Burma on a small scale, the Ministry of Cooperatives will be able to develop an institutional capacity to manage and operate such a facility. Through this increased capacity, the Ministry Cooperatives may expand the system to new areas, based on actual experience and thereby maximize return to the investment.

2. Recommended Improvements for Existing Edible Oil Extraction Plants

According to the Ministry of Cooperatives, there are 59 Cooperative Sector edible oil extraction plants in Burma. The locations and the capacities of the Cooperative Sector edible oil extraction plants

of the Magwe, Pegu, Sagaing, Mandalay and Irrawaddy Divisions are illustrated in Annex E. Since these five Divisions are the main oilseed producing regions, the Study Team Recommends that low-cost improvements be made to improve the efficiency and enhance the quality of their products.

In Burma, the only extraction process in use is to squeeze edible oil out of the oilseeds using a machine called an expeller. In an expeller, of a rotating tapered shaft on which section of wormscrews force the oilseed mass forward. The tapered workshaft and worms rotate in a drainage barrel which is made of rectangular bars fitted closely together in a heavy frame. A knife bar keeps the oilseed from revolving and forces the cake forward. As the pressure builds, oil passes between the bars on the drainage barrel.

As in all machines, adjustments must be made on a regular basis for the expeller to operate at maximum efficiency. Of greater importance, the internal moving parts of the expeller are subject to constant wear and the expellers must be broken down to remove the bars and worms for rebuilding. The period an expeller is inoperative decreases its efficiency over time. Furthermore, edible oil extraction efficiency decreases with worn parts.

The Study Team recommends that hard facing capacity be included in the services offered by the Industrial Producers Cooperative Societies now providing replacement and rebuilt parts for the existing edible oil extraction plants. Investment costs would include three essential items: a good quality electric welder, hardfacing rods and a quality metal grinder to smooth the surface of the weld. Included would also be in-

service training to decrease the loss in time and materials that would be spent in learning the process. It is further recommended that the hardfacing capacity be included in three Industrial Producers Cooperative Societies located in Yenangyaung, Meiktila, and Mandalay. No time phasing for such an investment is necessary as all three now have the capacity to accept such an upgrading in capacity without delay.

The Study Team recommends that a quality improvement program be set in action at the existing edible oil extraction plants. The program would have two aims: to improve the quality of the final product and to improve the handling of raw materials and final product. The present edible oil extraction plants that were visited by the Study Team all had one thing in common--poor sanitary conditions. The following suggestions would be very inexpensive, and would be easy to implement. First, regardless of the quality of the oil leaving the expellers, transferring the oil from the expeller to a receiving tank, and from the plate filter to the storage tank in exposed gutters allows the possibility for contamination. The Study Team Recommends that such a condition be corrected by covering the gutters with removable covers. The recommendation will require some changes, but generally, the changes will be inexpensive. In addition, filters should be covered to decrease the possibility of contamination of the edible oil from the dusty plant environment.

C. Improvements in the Edible Oil Distribution Process

Recommendations for improvements in the edible oil distribution process will be broken down into those recommendations for the new solvent extraction plants and recommendations for the existing expeller facilities. The following discussion will be concerned with only edible oil, as local distribution and use of oilcake appears to be adequate and the transportation of oilcake for export is the responsibility of the Ministry of Trade.

With the production of a high quality oil in plastic bottles, most of the existing oil distribution system in oil deficient areas will become obsolete. A method of handling the bottles from the new solvent extraction plants to the Consumer or Village Tract Cooperative Society's shelf, however, must be addressed.

The Study Team recommends that a plastic bottling handling system be put in operation utilizing reusable wooden cartons. Reusable wooden cartons are recommended in place of cardboard for two reasons: sufficient materials and expertise are now or can easily be put in place for the construction of such cartons, and, due to the economical construction of the plastic bottles, a carton must be used that will be able to support the weight of stacking without relying upon the strength of the bottles. As the flow of the bottled product will be contained within the Cooperative Sector, the control and transport of the reusable carton will be easily managed.

The Township Cooperative Societies in Rangoon, for example, will not have to be concerned of the quality of the edible oil when they purchase the bottled oil. Cartons of bottled oil will be delivered to the Township Cooperative Society's Distribution center as is now the practice with bulk oil in barrels. However, the bottled cartons will be distributed much the same way that the Distribution Center now distributes powdered milk, condensed milk and other pre-packaged foods. The transfer of the product from barrel to barrel will be eliminated and the hygienic quality of the edible oil will remain at the same high standard as it leaves the new solvent extraction plant.

The existing expeller plants will continue operating with the barrel system for distribution to the area immediately surrounding the expeller

plants. There are, however, several areas for changes which will make the handling and distribution of the edible oil easier while at the same time maintain, as much as possible, the quality of the edible oil that leaves the existing expeller plant operation.

The Study Team recommends that barrel cleaning facilities be installed in every edible oil extraction plant now in operation. No such facilities were seen during the Study Tour. A barrel tumbling facility could easily be built by the Industrial Producers Cooperative Societies to roll the barrel in a fixed location while a short piece of chain scours the inside of the barrel. Following this step, the barrel should be steam cleaned. As most of the existing facilities have the capacity to produce steam for precooking the raw materials before pressing, simple adjustments in the system would allow for the steam cleaning process with a minimum amount of additional costs.

The Study Team recommends that, where possible, the storage tank for bulk oil be located so as to make filling of barrels and subsequent loading onto trucks an easier process. By pumping the edible oil from the filter press to a tank which is high enough to allow gravity filling of the barrel, and subsequent loading of the barrel onto a truck, the handling of the barrels would be reduced and the physical condition of the barrels would be maintained.

The Study Team recommends that the barrels filled with edible oil at the existing facilities be transferred to the Consumer or Village Tract Cooperative Society's retail outlet without the transfer of the edible oil from barrel to barrel every step along the way. Such a practice would require a form of deposit and return of the deposit upon

return of the barrel in good condition. Any reduction in repackaging of the edible oil will reduce the possibility of contamination. Furthermore, if the existing edible oil extraction facilities have a barrel cleaning capacity, the consumer will be assured of a quality product upon purchase of the edible oil from the Consumer or Village Tract Society.

The Study Team recommends that an improvement be made in the display and sale of bulk edible oil by the Consumer and Village Tract Cooperative Societies. Hand pumps now in use should be cleaned on a regular basis and stored, while not in use, in areas to reduce contamination. The same recommendation holds for the display vessel and the unit measure containers.

D. Improvement of Oilseed and Product Pricing Structure

Current average operating margins of Cooperative Sector oilseed processing plants are shown in Annex E, Tables 5 and 6. One can easily see that the lack of definitive information on operating costs of edible oil extraction costs, as well as transport and handling costs, has led to the current conditions existing in setting prices paid to the farmer members of the Cooperative Sector as previously described in Section IV. G.

To improve the oilseed and product structure requires three basic areas of improvements: (1) the introduction of new edible oil extraction plants which by being more efficient will reduce operating costs and therefore improve margins, (2) a more frequent determination of prices paid to producers for oilseeds, and (3) an increase in the capability to collect appropriate data and analyze such data, therefore allowing decision-makers to choose among a range of alternatives with the expected outcomes of each alternative known.

1. Improved Operation Efficiency

New prepress solvent extraction plants, being more efficient, generate an increase in value added (more edible oil extracted from oilseeds) and a decrease in operating costs per ton. Such a facility should have the following theoretical operating cost structure:

MARGINS PER BASKET OF UNSHELLED GROUNDNUTS

One Basket	Volume	Price	Value
Value of Oil produced[1/]	2.45 viss	23 K/viss	56.30 Kyats
Value of Oilcake produced[2/]	2.29 viss	2 K/viss[3/]	4.58 Kyats
Total Value			60.88 Kyats
Estimated costs of processing[4/]		300 K/ton	-3.32 Kyats
Operating Margin			57.56 Kyats
Inbound transport			-2.50 Kyats
Primary Cooperative Handling			-0.50 Kyats
Net Margin Available for Purchasing Unshelled Groundnuts			54.56 Kyats

As a result of the above, the Cooperative Sector price structure could be easily redesigned so as to compete very effectively with the Private Sector.

Therefore, there are three options that the Cooperative Sector may undertake in regard to pricing structure. First, the price for groundnuts paid to Primary Cooperative Society members could be increased as shown above. Even assuming that the administrative cost of the Township

1/ 47 percent extraction rate

2/ Balance of oilseed in cake with loss factor of 2.5 percent

3/ Oilseed cake is valued slightly higher because of improved quality

4/ $50 per ton for 25 ton/day plant at 7.8 Kyats per dollar

Cooperative Society could be as high as 25 percent of the net margin available for purchasing groundnuts, this would still allow a producer price of nearly 41 kyats per basket. Even this less than optimal calculation of possible producer price is more than the current Private Sector price in major groundnut producing areas.

The second option is to hold producer prices at current levels and to reduce the wholesale price of edible oil. This wholesale price could be reduced to 19.1 kyats per viss even considering the administrative costs of the Township Cooperative Society. The Study Team recommends that this option not be considered because it is not econimically viable. The use of such a pricing approach will tend to place the Cooperative Sector at a great disadvantage in the purchasing of oilseeds and therefore restrict the flow of raw materials to new processing plants causing the plants to shut down which increases the level of operating cost far beyond the current estimate.

The third option is to basically proportion the increased operating margin between consumers and producers in such a way that producers receive a fair price for their production yet still enable the Cooperative Sector to more effectively stabilize the price of edible oils to the consumer.

2. Producer Price Flexibility

The Study Team recommends that fixing of prices be more frequent than twice a year as is the current practices. The Cooperative Sector is currently a price follower and not a price leader, both in consumer prices and producer prices. The Study Team therefore recommends that prices should be fixed on a monthly basis so that the Cooperative Sector can adeaquately compete with the Private Sector in raw material procurement. In this manner, the Cooperative Sector becomes a price

setter, not a price follower.

3. Increased Capability to Utilize Information

To be able to address the above Study Team recommendations, institutional improvement in the ability to collect needed data such as price information, transport cost information and operating cost information as well as improvement in ability to analyze such information and present decision-makers a series of alternative actions and outcomes. This recommendation will be further addressed in Subsection E.

E. Improvements in the Institutional Capacity of the Ministry of Cooperatives

The present section addresses the recommended improvements in the institutional capacity of the Ministry of Cooperatives. The recommendations are based on future required improvements which are necessary to assist the Ministry of Cooperatives to meet its goal of increased availability of edible oil for an ever increasing population. The recommendations are in no way meant to be critical of the Ministry of Cooperatives but should be taken as constructive steps to improve the efficiency of operations throughout the Cooperative Sector. The recommendations will address institutional strengthening for edible oil facilities, the planning process within the Ministry of Cooperatives, the technical services offered by the Ministry of Cooperatives and the management capability of the Cooperative Department.

1. Institutional Strengthening for Edible Oil Facilities

The new solvent extraction facilities will require a specialized group of individuals highly trained in the area of operation, safety, and management. The process is a new process for edible oil production in Burma and, for that reason, the training of such individuals

will require technical expertise from outside Burma and,in some cases, the training will have to be conducted outside Burma.

The Study Team recommends that the solvent extraction plant manager with a chemical engineering background and management experience, serve a period of on-the-job training in facilities with similar characteristics as the proposed facility for Burma. The training should include on-site briefings at the manufacturing facilities for the solvent extractor to become familiar with the specifications of the solvent extractor. Following this orientation, the plant manager will serve for a period of time as an apprentice at a solvent extraction facility with similar characterisitcs as proposed for Burma. Training will include knowledge of operation and maintenance with an emphasis on safety. Upon completion of on-the-job training, the plant manager will return to Burma and will assume a role of assisting the construction supervisory team during the construction of the new facility. At that time, the plant manager will be assisted by the future operators of the new solvent extraction plant. The purpose of this training is to familiarize the operators of the plant workings from the most rudimentary level up to operation. As the design of the physical plant will depend upon safety and technical specifications which are dependent upon the manufacturer of the solvent extractor, a technician from the manufacturer will be present for the supervision of the installation and start-up. The plant manager and future operators will be required to work along with this technician.

The Study Team recommends that a full-time chemist be trained to operate each proposed laboratory to be installed with the new solvent extraction plants. The chemists will be locally trained college

graduates in chemistry with emphasis on inorganic, organic and analytical chemistry.

The Study Team recommends that an edible oil chemist be trained to operate the refinery to the Masters of Science level in the specialized field of edible oil chemistry. Such training will be, by necessity, in an area that offers such a degree program and consequently, outside of Burma.

2. Institutional Strengthening for Existing Edible Oil Facilities

The primary recommendation presented in Section B dealing with existing edible oil facilities concerns hardfacing. The Industrial Producers Cooperative Societies mentioned in the previous section have the capacity to expand into hardfacing. The only other factor to be considered beyong the necessary equipment and materials is the learning of the technique of hardfacing.

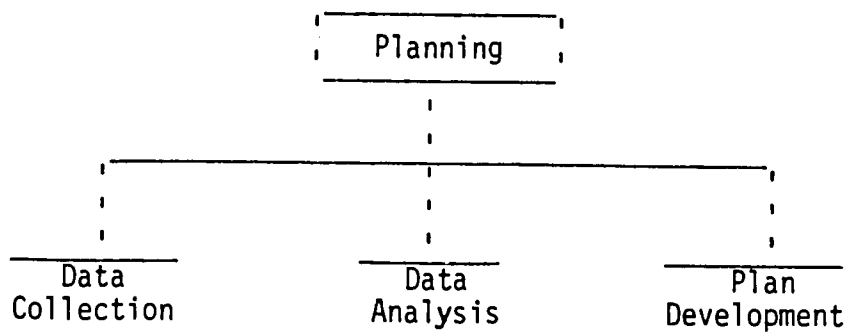
The Study Team recommends that a practical expert in hardfacing be contracted to come to Burma to teach the art of hardfacing and material preparation and finishing. The training will be for the member workers of the Industrial Producers Cooperative Societies and will be of a short-term duration.

3. Planning Capability

The ability of any organization to be responsive to the dynamic, changing environment in which it must operate is only as good as the information as its disposal at the time decisions are made. There is strength in numbers and the organization that has data and knows how to interpret the data will be a more efficient organization.

The Study Team recommends that the Ministry of Cooperatives strengthen the planning capability of the Cooperative Department so as to be able

to create and maintain a data base, analyze the data base and efficiently plan for future development of the Ministry of Cooperatives based on the analysis of the data base. The recommended structure of such a unit could be as follows:



Such an organization would be imperative as the Cooperative Sector reaches toward its goal of 50 percent of the national economy by the end of the Twenty-Year Plan in 1993/94. In particular, such an organizational capability would assist the Ministry of Cooperatives to more efficiently operate in the area of edible oils.

In reference to the area of edible oils, the Study Team recommends the creation of a data base with information concerning, among others, the following: oilseed production data, Cooperative Sector purchases, Private Sector activities (purchase of raw materials and sale of edible oils), prices paid to the producers by both the Cooperative and Private Sector, household budget studies to ascertain per capita consumption levels, and transport and transportation and distribution costs. Once a data base is created, only then can a true analysis be undertaken. The Study Team recommends the creation of a capacity to analyze the newly created data base. The analysis capability will enable the Ministry of Cooperatives to more efficiently prepare projections and forecasts, determine price relationships between prices, sales volumes,

and procurement of raw materials, what portion of the edible oils are marketed by the Cooperative and Private Sectors, consumption and price analysis, transportation cost analysis, distribution cost analysis, and facility location analysis, among others.

The Study Team recommends that the proposed improved data collection and analysis capacity be directed to assisting in improvement of the plan development capacity of the Ministry of Cooperatives. Through such a capability the decision-makers of the Ministry of Cooperatives will be able to rely on a constant stream of development alternative courses of action which will allow the decision-makers to predict the possible outcome of each alternative before costly implementation. The capability will also allow the decision-makers of the Ministry of Cooperatives to stay abreast of development plans as they are implemented and suggest corrective actions as required. Furthermore, the capability will allow the Ministry of Cooperatives to develop their planning based upon the level of achievement as related to past plans.

The Ministry of Cooperatives is presently staffed with a cadre of well qualified, primarily young professionals. The Study Team recommends that the professionals in the planning section of the Cooperative Department be further trained in the skills of data collection, data analysis, and plan development. The data collection skills should be taught to assure proper adaptations to the Burmese conditions. There are several highly competent and qualified individuals and organizations that can fulfill such a training role. A series of highly applied and comprehensive short courses could also address the training requirements for planning, price analysis, forecasting, economic analysis, financial analysis, and transportation and location analysis. These two types of

short-courses should be implemented as soon as possible. In the long term, upper level supervisors should be trained abroad in areas of business (market research, management, and short and long term planning) and agricultural economics (marketing, marketing research, and analytical skills).

4. Improvement of Technical Services

The Cottage Industries Department is responsible for offering technical services to the Cooperative Societies. The technical services required from the Cottage Industries Department in reference to edible oil processing are in the areas of edible oil analysis support, physical plant design and operational support.[1]

The Study Team recommends that the Central Services laboratory of the Cottage Industries Department become the standard laboratory for the edible oil processing of the Cooperative Sector. As the Standard Reference Laboratory, the functions of the laboratory will be two-fold. First, the laboratory will supervise, standardize, and monitor the activities of the quality control laboratories to be installed at each solvent extraction facility. As these facilities will be located in areas of production, the plants will generally be isolated from the services of routine maintenance. The function of the Standard Reference Laboratory will be to supervise the activities of the solvent extraction quality control laboratories so as to assure the efficient operation of the extraction process and to maintain the quality of the edible oil produced. Second, the Standard Reference Laboratory will have the capacity to conduct more technical chemical analyses required by the oil extraction process than can be conducted at the small quality control laboratories.

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[1] A description of the present functions, staff and facilities of the Central Services Laboratory is presented in Annex II.

To implement the recommendation, the staff of the Cottage Industries Department must be reinforced. The reinforcement will be primarily in terms of well trained chemists and chemical technicians. A step toward such an improvement is already in process. The new building under construction for the Cottage Industries Department has space allocated for new laboratory facilities. However, additional laboratory equipment is also needed. Specific equipment that must be procurred will depend upon the types of specialized analyses that the solvent extraction process and related activities demand.

The Study Team recommends that the physical plant design and operation support capability of the Cottage Industries Department be strengthened. The Cottage Industries Department is responsible for offering technical support to the Cooperative Societies in the area of physical plant development, improvement and operation. As the proposed recommendations will dramatically increase the demand for these services, the Cottage Industries Department must also be prepared to meet the future demand by increasing its staff of highly qualified professionals and technicians, training the staff in the specific techniques that will be required by the sophisticated solvent extraction process, and preparing its staff to be able to function as safety hazard experts. The quality of education offered by universities in Burma is sufficient to meet the need for professional preparation, however, specific, short-term in-country training will be required for the technical areas directly related to solvent extraction plants.

5. Improvement in the Management Capability of the Cooperative Department

Once the planning capability of the Ministry of Cooperatives has been improved, the emphasis focuses on the implementation

capability. Planning enhances management of activities by allowing the decision-makers to choose from alternative courses of actions and helping to know what the expected outcome will be. Consequently, decisions can be made on a sound economic basis as related to the context of the system, both politically and socially.

The Study Team recommends that in-country short-term training be offered to the professional staff of the Cooperatives Department to refresh the staff on the use of a sound data base and the implementation of projects as a result of comprehensive analyses. Professional staff should be trained in the conceptialization, design, development and implementation of Cooperative Sector activities. Only through knowing thoroughly every step in the system will individuals be able to contribute to the better management of their own particular part of the process. By understanding how new activities are designed and put into operation, the Cooperatives Department will increase their efficiency and will be closer to the goal set forth by the end of the Twenty-Year Plan of contributing to 50 percent of the Union economy. To maximize the quality of the 50 percent contribution to the economy, efficient management is a must.

VII. EXPECTED BENEFITS OF IMPROVED EDIBLE OIL EXTRACTION AND DISTRIBUTION

A. Beneficiaries

The beneficiaries resulting from improvements in processing and distribution of edible oils are (1) consumers, (2) farmers, and (3) workers and (4) the Ministry of Cooperatives and the Cooperative Sector.

The consumer will benefit from an improved product quality which is produced under sanitary conditions, having less chance of contamination or adulteration. Consumers will also benefit from the increased quantity of available edible oils and more stable prices which will be the result of larger quantities of edible oils and the reduction of operating costs for new edible oil processing facilities.

The farmer will benefit by the probable increase in the producer price received from sales to the Cooperative Sector which can be the result of improved extraction efficiency and the reduction of processing costs.

Workers will benefit because of increased employment opportunities as well as by the improvement in the level of skills.

Finally, the Ministry of Cooperatives and the Cooperative Sector will benefit through the development of additional skills, improved management and supervisory techniques. This benefit will be diffused by the Ministry to the Cooperative Sector.

B. Employment Opportunities

Employment opportunities will be generated by the construction of new facilities, improvements in old facilities, changes in the distribution system and the development of institutional capabilities. The total amount of increased employment can not be calculated due to data constraints, however, employment will increase in construction trades,

manufacturing trades, and the distribution system.

C. Indicated Internal Rates of Return

The indicated internal rate of return for a 25 metric ton per day prepress solvent extraction plant is 31.0 percent. The internal rate of return is based upon paying current Cooperative Sector prices for raw materials and selling edible oils and oilseed cake at current Cooperative Sector prices. The plant is assumed to require two years in construction and the first year of operation at one-half capacity. Thereafter, the plant will operate at full capacity.

A series of sensitivity analyses, using different assumptions, were performed. The resulting changes in the internal rate of return is as follows.

Alternatives	Percent
Increase Cooperative Sector price to level of Private Sector prices	23.0
Operation of plant at one-half capacity	4.0
Operation of plant at three-fourths capacity	20.0
25 percent increase in construction costs[1/]	27.0
25 percent increase in construction costs plus increasing the Cooperative Sector producer price to the level of Private Sector producer price	18.0

This sensitivity analysis reveals that higher producer prices could be paid without dramatically affecting the economic viability of the edible oil processing facility. The major factor that impacts upon the economic viability of such a processing plant is operation at one-half potential capacity. Therefore, it must be re-emphasized that the need

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1/ Investment costs for refining and bottling within the plant

to purchase raw materials for such a facility is extremely important. Operation of such a facility at any level below three-fourths stated capacity causes a dramatic decrease in the internal rate of return.

A comparison between the internal rate of return for the model 25 metric ton per day prepress solvent extraction plant and a 23 metric ton per day mechanical extraction plant reveals that the internal rates of return are 31.0 and 15.4, respectively.[1/] The payback period for the solvent plant is five years whereas the payback period for the mechanical expeller plant is seven years.

The associated rate of return for the model prepress solvent extraction plant is estimated to be in excess of 35 percent[2/] Therefore, the social rate of return will easily exceed 50 percent.[3/]

1/ Source: "Feasibility Report on 23 Tons Throughout Oil Expeller Plant", Cooperative Management Services, Cooperative Department, Ministry of Cooperatives, December, 1982

2/ Associated benefits are those benefits that are associated with a specific project, but do not accrue directly to that project. Such benefits in this particular case would be the value of construction employment, the value of skilled employees in the total system, the value of pure edible oil to the consumer, the value of extra edible oil produced for consumers, the value of the possible reduction of edible oil imports, and the value of farmer benefits from higher producer prices. Associated costs would include the training cost of personnel and the cost of required technical assistance.

3/ The social rate of return is the internal rate of return plus the associated rate of return. This is rate of return on all investment generated by the total benefits to the total society.

VIII. FUTURE DONOR ACTIVITIES

A. Current Donor Activities

A short listing of the current donor activities relating to edible oil is presented in Annex V. Of primary importance are the Maize and Oilseeds Production Project being implemented by the Agriculture Corporation of the Ministry of Agriculture and Forests and financed by the United States Agency for International Development and the German Agency for Technical Cooperation project financed by the Federal Republic of Germany being implemented by the Cottage Industries Department of the Ministry of Cooperatives. Upon successful implementation of the Maize and Oilseeds Production Project, a greater quantity of oilseeds will be available for purchase and processing into edible oil. Once the improved oilseed production practices are incorporated into a larger proportion of the oilseed producing townships, intelligent decisions can be made in regard to the location of future solvent extraction plants.

The German Agency for Technical Cooperation Project involves the upgrading of the technical skills of the Industrial Producers Cooperative Societies. A logical improvement would be to introduce hard-facing techniques into the Industrial Producers Cooperative Societies that provide spare parts and rebuilt parts to the Cooperative Sector edible oil extraction plants. Fortunately, during a protocol visit of the Study Team to the offices of the above project, the foreign technicians were preparing a procurement list for Industrial Producers Cooperative Societies in the oilseed producing areas. The Study Team was able to make suggestions as to the types of equipment and materials needed to

introduce hard-facing in Burma, and the suggested items were included in the procurement list.

B. Future Donor Activities

The Ministry of Cooperatives is in an extremely advantageous position in regard to potential donor activity in the area of edible oil. Several donor organizations have expressed a desire to assist the Ministry of Cooperatives in meeting the goal of increasing the quantity and quality of edible oil available to the ever increasing consumer population of Burma. While such a situation leads to surges of optimism, a note of caution must be raised.

Two possible scenarios may be presented in regard to donor activity toward meeting the goal. The first scenario that could conceivably occur is that the donor community would divide the oil producing areas among themselves and each begin an edible oil extraction project for that particular area. This action would be the least complicated for the donor community but probably the most difficult for the Ministry of Cooperatives to implement. Based on the internal rate of return on the investment, the new processing facilities will probably be solvent extraction plants. Therefore, the Ministry of Cooperatives will run the risk of trying to coordinate activities and actions between a series of solvent extraction plant, each of which could be of a different make with necessarily different requirements. Furthermore, if a whole series of efficient solvent extraction plants is installed at one time, the available technical skills and raw materials in Burma for the efficient management, operation and maintenance of the plants would be severely taxed.

A second and suggested scenario is to accept the donor assistance, but in the Burmese context, i.e. follow a logical and calculated approach to the situation that will not only enable the Ministry of Cooperatives to meet the goal but also assure success of every step along the way toward meeting the goal. The assumption can be made that the Ministry of Cooperatives will implement six solvent extraction plants over the next eight years and that the required investment, including donor assistance, will amount to US$50 million. To logically invest such an amount of money in this activity requires planning. Planning requires analysis of alternatives and analysis requires good, sound data. The Study Team suggests that the Ministry of Cooperatives allocate personnel to the process of data collection and analysis. Only through knowledge of the current and projected situation can the Ministry of Cooperatives enter into developmental assistance dialogue with the donor community. It is further suggested that the Ministry of Cooperatives assign the individuals from the Ministry of Cooperatives that have been instrumental in the preparation of this feasibility study as the basis of the data collection and analysis team. At this point in time, these individuals are the most knowledgeable Burmese citizens in the area of edible oil production, processing, and utilization.

With a sound data base, the Ministry of Cooperatives can then begin the sequential process of implementation with the assistance of the donor community. The first step is to improve the Ministry of Cooperative's installed capacity to collect data, analyze data, and plan based on the information as described in Section E.4. Training is essential and does not have to be time-phased. The Ministry of Cooperatives has

qualified professionals for potential training. The second step is to select the best site for a new solvent extraction plant. The facility should be carefully planned to serve as a model unit that will show success and allow the Ministry of Cooperatives to experience the process before the selection of specifications for subsequent facilities. The time lag between the operation of the first solvent extraction plant and the second is critical so as to accept the foreign technology, test it under Burmese conditions, improve it, and then, based on this position of strength, design the next solvent extraction facility. Furthermore, regardless of the quality of design that will go into the first facilit modifications will have to be made based on operation in Burma and, only after the facility is operating, can the next design be developed. The first facility will be a small facility, in comparison to what today's technology can produce, but it will, by default, be a new, large operation for Burma and the Ministry of Cooperatives. By starting at a comfortable size and showing success, the Ministry of Cooperatives will be able to learn from the first facility and assure success in the later investments.

In conclusion, the goal to increase the quality and quantity of available edible oil in Burma is a Burmese goal. The steps that are taken to attempt to achieve the goal are also at the discretion of the Burmese decision-makers. The Burmese citizens will be the final judge as to whether the goal has been met. Consequently, the task facing the Ministry of Cooperatives is to rationally accept the involvement of the foreign donor community in the Burmese context and move forward toward meeting the goal.