OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

17460

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Distr.
LIMITED

PPD/
17 August 1988
ENGLISH

EXPERT GROUP MEETING ON THE
PROCESSING OF RAW MATERIALS
Vienna, 22-26 August 1988

INDUSTRIAL PROCESSING CONSIDERATIONS FOR THE CONVERSION OF OIL-SEEDS AND OIL FRUITS INTO EDIBLE OIL AND PROTEIN ANIMAL FEED COMPONENTS*

by

J. Turinski
UNIDO Consultant

14

* The views expressed in this report are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

CONTENTS

1. INTRODUCTION

2. THE IMPORTANCE OF EDIBLE OILS AND PROTEINS IN HUMAN NUTRITION

3. PRODUCTION OF OIL-SEEDS, OILS AND OIL MEAL PROTEIN COMPONENTS
   - 3.1. Production of oil-seeds,
   - 3.2. Production of oils and fats,
   - 3.3. Production of oil meal protein components.

4. NEW TRENDS IN PROCESSING TECHNOLOGY
   - 4.1. Raw materials storaging technique and facilities,
   - 4.2. Preparation and mechanical oil extraction,
   - 4.3. Solvent extraction,
   - 4.4. Meal desolventising,
   - 4.5. High quality soybean protein meals production,
   - 4.6. Fullfat soybean extrusion method,
   - 4.7. Production of protein foods and concentrates from other oil-seeds,
   - 4.8. Refining and deodorising,
   - 4.9. Hydrogenation,
   - 4.1o.Rearrangement of fats,
   - 4.11.Fractionation,
   - 4.12.Confectionery fats,
   - 4.13.New technologies.

5. ROLE OF RESEARCH CENTRES AND SIMILAR RESEARCH AND DEVELOPMENT INSTITUTIONS

6. PRESENT CONSTRAINTS AND NEED FOR COOPERATION AMONG DEVELOPING COUNTRIES

7. INTERNATIONAL TRADE IN OILSEEDS, OILS AND RELATED PRODUCTS

8. OBSTACLES TO TRADE IN OILSEEDS,OILS AND OIL MEAL PROTEIN COMPONENTS

INDUSTRIAL PROCESSING CONSIDERATIONS FOR THE CONVERSION OF OIL-SEEDS AND OIL FRUITS INTO EDIBLE OILS AND PROTEIN ANIMAL FEED COMPONENTS

1. INTRODUCTION

An efficient oil bearing raw materials' processing industry is a fundamental agro-industry, essential for food supply and for overall industrialisation of a country.

It acts as a starting point for the establishment of a chain of linked industries that use crude vegetable oils to produce refined oils used in the manufacture of cooking oils, frying oils, salad dressings and ice-cream.

Other down-stream products are based on hydrogenated and fractionated vegetable oils, such as margarine, shortening and ghee. The third group are technical oils, used in the production of "oleochemicals" for paints, varnishes, lubricants and plastics. By-products of vegetable oils and fats industry are used in manufacture of soaps and detergents, based on fatty acids.

The seeds and fruits of many oil bearing raw materials are very rich in protein content (soybean,groundnut, palm kernels, sunflower seed, cotton seeds,etc.) crucial in animal feed production indispensable in modern animal husbandry.

Thus, oilseeds processing industry contributes also, indirectly, to an improved supply of protein food components.

2. THE IMPORTANCE OF EDIBLE OILS AND PROTEINS IN HUMAN NUTRITION

Worldwide, vegetable oils and fats are of a great importance for human nutrition. They account for about 12% of the nutritional energy used nowdays by mankind.

However, vegetable oils and fats are not only a source of energy. They also provide human beings with vital nutritive biologically important substances, that are essential for maintaining and controlling of certain bodily functions.Vegetable oils are the source of "tocopherols" which is the generic term for the fat-soluble, liquid phenolic compounds, containing vitamine E and two-fold unsaturated fatty acid. Both of them contribute to the formation of "prostaglandine", the hormone-like compounds which, inter alia, stimulate smooth muscles and lower the blood pressure.

Oilseeds and kernels protein meals and cakes are of great importance as a second product utilized from oilseeds and oil fruits.

Plant proteins, generally, have a lower biological value compared to animal proteins. However, it is possible to produce required compositions of optimally selected proteins, obtainable from different oilseeds and kernels to meet the special nutritional requirements of an animal. Thus plant proteins are adaptable to specific uses by variation and combination of technological processes during treatment and extraction of oilseeds.

New technological processes usually include protein enrichment, isolation and its modification and transformation into a consistency that is suitable for consumption. The modified proteins from oilseeds and kernels are used in production of bread, pastries, biscuits, creams and desserts, cereal products, snacks, soups, dairy and dietary foods, sausages and other meat products. However, the general tendency is an increased use of plant proteins (including those from oil bearing raw materials)in animal husbandry,which means increased production of animal proteins and their use in human consumption. Such trends are pursued in the developed countries and have to be supported even more in the developing ones.

3. PRODUCTION OF OIL-SEEDS, OILS AND OILMEAL PROTEIN COMPONENTS

3.1. PRODUCTION OF OILSEEDS

World production of selected, most important oilseeds increased from 197.o mil.tons in 1979-81 to 231.2mil.tons in 1986, having an average annual growth rate of 3.6%.Table 1 shows the production of these selected oilseeds and also the share of developing countries in the total world production.

Soybean was,in 1986, by far the most important oilseed crop (41.3%) followed by coconut, cottonseed, groundnut, sunflower seed, rapeseed , etc. The developing countries are the sole producers of coconuts, palm oil, palm kernels and virtually the only producers of sesameseed and groundnuts. They are also becoming increasingly dominant producers of cottonseed and safflowerseed and are advancing further their share in production of sunflowerseed and soybean. The share of developing countries in the total world oilseed production slightly increased from 55.5% in 1979-81 to 59.5% in 1986.

3.2. PRODUCTION OF OILS AND FATS

World production of oils and fats increased from 49.8 mil.tons in 1976 to 72.o mil.tons in 1986 with an annual growth rate of 4.45%. The highest growth rate of 14.12% per annum was witnessed in palm oil production while very high annual growth rates were also reported in production of: rapeseed oil (12.1%), sunflowerseed oil (9.7%), palm kernel oil (7.1%) and soybean oil (5.o%).

Soybean oil still has the leading position in the world vegetable oil production (28.5%) followed by palm oil (15.6%), sunflowerseed oil (13.1%), etc.

Table 2 shows the production of more important oils in 1976, 198o,1984 and 1986, as well as their growth rates over a period of 1o years.

3.3. PRODUCTION OF OIL MEAL PROTEIN COMPONENTS

World production of oilcakes and oilmeals protein components increased from 33.7mil.tons in 1976 to 48.8mil.tons in 1986 at an average annual growth rate of 4.48%.

/

Table 3 shows world production of selected oilcakes and oilmeals in 1976, 198o, 1984 and 1986.

4. NEW TRENDS IN THE PROCESSING TECHNOLOGY

Significant changes occurred in the oilseeds and oil fruit processing industry during the past 25 years. Such intensive and impressive development was also characteristic of some developing countries (Malaysia, Brasil, etc.).

New trends in processing technologies, starting from oilseed storaging, including processing and final products' modifications, will also be discussed as they have a great influence on the market demand for vegetable oils and fats and also on the chances of developing countries to penetrate the international market.

4.1. RAW MATERIALS STORAGING TECHNIQUE AND FACILITIES

Oilseeds are not resistant to rancidity and biological deterioration . Therefore, careful harvesting with minimum physical damage, careful drying and good storage conditions are important. Many of them under high moisture conditions easily grow moulds and are contaminated with other microorganisms. Groundnuts and some oilseeds easily grow Aspergillus flavus species which produce mycotoxin- Afflatoxin. This mycotoxin is harmful and dangerous to human beings and animals, since it also develops easily in the oilseed cake.

Storaging facilities normally include the conventional preparation system with cleaning and drying prior to storage. Thay are constructed, nowdays, from steel or concrete in the form of silo-cells or units. Units are completed with automatic temperature control, micro-processor control, heavy duty and evenly distributed ventilation and cell to cell recirculation systems. As many of the moulds grow slowly below 1o°C, the use of refrigerated air for active ventilation is recommended (GRANIFRIGORS).

/

4.2. PREPARATION AND MECHANICAL OIL EXTRACTION

A good preparation technique is fundamental for the oilseed processing. Basically, the design of preparation systems varies from case to case, depending on oilseeds or fruits concerned. Generally speaking, they are adapted to the soft seeds and fruits or to hard seeds and kernels. As the size reduction is also important, cutting, breaking and flaking are necessary depending on the seed.

Introduction of the fluidbed technology in processing of soybean is an example of a sound investment and energy saving.

A modern palm fruits preparation plant, prior to oil extraction, involves sterilisation, mechanical removal of fruits from the bunch and mechanical breakdown of the fruit structure.

Sunflower seeds require dehulling before preparation and conditioning before mechanical expression. All modern soybean processing plants combine breaking, conditioning and flaking prior to direct solvent extraction. The most modern soya processing plants apply extrusion technique for a better recovery of oil and higher soya meal quality.

Problems associated with rapid growth of acidity in the rice bran after milling were known to appear just before commercialization of rice bran.

The advanced technology for milling and solvent extraction of rice bran was developed in Japan, but is nowdays widely used in India and Burma. It is possible to slow down or even stop deterioration of oil by heating the bran immediately after milling, to destroy the lipase activity, responsible for the deterioration.

There are three ways of extracting oil by mechanical pressing:

- prepressing followed by solvent extraction ;

- pre- and post pressing; and
- single pressing operation.

The residual oil content in the cake depends to a great extent on the kind of the seeds, their ripeness and the way in which the oil-bearing materials are conditioned.

4.3. SOLVENT EXTRACTION

Solvent extraction involves the oil bearing material in a suitable solvent- most efficiently in a " counter current" way. The oil dissolves in the solvent to form a solution or " misçella", which drains from the meal. Modern, new solvent extractor systems are designed for large capacities. They can process up to 4 000 t daily. Maximum utilization of energy, previously accepted as "waste heat" is attained at all stages of the extraction, distillation and desolventising operations.

Modern continuous solvent extraction systems were designed in the United States and Europe, but have nowdays become known all over the world , including the developing countries.

4.4. MEAL DESOLVENTISING

In the process of solvent extraction of oilseeds the spent or freshly extracted material comes from the extractor with approximately 30% solvent (hexane) content. This solvent must be removed from the meal. There are several methods of desolventising and toasting to suit the characteristics of different materials, their heat sensitivity, protein, urease and other nutritional aspects. In addition to desolventising and toasting, drying and cooling are also often necessary. An advanced technology is achieved in DTDC units , with significant advantages over previously applied systems (DTDC: desolventiser, toaster, dryer, cooler).

4.5. HIGH QUALITY SOYBEAN PROTEIN MEALS PRODUCTION

Two modern systems for production of high and low protein dispersibility index, edible extracted soybean flakes, were invented.

First, flash desolventizing system by the Northern Regional Research Center, Peoria IU. was described in 1959 and installed in early 196o`s. A new system with positive solvent recovery was combined with flake stripping and cooking. This system is flexible enough and permits production of soya-flakes with high, medium or low PDI values (from 85-9o PDI to 2o-25 PDI) which is very important for further processing of vegetable protein components for animal and human nutrition.(protein concentrate and isolate production).There is also another technique which applies up-to--date knowledge for protein components processing and is known in practice as VDVD system (vapour desolventising. vapour deodorising).

Many developing countries are not familiar with the new technology. They are faced with many problems related to antinutritional and toxic factors such as: tripsin inhibitor factors in soya meal for animal feeding, gossipol in cotton seed meal, thioglucosinolates in rapeseed meal and afflatoxin in ground nut. Although invented in the USA the positive flow related to new methods and techniques as well as the new knowledge for soybean processing is nowdays being shifted to Brasil and also to some other countries.

Brasil presently produces , from specially desolvented soyameals, large quantities of isolated soya proteins and also texturized soya proteins which are partly exported and partly sold at the local market.

4.6. FULL-FAT SOYBEAN EXTRUSION METHOD

Full-fat soybean extrusion method for production of animal feed has also been recently developed in the United States. The machine was called the " Enhancer". The experimental work was carried out with full-fat soybean and cottonseed meal. The same method is quite wide-spread in Brasil. The passage of coarsly flaked beans through the so called " grain expanders" produces important structural changes with significant advantages for solvent extractor performance. The extruded full-fat soya flakes are excellent feed-stuff for animals where inactivation of anti-nutritional factors was simultaneously accomplished.

4.7. PRODUCTION OF PROTEIN FOODS AND CONCENTRATES FROM OTHER OILSEEDS

Production of protein food and concentrates from other oilseeds was initiated some 10-15 years ago. The protein isolate process, which used groundnut kernels was developed by the Central Food Technological Research Institute (C.F.T.R.I.) at Mysore, India and its patent rights are held by the Indian Government. The problems with cottonseed arised from the presence of gossipol. The first process, designed to produce " low gossipol content" product from cottonseed, which is actually in commercial use is the "Vaccarino process" developed in Italy. That is an extraction process using acetone as a solvent.

Although copra is not an ideal raw material for the milling process and in addition to the fact that it is liable to develop a high free fatty acid content, a few processes involving special preparation of coconuts were developed in the USA, Philippines, Guatemala and West Germany. A very interesting method was developed in the National Institute Research Centre (Philippines) for industrial production of coconut cream, which can be defined as an emulsion, extracted from fresh mature coconut kernel by a process involving milling and pressing with or without water.

Some experiments were also carried out with sunflowerseed and rapeseed. The presence of chlorogenic acid in the first oil raw material and thioglucosinolates in the second, complicated obtaining of positive effects and the experiments are still in the " pilot plant" and " in vitro" stages. Apart from that, sunflowerseed and also sesameseed can be used directly for human nutrition in many food products, cakes and confectionaries.

4.8. REFINING AND DEODORISING

Refining and deodorising are the final steps in oilseed and oilfruit processing. Great efforts have been made in improving edible oil quality.Better refining, bleaching and deodorisation have, apparently, largely removed the problems associated with soybean oil reversion flavour. The evolution of these improvements in soya bean refining can be summarized by the use of stainless steel equipment, better control of caustic refining to curb the losses down to 3.5% , improved bleaching practices, utilizing of activated clay and improved deodorization process. All these new experiences in processing of soya oil are, at present, well nown in many developing countries. There are two types of refining methods which are currently being used in Malaysia , namely: (A) alkaline refining and (B) physical refining. Physical refining is increasingly gaining in popularity within the Malaysian oil industry because of the high cost of chemicals in the alkaline process. A new bleaching procedure was developed in order to obtain constant and high quality edible palm oil. Impurities, such as free fatty acids (FFA), phosphatides, colouring matter, odour, moisture, dirt particles and trace elements are removed by means of modern processing technologies also developed over the past lo years. Due to the use of the new technique nearly all Malaysian palm oil products are exported in the semi-refined or fully refined state. However, in view of inappropriate storage, handling and transportation coupled with the sensitivity of oil and climatic conditions, semi-refined palm oil appears to be more acceptable for long distance transportation.

4.9. HYDROGENATION

Hydrogenation is a chemical reaction of hydrogen with unsaturated double bonds in oils and fats to produce products with selected higher melting points and specific rheological properties. The new hydrogenation technology provides for these products through a careful control of the reaction conditions, pressure, temperatures agitation and catalyst type as well as concentration. Because of the absorption of hydrogen in oil and fat-hardening is very slow- a catalyst is used to accelerate reaction. The most commonly used catalysts are nickel based, although more selective catalysts based on other metals such as copper and platinum are available. Hydrogenated fats are essential for the formulation and processing of margarines, shortenings and other cooking fats, widely consumed throughout the world.

Due to the exotermic reaction and through development of a heat recovery system, the modern hydrogenation plants operate without any steam and with 8o% heat recovery. The process is managed and controlled by micro processors based on the programmable logic control (P.L.C.).Hydrogenation technology offers great possibilities for developing countries. Some of them are already familiar with the technique. Furthermore, it is already used in Brasil and some other developing countries for production of margarine and shortening and in India and Pakistan for production of vanaspati which is prepared by blending hydrogenated, fully refined, bleached and deodorised vegetable oils.

4.1o. REARRANGEMENT OF FATS

Rearrangement of fats referred to as transesterification, interesterification or ester interchange, belongs to the group of the most sophisticated technologies. The term interesterification refers to the reaction of fats and oils in which fatty acid esters react with other esters or fatty acids to produce new esters by an interchange of fatty acid groups. If a fat or mixture of fats is non-random with respect to distribution of fatty acids on the glycerin present, treatment with sodium methylate at temperatures above the melting point of the mixture will result in reshuffling of fatty acids to approach random arrangement. If interesterification is conducted at temperatures below the melting point of the fat, direct rearrangement can occur. The technology is being tested and its commercial application will include hard butters (CBS and CBE fats) production with palm kernel oil as the raw material. Many millions of kilograms of palm kernel oil are being processed in this manner in the USA, each year.

4.11. FRACTIONATION

Fractionation operations in the processing of edible oils are basically the ones of physical separation of oils into two or more fractions, with different melting points. This process has a broad application in edible oil technology. Production of cocoa butter equivalents from palm oil, palm kernel oil and shea fat and from hydrogenated soybean and cottonseed oil has become a common knowledge. In many countries of the Far East, South America and West Africa, where coconut oil and groundnut oil are traditionally used for cooking , there is a tendency of using the liquid part of the fractionated palm oil as a substitute for more expensive traditional oils. Many fractionation plants were established in Malaysia, Indonesia, Singapore, Cote d^Ivoire and Columbia.

In order to diversify its product range for export markets, the Malaysian refining industry has generally adopted the process of fractionating palm oil. The process involves two main steps.First , crystallisation under strictly controlled conditions and secondly, separation of the solid phase (stearin) from the liquid phase (olein).Presently, two main processes are being used which differ between themselves in the separations stage. A few plants adopted a third type of the process in which crystallisation is made from a solvent solution and is followed by filtration. The first is a dry process. Cooling of palm oil (or other oils) is gradual with specific seeding conditions. So, different types of glycerides crystallise selectively and successively, according to their melting points. As for the separation of the solid from the liquid phase the process uses the florentine filter which has been designed for fast and continuous separation. The second processing method uses detergent as the wetting agent and centrifugation for separation , thus avioding the conventional filtration method.

Development of palm oil fractionation in tropical developing countries started around 197o. Up to the present time, many new plants were established, most of them producing olein as the liquid oil substitute and stearin for margarine and vegetable fat production as well as cosmetics.

4.12. CONFECTIONERY FATS

Confectionery fats make a group of fats including

(a) cocoa butter substitutes (CBS) -laurics, incompatible with cocoa butter (physical properties resembling those of cocoa butter);(b) CBS, non-laurics, partlycompatible with cocoa butter; and (c)cocoa butter equivalents (CBE) fully compatible with cocoa butter (chemical and physical properties similar to those of cocoa butter).Commercial technologies which are in use today include hydrogenation, inter-esterification, replacement or reesterification and fractionation. Currently, there is a factory in Malaysia producing palm kernel stearin (obtained from fractionation of palm kernel oil) which is after a slight hydrogenation suitable for use as a cocoa butter substitute. Hydrogenated palm kernel oil is also suitable for such applications. Palm mid--fraction (obtained from double fractionation of palm oil) is commercially available for use as a cocoa butter equivalent (CBE).

Raw materials for confectionery fats have a great importance for developing countries as they are available only in tropical regions. Some of them may be listed as foolows:

- palm oil (elaeis guinensis) in Malaysia, Indonesia and Africa;
- shea butter (butyrospermum parkii) in West Africa;
- sal fat (shorea robusta) in India;
- Borneo tallow (-Tenkawang)(shorea stenoptera) in Malaysia and Indonesia;
- mango (magnifera indica) in India;
- mowrah (mee)(bassia latifolia) in India and Sri Lanka;
- illipe butter (bassia longifolia) in India.

Having in mind the large developed confectionery industries in the developed countries and their requirements for cocoa butter and its substitutes (CBS and CBE) as well as the growing market for these products, hard butter (processed and unprocessed) could provide substantial opportunities for exports of numerous developing countries. They will have to either develop or adopt new technologies based on their mutual cooperation.

4.13. NEW TECHNOLOGIES

New technologies for some less known sources of oils and fats are also being investigated and developed. Rice bran processing in India and Burma has been mentioned before. Olive oil is of a great interest for the Mediteranean developing countries. Grape seed oil is a relatively new product eventhough grape is one of the oldest plants known to be used by man. Safflower (carthamus tinctorius) is a very old crop. Utilized in the past as a base for textile dyes it has now become a new source for oil of importance for some developing countries. In a UNIDO study titled " The Jojoba Potential", the necessity for development and establishment of an appropriate jojoba seed processing technology was discussed. This plant, as a new oil raw material, endemic to the Sonora Desert of Mexioo and the US, could be spread to many desert areas of some developing countries where agro-climatic conditions match the requirements. Jojoba oil is suitable for nutrition and also for use as technical oil with excellent properties. Maize is very popular in many developing countries, as one of the most important sources of both human food and animal feed. The old varieties contain "germs" (5%) with about 50% of corn oil. New hydbrids of maize contain even more (up to 6%) oil of a very high quality.

The world production of maize is very large (480.6 mil. tons in 1986). By developing and adopting the technology for maize processing into starch, derivates and corn sugar (wet miling process) large quantities of maize germ oil could be obtained as a by-product in developing countries.

5. ROLE OF RESEARCH CENTRES AND SIMILAR RESEARCH AND DEVELOPMENT INSTITUTIONS

Research centres and similar institutions have to be the cores (nucleus) in the development of oilseed and oilfruits processing industry in developing countries. They have to provide a positive flow of knowledge and new technolcgies to developing countries and their consistent development.

In the field of food and agro-industries as well as in the oilseeds and oilfruits processing sector, emphasis should be laid on raw materials production, storage facilities, transport, processing, marketing and distribution, planning and management of production, engineering and food science and technology.

In those developing countries where technology assessment, selection, modification, transfer and development is inadequate, governments could create bodies responsible for the advancement and application of science and technology in various sectors including the oilseeds and fruits processing industry, and encourage their activities.

The rapid growth of the palm fruit processing industry and its penetration of international markets including even the ones of developed market-economy countries, is well known. In an effort to promote development of palm oil industry and increase exports of palm oil the Malaysian Parliament proclaimed an Act on May 19,1979. The Act set the objectives of the Palm Oil Research and Development Board as follows:

(a) to conduct and promote research into the production extraction, processing, storaging, transport, marketing, consumption and use of palm oil and oil palm products;

(b) to secure development and exploitation of the results of research activities;

(c) to control and coordinate activities and policies of all research and development organisations financed wholly or mainly from the Fund;

(d) to collect, collate and disseminate information relating to oil palm, palm oil , oil palm products and other vegetable and animal oils and fats and to promote the use of palm oil and oil palm products in competition with other materials;

(e) to coordinate activities within and outside the Federation relating to research, development, publicity and other matters of relevance for the palm oil industry, etc.

Soon after the entry into force of the Act, the research work started to evolve. However, the nucleus was transferred from the Malaysian Agriculture and Research Development Institute and the Palm Oil Research Institute of Malaysia (PORIM) was established.

The most important research activities carried out so far include, inter alia:

- creation of a new palm hybrid, tenera hybrid , from the two previous genotypes: dura (fruit with a thick shell) and pacifera (without the shell);
- improvements in the yield of fresh fruits , after systematic breeding was organized;
- development of oil palm protection chemicals;
- improvements in palm oil processing technology;
- development of new technologies adapted to palm oil processing (fractionation techniques, hydrogenisation, inter-esterification, etc.);
- development of new products attractive for the international market (olein, stearin, palm kernels stearin, CBS and CBE).

Similar actions were carried out in other developing countries. Brasil developed its soybean processing industry owing to the international cooperation in the field of soybean production and processing.In its efforts to penetrate the international market of soybean oil and soybean meal protein components,Brasil established modern research centres and institutions aiming at improving the quality of soya oil (elimination of flavour reversion) and upgrading of soybean meal protein components and their use for animal feed as well as for human nutrition.

New, high oil yielding hybrids of sunflowerseed , based on two old Russian varieties, were created in a research centre in Yugoslavia. Rapeseed with low content of erucic acid and glucosinates, became popular in the countries of Northern Europe and North America. The development of coconut processing sector through technical cooperation in existing commercial processes was initiated and promoted by UNIDO in 1978. A project titled "Establishment of Coconut Processing Technology Consultancy Service for the Asian and Pacific Coconut Community (APCC) provided availability of coconut processing technology through a consultancy service within the framework of technical cooperation among developing countries interested in improving coconut processing. Such cooperation and improvements could mean higher income and better living conditions for several hundred million people living in the coconut growing areas of the world.

6. PRESENT CONSTRAINTS AND NEED FOR COOPERATION AMONG DEVELOPING COUNTRIES

Numerous constraints are common to oilseed and oil fruit processing industries of most developing countries just as there are common factors in other industrial sectors. Among these the most important ones are related to raw materials supply, storage facilities, technology and processing, marketing and distribution, skilled technical personnel and management, research development, financing and investments.

The growth of agriculture is low and still falls behind the population growth rate in most developing countries. These countries are largely dependent on imported technologies, equipment, machinery, chemicals and other inputs. The absence of up-to-date technologies leads to considerable inefficiency, poor products quality, high energy losses and low productivity. Equipment and machinery are not locally manufactured and there is no adequate education and training of personnel, all of this resulting in an improper process management, as well as inappropriate maintenance.

The lack of adequate research and development causes inefficient use of the large agroindustrial potential. In most developing countries marketing organisations do not exist while in others they are not organised in a manner which would provide for appropriate market survey, products management and penetration of international markets.

Low yields per hectar in most cereals and oilseeds production are attributed to poor inputs such as breeding materials, fertilizers, and crop protection chemicals. Extension services are underdeveloped and most farmers in developing countries use old and semi-modern methods with little mechanization. Collection and transportation of raw materials are also inadequate, causing large post-harvest losses. Inappropriate storaging facilities bring about further losses in processing and result in inferior quality of final products.

Problems related to inadequate oilseeds production and their insufficient and variable availability became the main reason for under-utilisation of the installed capacities of the existing processing industry. The lack of marketing services cannot provide and accelerate the trade even among developing countries themselves.

In order to strenghten their position in the world in oilseed and oilfruit processing industry and avoid obstacles when trying to penetrate international markets, the developing countries have , first of all, to cooperate among themselves.

Direct cooperation among research centres and similar research and development institutions is recommended.It has to provide for an exchange of scientific experience, research findings, inventions , innovations and scientists themselves. Joint scientific and research work can lead to the establishment of regional research centres for specific oilseeds and oilfruits and for their processing.

Another form of technical cooperation among developing countries could be implemented in the field of training by setting up of joint training centres and exchange of fellowships, while cooperation among educational centres and universities would also be possible. But, the really profitable form of cooperation among developing countries is the one of joint ventures.

International organizations, UNIDO and FAO, promoted such cooperation by organising many international fora,consultations, solidarity ministerial meetings, round table ministerial and high level meetings for cooperation on the bases of mutual benefit. UNIDO is continuing to organise similar ECDC/TCDC meetings and to support establishment of scientific and technical cooperation, exchange of technicians, technical information and literature. UNIDO is also organising and promoting technical workshops, seminars, advisory services, study tours, training and other joint industrial programmes.However, there is still some room left for introduction of new activities.

7. INTERNATIONAL TRADE IN OILSEEDS OILS AND RELATED PRODUCTS

The dominance of some developed countries in oilseeds and oiseed products trade began to crack already in 197o^s. Developing countries decreased their share in world export of soybean (21.3% in 1986) but instead increased their share in world exports of soya oil (4o.5% in 1986).The share of developing countries in soybean meal export amounted to 53.3% in 1986.

The export of palm oil from developing countries amounted to 6.1mil.tons in 1986 which accounted for 97.2% of the world palm oil export. Malaysia became the major palm oil exporter, followed by Indonesia, Nigeria , etc.

Introduction of low erucic acid and low glucosinolate varieties of rapeseed fostered a rapid expansion of planted acreage in North America and Europe. The share of developing countries in world exports of rapeseed and rapeseed oil is very low , although they increased their share in rapeseed meal exports by almost two times (from 28.2% in 1984 to 51.6% in 1986).

The world groundnut oil exports are retained at the same level but the share of developing countries has been significantly reduced over a period of 25 years. In 1986 it accounted for 68.3% of the world groundnut oil exports.

High oil sunflowerseed varieties were introduced in Argentina, Brasil, US,Spain,Romania and Yugoslavia. The oil was promoted for its increased stability and high content of PUFA (Poly Unsaturated Fatty Acids) .The share of developing countries in sunflower seed oil exports increased to 49.3% in 1986.

The exports of coconut oil increased to 1.64mil.tons in 1986. Developing countries are the major world exporters of coconut and palm kernel oils with a share of 95.7% in 1986.

Exports of cottonseed oil decreased.The share of developing countries in the world exports was reduced to 39.7% in 1986.

Developing countries are still comparatively insignificant exporters of margarines and other vegetable fats. As there is still a lack of technologies for production of high quality margarines and vegetable fats, their share in the world exports accounted for only 18.2% in 1986. At the same time the developing countries remain importers of these goods.

Other information concerning the market for oilseeds oils and oilmeals and cakes are given in tables 4,5,6 and 7. Tables 8 and 9 show production estimates and forecasts for main oilseeds, edible oils, fats and oil meal protein products up to 1987/88.

On its twenty-fourth session in Rome (7-26 November 1987:Agriculture toward 2ooo) FAO predicted a relatively high growth rate in exports and imports of oilseeds and vegetable oils (oil equivalent) for 94 developing countries. The Organisation forecasted exports of 16.7 miltons in the year 2ooo, with an annual growth rate of 4.1% and 5.1% for exports and imports respectively in the period from 1983/85 to 2ooo. Such considerations show the increasing importance of oilseeds and oil fruits processing sector in developing countries and its great influence on the internations market.

8. OBSTACLES IN TRADE OF OILSEEDS, OILS AND OIL MEAL PROTEIN COMPONENTS

Tariff and non-tariff measures hamper, to a great extent, international trade in oilseeds, oils and oilmeal protein compoenents.

Increasing tariffs inhibit development of downstream processing activities in developing countries by supporting the export of products in a less processed form. The import of oilseeds to developed countries is virtually duty-free.Higher tariffs are set on intermediate product (crude oils and oil meals) while still higher duties are charged on edible oils, margarine and vegetable fats. Table 1o shows average tariffs rates for oilseeds, vegetable oils and related products in major developed markets.

Although a detailed analysis of tariffs applied by developing countries is not available , Table 11 indicates tariff rates for oilseeds and oils in selected developing countries. They are generally considerably higher than the corresponding tariff rates imposed by developed market-economy countries.

A large number of non-tariff measures are applied to the import of oilseeds, oils and oilseed meals not only by the developed but also by developing countries. Non-tariff measures include all types of governmental actions and barriers which may have an effect on trade. The measures which are applied most frequently include import bans, quotas and licences, authomatic authorizations, various levies, health and sanitary requirements and regulations.

Non-tariff measures cause additional problems to developing countries by adding to the instability of prices at the world market. That is an important issue, since major variations in prices create uncertainty in export earnings, impair financing of development programmes and create difficulties in servicing of these countries' external debt. Table 12 shows some direct import control measures applied in 23 developed and 22 developing countries, on oilseeds and their products and the frequency of their application (in terms of percentages).

It is well known that almost all countries apply sanitary regulations . These requirements and the complicated procedures involved can be used to obstruct, delay or even prevent imports of oilseeds , oils and oilseed meals.

Quality standards, mycotoxin, pesticides content and "heavy metals" content regulations also create obstacles to developing countries when trying to penetrate international markets.

Cooperation among developing countries must also include quality standards and their upgrading. They have to increase the exchange of information on both the existing and proposed measures, laws, regulations and procedures controlling the import of oilseeds, vegetable oils and related products.

Cooperation in technological development could have a great influence on the quality of final products, vegetable oils, margarines and vegetable fats.

The exchange of experienced personnel, laboratory staff and scientists will help to meet international quality standards (Codex Alimentarius for oils and vegetable fats) aflatoxin and other mycotoxins regulations for oilseeds and oil meal protein components and all other reguirements which make access to international markets more difficult.

Although per capita consumption of vegetable oils and

and fats increased in many developing countries there are still regions with very low consumption (South Asia, Africa, CPE Asia, etc.-see Table 13).The estimates are that the increasing trend in the world per capita consumption of vegetable oils and fats will continue to the year 2ooo, which reflects an increased emphasis on vegetable oils and fats in human diets. It is estimated that per capita consumption of vegetable oils and fats is growing significantly in developing countries as well.Therefore, the possibility for developing countries to increase their exports of oilseeds, oils and oilmeal protein products may be found in trade among themselves.

TABLE.1 WORLD PRODUCTION OF SELECTED OIL SEEDS (in 1000 MT)

Commodity [a]	1979-81				1984				1986			
	World	All dev.ped	All dev.ping	% share of DC	World	All Dev.ped	All Dev.ping	% share of DC	World	All Dev.ped	All Dev.ping	% share of DC
Soy bean	86013	56939	29079	33,8	90233	53339	36893	40,9	95521	58108	37413	39,2
Coconut	34945	-	34945	100,0	33315	-	33315	100,0	39453	-	39453	100,0
Cottonseed	27265	11593	15672	57,5	35148	10730	24418	69,5	28472	9681	18791	66,0
Groundnut	15552	2004	13548	89,2	20145	2216	17929	89,0	21512	1933	19579	91,0
Sunflowerseed	14397	11074	3323	23,1	16465	11161	5303	32,2	20804	13066	7738	37,2
Rapeseed	11131	5797	5335	48,0	16592	9387	7205	43,4	19641	10614	9028	46,0
Palm Kernels	1752	-	1752	100,0	2410	-	2410	100,0	2753	-	2753	100,0
Sesame seed	1963	3	1960	99,8	2023	2	2021	99,9	2381	2	2379	99,9
Safflowerseed	968	165	803	83,0	882	132	749	85,0	659	120	539	81,8

a/ Commodities listed according to the total world production in 1986

Source: FAO Production Yearbook, Rome, 1986, Vol.40

TABLE 2. WORLD EDIBLE/SOAP FATS AND OIL PRODUCTION a/ (in 1000 tons)

FATS AND OILS	1975	1980	1984	1986	1986/1975
SOY BEAN OIL	10.000	14.800	12.800	15.000	50,0
PALM OIL	3.400	5.100	6.900	8.200	141,2
SUNFLOWERSEED OIL	3.500	5.400	5.500	6.900	97,1
RAPESEED OIL	2.800	3.400	4.700	6.200	121,4
GRAUNDNUT OIL	3.600	3.200	3.300	3.600	00,0
COTTONSEED OIL	2.600	3.300	3.100	3.500	34,6
COCONUT OIL	3.300	2.800	2.500	3.400	3,0
OLIVE OIL	2.000	1.700	1.800	1.800	- 10.0
PALM KERNEL OIL	700	800	1.100	1.200	71,4
OTHER VEGETABLE OILS b/	2.000	2.400	2.900	2.900	45,0
BUTTER/LARD	9.400	10.300	10.900	11.200	19,1
TALLOW/GREASES	5.400	6.100	6.500	6.600	22,2
MARINE OILS	1.100	1.200	1.500	1.500	36,3
TOTAL	49.800	60.500	63.500	72.000	44,5

a/Production estimates assume that, after allowing for non-crushing uses, all the available crop is crushed. Commodities are listed acording its production,

b/Including sesame seed, maize, rice bran, and saffilower oil. Source: Food Outlook Statistical Supplement, February 1988.

TABLE 3. WORLD PRODUCTION OF SELECTED OIL MEAL PROTEIN PRODUCTS (in 1000 tons) a/

OIL MEAL PROTEIN	1976	1980	1984	1986	Share
SOY BEAN MEAL	20.000	28.700	24.900	29.100	59,6
COTTONSEED MEAL	3.400	4.100	4.200	4.700	9,6
FISH MEAL	3.100	3.200	3.900	4.300	8,8
RAPESEED/MEAL	1.600	1.900	2.700	3.500	7,20
SUNFLOWER SEED MEAL	1.400	2.300	2.300	3.000	6,1
GROUNDNUT MEAL	2.400	2.100	2.300	2.400	4,9
COPRA/PALMKERNELS CAKE	500	500	500	700	1,4
LINSEED MEAL	500	600	500	500	1,0
OTHER MEALS b/	800	900	800	600	1,2
TOTAL	33.700	44.300	42.100	48.800	100

a/ Commodities are listed according the production

b/ Including sesame seed and safflowerseed cake

SOURCE: Food Outlook Statistical Supplement, February 1988

TABLE 4. EXPORT AND IMPORT OF SELECTED OIL SEEDS (in 1ooo mt)

COMMODITY		1984		1986	
		Import	Export	Import	Export
SOY BEANS	World	24.628	25.775	27.279	27.635
	Div.ping	4.603	6.035	5.504	5.901
	%	18,7	23,4	20,1	21,3
COTTONSEED	World	2.050	2.155	2.419	[illegible]
	Div.ping	864	1.587	672	1.705
	%	42,1	73,6	27,8	68,4
GROUNDNUTS	World	746	746	908	925
	Div.ping	114	442	227	[illegible]
	%	6,2	59,2	25,0	62,9
SUNFLOWERSEED	World	1.840	2.153	2.093	2.074
	Div.ping	605	169	650	565
	%	3,29	7,8	31,1	24,2
RAPE + MUSTARD SEED	World	2.914	2.791	3.777	[illegible]
	Div.ping	98	115	31	21
	%	3,4	4,12	0,82	0,5
COPRA	World	312	289	410	403
	Div.ping	102	289	169	403
	%	32,7	100,0	41,2	100,0
PALM KERNEL	World	124	132	106	[illegible]
	Div.ping	7	132	1	107
	%	5,6	100	0,94	99,1
SESAME SEED	Wolrd	301	317	325	[illegible]
	Div.ping	139	315	150	354
	%	46,2	99,4	46,2	[illegible]

SOURCE: FAO trade Yearbook 1986,Vol.4o, Rome

TABLE 5. IMPORT AND EXPORT OF SELECTED OILS (in.1000 MT)

COMMODITY		1984		1986	
		Import	Export	Import	Export
SOY BEAN OIL	World	4.151	4.026	2.826	2.940
	Div.ping	3.143	1.517	2.013	1.192
	%	75,7	37,7	71,2	40,5
COTTON SEED OIL	World	300	340	295	295
	Div.ping	266	143	245	117
	%	88,6	42,0	83,0	39,7
GROUNDNUT OIL	World	321	304	344	344
	Div.ping	51	226	62	235
	%	15,9	74,3	18,0	68,3
SUNFLOWER OIL	World	1.691	1.656	2.004	2.093
	Div.ping	673	625	980	1.036
	%	39,6	37,7	48,9	49,3
RAPE + MUSTARD OIL	World	940	1.078	1.262	1.397
	Div.ping	472	28	663	22
	%	50,2	2,6	61,5	1,6
PALM OIL	World	3.96[illegible]	4.307	6.040	6.272
	Div.ping	2.614	4.175	4.117	6.099
	%	65,9	96,9	68,2	97,2
COCONUT OIL	World	1.04[illegible]	991	1.550	1.643
	Div.ping	15[illegible]	912	287	1.573
	%	14,9	92,0	18,5	95,7
PALM KERNEL OIL	World	501	536	688	675
	Div.ping	55	481	96	644
	%	11,0	89,7	14,0	95,4

SOURCE: FAO trade Yearbook 1986, vol. 40, Rome

TABLE 6. EXPORT AND IMPORT OF SELECTED OIL MEALS (in 1000 MT)

COMMODITY		1964		1966	
		Imports	Exports	Imports	Exports
	World	21.162	20.339	22.861	21.334
SOY BEAN	Div.ping	3.741	11.042	3.990	11.372
MEAL	%	17,7	54,3	17,5	53,3
	World	540	526	996	1.027
COTTON SEED	Div.ping	28	490	73	945
MEAL	%	5,2	93,2	7,3	92,0
	World	557	645	529	522
GROUNDNUT	Div.ping	52	595	85	488
MEAL	%	9,3	92,2	16,1	93,5
	World	1.206	1.240	1.972	1.968
SUNFLOWER	Div.ping	58	872	153	1.500
MEAL	%	4,8	70,3	7,8	76,2
	World	1.295	1.273	2.096	1.998
RAPESSED	Div.p ing	102	360	223	1.036
MEAL	%	7,9	28,2	10,6	51,8
	World	694	655	1.314	1.369
COPRA CAKE	Div.ping	5,[illegible]	620	5,9	1.324
	%	0,[illegible]	94,7	0,45	96,7
	World	[illegible]	667	1.026	1.067
PALM KERNEL	Div.ping	11	662	0,05	1.047
CAKE	%	1,7	[illegible]	0,005	98,1
	World	649	656	602	503
LINSEED CAKE	Div.ping	0,016	448	6	356
	%	2,5	68,3	1	59,0

SOURCE: FAO trade Yearbook, Rome, 1966, Vol.40

TABLE 7. MARGARINE EXPORT AND IMPORT (in 1000 MT)

COMMODITY a/		1984 Import	1984 Export	1986 Import	1986 Export
MARGARINE etc.	World	52o	53o	46o	466
	All Dev.Ped	3o1	428	277	381
	All Dev.ping	22o	1o2	183	85
	share of Dev.ping %	42,3	19,2	38,o	18,2

a/ Commodity includes all other vegetable fats

SOURCE: FAO trade Yearbook 1986, Vol.4o, Rome

Table 8 - Main Oilseeds and Oils: Production Forecasts for 1987/88 as of mid-November 1987

Unit: million tons

	1985/86	1986/87 estim.	1987/88 f`cast
SOYBEANS	97.3	98.7	102.9
United States	57.1	52.8	53.6
Brazil	14.1	17.0	17.5
China	10.5	11.7	11.8
Argentina	7.3	7.3	9.5
EEC	0.3	0.9	1.4
Others	8.0	9.0	9.1
COTTONSEED	31.6	28.1	30.0
U.S.S.R.	5.4	5.1	5.3
United States	4.8	3.5	4.7
China	8.3	7.1	8.2
GROUNDNUTS (in shell)	21.4	21.3	20.7
India	5.5	5.9	4.5
China	6.8	6.0	6.7
United States	1.9	1.7	1.7
Sudan	0.3	0.5	0.4
Senegal	0.6	0.8	0.8
Nigeria	0.6	0.7	0.7
Others	5.7	5.7	5.9
SUNFLOWERSEED	19.6	18.8	19.8
U.S.S.R.	5.2	5.3	4.9
Argentina	4.1	2.3	2.8
United States	1.4	1.2	1.0
China	1.7	1.4	1.4
EEC	2.7	3.2	4.3
Others	4.5	5.4	5.4

	1985/86	1986/87 estim.	1987/88 f`cast
RAPESEED	18.7	19.7	22.2
China	5.6	5.9	6.1
India	2.6	2.7	2.9
Canada	3.5	3.8	3.7
EEC	3.8	3.7	5.9
Others	3.2	3.6	3.6
OLIVE OIL	1.8	1.8	1.8
Spain	0.4	0.5	0.4
Italy	0.7	0.4	0.7
Others	0.7	0.9	0.7
	1986	1987 estim.	1988 f`cast
COPRA	5.4	5.0	4.5
Philippines	2.4	2.2	1.9
Indonesia	1.3	1.2	1.1
Others	1.7	1.6	1.5
PALM OIL	8.2	8.5	8.9
Malaysia	4.5	4.7	5.0
Nigeria	0.8	0.8	0.8
Indonesia	1.3	1.4	1.4
Others	1.6	1.6	1.7
PALM KERNELS	2.7	2.9	3.0
Brazil(babassu)	0.3	0.3	0.3
Nigeria	0.4	0.4	0.4
Malaysia	1.3	1.5	1.6
Others	0.7	0.7	0.7

SOURCE: FAO

Table 9 - Edible/Soap Fats and Oils, Oilmeal Protein: Production Forecasts for 1988

Unit: million tons

	1986	1987 estim.	1988 f`cast		1986	1987 estim.	1988 f`cast.
FATS AND OILS	72.0	71.8	74.3	**OILMEAL PROTEIN**	48.8	48.4	50.8
Soybean oil	15.0	15.1	15.8	Soybean meal	29.1	29.2	30.5
Sunflowerseed oil	6.9	6.7	7.0	Cottonseed meal	4.7	4.2	4.4
				Groundnut meal	2.4	2.4	2.3
Groundnut oil	3.6	3.6	3.5	Sunflower meal	3.0	2.9	3.1
Cottonseed oil	3.5	3.1	3.3	Rapeseed meal	3.5	3.6	4.1
Rapeseed oil	6.2	6.5	7.3	Linseed meal	0.5	0.6	0.5
Olive oil	1.8	1.8	1.8	Copra/palm kernel cakes	0.7	0.7	0.6
Coconut oil	3.4	3.2	2.9				
Palm oil	8.2	8.5	8.9	Fish meal	4.3	4.1	4.5
Palm kernel oil	1.2	1.3	1.4	Other meals 2/	0.6	0.7	0.8
Other veg.oils 1/	2.9	2.9	2.9				
Butter/lard	11.2	11.1	11.2				
Tallow/greases	6.6	6.5	6.6				
Marine oils	1.5	1.5	1.6				

SOURCE: FAO

Notes: The split years bring together northern hemisphere annual crops harvested in the latter part of the first year shown, with southern hemisphere annual srops harvested in the early part of the second year shown.

- Production estimates assume that, after allowing for noncrushing uses, all the available crop is crushed
- Conversion and totals computed from unrounded figures

1/ Including sesameseed, maize, sheanut, safflower oils and other minor edidble/soap fats and oils

2/ Including sesame and safflowerseed cakes

Table 10. AVERAGE TARIFF RATES FACING OILSEEDS, VEGETABLE OILS AND RELATED PRODUCTS IN MAJOR DEVELOPED MARKETS

Country/ product sector	Importfrom GSP beneficiaries	Import from GSP non-beneficiaries
AUSTRIA		
Oil Seeds	0.1	1.1
V.Oils and products	0.3	3.0
EUROPEAN COMMUNITY		
Oil Seeds	-	-
Vegetable oils and prod.	7.2	9.6
FINLAND		
Oil Seeds	1.1	1.1
Vegetable oils and products	4.9	1.2
JAPAN		
Oil Seeds	2.1	4.8
Vegetable oils and products	4.4	8.3
NORWAY		
Oil Seeds	-	-
Vegetable oils and products	1.5	3.1
SWEDEN		
Oil Seeds	-	-
Vegetable oils and products	-	2.7
SWITZERLAND		
Oil Seeds	0.1	0.2
Vegetable oils and products	8.6	4.9
UNATED STATES		
Oil Seeds	-	5.1
Veg.oils and products	1.1	3.5

SOURCE: UNCTAD deta base on trade measwes

Table 11. AVERAGE ad Valorem* tariff rates on oilseeds and oils in selected developing countries a/

Region /Country	YEAR	TAFIFF
AFRICA		
Egypt	1977	10,8
Ghana	1977	26,8
Ivory Coast	1977	8,7
Malawi	1977	3,1
Mauritius	1979	5,3
Marocco	1978	17,9
Tunisia	1977	24,0
Zaire	1978	7,5
ASIA		
Cyprus	1978	5,2
India	1976	61,9
Republic of Korea	1976	32,9
Pakistan	1977	55,5
Philippines	1977	46,4
AMERICAS		
Argentina	1979	10,8
Bahamas	1977	20,9
Bolivia	1977	10,6
Brazil	1977	35,1
Columbia	1977	16,7
Jamaica	1976	9,2
Paraguay	1978	17,0

a/ Inicluding animal fats

Source: National tariff shedules

* ad valorem (Lat)
taxes in proportion to the estimated value of the goods

Table 12. Selected import Control measures applied in 23 developed market economy countries and 22 developing countries, on oil seeds and their products (persentage)

Importing markets	Measures	Frequency of applicalion		
		All products	Oilseeds	Oils and products
DEVELOPED COUNTRIES	Prohibition	1.9	2.2	1.9
	Quota and licencing	22.2	21.7	22.4
	Automatic autharization	4.8	6.5	4.3
	Variable levy	9.7	-	12.4
DEVELOPING COUNTRIES	Prohibition	11.1	9.1	11.7
	Quota and licencing	22.7	34.1	19.5
	Automatic authorizetion	-	-	-
	Variable levy	-	-	-

Source: UNCTAD data base on governmental measures of a product - specific nature

Table 13. Estimated apparent co. .iption of vegetable oils and fats by region, 1980, 1990 an 2000 a/

Unitad region	1980		1990		2000	
	kg/cap	thousand Tons	kg/cap	thousand Tous	kg/cap.	Thousand Tons
Nort America	20.4	5027	21.2	5802	22.0	6582
West Europe	16.5	6187	16.9	6570	17.4	6895
CPE Europe	12.1	4564	13.3	5396	14.5	6253
Japan	22.2	2580	24.6	3025	26.9	3479
Other developed	10.3	485	10.7	626	11.0	804
Lation America and Caribbien	13.8	5046	15.2	6990	16.7	9453
Tropical Africa	10.0	3311	10.7	4823	11.3	6978
North Africa and West Asia	13.9	3247	14.8	4754	16.0	6607
South Asia	4.6	4354	5,4	6279	6,4	8791
South - East Asia on Oceania	11.7	3638	13.0	5912	15.5	8260
CPE Asia	6.5	7013	7,9	9048	10.0	12831
World Total.	10.2	45454	11.3	59224	12.6	76933

a/ Included: edible soft oils, coconut and palm Kernel and palm oil

Source: UNIDO secretario projections "The vegetable oils and fats industry in developing Countries": Outlook and Perspectives, N° 13. Vol. 1. 1984

REFERENCES

1. UNIDO First Consultation on the Food Processing Industry The Hague, 9-13 November, 1981, Report

2. UNIDO Second Consultation on the Food Processing Industry with special emphasis on vegetable oils and fats, Copenhagen,Denmark , 15-19 October 1984, Report

3. FAO Trade Yearbook 1986, Vol.4o Rome

4. FAO Production Yearbook 1986. Vol.4o,Rome

5. UNIDO "The Jojoba Potential", IO 425 ,1981

6. PORIM PORIM Bulletin, Special Issue,ISSN:0127-0249 Kuala Lumpur

7. A.C.Mosha:Vegetable Oils and Fats Industry in Developing African Countries , ID/WG.4o4/2,1983

8. UNIDO/ECDC UNIDO's Activities to Promote and Implement ECDC/TCDC with Special Emphasis on the Agricultural Field, 1986

9. FAO Food Outlook Statistical Supplement, February 1988

10. FAO Committee on Commodity Problems , Intergovernmental Group on Oilseeds, Oils and Fats CCP:88/4,December 1987

11. UNIDO Performance and Integrated Approach to Development of Vegetable Oils and Fats Industry, ID/WG 427/9,1984

12. UNIDO Report of the First Session of the Regional Consultative Forum on the Vegetable Oils and Fats Industry for Asia and the Pacific, Djakarta, 1981, UNIDO PC.4

13. UNIDO The Vegetable Oils and Fats Industry in Developing Countries: Outlook and Perspectives, N.1B,Vol.1,UNIDO IS.477,1984

14. UNIDO The Vegetable Oils and Fats Industry; The Sector in Figures,1985.NO.22,UNIDO/IS.6o4,1986.

15. UNIDO Tariff and Non-tariff Measures in the World Trade of Oilseeds,Vegetable Oils and Related roducts, No.28, UNIDO/IS.519,1985

16. UNIDO Issues to Be Considered by the Consultation Meeting Madrid, ID/WG.26o/4,1977

17. Fats and Oils Industry Changes,I.A.O.C.S.Vol.65, No.5,May 1988

18. Fullfat Soya, a Regional Conference, Milan,Italy 1987

19. FAO Agriculture: toward 2000, 24th Session, Rome 7-26 November 1987

20. FAO World Conference on Oilseed and Edible Oil Processing, I.A.O.C.S.Vol.60,No 2,February 1983

21. UNIDO Report of the First Consultation Meeting on the Vegetable Oils and Fats Industry,Madrid,ID/WG 260/9,1977