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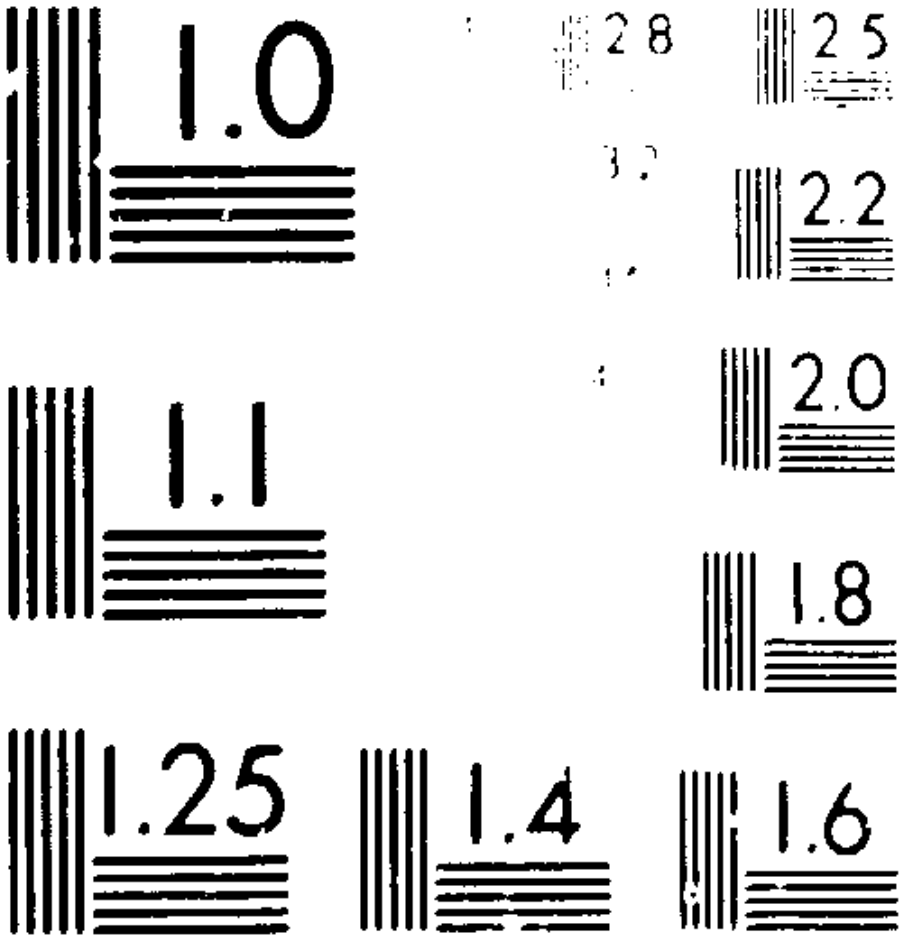
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org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MEASURES AND FORMS TO PROMOTE INTEGRATED DEVELOPMENT OF THE VEGETABLE OILS AND FATS INDUSTRY WITHIN THE FOOD-PROCESSING INDUSTRY*

DISCUSSION PAPER

by

H.B.W. Patterson
UNIDO Consultant

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CONTENTS

1.0 Meaning of Integration - Lessons from the Past. Guides to the Future

Prudence demands at the outset of a discussion we define our terms so that our intention is clear when recommending a future course of action. If there is a past already rich in the experience of such action it should be taken into account to render success in the future more likely, even if it does not guarantee it.

To integrate means to make parts into a whole; this is stronger and more intimate than mere association.

Vertical integration as far as industry is concerned looks forward to the products being delivered to the consumer and back to the origin of the materials being processed. In both directions other materials and services may be essential although regarded as subordinate. Often as the consequence of the processes, other valuable products arise. Called "by-products", or if sufficiently valuable, "co-products", they may yield the profit, or most of it, without which the enterprise withers. Thus the manufacturer of vanaspati looks back to the plantations, the fields, the farms from which come the palm, the cottonseed and the soyabean oils to provide his product after the chemical industry has made available alkali, bleaching earth and hydrogen to convert it to the edible fat his customer requires.

Along the way the degumming of the soyabean oil has offered the opportunity to produce lecithin. If crude oil is neutralised with alkali this produces a soap solution/oil mixture, or stock, which for economy of transportation is converted to an acid oil (98% fatty matter); if neutralised by physical refining the fatty acids stripped from the cleaned crude oil need no further concentration, although if they become the feedstock for the oleochemical industry they may be fractionally distilled; easiest and cheapest of all if the oil refinery and soap factory occupy the same site the already saponified fatty acid and the oil of the soapstock may be transferred from one to the other simply by pumping. It is clear that the nature of the material and the process thrusts the possibility of so-called vertical integration under the noses of producers. Further, just as vertical integration exists in the technological field, here quoted, it also exists in the commercial field of marketing, transport and packaging. All these are necessary to bring the product to the customer. Exploitation of any link in the chain must show some profit but the overall profit should be shared.

Horizontal integration is less compelling. It may amount to a manufacturer providing his own services or what have been described

above as subordinate materials. Frequently an oil hardener makes his own hydrogen but very rarely his own catalyst. If he is in close proximity to a large unit in the fertiliser industry or a petrochemical complex where vast quantities of hydrogen are continuously available it is almost certainly cheaper to buy it than to make it. But horizontal integration is not necessarily confined to the area of subordinate materials. When it spreads to activities which are not essentially related to the main purpose of the enterprise it is more generally described as "diversification". Thus for example a manufacturer of margarine, shortening, salad oils etc. might diversify into soft drinks on account of the fact that he has a well developed marketing organization already in existence. "Why," he may ask "should we not give the marketing personnel something else to sell?" These situations can only be judged on their merits individually and fall outside of the scope of "horizontal integration" as the term is used in this paper.

It must however be understood that if the enterprise of producing and marketing a product which is not essentially related to the main business of the enterprise proves a failure it must not continue to be subsidized to keep it in existence. Engineers ask if something works, chemists why it works but accountants if it pays. If any organization, public or private, is resolved to keep a loss making activity in being the cost of so doing must be discoverable. History provides numerous examples of the past success of integration - vertical and horizontal - and as we shall see later in this paper many in existence at the present time. It is an error, nevertheless, to suppose integration is justified solely by our faith in it: it must be seen to work. There is a further vital ingredient for success. This is the personal commitment and competence of those operating an enterprise. Whatever the system, people of the correct calibre and disposition are needed to make it a success.

1.1 Links in the chain within the vegetable oil industry

Failure in the food industries of developing countries has as one of its principal causes the lack of effective links between the market (consumer), the processing plant and the producer of raw material (agriculture) (1).

In consequence, for successful integration in the oils and fats industry, like other industry, the first step is to identify a consumer demand (market) and its size. The capacity of plant or plants and their

location to meet this demand is then calculated. The requirement in raw material from agriculture, its transport and storage can then be estimated. If the commodity in question has both an export and domestic market it is generally economically healthy to look for a home market, which at least covers the financial break even point for the capacity chosen (2). This could be as low as 30% of the total capacity and gives a safeguard against fluctuation in world prices. If the oilseed crop in question is not already cultivated in the country some preliminary research must establish that climate, soil and available labour are suitable. The planning is multi-disciplinary; it is here that a UN agency, friendly developed country, specialist consultants or experienced TNC such as Unilever, can be of great help. To the maximum extent feasible added value should be achieved in the developing country of origin. Exceptions will be when most of the cost of the final product because of some special circumstance in processing or packing resides overseas from the developing country (3 issue 2). The Indian co-operative movement has become the largest in the world after 75 years of growth. Although it came into existence simply to provide credit it is now an integrated system which also provides inputs to the farmer, processes and markets his produce and even may sell back to him other consumer goods (4). The market has provided the motivation to produce; the links in the chain have joined to form a loop.

1.2. Links between the vegetable oil and other industries

The obvious need for these to exist is that both main and by-products of the vegetable oil industry provide many inputs to other manufactures such as bakers, confectioners, ice cream makers, soap makers, paint manufacturers and an immense list of those in the oleo-chemical industry. The recognition of these opportunities is vital to success and it precisely here that the advice of an experienced oil technologist is most rewarding. First, imports may be substituted directly by a domestic product, or a highly priced vegetable oil exported and a much less costly animal fat imported when the latter serves the domestic purpose equally well or even has some advantages. Additional export opportunities may be identified and a decision taken whether a modest addition to an existing plant or process will convert a by-product currently going to waste to a highly priced export. Another factor encouraging relationship between the

vegetable oil industry and other sectors is that the solution to a technical problem in one may resolve a problem in another not at first recognized as being similar. Conversely, the vegetable oil industry is a customer to others for packaging, process chemicals and services as well as equipment. Recognition and acceptance of items of common use such as valves, pumps, filtration equipment, paves the way to useful economies at time of purchase.

Although what has just been written relates to the technical side of the industries concerned it may also be the case that opportunities exist for substantial savings by co-operation in sharing common facilities in marketing, i.e. avoiding duplication of transport and storage.

1.3. Requirements for successful integration

Much the same requirements are voiced by a range of different authorities. A selection of several of themost important requirements given below with references from which they are derived.

i) The cardinal requirement for success is economic viability: if social gains are made at the same time, so much the better (3, issue 4).

ii) In verical integration the component links in the chain must each pay their way (6).

iii) The real issue for developing countries is how to integrate - by using their own resources and foreign collaboration to greatest advantage. Critical elements in the chain are technology, management and marketing (7).

iv) Planning should start from the market - - - Food industries must not be established merely to get rid of a temporary agricultural surplus - - - Agro-industry development start from small modules - - - and should in most cases have its own energy source (1).

v) The success of AMUL* is in its integrated approach - - - this permitted the producer to receive a genuine share in value added gains (4).

vi) Major constraints (in Africa) include internal political indifference, poor linkage between agriculture- processing and marketing - - - inadequate infra-structure - - - external barriers of protective tariffs. Integration would be promoted by firm political commitment; applying vertical and horizontal integration to agriculture, processing and marketing; training skilled manpower and minimizing barriers (5).

vii) "It would be cynical, to say the least, to promote the virtues of private investment and the market economy and then, through import restrictions, deny developing countries the fruits of their enterprise" (8).

*AMUL = Kaira District Co-operative Milk Producers Union Ltd.

1.4. The Outlay to Achieve Integration

In a hypothetical case to follow the estimating principles advanced in the sections above we may first suppose investigation has shown the market consists of one million people with a likely requirement for visible vegetable oil (i.e., oil separated from the original plant and no part of oils and fats consumed in other items of the diet such as fruit and nuts) of 8 kg. per head per year. The projected all visible oils and fats annual consumption, (vegetable and animal, of which probably two thirds will be vegetable) for the world in 1985 is 10.5 kg. (9) (10). The figure of 8 kg. is about double the consumption of some countries in Asia and a little over a third of that in colder developed countries. This throws up an annual production requirement of 8 million kg. A refinery working a 5 day week for 50 weeks in the year with a capacity to process 50 tons crude oil per day should have no difficulty in providing 200 tons fully refined oil per week making generous allowance for transfer of free fatty acid to soap and process delays. If this potential 10,000 tons per year output capacity is employed to produce only the 8 million kg. consumed this represents a utilisation of 80%. To maximise profit more would be expected, but at least this is far above the breakeven point. Now comes the most interesting and important question, which crop and what area of cultivation will suffice to provide the input of 12,500 tons crude oil required?

	Nominal crude oil per hectare	Area to yield 12,500 tonnes	
crop	metric tonnes	hectares	(sq. miles)
oil palm	3.0	4,167	16
Soyabean	0.4	31,250	120
Sunflower	0.6	20,833	80
Cottonseed	0.19	65,789	253
Groundnut	0.79	15,783	61
Coconut	1.28	9,766	38

The 3 tons palm oil per hectare does not include the possible 0.5 tons palm kernel oil available. It is astonishing that the admittedly low visible oil ration for million people can grow in a 4 x 4 miles area of cultivation to which the area of road communication should be added. Cloning, pollination by weevils and scientific husbandry in general are well set to produce even higher regular yields of oil per hectare and these techniques in not too many years may come to be

applied to other plants.

Oil yields per hectare for the other crops mentioned are lower, but the protein from soyabean and sunflower meal is, of course, extremely valuable and cotton provides a textile fibre as well as a meal for animal feeds.

Reliable data for the proportion of meal to oil (11) and protein in respective meals (9) enable us to calculate the amount of protein which would correspond to the oil yields for certain of the crops described.

Crop	Nominal crude oil per hectare metric tons	Corresponding protein from meal per hectare metric tons
Soyabean	0.4	0.79
Sunflower	0.6	0.37
Cottonseed	0.29	0.21
Groundnut	0.79	0.52
Coconut	1.28	0.30

For soyabean and sunflower a protein content in meal of 45% has been assumed and for cottonseed 40%.

It must here be stated that the various vegetable proteins possess a limitation in terms of one or other of the amino acids which are essential for human or animal diets. Thus, soyabean protein is low in methionine and rich in lysine, whilst sunflower is low in lysine but adequate in methionine. When this is understood satisfactory blends can be made of optimum economy, and these correspond approximately to the balance in egg yolk.

Since integration is being discussed and balance is of the essence of integration it is useful to consider briefly what contribution the areas of crops just mentioned might make to human protein usage. The countries which averaged a consumption of visible oils and fats of 8 kg./head/year consume about 22 kg./head/year of protein, but now most of the top consumers are only about 50% above, whilst the low consumers are 35% below (9). What does make a tremendous difference is that cycling vegetable protein through animals yields only about one kg. animal protein for every seven kg. vegetable protein given in the animal feed. Obviously if climate, terrain and social factors allow consideration must be given to producing vegetable protein as well as oil where some degree of self sufficiency is sought.

Approximate 1983 costs are shown below for equipment to perform certain basic activities.

		U.S. $ (millions)
a)	Milling/Extraction of 100 tons seed per day	1.50
b)	Neutralising/Washing 50 tons crude oil per day	0.27
c)	Drying/Bleaching 50 tons neutralised oil per day	0.13
d)	Deodorising 50 tons oil per day	0.24
e)	Hydrogenating 30 tons oil per day	0.195
f)	Generating 1000 scf/h (30m ^{3}/h) hydrogen by electrolysis	0.245
		2.580

Shipping 10%	0.258
Erection 20%	0.516
Civil Engineering 50% (buildings, roads)	1.290
	2.064

Grand Total ---------- ----------4.644

To achieve some economy of scale for a manufacturing task of this size it is desirable no one function be divided to lower than the tonnage indicated, but if the crop areas are distant from the main area of population then the milling/extraction/feed preparation function could be performed in the growing area and crude oil moved in tankers to the refinery in the urban area.

Depending on the free fatty acid content of the crude oil neutralised an availability of 20 - 150 kg. finished soap (63% fatty matter) should result from neutralisation (2). Beyond this the detail of each case has to be settled according to circumstances. The case of rice bran oil (section 6.2) is also an example how development of some feature of technology opens up the possibility of further profitable vertical integration of an existing industry. Much sound advice on costs and usage of utilities is available at (2) and an accounting model can be derived from (12).

1.5. Existing Integrated Vegetable Oil Industries

Malaysia

Since 1970 forty six palm oil refineries have been opened in Malaysia where it was foreseen that some crop ought to replace the declining natural rubber cultivation. The cultivation of the oil palm is now divided among 52% large estates, 42% Government large co-operatives and 6% small holdings. Cross breeding of earlier natural varieties has resulted in the tenebra variety which is both easy to harvest and after 4 years can yield 5 tonnes palm oil/ha/ann. for another 25 years (13). This is not not the end of the story since 1981 as a result of research by Unilever in co-operation with the Commonwealth Institure of Biological Control (14). An increase in production of 400,000 tons palm oil and 320,000 tons palm kernels is expected for 1982 on this account. Research initiated in U.K. in 1967 is now literally hearing fruit in Malay where the artificial propagation of young plants from one ideal parent by cloning has proved practical. The technique appears likely to be applicable to other crips with far reaching benefits. In producing millions of clones it is necessary to be wary of committing oneself to a variety vulnerable to some particular disease since all clones would then be equally vulnerable if infected. By 1980 Malay's production of 2.8 million tons palm oil accounted for over half of the world production of 4.8 m. tons and nearly 88% of world palm oil exports. Output is scheduled to rise to 4 m. tons in 1985 and 6 m. tons in 1986 (13). Since palm oil is not rich in unsaturated fatty acids especially linoleic acid in comparison with several other oils its production is likely to reach a plateau as far as human nutritional demand is concerned and this applies to coconut oil for similar reasons whereas soyabean, sunflower and canola oils seemed destined for long increases 915). Malaysia not only provides an example of outstanding agricultural progress within a decade in large national co-operative and private estates alike, but has deternimed to be more than a producer of a primary produce such as crude oil and to share in the added value of further processing which can be so directed as to defind its overseas market; this like Icelandic fish exports far exceed what can be consumed at home. Hence some of the most advanced plants for refining and modifying palm oil have lately come to be located in Malaya. By modifying an oil is meant some basic change in its physical character and this may entail a change in chemical composition. Thus we have hydrogenation which will

stablise the keeping quality of an oil and which is most often also performed to increase the solid content at ambient temperatures. The solid fat produced may be of the rapid or slow melting type according to the final use of the product. Fractionation is the oldest of the oil modification processes and basically aims to remove a proportion of the higher melting components by chilling and filtering. The so called "soft" and "hard" fractions thus obtained have their own. special uses which could not be met by the unmodified parent oil alone. The process of interesterification modifies an oil by redistributing the fatty acid components among the various triglycerides present so that the physical character (texture) alters in a desired direction. Interesterification may be performed on a single oil or on a mixture of two or more. Further, one modification step may be followed by another, thus for example, the soft fraction obtained in a fractionation may then be hydrogenated in such a way as to produce a solid which melts very rapidly. By obtaining the knowledge and equipment to perform these modification processes a country such as Malaya increases the added value of its vegetable oil products and strengthens its export position.

The development of the palm oil industry in Malaya is the responsibility of both of government and the industry itself. Control is exercised through four important organizations.

a) The Palm Oil Registration and Licencing Authority (PORLA) with government and industry representation.

b) The Palm Oil Research Institute of Malaysia (PORIM) managed by representatives of government and industry.

c) Malaysian Oil Palm Growers' Council (MOPGC) working closely with the other three organizations mentioned here and with other bodies such as the Standards and Industrial Research Institute of Malaysia.

d) The Palm Oil Refiners' Association of Malaysia (PORAM) which includes in its membership 95 per cent of the palm oil refiners in Malaysia and speaks on their behalf to government and the remainder of the industry as well as other bodies mentioned here (30).

Philippines

The cultivation of the coconut and its employment have reached their most advanced stage in the Philippines. The experience gained is not being shared with some 10 members of the Asian and Pacific Coconut Community through headquarters in Jakarta. This co-operative effort between members and UNIDO has resulted in the formation of a coconut

processing technology consultancy service whose 1980 publication covered harvesting, copra manufacture, oil extraction, refining and modification, desiccated coconut, domestic coconut food processes, fibre, shell and other miscellaneous coconut products. It is true to say that no part of the plant need go to waste and for several a variety of uses have been found. In a world production of coconut oil rising slowly above 3 m. tons/year the Philippines produce nearly a half; of this about 1 m. are exported. The APCC stretches from Sri Lanka to the mid-Pacific.

India

Today 60 million of the 80 million members of India's vast co-operative movement belong to the farming community. The integration which covers not only dairying and cotton but oilseeds. sugar, vegetables, poultry, fish and consumer goods takes various forms. Overall policy is made by central government, planning and administration is carried out by the individual states which are charged with giving technical advice to their own various co-operatives, but commonly it is at the village level in the PACS (Primary Agricultural Credit Society) that working integration becomes obvious in matters such as granting of credits, supply of inputs (fertilizer, machinery and spares), procurement, marketing consumer distribution and probably arranging of storage and transport of produce. Different co-operative organizations have been able to work effectively within this system for many years. The Farmers Fertilizer Co-operative, for example, is the largest manufacturer of fertilizer in the country, supplying some 45% of total market (4).

**

Integration in Trans National Corporations such as Unilever

The transfer of technology is a continuing business and involves a continuing flow of information, advice and people between the clearing house of head office and operating companies in all parts of the world. Basic research is largely in the hands of three European laboratories, but some 20 years ago one was also established in Bombay, especially to discover ways of using India's existing natural resources to the greatest

** The examples of integrated vegetable oils processing in other developing countries will be eventually supplemented at a latter stage.

effect and this kind of work has now benefitted other developing countries.

For technical, engineering, safety, environmental protection, legal and a range of other 'back-up' services Unilever does not charge its operating companies item by item fees, but a general service fee, usually related to the company's turnover. This means although over 80% of such fee income derives from industrialised countries the developing countries have full access to the information. This communal effort achieves full advantage of the economy of scale. One Unilever chairman after another has emphasised that people form a vital asset of the business. One facet of this is that when the results of R and D come to be applied in the field or factory experienced personnel are available to commission the work. Personnel from developing countries are trained in Europe and in their own country. It is UNIDO which has said, "Appropriate technology may not necessarily mean simple technology. Often a very appropriate solution can be reached ..... using the simple application of what is, in fact, the result of high technology". This will continue and become increasingly the case.

2.0. Vertical Integration

In the face of so many enterprises across the world which claim to be organized on a basis of vertical integration and indeed to owe their success in large measure to so doing it comes as a shock to read in the conclusion of D.K. Fieldhouse's recent book (6) the statement: "Unilever did not believe in vertical integration after the early 1920's ....", but read on and the shock dwindles away ...."and all internal transfers were charged on a fixed formula whose aim was to ensure that no part of the business made a profit at the expense of any other part". This begins to sound very like the policy of allowing the farmer to share in the profit of the processor, the transporter, the retailer and the exporter. In fact Unilever did not form until 1929 but Lever and others had already learned some sharp lessons. The spectacular drop in palm oil price from £98/ton in 1920 to £39/ton in 1923 faced W.H. Lever with a heavy loss and A. Jurgens was also placed badly because of his commitment to copra. Lever then resorted to a policy of what in terms of marine architecture might be called "bulkhead construction". A leak in one section would not be able to sink the

ship. The policy continues today. It can and does pay, at times very well. Having been dissuaded by the British Government from establishing more highly organized palm oil trade in West Africa (upsetting the local way of life) he rented huge areas of the Congo in 1911 for the purpose. These went on to produce in quality and quantity a world leader in this commodity and to provide (a condition of the tenancy) a considerable infra-structure in communications, hospitals, schools etc. Although only with the introduction of plantations in later years were the fullest social benefits obtained.

So much for defensive vertical integration; when Lever bouhgt ships to bring his oil from Africa (horizontal integration?) he was faced by the wrath of the Liverpool ship owners who threatened to construct a soap factory in opposition. Lever sailed on and won. With caustic alkali it was different and he discontinued its manufacture as part of his soapmaking business when the nearby powerful chemical manufactures (later to become Imperial Chemical Industries) objected. Caustic alkali was then regularly brought in by barge. This glimpse of the earlier industrialization of the vegetable oil industry is given here to show integration has a long past and that its success still depends upon the manner in which it is applied which in its turn is intimately involved with the people who apply it. Mautner (3 issues 7, 8 and 23) emphasises, "The redistribution of the net income, back to agricultural production... is the only way, therefore, to really increase agro-business in developing countries". The need for large agro-business complexes as the only way to secure this is not everywhere accepted to say the least. The point is well made (1) that some degree of decentralization may be fitting where it is more economic to site the first processing stage in the growing area. This keeps down the cost of transportation and is a powerful factor in opposing rural depopulation as well as providing the best chance of bringing relatively fresh material to the mill. As mentioned in Section 1.4, crude oil can then conveniently be shipped out to urban factories or for export. On the other hand the central availability of information and technical assistance is a seemingly obvious way of avoiding duplication of R and D effort whilst one area may then most easily benefit from the experience gained in another. "Area" may here mean not only different locations within a country or geographic region but that studies connected with ice cream manufacture may unexpectedly also yield results of importance in detergency.

2.1. Necessity for Flexibility

As integration extends this infers the enterprise has grown and therefore the task of preventing temporary stagnation or hold up of resources whether people, money, materials or plant increases. Factory design offers a model for the wider organization. If the intake of raw material is seasonal a balance has to be struck between cost of holding raw material, capacity of processing plant and how much finished stock can be held for how long, taking into account its stability or shelf life and the swings in sales volume. If more than one harvest of the same kind of crop is grown in a year this helps. If the plant is so designed that more than one variety of seed can be processed and their harvesting seasons do not coincide too closely this is a common strategy for better utilisation of plant and people. A sensible provision and management of credit promotes cash mobility in particular at the launching of some new phase in the enterprise.

Within a factory the provision made for storage of semi-processed material between stages confers flexibility but it costs money to construct and maintain. Further, it is undesirable from a quality control aspect that semi-processed oils should be held in intermediate storage for longer than intelligent planning can contrive. Within the factory where a number of different oils have to be processed simultaneously forethought must be exercised - and some expenditure - to render their segregation reasonably easy, otherwise mixtures occur, downgrading value, or constant delays arise for line clearance etc. Outside of the factory it is probably advantageous for the enterprise to control its own transport for input of raw material and outward movement of finished product. Where different co-operative enterprises supply similar outlets there is a good case for a common transport facility. The reduction in costs for the agro-business in adopting bulk transport where possible in place of relatively small containers has been stressed (3 issue 17). Soapstock is the obvious useful by-product of oil refining, lecithin from degumming, tocopherol recovery from deodorisation and, often of crucial importance, is the opportunity to sell cake/meal as livestock/poultry feed at an economic price. In the compounding of the latter co-operatives of different kinds (oil, cereal, sugar) may support one another.

Lastly (3 issue 23) an alert experienced management is an essential for shooting trouble before it arises. Some formal training in the

science of planning is needed in addition to technical qualification. This is true in production, engineering and marketing.

3.0. Horizontal integration and measures to promote it.

Some forms of horizontal integration have already been described here (sec. 1.0) as provision by the enterprise of some of its own requirements by manufacture. Thus hydrogen by the hydrogenator of oils. This does not necessarily mean venturing into the chemical industry to supply other people with their hydrogen. Indeed the hydrogenator often makes his own hydrogen because he has no other source of supply at anything resembling an economic price. If such a source of hydrogen does exist nearby at far greater volume than his own requirements, there would be no point in making more, always supposing acceptable contracts could be made. With a material such as sodium hydroxide this can be economically transported, even from one country to another, so purchase is likely to be the most practical. Each situation has to be judged on current conditions and future prospects to the extent these can be foreseen and that may be the heart of the difficulty. If the vegetable oil producer has a continuing demand by his own process for some ancillary reagent that situation is reassuring, but the time may come when another producer enjoying an economy of scale can supply the commodity more cheaply.

There is the wider interpretation of horizontal integration which means taking advantage of some facility held in one kind of business which is highly relevant to another. Unually this facility has a technological besis to which there may be attached a further marketing advantage. This can lead to diversification. This may be justified because it increases the level of productivity of the resources held rather than leaving them to be duplicated by a potential competitor. An example of successful diversification is provided by the Kaira Co-operative in Gujerat (AMUL) which, first operating in milk production and distribution, then spread not only to butter, cheeses, malted milk, but milk chocolate, thence to cocoa beans, limes and lime juice bottling, and a modern rice mill for those of its members who grew paddy (4). The Warana co-operative in Maharashtra has expanded steadily from sugar into flour milling, spice powdering, papad making, poultry and dairy produce. It owns its printing press and a local bank (4).

The Podravka enterprise in Croatia (16) also illustrates diversification, usually into technically related fields. All these examples illustrate steady growth taking advantage in most cases of acquired "know how" and facilities. If several enterprises diversify in different directions they may end up by competing with one another in at least some types of activity and duplication of effort ensues. If they are geographically widely separated the duplication is minimized and may be insignificant. It is not possible, therefore, to lay down a rigid set of rules as to what will be advantageous.

Before diversifying it would pay many enterprises in the third world to overcome the astonishing losses between harvesting and consumption which range from 20 to 40% of the crops concerned (17). Again it is calculated in 70% of the world's agricultural land yields are no more than 20 - 30% of what could be possible. The obvious starting point in investigating what type of diversification is most promising is to consider what by-products are thrown up by the enterprise. Vegetable oils are, of course, a renewable resource as distinct from fixed mineral oil assets, and in several countries are attracting attention as possible future fuels - alcohol being another. Industrial fats and oils account for 15% of world production, but of these at the moment 80% is of animal origin. The relative importance of the non food uses is shown by the following distribution.

Table I

	%	
Soap	45	
Detergents	19.5	
Surface coatings plasticizers	18.3	
Greases	7.9	
Food Additives	6.3	(as distinct from food itself)
Cosmetics	3.0	

4.0. Possible forms of integrated development

A study of the subject quickly shows that several organizational forms of integration can succeed (1) just as several forms of plant life can succeed, but they all have to come to terms with their

environment. The three forms of organization which dominate the integrated vegetable oil industry are:

- State owned and operated enterprises
- Co-operative owned and operated enterprises
- Private and mixed Private - Public owned and operated enterprises

There are of course examples in which a national or regional government plays a big part in advising large co-operatives, as in India, or where a large private company helps to organize and advise a co-operative and then buys the product to process further or retail to the public, as in U.S.A., India and both developed and developing countries. Whatever the form, some common aspects of control exist in these enterprises as discussed below (sec. 4.1). There is for most forms a common need to promote the idea of integration and its advantages to farmers, mill owners, operatives etc., depending upon the local situation and the sophistication of the personnel who are to take part in running the integrated enterprise. Generally speaking motivation arising from perceived mutual benefit is the key factor. Even the members of monastic communities who take common ownership of the means of production and distribution for granted and adhere to poverty, chastity and obedience, still cherish long-term plans for personal success. It has been remarked (3 issue5) that farmers co-operatives, chain stores and government collective farms are all able to operate in an integrated manner even within differing political systems, but they must ensure that the added value of the enterprise is distributed justly, not merely for the immediate benefit of members but also as investment to allow future growth. References (1) (4) (16) arrive at substantially the same conclusion.

4.1 Control within integration

Granted members have some degreee of motivation and what they are trying to do together is not hopelessly at odds with their physical environment, day to day control is by cash - this may be seen as a daily payment each evening for the milk delivered that morning as in AMUL (4), or high level decision as to how much of the annual profit is to go to which activity of the co-operative; this, too, eventually has its day effect on the lives of members.

PODRAVKA established its own bank (16) and Warana (4) also. Fieldhouse's study (6) of Unilever Overseas through the decades is heavily concerned with the separate profitability or otherwise of the different subsidiary companies. The better able an enterprise is to

finance its own expansion from profits the stronger it becomes since less profit is being drained away to service debt. This does not mean the established co-operative should never borrow outside. A wise choice for development can both pay back debt and yield profit. A decision has to be taken if one component of an integrated unit is currently earning more profit than another whether this is allowed to affect the rewards for some members as against others and we have already said the success of integration depends upon the perception of mutual benefit. Where the relationship is more on a horizontal level rather than one section deriving all its raw material from an earlier stage, then the decision must be how long the loss making activity is to continue. It may have to be re-organised or abandoned.

An important point needs to be mentioned here. Technical statistics and financial accounts need to be reviewed side by side. For three successive quarters the cost of steam used per ton of soap produced may rise, not because more steam has been used, but because the price of fuel to raise the steam is steadily increasing. The free fatty acid of a crude vegetable oil may remain constant whilst the refining efficiency apparently grows steadily worse simply because the gum content has been allowed to rise. Bad relations can grow between different components of an integrated system or between customers and suppliers in an open market if analytical test procedures differ and this fact, known only to a few chemists, if at all, throws up different results on identical material. Even when a financial control is operated justly faults may continue which have a technical origin. In this case the control operates to spread equal misery rather than mutual joy. A recipe for even greater misery is to have unjust financial control working with inefficient technical management. Lastly, having obtained highly motivated people working a technically sound sequence of process steps for a fair share of profit, planning remains essential if profit is to be maximised and recriminations avoided. Failure of the food industries in developing countries has been ascribed to the non-existence of a proper link between production, processing and marketing (1). Integration must include planning which itself possesses some degree of flexibility and the planners some degree of responsibility. Some knowledge of one another's difficulties, obtained by personal contact between management of production, processing and marketing, is a first step towards harmonious relations.

4.2. State integrated development of agro-industry

Prior to the establishment of an integrated industry various small units exist possibly using outdated technology, not working in any particular harmony and falling far short of realizing full added value opportunities because they despatch raw materials to distant processors.

A second situation is where no raw material is as yet available, so planning should be aimed at producing the raw materials which UNIDO strongly recommends are first identified by market research (1). The complex should be formed by starting comparatively small modules which are so designed that their progressive expansion is unhindered as demand grows.

The region around Pelotas in South Brazil was an example of the first situation. The agro-industry was therefore re-organized with UNIDO's advice and the co-operation of Government and industrialists. Government had to provide credit to increase quality and quantity of of production. Very early a centre was established to give training to process personnel and technical help to plants, the smaller ones being merged to achieve some economy of scale, whilst more modern equipment was provided. Some degree of specialisation was arranged. Within a space of five years it is expected this less developed region will be so competitive as to operate successfully in the national market against imported products. A second example of the same kind is provided by the States of Minas Gerais (Brazil) where agricultural production was in fact shrinking at the rate of 0.5% per year in the late 1960s. The Industrial Development Institute having first identified lack of the right raw materials introduced projects which not only encounraged farmers to produce them but arranged their processing afterwards. Within five years a growth rate of 6.2% per year of agro-business had been achieved, 46 existing enterprises enlarged and 61 new ones introduced.

As an example of the second type of situation UNIDO co-operated with the Mexican Government to identify some 40 opportunities for creating integrated food processing plants for two regions, the experience from which will serve as models for others throughout the country. UNIDO is co-operating with the Nigerian Government along similar lines.

It will be obvious that for developments to take place on this scale public money must be involved. A helpful practical feature is that although large projects may be planned for the longer term, UNIDO has found small yet efficient processing equipment for fruit and vegetables for

the industrial modules it recommends as the first stage of integrated development, and three such units are now being arranged for three different developing countries. The need for regular checking of progress against target in all national development plans has been emphasised (5).

It is advantageous to recognize that it is prudent to bear in mind that integration must have sensible limits. In particular it must not be so extended that one enterprise begins to exersise a monopoly over a large segment of the national life. This will arise if it develops a controlling interest in activities peripheral to its main concern.

4.3. Co-operative integrated development of agro-industry

Co-operatives in various sizes and forms and in very different political environments have been known for well over a century. Integration is the immediate object of our attention and we are assured it works independently of the political system (3 issue 21). Farmers long ago organized their own retail outlets and the converse has happened in a big way where big retail chains have joined hands with big farm co-operatives to produce the benefits of integration. What has proved desirable in the developed countries as an organizational form would seem at least equally desirable in the developing countries.

The integrated co-operative form of agro-business is advanced as the answer to the artificial advantages of permanently subsidized agriculture. It is one thing to extend credits to get a business on its feet, but quite another to carry it for the rest of its life. The need for high personal commitment for the success of an integrated - or any other - system has already been argued. Similarly it seems the sensible limits of diversification should somehow be established. These seem to vary according to circumstance - merely economic phenomena without any moral connotation. It was the government of India who invited Dr. Kurien, the chairmen of the National Dairy Development Board, to extend to production, processing and marketing of oilseeds and vegetable oil in Gujerat the same techniques of management which he had made outstandingly successful in his management of AMUL, the dairy co-operative. He did this to such good effect that membership of the Gujerat Co-operative Oilseeds Growers' Federation (GCOGF) grew from 300 members in 1980 to 70,500 by the end of 1982. Better prices were offered to the farmers and reliable supplies of seed, fertilizers, pesticides, rhizobium cultures and equipment were secured. By the end of 1982 the co-operative

came to own two oil mills and was able to plan expansion to more processing units costing in all about U.S. $ 850 million (29). The extension of AMUL's activities into bottling lime juice (sec. 3.0) came about from the spontaneous demand of some members of the AMUL co-operative who also included the cultivation of lime trees along with the dairy interests.

4.4. Private and mixed private - public integration

The ownership of an enterprise does not necessarily relate with whether it becomes integrated or, if integrated, successful. The large TNC's in the oils and fats business are all integrated, some to a remarkable degree. They have had successes and failures. Was the omission to go into pet foods by a supplier of human foods really a major missed opportunity of diversification - or vertical integration? Seemingly - yes. Not everything can be foreseen. The success of integration depends upon how it is done. Two points may be emphasised for general application. Each link in the vertical chain must be scrutinised by the accounting system so as to see that its continued operation contributes some profit, and if not, why. The operation of a joint private - public integrated enterprise should derive much initial support and chance of success if the private part can feed in expertese and experience, people and money, very much as a government ministry provides technical and financial back-up to a new farmers' co-operative which could certainly not afford such service in its early years. The private enterprise is likely to be the customer of the co-operative and provide much of the later section of the chain.

In 5 years from 1963 Hindustan Lever dispersed about £1m. to promote a co-operative dairy industry in Etah (Northern India) which would give greater availability of milk within a smaller area, thus lowering collection costs at the same time benefitting the farmers. The scheme did not succeed at all until the company used its employees who were graduates in agriculture, who up to then had merely supervised milk collection, to go out and live in the villages to show them how to help themselves by using fertilizers, crop rotation, veterinary care and government extension scheme credits rather than private borrowing from money lenders. Then came the turning point, and the villagers willingly accepted a free artificial insemination service from higher yielding cattle breeds (Holstein, Jersey), and help to purchase higher yielding (Murrah) buffaloes. The Hindustan Lever Integrated Rural Development Programme has also lifted the level of agricultural

production in various crops among 35 villages so successfully that it plans to expand to 60 village clusters, the emphasis remaining on village communities taking their own decisions. The programme now has an annual budget of £170,000 and will soon possess its own R and D centre for agriculture and animal husbandry. Success did not come immediately and was achieved by personal commitment and belief that benefit would really result (18).

In another example of private - public enterprise, Nestlé, supervised the creation of milk co-operatives in Mexico and in up to 6 years produced and distributed over 60% of all milk consumed in the country. Further, various Japanese firms have promoted extremely successful agro-complexes in South America and Indonesia (2 issue 11). These various examples of practical help are well summarised by the remark. "It's not so much what you say that matters, it's what you do". (19).

4.5. Promotion Policies for Integration

Policies are general strategies and are therefore discussed in broad terms here. The tactics or practical measures suited to implement particular policies will be examined in detail in later sections. Policies involve choosing one or more options and may be presented in this way. Here are eleven of the important options.

a) Before embarking on an integrated project a market must indeed be identified first, but secondly, is the oil source to be linked prominently with protein if possible (soyabean, sunflower, canola), and is a conscious effort to be made at the same time to direct a traditional eating habit to a better nutritional level by propaganda and maybe mild cost incentive (14).

b) How much money can be found initially; how long is the pay back period; how much more money will be forthcoming later for possible expansion; will a private foreign partner (if any) be allowed to repatriate a proportion of profit?

c) Will there be a declared policy against possible environmental hazard with realistic limits?

d) Is the modular approach to be used and therefore the probable need to acquire larger equipment in say 10 years?

e) In the case of moderately extensive vertical integration who will define the limits for horizontal integration - the State or the owners?

f) Will any export target be set and will early further vertical integration be deliberately promoted to achieve it? A by-product such as wax from rice bran oil if cleaned may sell well abroad, but not at home (3 issue 7).

g) What allowance is to be made for R and D, the seed corn of further growth and can it be provided by a foreign partner (13) (14), and under what conditions?

h) What is to be the scope allowed under contracts granted to TNC?

i) Is there a policy for pruning 'dead wood', thus encouraging healthy growth of the industry.

j) Bearing distance and transport cost in mind as well as social obligations, is it decided at some point in the processing stage to split the integrated process if necessary (1)?

k) Is it agreed to use bulk handling (home and export) as far as possible, and to employ indigenous packaging materials when needed (3 issue 17)?

Reference is again made to the warning at the end of section 4.2 that integration should not be carried so far that one enterprise monopolises facilities in which others have and equally genuine interest.

5.0. International co-operation and integration in the vegetable oils and fats industry

By the "types of international co-operation" we may understand its geographical distribution, the nature of assistance provided, whether it is free or has to be bought. The type will vary according to the kind of co-operation we have in mind. In the next section different important fields of international co-operation are mentioned and some pointers given as to how this co-operation is most effectively operated.

5.1. Information

Information is one of the big factors affecting integration in the vegetable oils and fats industry as in many others. Its storage and rapid efficient retrieval has advanced enormously in the last decade to become a science in itself.

Distance no longer matters. It is a help, however, if a person sitting on top of the answers in a developed country understands the questions from developing countries. That is why it is an advantage if the graduates in charge of different bits of the information bank have practical experience of the technology in question and rotate their service from the centre to work in the field or factory and back again. It also helps if the manager in the developing country knows the information exists and how to contact the centre which has it. Very frequently he does not. International co-operation can take the very effective form of establishing an information centre in the region of several developed countries which are seen to have common problems and interests, thus we have the creation in Jakarta of the Asian and Pacific Coconut Community headquarters to serve 10 or more countries. In support of the APCC are UNIDO and FAO. In the private sector we have the Technical Information Services in Rotterdam

and London of a TNC such as Unilever to quote an obvious case, which serve 70 different countries, whilst a research laboratory in Bedfordshire, for example, is making the pace for the advancement of cultivation of the oil palm, first in Malaya, but finally for any country in which the palm tree will grow.

The large central R and D establishment not only achieves economy in avoiding having to duplicate very expensive items of equipment in several laboratories but since much research is multi-disciplinary it derives advantage from concentrating many researchers in one place.

Figuratively and literally the mere exchange of information will be fruitless unless the appropriate action is taken. One of the best ways of promoting action is personal contact by experienced individuals sent out to the scene of operations by a UN agency or a TNC parent company at a mutually agreed time to observe and take part in the work. A quick, even if modest dividend from such a visit is always stimulating and encouraging to the organization visited. Action does not always have to be positive in order to be profitable. Stopping people doing a wrong or unnecessary thing saves time, money and plant capacity and invites no extra effort. Wrong action follows from ignornance, unnecessary action often derives from its having been the effective answer to some exceptional problem in the distant past which is no longer present, but the action has become secrosanct in local understanding. This error is by no means restricted to the developing countries.

5.2. Feasibility, Planning and Investment

These go hand in hand. Feasibility is an appraisal of the circumstances to discover if they allow of a lasting success. If they appear to do so, then comes the question of how to plan its achievment and at the same time estimate the cost (investment) for each plan if there is a choice. This sequence is common to all projected enterprises as well as integration of vegetable oil agro-business. Sensible plans almost certainly depend upon experience within the same field and this may either come from a person who has always worked in that region of the world or an expatriate who has spent years in a very similar environment.

A chemical process, however, is probably designed to operate in its own environment (temperature, pressure, catalyst) so the expertese is unlikely to have particular local connections and, therefore, international advice should be easily available and from several sources.

The foreign investor is likely to point out that jobs will be created and only after local taxes have been paid is a proportion of the profit repatriated. This will all be settled at the planning stage as it is obvious the scope of the plan depends on the rate at which cash is to be fed into the project until it becomes self supporting. It is for consideration whether and for how long a new project should enjoy some kind of tax holiday. Some very clear detailed advice on what form of financial assistance it is safe to accept is given in the UNIDO publication (2).

5.3. Training

So far as international co-operation is concerned training to promote integration of the vegetable oils and fats industry in developing country is given in appropriate factories, technical institutes and universities within the developed country or a developing country which happens to have established in it some institution especially well equipped in the oils and fats field and will also accept trainees from other develping countries. This is likely to be particularly appropriate if the developing countries are in the same area and possess similar climates with the same crops. Costs may also be low. The organization of these trainee opportunities falls primarily within the jurisdiction of governments in conjunction with UN agencies whose huge work here is well publicised. A TNC can act similarly as regards its own managers nearly 600 Unilever managers travelled to Europe for formal training of up to 6 months during 1982, whilst during the same time Hindustan Lever accepted 11 managers from Nigeria, U.K., Bangladesh, and Zimbabwe, and sent 22 of its managers to other countries. Some secondments may be for 3 years. The annual formal training cost is around £30m/ann. (14). Conversely, regional residential courses are held for two weeks, at which some European experts are present to assist in the instruction. Further, whether the expert is sent out by a foreign developed country government, UNIDO, FAO, or a TNC, it should be understood and commonly is, that part of his management task is to prepare a replacement from the developing countries as well as to train workers at a subordinate level. In this case the enterprise becomes more self-sufficient and able to expand its integration programme now financed, at least in part, by its own earlier success.

Training must cover many aspects apart from the technical side of the enterprise such as marketing and personnel work. Training on how to run operational planning of agro-business complex (2 issue 16) is important and even instruction on how to train.

5.4. Trading

Developing countries need to be helped to export such goods as they are well able to produce rather than hindered by tariff walls (see end section 1.3.). Exporting to one another within a group of developing countries such as the Caribbean Community is a means of reducing foreign exchange difficulties; pooled manufacture of agricultural equipment is another example. (3 issue 12). Direct exchange of goods between two partners may be elaborated (if markets exist) to a cyclic exchange among three or more, one of whom may be a developed country which itself has an incentive to take part.

The trade agreements must remain in force long enough for the respective agro-businesses to develop strength. Finally, if several neighbouring developing countries connot manufacture some of their own requirements they may be able to obtain better purchase terms by operating a common buying agency just as individual companies in a TNC do when they pass their requirements to Head Office. It is therefore desirable to consider joint ventures between developed and developing countries or even between developing countries themselves. Common marketing arrangements for such groups should also be examined.

5.5. Indirect co-operation

Besides the obvious forms which have just been mentioned, of helpful co-operation with developing countries, a number of other ways of assisting exist which, although they may be less direct and not confined to the vegetable oil industry alone, nevertheless enable the developing countries to achieve the full potential of its natural resources at a greater rate. They include making available at low or no cost services in meteorology, aerial survey, geological survey, indentification of plant diseases and other back-up services too expensive for the developing countries to maintain in an elaborate form. Having said this it is fair to conclude that the best service among the many which could be provided by the developed countries is a market.

6.0. Action

Action to promote integration must itself be integrated, certainly within a country, but in many regards at a wider level, so that progress made in some items is not frustrated by failure in others. The wider level here mentioned refers not only to geographical boundaries but also to classes of commodities such as oils and fats. Identifying the nutritional needs, the appropriate crops and the countries in which these needs occur corresponds with our acceptance of the fact that the first step in integration is identifying a market which will then provide the economic incentive or motivation (20). It is the raw material of global resources in skill, money and equipment which then has to be processed to meet these needs. Priorities have to be recognized and action co-ordinated so that resources are managed and not wasted. It is, however, the action taken at the national level which is the immediate cause of the country's vegetable oil and fat agro-business expanding, granted that resources are transmitted to them via UN or national agencies or even private companies. Certain actions which will result in an early practical benefit are included in the following sections alongside those of more long term importance.

6.1. National Action

Even if the components of a national agro-business already exist, perhaps each one following an independent line of action, their integration to more profitable operation has to be planned as a sequence of steps, each one preferably self-sufficient within itself, but finally leading to the maximum profitability of a vertically integrated chain. If the exploitation of some particular crop not at present cultivated is found to have a market, preferably both at home and overseas, its development through cultivation, processing and marketing must follow a very similar pattern of planning.

National action should first be directed to discover, then obtain, what will provide the largest relative return for the least outlay in the shortest time. Bigger returns may well follow but are likely to take longer and require bigger investment. A rational plan which fits the vegetable oil industry into the development of the remainder of the economy is the most certain way of gaining this bigger return. As emphasised earlier it must be a return in food/cash for those doing the

work if momentum is to be maintained, and the momentum will be greater at all levels as the return is seen to be bigger. The quickest return may well be the negative action of stopping wrong or at least unnecessary procedures, i.e., waste. To stop waste it must be recognized. This may depend upon expatriate help, and should be given on the spot and demonstrated by the helper. The big return as distinct from the quickest must surely come from positive action.

Integrated action is achieved by co-ordinated planning, so someone must have the responsibility of putting the different parts of the jig-saw puzzle together, but in this particular game a piece which does not fit is allowed to be re-shaped. It is essential that the person having the authority be designated and as far as practicable the scope of the authority and responsibility delineated. In war this is called combined operations; soldiers, sailors and airmen may all take part; here we are concerned with tractor drivers, machine minders and shop-keepers. Standards of performance and efficient use of inputs (chemicals, man hours, steam, etc.) must be capable of measurement and managers motivated to keep watch on them in the same way as in TNC. In the study performed to decide whereabouts in the country the different components of the integrated industry are to be located care must be taken to keep transport to the minimum. A general rule is to locate the extraction of oil and handling of resultant meal in the growing area, whilst refining, hardening and other modification may possibly be performed with advantage in an urban area.

A tragedy for developing countries is that between harvest and consumption there may arise horrifying loss of raw material (20 - 40%) (17). A big proportion of this results from bad storage and handling as well as poor processing routines (5). Again, if the faults can be identified and first managers, then operators, motivated to avoid them, a much more profitable end result is obtained. It is almost certainly not possible to erect and operate in a very short space of time a storehouse with all the sophisticated means of seed handling, temperature and seed moisture control of the kind to be found in developed countries. Protection can be obtained from the worst rigours of climate by cheap means such as waterproof sheets and hard standing. For each increase in free fatty acid of 1% which is avoided, a 2% increase in refined oil is likely to be gained.

The use of bulk transport and handling already commonplace in developed countries and their overseas affiliates is another activity which gives a quick saving; it should be phased in as a normal feature of the integrated system.

Integrated enterprises such as PODRAVKA (16) already have more than 20 years experience of co-operation with foreign companies of their choosing in the food and pharmaceutical field with agreed exchange of information and training of personnel so that products made under licence in Yugoslavia have been developed in the PODRAVKA's own laboratories beyond the capability of the original. UNIDO is constantly attempting to promote help of this nature (16).

Governments operating a price control on purchase of primary crops expose themselves to several risks such as black market and smuggling especially if the system of collection is already weak (5).

A tax holiday of reasonable duration for investors in the agro-business would seem to be one of the most effective ways of promoting local and foreign investment. This information could be incorporated in the prospectus showing what market and natural advantages existed already for the agro-business planned, the scale of the project and what amount of financial support was already assured.

6.2. Regional and Global Action

Regional Head Quarters of organizations dealing with vegetable oils and fats should act as intermediaries between UN agencies and organization members with the purpose of co-ordinating assistance and preventing its being replicated where that would be wasteful. Where such organisaions do not exist on a geographical or commodity basis consideration should be given to setting them up.

Regional rather than national training centres would often give both basic instruction and a broadening of outlook to those attending. A training centre for oils and fats technology to be situated in one country of the region and so on, is an attractive working arrangement.

One research establishment in any particular field would seem to be an advantage for the whole group and this should maintain close links with kindred establishments in the developed countries to the extent of exchanging personnel and possibly programmes..

The Asian and Pacific Coconut Community, the Malaysian Government's assistance to Bangladesh, India, Thailand and the Philippines in developing

their oil palm industry, the sharing of facilities in the University of the West Indies, the application of Unilever's oil palm experience in the Cameroun to problems in Malaya, the sharing of research results by Unilever Research Laboratories, the USSR's progressive advancement of the oil bearing capability of the sunflower, and the creation of a genetic strain of rapeseed to give superior quality oil and meal by Canadian workers are only some of the more important examples of co-operation extending from the regional to the global level. Inspite of all this, pointers to the immediate future of the next two decades emerge which are not wholly reassuring for the uniform growth of integrated vegetable oil agro-industry in the developing countries as at present constituted. Wiedermann (15) describes those oils as indigenous which continue to maintain a strong position locally, but which in world trade have only a limited place. Further, they appear likely to become relatively more limited in future. Tables II, III and IV make this reasonably clear.

Table II

World Fats and Oils Production (mil.met.tons) (15)

	1970	1976	1982
Soyabean	5,93	9,98	13,82
Sunflower	3,80	3.67	5,35
Rapeseed	1.75	2.91	3.97
Cottonseed	2,66	2,69	3.51
Groundnut	3,30	3,54	3,25
Olive	1,25	1.79	1,30
Palm	1,76	3,23	5,38
Coconut	2,27	3,43	3,43
Other veg. oils	1,62	2,01	2,33
Total	24,34	33,25	42,34
Animal	12		15
Marine	1.2		1.3

TABLE III

World Fats and Oils Distribution of Production and Export 1982 (15)

(PERCENTAGES)

	Production	Export
Soyabean	23	33
Sunflower	9	6
Rapeseed	7	7
Palm	9	16
Coconut	6	7
Total	54	69
Other veg. oils	18	14
Animal/marine	28	17
	100	100

TABLE IV

World Production of Major High-Protein Meals (mil.met.tons) (15)

	1970	1976	1982
Soyabean	27,505	46,229	63,229
Sunflower	3,479	3,397	5,109
Rapeseed	2,778	4,524	6,227
Cottonseed	7,617	7,735	10,058
Groundnut	3,962	4,250	3,896
Copra	1,240	1,878	1,875
Marine	5,426	4,773	4,516
Total	55,46	76,00	98,20

Developing countries should take into consideration the following points in plannign future expansion of their vegetable oils and fats industry:

(a) The animal and marine fats and oils are expanding very slowly.

(b) Cottonseed, groundnut and olive oils are classed as indigenous.

(c) Expansion has been achieved chiefly by soyabean, sunflower, rape, palm and coconut oils.

(d) Where the production of oil is linked prominently with the production of protein the demand and hence production will be highest.

(e) Palm and coconut oils, whilst important, do not contain those unsaturated fatty acids (linoleic in particular) to the extent present in the seed oils and functionally the lipids of medium unsaturation are extremely useful. Hence, coconut oil production is seen as flattening out and eventually palm increasing slowly.

(f) As crops produced because of the protein value of their meal continue to expand the associated oil will be of a kind easily consumed itself or as a useful component in blends for those countries which do not produce sufficient locally.

(g) Oil milling/extraction investment is seen as being rather less flexible or versatile in operation than oil refining and therefore a factor militating against rapid change.

(h) Genetic engineering may influence things such as the protein/oil balance in the seed and adaptability of the plant to climate, but the requirement for oil and protein of maximum nutritional utility must remain.

The emphasis in demand on protein appears to be for animal feed and where there is a rising standard of living this will continue. More vegetable protein will have to be used for direct human consumption, but the shift in proportion as a whole is likely to be gradual. Wiedermann sees the development of the oils and fats agro-business as a part of the food business as a whole, not as an independent entity and this is virtually the same concept as is being put forward when we speak of success for agro-business depending upon integration.

The International Association of Seed Crushers (21) is quoted as finding that in the last two decades the world's increased needs for fats and oils have very largely been met from soyabean, rape and sunflower, along with palm oil and that world trade as seen in exports of coconut, palm kernel, groundnut, cottonseed and marine oils has not changed markedly in four decades.

Of other vegetable oils rice bran oil has the highest potential. Bran constitutes about 6% of the rice harvested; hence if it is efficiently separated from broken rice and husk its oil can be extracted. World production of rice already in excess of 400 million tons has an oil equivalent content of about 6m. tons (22). It is essential that the enzyme present in the bran be promptly inactivated (brief steaming) to deter rancidity before further processing (23). The oil is most desirable from a nutritional standpoint and has considerable by-product potential in its valuable wax components.(c. 8%). The

refined oil has good stability in itself and although this at present is not a main outlet it could be hydrogenated to fats of various useful consistencies (24). Prompt inactivation of the bran combined with transportation to tactically located extraction points is at the heart of the problem. This seems to be a matter requiring research at the global level. If, however, geneticists can contrive a high yielding easily harvested oil palm and engineers an acceptable conveyance of fruit bunches to mill it is not too optimistic to believe that a feasible and widespread use of bran sterilisation is already within the grasp of modern technology. By developing this technology so as to make it easily applicable we extend vertical integration of the rice industry and open up the possibility of using the major portion of rice bran oil production for edible rather than merely technical purposes.

On the regional scale must be mentioned the enormous oil potential of the several species of palm to be found in Brazil, which in total were it capable of being harvested, has been linked in tonnage to the remainder of the world's oils and fats supply. It must amount to many millions of tons and with this oil would go millions of tons of cake and by-products (25). At least 19 principal varieties exist, of which the best known are Tucum, Urucury, Curua, Murumuru, Babassu, Dendê and Cocotier (26). A means of processing the nuts exists, but their collection is a bigger task. The oils obtained resemble the familiar palm kernel and are, therefore, subject to the same constraint when used as food or as a raw material for soap and oleo-chemical manufacture. This is a matter for regional consideration.

Finally, and very much at the opposit end of the scale we have jojoba oil which is a vegetable oil extracted from a shrub grown in warm arid conditions, such as Arizona and Southern California.

The potential market has been estimated at about 3,500 tons p.ann. for cosmetics, food and high pressure lubricants, anti-foaming agents and in general as a replacement for sperm whale oil. It is superior in not containing the amount (25%) of glyceride oils in the latter, but esters(97%) made up of long (20 - 22 carbon atoms) chain alcohols and fatty acids, each with one double bond, no stearin and no fishy odour. A yield of oil per acre of one ton is the target for cultivation in California (27). The present price of US $ 70 per gallon fluctuates widely with the passage of time, but even relatively small projects of this kind might merit consideration for transfer to a developing

country where climatic conditions happened to be particularly favourable and labour readily available.

Regional and global action to lower or abolish tariffs is an obvious action which has to be constantly pursued to provide motivation for developing countries agro-business (28).

6.3. Action by International Organizations, including UNIDO

These are best designed to help developing countries help themselves since it is only from such help that improvement gained remains secure. Perhaps the first function of international aid in this sense is to make information available, then to assist in the making of choices by the developing countries. UN organizations should endeavour to faster the establishment of geographical and/or commodity organizations to co-ordinate the growth of the vegetable oil and fats industry in member countries.

In addition, UN agencies should assist developing countries to establish new research facilities for the vegetable oil and fats industry on both national or regional basis as applicable.

Training of personnel is vitally important for any industry and therefore a UN agency must continue to maintain the facilities for this, which it presently organizes, at a high level of priority in its programme.

Studies whether of a technical or commercial nature, including feasibility studies, remain one of the most valuable forms of assistance which a UN agency is able to complete for the benefit of developing countries. There follows the promotion of investment in the oils and fats industry of developing countries and the obvious need to provide technical assistance for the various projects undertaken. Even when the newly established agro-business becomes self-sufficient the arrangements for help in research and training must be maintained or even improved so as to maintain momentum.

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