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PROCESSING OF VIETNAMESE ESSENTIAL OILS AND RELATED NATURAL PRODUCTS

DP/VIE/84/010

VIETNAM

Technical Report:
Findings and Recommendations*

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

Based on the Work of J.G.Meredith, UNIDO Consultant

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NOTE

The following abbreviations have been used

CNRS (NCSR VN)	Centre National de Recherches Scientifiques Viet Nam(National Centre of Scientific Research Viet Nam - NCSR VN)
GENERALEXIM	Viet Nam National General Export Import Corporation
NAFORIMEX	Viet Nam National Forest and Native Products Export Import Corporation.
VINAFA	Viet Nam National Farmacy (Pharmacy)
VIET INSPECT	Viet Nam Inspection and Testing Office
UNIMEX BITIMEX	Import and Export Corporation at Provincial Level.

I. INTRODUCTION

In 1985, a Preparatory Assistance Document (VIE/84/010/A/01/37) was drawn up between the United Nations Development Programme and the Government of the Socialist Republic of Viet Nam, the development objective being:

"to establish an essential oil industry utilizing the country's natural resources of essential oil bearing plant species in order to substitute for imported products thus saving foreign currency now spent for imports of essential oils, aromas and flavours, and to contribute to the country's export earnings."

The immediate objective was:

- to carry out a feasibility study on local production of essential oils, aromas and flavour;
- to determine what are the existing activities and responsibilities in the country for the development and use of essential oils, aromas and flavours and how they are coordinated among the various levels of the Government;
- to assess the needs and opportunities to mount a development effort in this subject;
- to prepare a programme of technical assistance which would lead to the biggest impact and have the likely capacity for follow-up in the country.

It was agreed that the UNIDO inputs would be:

- a Consultant Economist (2m/m) responsible for covering the economical/marketing aspects of the pre-feasibility study.
- a Consultant Chemist/Technologist (2m/n) responsible for covering the scientific/technical aspects of the pre-feasibility study.

Due to unforeseen circumstances, the Consultant Economist could not join the team, so the Consultant Chemist/Technologist was required to prepare the pre-feasibility study.

This forms part of the Findings and Observations and is the result of his work.

II. SUMMARY

The mission took place between 9 April and 28 May 1986, during which time the Consultant was attached to the State Committee for Science and Technology, the Government Implementing Agency. His immediate contact was the National Centre for Scientific Research (Centre National de Recherches Scientifiques - CNRS) of Viet Nam (Annex III).

The desk and consultative work was carried out in Hanoi, the field work was concentrated in the area of Nam Thanh, district of Tren Hai in the Province of Thai Binh, 100 kms South-East of Hanoi where the cultivation of Vetiver (Vetiverria zizanioides Stapf) is under progress and the area of Dai Trach, Province of Binh Tri Thien, 400 Kms South of Hanoi just off the main

trunk road from Hanoi to Huế, where 200 hectares of Citronella (Cymbopogon winterianus Jowitt) are under cultivation based on "Java" cultivars specially selected.

The area of Bac Thai (Citronella experiments) 80 Kms North of Hanoi and those of Cao Bang and Lang Son (distillation of Illicium verum Hook - Anise oil or Essence de Badiane) 180 kms North of Hanoi although referred to in the findings were not revisited as these production areas had been studied by the Consultant during an ITC mission (Project No. VIE/82/008) in November/December 1985.

The first part of the mission consisted in discussions with the Departments working within the framework of the CNRS, (Annex IV) being Departments of Geography and Natural Resources (for Economic mapping); Geobotany and Ecology (for distribution of flora); the Survey Centre (interpretation of Landsat Photography) the Department of Natural Products Chemistry and the Intitute of Chemistry.

Where required, seminars were conducted on certain aspects of technology and marketing.

The field visits took place between the 15 and 21 April 1986.

The latter part of the mission centred on further discussions with the Department of Development Investigation (Planning) and with GENERALEXIM (Viet Nam National General Export-Import Corporation) on Export Statistics and Marketing and in compiling the pre-feasibility study data recorded in the Findings and Observations as well as in the Annexes.

The final part of the mission was concerned with the preparation of the project Document (Annex).

III. FINDINGS AND OBSERVATIONS

The opening discussions with the CNRS and GENERALEXIM (representing Foreign Trade) highlighted the existence of some misunderstanding about the activity implied in the title of the project:

Development of Industrial Production of Essential oils, Aromas and Flavours.

Whereas on the one hand, the exploitation of Viet Nam's resources of essential oil bearing plants and gum exudates had been well established in the past (see Publications during the 1930's of statistics on French colonial products) there was, on the other hand insufficient evidence of the specific use of perfumery products (aromas) or of flavours other than those used in culinary preparation (mostly spices) and sweet-meats or in local and regional preparations of biscuits, cakes and sweet rice delicacies as well as some oils used in the preparation of creams and unguents (medicinal use) and hair-rinses.

In themselves these preparations did not seem to warrant at this stage inclusion in a project aimed at raw materials.

The Consultant discussed the differences in applied technology indicating the elaboration of perfumery and flavour formulae necessitates the availability of a wide range of appropriate aromatic chemicals and the required and authorised solvents. In the absence of a Chemical Industry in Viet Nam, these products would have to be imported and selected personnel trained in their use. This does not appear to be a desirable proposition at this time as it may detract attention from the prime object of developing field production of essential oils and other natural products, as well as their isolates.

The Senior CNRS Scientists and their colleagues agreed that the overall Development Objective would be better served by concentrating at present on the treatment of oil-bearing plants by means of hydro or steam distillation and when necessary by means of extraction processes, using either water or water and ethanol mixtures of the required strength, and when required, a recommended solvent.

The recommendation was put forward that the suggested title - "Processing of Vietnamese essential oils, aromas and flavours" - should be changed to read:

"PROCESSING OF VIETNAMESE ESSENTIAL OILS AND RELATED NATURAL PRODUCTS"

III.1 Raw Materials of Botanic Origin

It has been estimated that there are about 10,000 species of plants in Viet Nam, more than 500 of them containing essential oil.

This represents some 5 -6 % of the flora in a Country where climatic conditions range from tropical in the south, through sub-tropical in the central zone to temperate and near Alpine conditions in the North.

There are also many varied micro-climates along the mountain range, the long Cordillera (Truong Son) which stretches from North to South along the border with Laos and Nampuchea and some peaks of which reach more than 2,500 m altitude.

The plants identified belong to 300 genus and 95 families of which the more important are : Compositae (41 sp); Lauraceae (18 sp); Leguminosae (18 sp); Zingiberaceae (18 sp); Rosaceae (14 sp); Umbelliferae (13 sp); Myrtaceae (13); Apocynaceae (13sp); Anacardiaceae (9sp); Magnoliaceae (1 sp); Rubiaceae(9 sp) and Liliaceae (9 sp).

The main species are listed in Annex VI with an indication of the present state of activity. The Government of the Socialist Republic of Viet Nam has a priority programme for the development of essential oils and related natural products and this is reflected in the comments made hereunder on the oils listed in order of priority.

III.1.1 Cymbopogon winterianus Jowitt

For centuries the two varieties of Citronella, C. winterianus (Java type) and C. nardus (Ceylon type) have co-existed in Viet Nam. The plant grows in the North and South delta areas and in the mountainous regions. The leaf has been used in its natural state or its distilled oil used in every day utilities, such as soap and as a pharmaceutical raw material.

Early this century, the French established a number of citronella plantations in some mountain provinces. The industrial exploitation of Citronella oil was first begun in 1924 in the Bac Thai Province. Since 1960, the cintronella growth pattern has been multiplied and the oil now comes from Provinces to the South where new plantation have been growing and distillation units erected.

Before 1980, the annual production of citronella oil reached 100 Metric tons and the citronellal and geraniol assays titled respectively 35/85. However, more recently some negligences occured in planning and in the cultivation process. Emphasis must be made on the age of the equipment and the fluctuating ex factory price of the oil. These and other factors led to a falling off of the quality of the oil, with assays of 32/85 citronellal/geraniol. New steps have been taken with appropriate investment in the cultivation, the introduction of improved field distillation processes with selected plant material for test purposes, to establish reliable citronella cultivation and distillation based on an expected annual productivity basis of 150 kg. oil per hectare.

Production now includes a development scheme in Dai Trach, in the Province of Binh Tri Thien, where 200 ha are under cultivation (Annex XIII).

The cultivars selected are true Citronella "Java" (Geraniol 85 % and Citronellal 35%) and are the subject of organized plantation by a State Company UNIMEX which controls its own estates of 100 ha and more and by the distribution of selected cultivars to the regional cooperative under the supervision of the Company.

The Consultant has found that the estates are well managed and maintained and that the locally constructed field stills are in reasonable working order, producing acceptable quality oil. Photographs (slides) of these country stills were taken and will be available to UNIDO after processing in Europe. The drums used for shipment of citronella oil are conventional and tend to be drums which are cleaned and reconditioned.

III.1.2 Ocimum gratissimum

Small plantations of this botanical are dispersed all over the country. Its oil has been used by generations of Vietnamese as a popular pharmaceutical material.

Since 1965 more attention has been paid to this plant and its oil but at present availability remains small with dispersed production.

However, land and labour are available and a good number of distillation units are under utilized. Investigated due to a high eugenol content it is proposed to increase production considerably. One problem of technology is how to increase reasonably the heavy fraction content thereby improving the content of eugenol. The next step is to try and obtain the process enabling the conversion of Vanilline from the eugenol. (Annex XV). Some R & D efforts may have be focussed in this direction.

III.1.3 Mentha arvensis

Mint has been grown by the Vietnamese for many centuries and its distilled oil has been used in traditional medicine, in foodstuffs and in consumer goods production.

Early this century, the French introduced plantations and the distilled oil was despatched to France.

Over the last decades, cultivation and distillation have increased, for local consumption and for export. The quality is generally good and stable, the mentol content varying from 60 to 75 dependent on the production unit.

With an increase in local demand forecast, six provinces are to produce Mint oil as part of a Government five year plan (1986 - 1990) to make the country self sufficient and to increase the export earnings. (Annex XV).

III.1.4 Illicium verum Hook

Star Anise oil, or Essence de Badiane was produced in large quantities and exported mainly to France for the extraction of Anethol. This was used extensively in anis flavoured drinks such as the "apéritifs anisés" (Pernod, Ricard, etc.)

The tree is highly estimated for its value and grows naturally in the Northern mountains. For more than a century, the Vietnamese have not only safeguarded the existing Star Anise forests but have recognised the need to replant.

Areas of old trees stand side by side with the new plantations. The annual production (yield) is around 1 000 MT of fruit (star anise) of which 40 % is destined for distillation. Proper industrial processing has been applied since 1962.

A new factory capable of producing more than 100 MT of Star Anise oil per annum had been commissioned in 1974, in Lang Son in the Province of Ca Lang, but was subsequently destroyed during the Chinese invasion of 1979.

What could be saved was rehabilitated under difficult conditions and now produces 80 MT of good quality oil per annum. The equipment that has survived consists of stainless steel stills, condensers, separators and a centrifuge. The stills are connected to an independent steam generator and are being used to the best possible effect. The drums used for shipment were found to be new, 200 kg, galvanised (Annex VIII).

III.1.5 Pinus merkusii

The pine and other conifers are of local origin. Although the tree most often tapped has been identified as Pinus merkusii a big part of currently exploited coniferous woods may not be homogenous or industrially planned. Annual production reaches only 600 MT, of turpentine and below the capacity of the existing treatment units. Those units are modern and have a total capacity of about 1 500 MT per annum. Better and more homogenous quality will improve the future picture of exports.

However, young planned plantations are shortly to reach maturity, thus greatly improving the situation. The main products produced after steam distillation of the resin are the turpentine and the residue Rosin or Collophane.

III.1.6 Vetiverria zizanioides Stapf

The development of the cultivation of vetiver was stimulated by the intervention of the CNRS. In effect, in the Province of Thai Binh, (as elsewhere) where 19% of the arable land is sand, at an altitude of 1 m or 1.5 m above sea level (thus prohibiting the cultivation of food crop) Vetiver had been grown and exploited for many years at a local level for use as incense in the pagodas and as a fragrance for hair-rinses favoured by the female population.

However, the root was pulled up at 12 monthly intervals for these purposes, so the Consultant advised that for production of vetiver oil, the root system should be 24 months old, by which time it is possible to assess its quality in terms of color and oil content.

Although at a trial stage (2 year old roots should be available 12 months from now) the potential in the commune of Nam Thanh is 72 ha, with a possible planting in other communes to a total of 300 to 500 ha.

The first trials have yielded after 12 months 2,153 kg of dry roots per hectare (Annexes I and XIV).

III.1.7 Litsea cubeba

This botanical has been reported growing wild in different parts of the country, widely dispersed in the forest regions. The peasants gather the fruits and distill them for oil.

Known locally as Mang Tane oil, it has upon investigation proved to contain a good level of Citral

III.1.8 Cinamomum

Some speculation exists on the true nature of the cinnamon tree growing semi-wild in Viet Nam.

Hévail (the author the Consultant is quoting) considers both the Saigon and the cassia cinnamon to be vairieties of Cinnamomum obstusifolium Nees.

The Saigon Cinnamon tree is of medium height and originally native to China. Its bark is collected from semi-wild trees in the mountains of Annan. The bark or ground bark has long been used by the Vietnamese as spice and its oil used as flavouring or in traditional medicine. The small quantities distilled are used in the national pharmaceutical preparations. Cinnamon plantations have been stabilized for some years. The vietnamese cinnamon bark is well-known on the Asian market for its quality, recognized in the colour: amber, the aroma: rich cinnamic, and with a thick oleaginous component.

III.1.9 Ocimum basilicum

This very aromatic labiate, known locally as Hung Qué has shown consistent levels of 85% methyl-chavicol, sometimes even higher. A variety under investigation has shown a content of 70 % citral. Its history in Viet Nam goes back for many years and concentrated growth has been encouraged in certain localities for the distillation of the oil. Every year, 1.5 Metric Tons are distilled and exported (Annex XV).

III.1.10 Melaleuca leucodendron

The quality of Cajeput oil obtained is high in eucalyptol.

III.1.11 Pemou oil

Also known as Peu Mou oil, this has been exported in the past under the name of Bois de Siam and has a Serquiterpene of balsamic character and used to be identified as having 83/90 % siamol. The CNRS Research Laboratories involved in the investigation of the main constituents of essential oils are also actively engaged in the study of alkaloids of plants used in traditional medicine.

There are over 500 species of medicinal plants in Viet Nam with a well spread North/South distribution. Some panax, among them one indigenous - found at an altitude of 2,000 m - has aroused great interest. So far, Chemical screening for alkaloids and saponines has been done on 329 samples taken from 138 species belonging to 66 families.

The above information, as well as (Annex VII) are given in this study because it is not possible to leave them out of a study of essential oils and related natural products.

III.2 Quality Control

As will be seen from the Organization Chart, Annex III, quality control of all essential oils and related products depends upon the work of the quality control services of CNRS and the mandatory quality control of VIETINSPECT, sole organisation empowered to provide certification of authenticity.

Both the CNRS and VIETINSPECT have access to libraries containing the works of Gildemeister and Hoffmann; Ernest Gunther's six volumes on Essential Oils, the late Stefan Arctander's two volumes; as well as many scietific publications in German and Russian.

There are also considerable sources of information on the physical and chemical analyses standards set by COMECON; the German pharmacopoeia, the French and the British pharmacopoeiae, as well as some of the BSI - British Standards Institution - standards handed over by the Consultant directly to VIETINSPECT. The ISO standards have been recommended by the ITC project on quality control.

The BSI methods of test for essential oils (BS 2073:1976) are used in conjunction with the traditional parameters of Appearance, Odour (aroma) and flavour.

The Traditional Physical and Chemical parameters are respected and are now backed up by instrumental analysis, gas liquid chromatography, ultraviolet spectrometry and infrared spectroscopy. HPLC (High Performance Liquid Chromatography) is to be introduced for resinoids.

The operators at VIETINSPECT regularly carry out determinations of solubility, of the congealing point (when necessary) and the determination of esters, aldehydes and so on.

The oils from the production centres are closely monitored by VIETINSPECT and regular quality control missions take place. Once the bulking of the oil is cleared and passed by VIETINSPECT, the consignments proceed to the port of shipment where, for the sake of quality control and certification, the local inspection office may be required to carry out a further check.

The procedure covers pre-shipment inspection carried out at the factory or processing plant before the drums or other containers are sealed, when necessary:

statistical quality control is used to estimate the quality of the "whole" from the quality of the samples taken from the drums or the containers making up the whole shipment.

random sampling is also used and consists in taking samples from a determined number of containers, say 1 in 5 or 1 in 10 comparing the physical constants with the parameters laid down.

III.3 PRODUCTION METHODS

Apart from extraction work carried out at laboratory level on essential oil-bearing plants and on medicinal plants, within the CNRS, the principal production method is that of hydro or steam distillation, carried out in direct fired stills, using wood or spent material, or sometimes with the assistance of a separate steam generator.

1. Water distillation - direct heating
   Citronella oil, Basil oil, Mint oil, Ocimum gratissimum

2. Steam distillation (water vapour)
Litsea cubeba, Cinnamomum, Melaleuca

3. Steam distillation with separate steam generator
Anise oil, Pine resin, experiments on citronella.

III.3.1 Lang Son

Where the salvaged equipment consists of fou steel stills, each of 10001 capacity, loading between 200 and 250 kgs., each of ground Star Anise.

The equipment which needs to be completed by the addition of new centrifuges, pumps, separators ad a grinder (2000kgs per hour milling), as well as a dust extractor (4,000 kgs per hour) is proposed to be aided by bilateral agreements.

III.3.2 Bac Thai

The mild steel stil' used for the distillation of Citronell oil (1,500 1 capacity each) need renewing but could be replaced by stills manufactured in Hanoi under the guidance of the CNRS.

III.3.3 Bin Tri Thien

Where the distillation of Citronella is carried on under the supervision of UNIMEX, two distillation units are operating. The first unit, consisting of one ,500 1 still, is directly operatted by BITIMEX; the second unit, consisting of two 2,500 1 stills, is operatted by the cooperative under the guidance of BITIMEX. Here again, the equipment can be overhauled and/or replaced by units manufactured either locally in Huê or possibly Da Nang, also under the guidance of the CNRS Equipment Department.

III.4 QUANTITIES PRODUCED (ACTUAL AND FORECAST)

The marketing heading deals as accurately as possible with the accent on the export markets. Hereafter are set out the actual and forecast figures spanning the years 1973 to 1990.

The availability of land is such that productionplans for essential oil bearing plants refer to locations at Ha Tuyen, Salai Ken tum, Song Be, Bin Tri Thien, Dan Nang and baria, to name but a few, each having available for cultivation areas from 400 to 500 heactares. this follows the pattern of the 1986-1990 Five Year Plan.

The vast areas of the Red River Delta in the North and the Mekong Delta in the South vastly increase the agricultural potential.

III.5 INSTITUTIONAL STRUCTURE

III.5.1 Research and Development

Having direct access to the Council of Ministers, on a par with the Office of State and the State Committee, the national Scientific Research Centre (CNRS) is the scientific link to the Ministry of Foreign Trade with the prime objective of assisting in the development of the natural resources of Viet Nam.

It is therefore, within the CNRS that all technological development work is to take place, the CNRS having not only consultative functions, but those required for applied technology and quality control.

The quality control, based upon national standards set by the CNRS and VIETINSPECT - the Viet Nam Inspection and Testing Office (Annex X), runs through the regional centres right down to the country-wide production units and back up to the commercial agencies, which have direct links to VIETINSPECT for certification (Annex III).

The internal structure of the CNRS, as shown in the Organization Chart (Annex IV), has a Development Department directly accountable to the President of the CNRS, but with deliberate operational links with the Department of natural Resources, Department of Ecology, Department of Chemistry and the Institute of Chemistry for the purpose of the development of Chemical Technology.

However, the key department within the CNRS is the Development Department (Annex V) with its special R & D functions and its research and production, as well as its information links with all the other services, as well as with the University and the Polytechnic.

It is this special development activity of the CNRS that sets it aside as being the centre from which the extension of propagation and cultivation, as well as field distillation and technical innovation not only takes place, but is scheduled by the Government as the base of industrial investigation into the revalorisation of the natural resources of Viet Nam.

Of Special interest is the Equipment Centre where all the equipment maintenance and repair work is undertaken. It is staffed by East German trained electrical and mechanical engineers and is equipped not only to design and develop field stills, but to manufacture them.

Stills similar to those designed and constructed in Nepal have been manufactured locally and successfully used for the field distillation to manufacture them.

Stills similar to those designed and constructed in Nepal have been manufactured locally and successfully used for the field distillation of Citronella. The programme calls for the manufacture of 10 complete distribution units in 1986, comprising stills, condensers (florentine flasks).

The R & D work undertaken by the section dealing with the chemistry of natural substances has involved all the botanicals, from those plants bearing essential oil to those with active medicinal properties.

Of necessity, this work has so far been restricted to laboratory-scale only, but it is expected to reach pilot plant-scale within the next two to three years.

The consultant confirms that being completed within the next few months at CNRS is a large pilot plant building with a roof level over 7 m high, quite capable of housing a versatile distillation/extraction plant, as well as a fractional distillation unit with a 4.5 m column.

Essential Oils and Resins in the Provinces South of Hue

Cultivations

1. Citronella

Minimi a Xentum	100 ha	c. winterianus Jowitt
Dong-nai	200 ha	
Song-Be	100 ha	

(Note: to the North there is a further 300 ha at Ha-Tuyen)

2. Mint

Tien - Gian	100 ha	M. Arvensis

Forests

1. Pine

Lam-Dong( )	Thousans of ha 1 distillery 1,000 tons	P. Kharya
Doc-Lac (	1 distillery 800 tons	
Bin Tri Thien	Thousands of ha	P. mercusii

(Note: to the North, there are also thousanes of ha at Quang Ninh with a distillery of 1,000 tons).

2. Cinnamon

Quang Da	3,000 ha	Cinnamomum

(Note: to the North, there are thousands of ha at Thanh-Hoa and thousands at Hoang Lien Son).

3. Melaleuca

		M. Leucodendron
Minh Hai	Thousands of ha	
Dong Thap	Potential 100 tons 1 distillery 100 tons	

Plantations

4. Rubber

Dong nai		Hevea brasiliensis
Song Be	Thousands of ha	

III.5.2 Marketing

The internationally accepted essential oil and oleoresin networks, as charted in Annex XI, were discussed but cannot, in real terms, be applied to the existing trade pattern in Viet Nam.

In effect, under the general supervision of the Ministry of Foreign Trade, there are three organizations, independent in their own right, but dealing in the development of home and export sales of essential oils and natural products.

The organization Chart (Annex XII) shows the link between the commercial agencies: GENERALEXIM, NAFORIMEX and VINAFA and VIETINSPECT, specifically mentioned under Quality Control.

The merchandising, however, is shared between the three agencies, VINAFA, with its twenty factories preparing and selling pharmaceutical goods to the home market. Prominent among these are Cao Sao Vang, a "Golden Star Balm", Cao Ba Binh, an "Aromatic Balm" and Dentoxit, a Piper lolot tincture based on Ocimum gratissimum oil, chlorophyll and menthol. VINAFA have always made a number of medicinal preparations based on the traditional formulae using extracts of medicinal plants

The Agencies GENERALEXIM and NAFORIMEX have shared the export burden and have both been concerned with the export circuit and the price structure. However, it is the Government's intention to have only one export pathway for essential oils and plant extracts, and the organization chosen to centralise the operation is GENERALEXIM Hanoi (Annex XVI).

As there are no independent brokers and merchants in Viet Nam, the structure places the export network in the hands of GENERALEXIM, which uses the Vietnamese agencies appointed abroad to disseminate information and for the distribution of samples.

The following overseas agencies are responsible for the "feed-back" to the commercial agencies in Hanoi of all information and comments concerning the interest in and use of Vietnamese products abroad:-

Atennas abroad for marketing

1. Commercial section in Paris, 44 ave. de Madrid, 922200 NEUILLY S/SEINE
2. Commercial Section in London, 12-14 Victoria Rd., London W 8
3. Commercial Section in Bonn, Constantin Strasse 37 53000 Bonn
4. Commercial Section in Hong Kong, Golden Star Building, 20-24 Lockard Rd., H.K.
5. Commercial Section in Tokyo, Motoyoyogi-cho, Shibuya-ku, Tokyo 151.
6. Commercial Section in Piazza Barberini 12 00.187 Rome.
7. Commercial Section in Singapore, 10 Leedon Park, Singapore 1026.
8. Commercial Section in Sweden Sjostigen 26 14.172 Huddinge.

The feed-back obtained by GENERALALEXIM is collated and the impulse passed on via foreign trade to the CNRS for comment. In the case of products already ear-marked for sale abroad, the impulse goes from GENERALEXIM down to the KCS production units through the administrative services in the provinces and the local operatives in the communes (Annex III).

In recent years, the production of Vietnamese essential oils has been modest, local requirements beng 10% to 30% of the quantity produced. the export figure accounts for the remainder and is in response to contractual obligations for delivery of goods stipulated in the government bilateral annual agreements.

The availability of Vietnamese essential oils to the main world markets and consumers in France, Great Britain, the Federal REpublic of Germany, Japan and Italy... is far from reaching market requirements.

At present, the country is striving to improve the quality and to increase production of the essential oils of Citronella, Mint and Ocimum gratissimum as a first step to improving the hard currency earning capability of the industry.

Once an essential oil has received approval and certification from VIETINSPECT the marketing team of GENERALEXIM take over, headed by Mr. Vo Co, Deputy-Director-General directly in charge of essential oil promotion, who has at his disposal a support organization consisting of 26 people in four departments, as well as the corresponding Government agency contacts, which make up the overseas "antennae" , 16 people residing in and covering France, Italy, FRG, Great Britain and Japan.

The pricing pattern is ot clearly discernible in that it does not conform to the price structure as understood on competitive markets. GENERALEXIM has kindly provided the following information on sales.

III.6 MANPOWER RESOURCES

The manpower resources are of two kinds, those required at organizational and laboratory level for development work and quality control and those required to manage and participate in the work of the country-wide production units.

The CNRS provides a good example of the academic levels attained by scientific study and work abroad (Annex XVII).

Nearly all, if not all, of the Ph.D's and graduates have obtained their scientific qualifications in Eastern Bloc countries, in those institutions which have specialized in the study of raw materiazls orf botanic origin. Among them are:

Institut de Médecine Traditioneelle, Faculté de Pharmacie	Halle
Institut de Biochimie Végétale	Halle
Centre Phyto-Chimique de Sophia	Sophia
Institut de Chimie Organique et de Biochimie	Prague
Institut de Phyto-chimie	Tashkent

Post-graduate fellowships have been obtained for further study in the USSR and the: Institut de Chimie des Substances naturelles, 91160 Gif-sur-Yvette, France.

OIL EXPORT PRICE LIST

COMMODITIES	YEAR	BASIS	SELLING Price FF	US$ EQUIVALENT 1985	1986
1. Menthol oil					
menthol 68%	1986	CIF Airpt. Paris,	150-160	15/16	19/20
		CIF Marseille	120	12	15
2. Basil oil -					
Methyl Chavicol 85%	1985	CIF Marseille	320-330	32/33	40/41
		CIF Air.Paris	350-360	35/36	44/45
3. Litsea Cubeba					
Citral 60%	1985	CIF Marseille	40	4	5
4. Citronnella oil					
35/85	1984	CIF Marseille	31	3.10	4
5. Anise oil					
Freezing pt.18°C	1984	CIF Marseille	110-115	11/11.5	13.5/14
6. Gum Rosin	1985	CIF Kobe	DM930/MT	-	-

At the time of sale, these prices were slightly higher than the average market prices, thus indicating some consumer preferences.

The CNRS, in three Research Departments today shows the following level of staffing:

Biologically active substances

The Head is a professor of biology, assisted by three Ph.D's, four graduates, as well as laboratory technicians.

Organic synthesis

Headed by a Ph.D, the back up is ten graduates in organic chemistry. as well as technicians.

Essential Oils

Headed by a Ph.D., Dr. Chin, the back up consists of nine graduates in chemistry and two technical assistants.

The small pilot plant that is in operation is controled by a director (A Ph.D), two assistant directors and ten graduates, as well as numerous technicians.

The manpower situation in the field comes under the jurisdiction of the provincial administration and the administration of the commune where the KCS production units are in operation.

From observation, the Consultant is satisfied that there is no shortage of labour and that the control of the field force is well maintained by local managers trained for the purpose.

IV CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

Following all the discussions in which the consultant participatyed involving not only the CNRS but GENEREXIM and VIETINSPECT, it would appear that in effect of the three agencies NAFORIMEX, VINAFA and AGENERALEXIM, the latter one has prime responsibility for the marketing overseas of Vietnamese essential oils and related natural products.

The feed-back on product requirements abroad and on product acceptance appear to be concentrated at GENERALEXIM for the Ministry of Foreign Trade.

In terms of quality control, the three agencies are subject to VIETINSPECT so there remains to consider the R & D aspect of the Government plant. The National Centre for Scientific Research has been designated as the point from which development of technology and agro-industrial assistance to producers should begin.

There are, however, two distinct UNDP projects operating in Viet Nam:

Project VIE/82/008, run by the ITC/UNCTAD/GATT on behalf of the UNDP to establish quality control of essential and resinous oils by assistance to VIETINSPECT.

Project VIE/80/032/K/01/37, run by UNIDO on behalf of the UNDP to upgrade the infrastructure and strengthen the R & D capabilities of the Institute of Materia Medica so as to produce modern drugs from plant raw material.

Between these two objectives, the Consultant believes there is the necessity of a project dealing specifically with assistance in the field on the technology of hydro-distillation and assistance at the R & D level in establishing a small pilot plant (say 250 Kgs capacity) for distillation and extraction at CNRS, together with adequate fractionating equipment.

Furthermore, in view of the rather weighty and complex negotiating circuits followed in the commercialization of Viet Nam's natural resources, the consultant believes that immediate assistance should be provided under the heading MARKETING to assist the commercial agencies and the Planning Office of Foreign Trade, working closely with the provincial production units, to formulate practical policies governing promotion and sales and to ensure proper follow up and communicating with the consuming centres outside Viet Nam through the means of feed-back information.

8. Recommendations

By the very nature of the feasibility study the recommendations must cover the MARKETING as well as the TECHNOLOGICAL aspects of any future project assisting in the development of Vietnamese essential oils and related Natural Products.

In Marketing terms, an effective sale is the proper end of the long economic process which begins with the Government investment in agricultural development and the transformation of indigenous raw materials into goods or entities, by sale abroad, can contribute strongly to the acquisition of foreign currency.

The recommendations that follow are in fact also based on the parameters of quality and continuity of supply which must be observed to meet World Market conditions.

1. The promotional and general Marketing activity of GENERALEXIM must be strengthened by means of study tours abroad for executives of Generalexim, or by the expertise which can be provided by an International Consultant dealing primarily in essential oils and natural products.

2. GENERALEXIM to be assisted in setting up all the necessary office procedures to transmit overseas as rapidly as possible all the available market and price information concerning Vietnamese raw materials.

3. GENERALEXIM to be assisted in the development of the "Know-How" of obtaining "feed-Back" from the main world-wide consuming centres either by direct links or by means of the Vietnames Agencies abroad.

4. The link between FOREIGN TRADE, GENERALEXIM, the CNRS and VIETINSPECT to be established on a regular basis to ensure the sharing of information.

5. The production link between GENERALEXIM, the CNRS and the KCS (field production units) to be strengthened by direct field technology inputs passed on through the CNRS. For this purpose selected CNRS Executives will be trained further by means of study tours or Fellowships to meet actual field conditions of primary distillation and encounter all the relevant problems.

6. The Chemists and Technologists of the CNRS to be trained selectiely by means of fellowships in the techniqeus of fractionation, of terpene chemistry, of organic semi-synthesis and synthesis and the current use of intrumental analysis.

7. The UNDP, through UNIDO, will supply the means of carrying out the Study Tours and the Fellowship programmes.

8. The UNDP/UNIDO will be required to supply basic field equipment for demonstration purposes primarily concerned with distillation of material of botanic origin.

9. The UNDP/UNIDO will be required to supply adeuate equipment for process demonstration and development to a practical level to be installed in the premises prepared by the CNRS.

10. The UNDP/UNIDO will also be required to supply whatever field vehicles and other forms of transport may be required to ensure regular and sustained control of field operations.

ANNEX I

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

DP/VIE/84/010/11-05/32.1.D
Project in the Government of Viet Nam

JOB DESCRIPTION

Post title	Expert in marketing of essential oils
Duration	Two man/months (2m/m)
Date required	early 1987
Duty station	Hanoi, with internal travel
Purpose of project	Processing of Vietnamese essential oils and related natural products.
Duties	The expert will function as part of a five-man team assisting the National Center for Scientific Research in the Socialist Republic of Viet Nam in the development of its resources of raw materials of botanic origin. He will be responsible to the Chief Technical Adviser for developing the marketing link between Foreign Trade and the CNRS, through the Viet Nam National General Export-Import Corporation (GENERALEXIM) which corporation operates the export pathway for essential oils and plant extracts by means of Government Agencies operating abroad. He will give lectures and conduct seminars where appropriate and participate in the "in-training" programme. The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further action which might be taken.

Qualifications	A marketing expert with up-to-date knowledge of the sale and distribution of essential oils, and related natural products on world markets. A knowledge of trading practices and quality assessment an added qualification.
Language	English and French
Background information	In Viet Nam, there are traditional plantations of star Anise, Citronella, Mint, Vetiver, Pepper and Ginger as well as production centres of Pine resin and related natural products. these resources are not fully utilized due to a certain weakness in the industrial means available for distillation and extraction. The Government has appointed the National Centre for Scientific Research to carry out all the technological development work and to apply the new technology which the project is required to make available. The long term objective of the project is to improve and increase the level of rural development and by exporting selected products obtained from raw materials of botanic origin to contribute to the National earnings of foreign exchange and hard currency.

ANNEX II

PERSONS AND INSTITUTIONS CONTACTED

National Centre for Scientific Research

Prof. NGUYEN VAN HIEU	President of the NCSR Member of the coundil of Ministers
Prof. HO SI THOANG	Vice president, Head Chemistry
Ing. LE VAN THU	Development, Head Economy
Dr. NGUYEN HUU KHOI	Development, Head Research
Dr. PHAM QUANG HANH	Geobotany
Ing. PHAN PHU BONG	Geobotany
Ing. NGUYEN VAN YEN	Geobotany
Dr. DANG HUY HUYNH	Ecology
Dr. LA DINH MOI	Ecology
Ing. NGUYEN VAN KHANG	Ecology
Dr. HOANG VAN PHIET	Chemistry
Dr. PHAM HOANG NGOC	Chemistry
Dr. NGUYEN QUEYET CHIEN	Chemistry
Dr. MAI VAN TRI	Chemistry
Dr. NGUYEN VAN NGUYEN	Chemical Technology
Dr. DANG XUAN HAO	Chemical Technology
Ing. NGUYEN VAN DON	Equipment, Head Engineering

Office of the Minister Council

Mr. VU TAT DOI	Economic Council Foreign Relations

GENERALEXIM

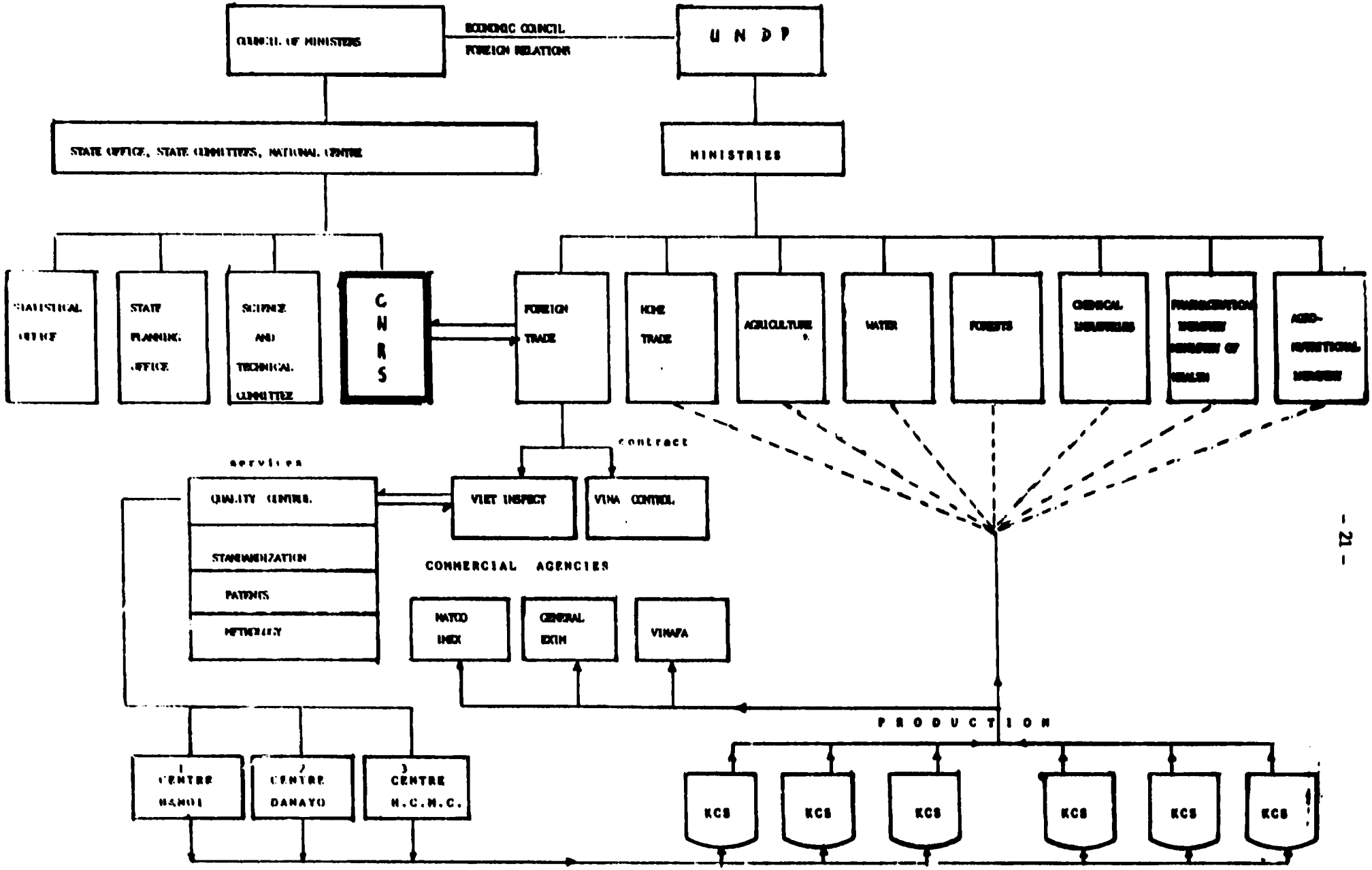
Ing. VO CO	Deputy-Director-General
Ing. LUU QUANG NGOC	Head Planning

Province of Thai Binh

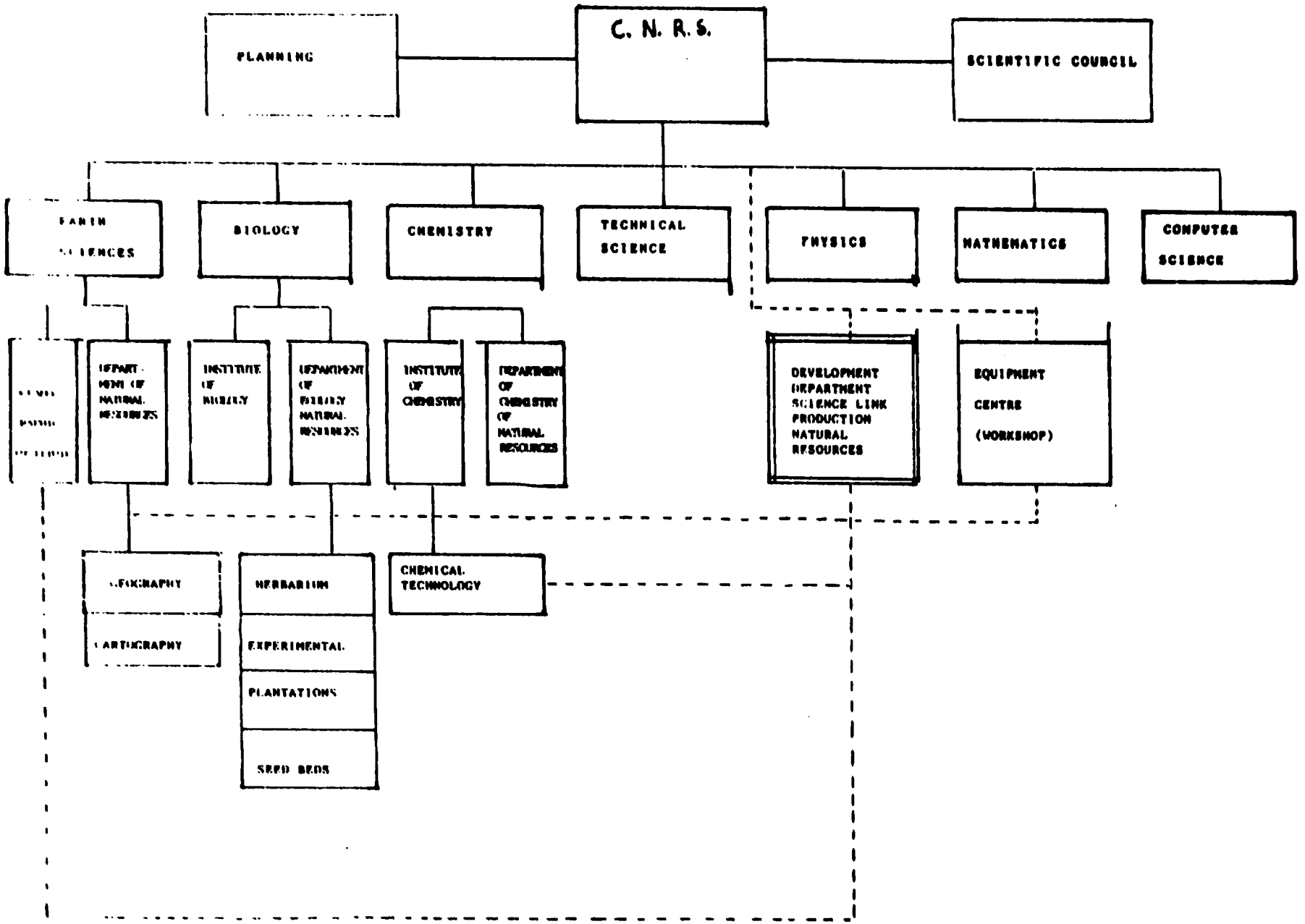
Mr. TRAN CONG TUYNH	Vice-President, Province Committee
Mr. NGUYEN VAN THANH	UNIMEX Thai Binh

Province of Binh Tri Thien

Mr. TRAN SU	Vice-President, Province Committee
Mr. PHAN DINH CHI	BITIMEX Binh Tri Thien


COUNCIL OF MINISTERS
ECONOMIC COUNCIL
FOREIGN RELATION
U N D P
STATE OFFICE, STATE COMMITTEES, NATIONAL CENTRE
MINISTRIES
STATISTICAL OFFICE
STATE PLANNING OFFICE
SCIENCE AND TECHNICAL COMMITTEE
C N R S
FOREIGN TRADE
HOME TRADE
AGRICULTURE
WATER
FORESTS
CHEMICAL INDUSTRIES
AGRO-FOOD INDUSTRY
services
contract
QUALITY CENTRES
STANDARDIZATION
PATENTS
METROLOGY
VIET INSPECT
VINA CONTROL
COMMERCIAL AGENCIES
MATCO IMEX
GENERAL EXIM
VINAFA
PRODUCTION
1 CENTRE HANOI
2 CENTRE DANANG
3 CENTRE H.C.M.C.
KCS
KCS
KCS
KCS
KCS
KCS

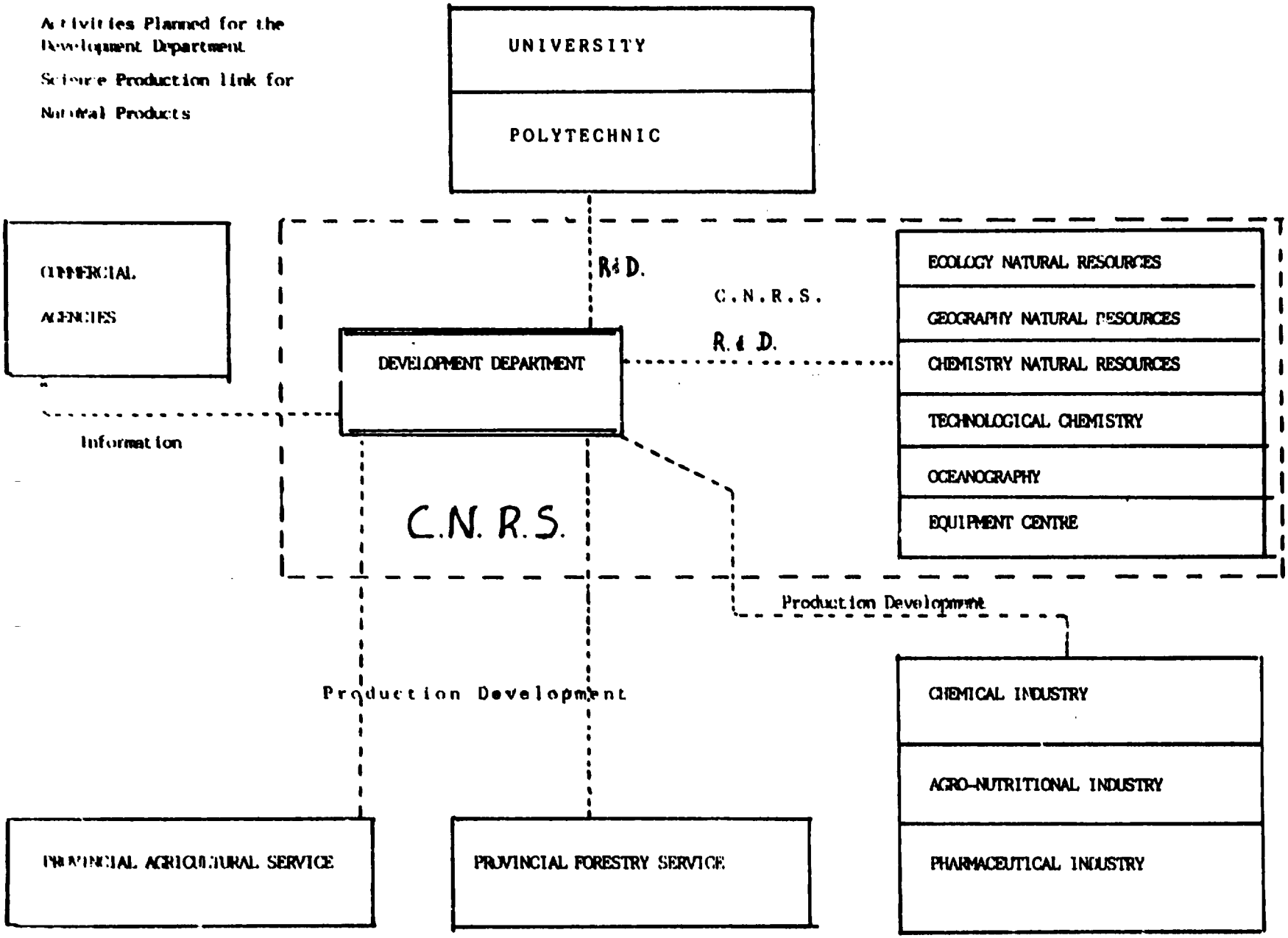
ORGANOGRAM POSITIONING OF THE DEVELOPMENT DEPARTMENT WITHIN THE C.N.R.S. ANNEX IV



ORGANIGRAM

Activities Planned for the Development Department

Science Production link for Natural Products



ANNEX VI

	EXPLOITED IN THE PAST	AVAILAB. WILD	CULT	USE	MARKETS LOCAL	MARKETS EXP.
1. Acacia Farnesiana	X	X				
2. Ageratum Conyzoides		X				
3. Aglaia Odorata			X	(Incense)	X	X
4. Aglaia Odoratissiumum		X	(Incense)		X	X
5. Allium Fistufosum			XX	Cooking	X	
6. Allium Odorum			X	Cooking	X	
7. Alpinia Sativum			XX	Cooking	X	
8. Alpinia Galanga			X	Cooking	X	
9. Alpiana Nutans		X		Cooking	X	
10. Alpinia Officinarum			X	Cooking	X	
11. Amomum Repens		X		Medicinal Plants	X	
12." Thyrsoideum		X		S/D	X	
13." Villosum			X	S/D	X	
14. Apium Graveleons			X	Cooking	X	
15. Aquilaria Agallocha		X		Resin		X
16. Arabotrys Ioneinatus		X	Med for flowers	X		
17. Artemisia Annua			X		X	
18. Artemisia Vulgaris			X	Anti-malarials	X	
19. Backea Fratiscens	X	X		S/D Medicinal	X	
20. Benzoin Resin (styrax tankinemsis)	X	X		Gum	X	X
21. Blumea Balsamifera	X	X		S/D Medicinal	X	
22. Cananga Odorata	X		X	flowers	X	
23. Canarium Album	X	X		S/D	X	
24. Cestrum Nocturnum			X	flowers	X	
25. Chenopodium Ambrosoides	X	X	X	S/D	X	
26. Chlorantus Spicatus		X		flowers	X	
27. Cinnamomum Camphora	X	X		S/D medicinal	X	
28. Cinnamomum Cassia	X	X	XX	S/D also medication	X	X
29. Cinnamomum Obtusofolium	X	X		S/D	X	X
30. Cinnamomum Zeylanicum	X	X	XX	S/D	X	X
31. Citrus Aurantium			XX	S/P fruit	X	
32. Citrus Deliciosa			XX	Peel fruit	X	
33. Citrus Limon			XX	for	X	
34. Citrus Maxinia			XX	soap	X	
35. Citrus Sinesis			XX	soap	X	
36. Coleus Aromaticus			X	medicinal	X	
37. Coriandrum Sativum			X	S/D	X	X
38. Cupressus Torulosa	X		X	S/D	X	
39. Curcuma Longa		X	XX	Spice	X	

	EXPLOITED IN THE PAST	AVAILAB. WILD	CULT	USE	MARKETS LOCAL	EXP.
40.Cymbopogon Citratus		X		S/D	X	
41.Cymbopogon coloratus		X		S/D	X	
42.Cymbopogon Martini		X		S/D	X	
43.Cymbopogon Nardus		X		S/D	X	
44.Cymbopogon Winterianus	X	X	XX	S/D	X	
45.Cyperus Rotundus	X	X		medicine for Plant	X	
46.Dianella Ensifolia			X	flower	X	
47.Dipterocarpus Alatus		X				
48.Dipterocaupus Odorata		X				
49.Elscholtzia Cristata			X			
50.Eucalyptus Citriodora	X		X	S/D	X	
51.Eucalyptus Citriodora	X	X		S/D	X	
52.Eucalyptus Robusta			X	S/D		
53.Eucalyptus Rostrata			X	S/D		
54.Eupatorium Odovatum	X	X				
55.Eupatorium Siaechadosmum	X	X				
56.Fokienia Gadyinsu	X	X	X	wood & root	X	X
57.Fortunella Japonica			X	ornamental	X	
58.Gurjun Balsam (Dyptocarpus Alatus)	X	X		S/D	X	X
59.Homalamera Aromatica	X	X	X	medicinal	X	
60.Illicium Griffithic			X		X	
61.Illicium verum Hook	X	X	XX	S/D	X	X
62.Jasminium Sambac			X	flower	X	
63.Kaempferia Galanga		X		root med.	X	
64.Litsea Cubeba	X	X		S/D	X	
65.Melaleuca Leucade-Mdron	X	X		S/D	X	
66.Mentha Arvensis		X	XX	S/D	X	X
67.Mentha Aquatica			X	Spice	X	
68.Mentha Crispa			X	Spice	X	
69.Michelia Alba	X		X	flower	X	
70.Michelia Champaca	X		X	flower	X	X
71.Myristica Fragans		X	X	medicinal	X	
72.Nelumbo Nucifera			X	flower & fruit med.	X	
73.Ocimum Basilicum		X	X	S/D	X	X
74.Ocimum Gratissimum			XX	S/D	X	X
75.Ocimum Sanctum			X		X	
76.Osmanthus Fragrans		X		Ornamental & tea flower	X	
77.Perilla Ocimoides			X	vegetable	X	
78.Pinus Khasya	X	X	XX	S/D	X	X
79.Pinus Merkusic	X	X	XX	Resin S/D	X	X
80.Piper Betle			X	Spice	X	
81.Piper Nigrium			XX	Spice	X	
82.Pogostemon Cablin	X	X		investigation		

	EXPLOITED IN THE PAST	AVAILAB. WILD	CULT	USE	MARKETS LOCAL	EXP.
83. Polianthes Tuberosa			X	investigation		
84. Polygonum Odoratum			X	spice & medicinal	X	
85. Santaluni Album		X		spice & medicinal		
86. Storax (Liquidambar Formosana)	X	X	X	S/D	X	
87. Vetiveria Zizanoides	X	X	XX	expensive	X	X
88. Zanthoxylu Aviceniae		X				
89. Zanthoxylum Nitidum		X				
90. Zingiber Officinals	X		X	raw material	X	

ANNEX VII

LIST OF MEDICINAL PLANTS IN VIET NAM

1. Choerospondias axillaris (Roxb) Burtt et Hill	Anacardoaceae	Tree	BarK
2. Alstonia Scholaris (L) R.Br	Apocynaceae	Tree	Bark
3. Catheranthus roseus (L) G. Don	- " -	Herb	Bulb
4. Holarrhena antidysenterica Wall ex A.De	- " -	Tree	Bark
5. Rauwolfia cambodians pierre Bagae	- " -	Thieket	Root
6. Strophantus divaticatus (lour) Hook et Arn	- " -	- " -	flower
7. Acorus Calamis L.	Araceae	Herb	Root
8. Acorus graminous Boland	- " -	Herb	Root
9. Hotakomena aromatica Schott	- " -	Herb	Root
10. Pistia Stratiotes L.	- " -	Herb	Leaf
11. Typhonium divaticatum (L) Deone	- " -	Herb	Root
12. Typhonium trilobatum Schott	- " -	Herb	Root
13. Acanthopanax trifoliatus (L) Merr	Araliaceae	Thieket	Bark
14. Panax pseudo - genseng Wall	- " -	Herb	Root
15. Polysctas fruticosa (L) Harms	- " -	Herb	Root
16. Schefflera octophylla (Lour) Harms	- " -	Tree	Bark
17. Telosma cordata (Busmf.) Merr	Asclepiadaceae	Thieket	Bark
18. Asparagus cohichinensis (Lour) Merr	Asparagaceae	Herb	Root
19. Artemisia Vulgaris L.	Asteraceae	Herb	Leaf
20. Pluchea pteropoda Hemsl	- " -	Thieket	Leaf
21. Siegesbeckia orientalis Mak	- " -	Herb	Bulb
22. Kanthium strumarium L.	- " -	Herb	Fruit
23. Gossampinus malabarica (D.C) Merr	Bombaceae	Tree	Bark
24. Codonopsis Javanica Blume	Campamulaceae	Herb	Root
25. Linocera japonica Thunb	Caprifoliaceae	Thieket	Seed
26. Euonynuis chinensis Lindl	Celastraceae	Thieket	seed
27. Euonyuius javanicus pierre	- " -	Thieket	Bark
28. Chenopodium ambrosioides L.	Chenopodiaceae	Herb	Leaf
29. Quisqualis indica I.	Combretaceae	Thieket	Flower
30. Terminalia chebula Retz	- " -	Tree	Bark
31. Onious japonicus D.C.	conipositae	Herb	Root
32. Kalipta alba Hasak	- " -	Herb	Leaf
33. Wedelia calendulaceae Less	- " -	Herb	Leaf
34. Thuja orientalis L.	Cypresaceae	Tree	Leaf
35. Cyperus rotundus L.	Cyperaceae	Herb	Root

36. Cibotium baromotz (L) J. Sm	Dickasoniaceae	Thieket	Trunk
37. Dipsacus japonicus Miq	Dipsacaceae	Herb	Root
38. Discorea persimilis prain et Burk	Discoreaceae	Thieket	Root
39. Dracaena cambodiana gagnop	Dracaenaceae	Thieket	Trunk
40. Desmodium triangulare (Retz) Morr	Fabaceae	Thieket	Leaf
41. Leucaena leucocephala (lank)Desit	- " -	Tree	flower
42. Milletin reticulata benth	- " -	Thieket	Trunk
43. Coix lachryma - Jobi L.	Graminae	Herb	flower
44. Coleus aromatious Benth	Labiatae	Herb	leaf
45. Leonurus heterophyllys S.W.	- " -	Herb	Bulb
46. Cinnamomum iners Reins	Lauraceae	Tree	Bark
47. Cinnamomum loureirii Nees	- " -	Tree	Bark
48. Litsea glutinosa C.B. Rob	- " -	Tree	Bark
49. Allium odorum L.	Liliaceae	Herb	Bulb
50. Polygonatum kingianum coll et Hemsl	- " -	Herb	Root
51. Smilax glabra Roxb	- " -	Thieket	Trunk
52. Strychnos toxifera	Loganiaceae	Tree	flower
53. Strychnos nux - vomica L.	- " -	Tree	Flower
54. Hibiscus sagittifolius kurz	Malvaceae	Herb	Root
55. Coscinium fenestratum (goortn) Colebr	menispermecece	Thieket	Trunk
56. Fibraurea tinctoria Lour	- " -	Thieket	Root
57. Stephania rotunda Lour	- " -	Hert	Root
58. Myrietica Fragrans Houtt	Myristicacene	Tres	Fruit
59. Baecksa frutescens L.	Myrtaceae	Thieket	Leaf
60. Clelistocalyx opreculatus (Roxb) Merr ot Perry.	- " -	Tres	Leaf
61. Kalaleuca leucadendra L.f	- " -	Thieket	Leaf
62. Rhodomyrtus tomentosa (Ait) Hassk	- " -	Thieket	Leaf
63. Nelumbo nucifera gacrtn	Nelumbonaoeae	Herb	Flower
64. Boerhaavia repens L.	Nyotaginaceae	Herb	Root
65. Papaver somniferum L.	Papaveraceae	Herb	Fruit
66. Erythrina indica Lamk	Papilionaceae	Tree	Barkle
67. Sophora japonica L.	- " -	Tree	Seed
68. Cassia fora L.	Passifloraceae	Herb	flower
69. Passiflora foetida L.	- " -	Herb	flower
70. Polygonum multiflorum Thumb	Polygonaceae	Herb	Root

71. Zizyphus jujuba Lamk	Rhamnaceae	Tree	Flower
72. Docynica indica (Wall) Decne	Decaceae	Tree	Fruit
73. Mallus doumeri (Boiss) A. Chev	- " -	Tree	Fruit
74. Rosa isevigata Michx	Rosaceae	Thieket	Fruit
75. Gardenin jasminicides Ellis	Rubiaceae	Thieket	Fruit
76. Morinda officinalis How	- " -	Herb	Root
77. Morinda citrifolia L.	- " -	Tree	Root
78. Oldenlandia capitellata O. Ktze	- " -	Herb	Bulb
79. Citrus deliciosa Tenore	Rutaceae	Tree	Fruit
80. Euphoria longana Lamk	Sapindaceae	Tree	Fruit
81. Adenosma gletinosum Druce	Scrophulariaceae	Herb	Bulb
82. Adenosma indianum (Lour) Merr	- " -	Herb	Bulb
83. Serophularia buorgoriana Hiq	- " -	Herb	Root
84. Bruceae Javanica (L) Merr	Simaroubaceae	Thieket	Flower
85. Datura metel L.	Solanaceae	Herb	Leaf
86. Stemona tubercea Lour	Stemonaceae	Thieket	Root
87. Clerodendron fragrans Veut	Verbenaceae	Herb	Leaf root
88. Yitex trifolia L.	- " -	Thieket	Flower
89. Alpinia officinarum Hance	Zingiberaceae	Herb	Root
90. Amomum xanthioides	- " -	Herb	Flower
91. Cuscuma zedoaria Rose	- " -	Herb	Root
92. Kaempferia galanga L.	- " -	Herb	Root
93. Zingeber officinala Rose	- " -	Herb	Root

ANNEX VIII

PROFILE OF OIL OF STAR ANISE

Distilled from the fruit of Illicium verum Hook. The oil is also known as Essence de Badiane, or Essence d'anis etoile. The principal constituent is Anethol.

Production areas are in China and in Viet Nam. Most of the fresh (green) fruit is used by the natives for distillation of the essential oil but under control conditions selection of the fruit may be specified.

Planting and Cultivating

Seed is collected from older trees known for their high yield of fruit. The seed is removed from the fruit and should be brown in colour as this denotes maturity.

Yield: 1kg of fruit yields + 1000 seeds suitable for planting.

After stratification the seeds are planted 3 to 4 cms apart in a well protected bed. As the seed loses its germinating power rapidly, it must be planted within three days after the harvest.
Seedsbeds are started usually in October or November.

When the young plants develop the 4th leaf, they are transferred to a nursery and planted abut 25 cms. apart, and there they remain for three years, and if strong enough they are planted out, 5 to 6 m apart.

Fertilisation

On a plantation, every tree should receive at the beginning of summer about 7 kgs of stable dung (manure) and 45 kgs of ammonium sulfate.

For maximum oil content, the star anise fruit should be gathered before complete maturity.

Yield of fruit

A star anise planting comes into production when about 10 (Ten) years old.

- The first harvest is small: 0.5 kg to 1 kg per tree
- at year 15 the harvest yields: up to 20 kgs per tree
- at year 20 the harvest yields: + 30 kgs per tree

The life span of the tree is from 80 to 100 years, sometimes more. Productivity can vary greatly.

Drying

The fruit is exposed to the sun, in flat baskets for about 10 days 100 kgs fresh fruit yields 25-30 kgs dried fruit.

Distillation

The fruit, partially ground, can be distilled in stainless steel or mild steel vessels and equipment but steel is preferable as the mild steel products a darker coloured oil. A still may be heated either directly be open fire or by steam produced in a separate generator.

Yields of oil (generally recognised)

100 kgs fresh fruit distilled for 48 hrs yields 2.5/3 kgs
100 kgs dried fruit distilled for 60 hrs yields 8.0/9.0 kgs.

High quality oil

High quality oil can be obtained by rectification of the native supply. The quality of star anise oil, like that of anis oil can be evaluated by its congealing point.

Congealing point	Quality
18	Best
17	Very good
16	Good
15	lowest limit acceptable
below 15	Not acceptable

Star Anise oil is a well=known and much appreciated source of natural Anethol.

ANNEX IX

PROFILE OF VETIVER OIL

Vetiver oil is obtained by distilling the roots of Vetiverria zizanioides Stapt - (Andropogon muricatus Retz), belongong to the Graminaceae family.

Soil:

It grows spontaneously in tropical or sub-tropical countries where the climate is ot and moist. Poor soil yields very little oil.

Roots:

The roots are highly scented and the oil derived from older root is usually darker in colour than oil derived from the younger root. A good quality root has a slightly reddish-brown colour. Light or whitish root contains very little oil. Best material is obtained from 2 years old root.

Cutting:

Once drawn from the soil, the root material is prepared for distillation. An important point is the length of root material. Preferably it should be about 2.5 cms. long.

Distillation:

This is preferably water and steam, however, simple country stills can suffice although distillation time can be as long as 36 to 48 hours. When it is possible to effect, COHOBATION is to be preferred,

Yield:

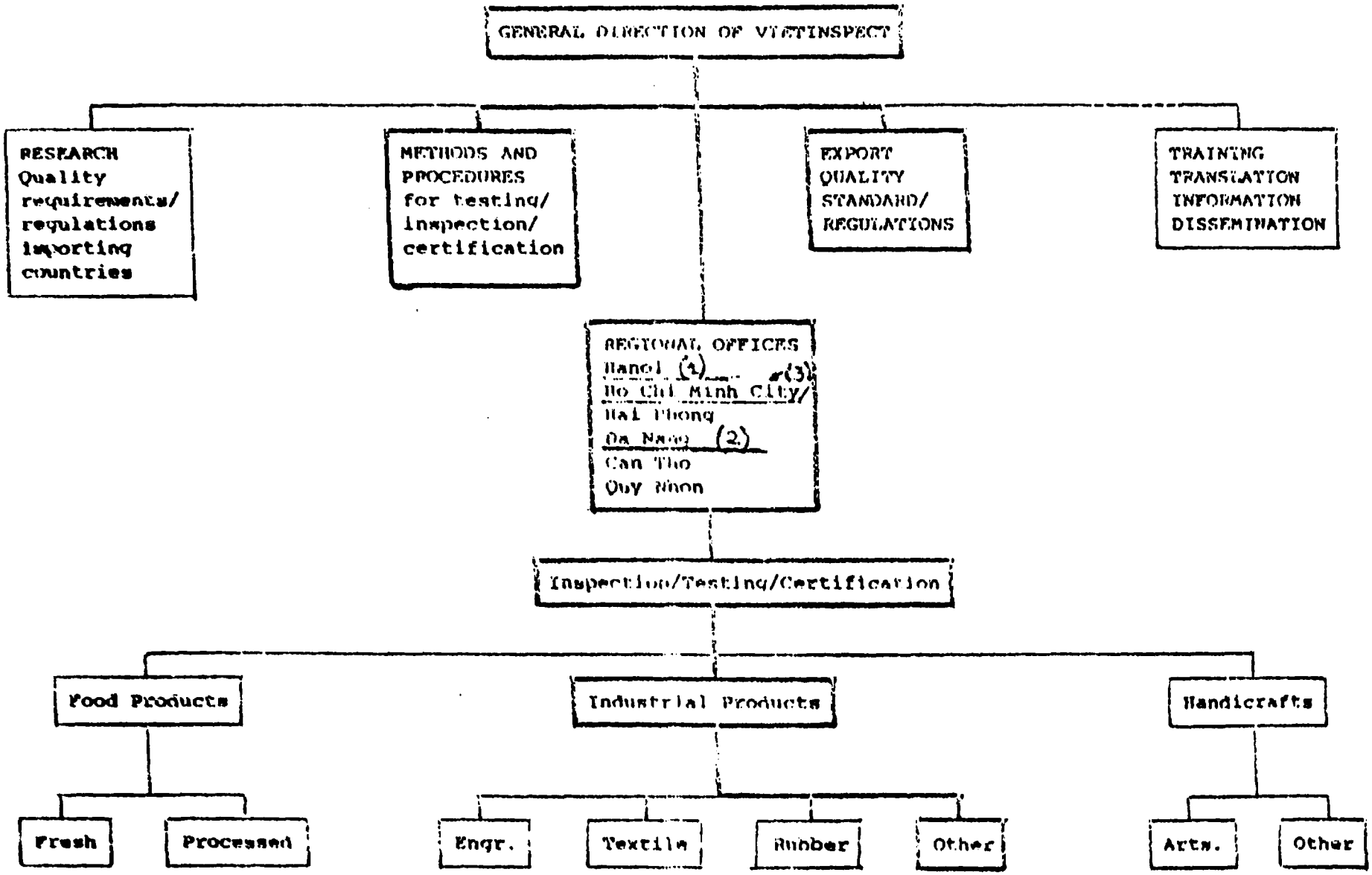
The dried roots of vetiver "Java" give a yield varying from 1.2 to 2.0% rarely 3.0%.

the normal production unit is 3000 litres with a material load of 500/600 kgs. Whenever possible, a centrifuge should be used to fire the oil of water.

A particularity of the oil is that it has a portion lighter than water and a portion heavier than Water. The two fractions must be separated out and blended to form a whole.

The BSI standard gives the analytical specification and the BS 2073, the method of testing the oil. Sampling quantities are also mentioned, so is the relevant packaging which varies from small drums of 50 to a larger 100 kgs. Contracts are usually placed for 200 or 300 kg lots.

As published information suggests a reasonable yield of material as being 2000 kgs of roots per hectare, which, on the basis of a yield in oil of 1.2%, would mean planning for a production of something in the region of 10,000 to 20,000 kgs of roots, in other words about 5 to 10 hectares of arable land. Quality control is based on the constituent Vetyverol and the odour and colour of the oil.


GENERAL DIRECTION OF VITTINSPECT
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Quality
requirements/
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METHODS AND
PROCEDURES
for testing/
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EXPORT
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REGULATIONS
TRAINING
TRANSLATION
INFORMATION
DISSEMINATION
REGIONAL OFFICES
Hanoi (1)
(3)
Ho Chi Minh City/
Hai Phong
Da Nang (2)
Can Tho
Quy Nhon
Inspection/Testing/Certification
Food Products
Industrial Products
Handicrafts
Fresh
Processed
Engr.
Textile
Rubber
Other
Arts.
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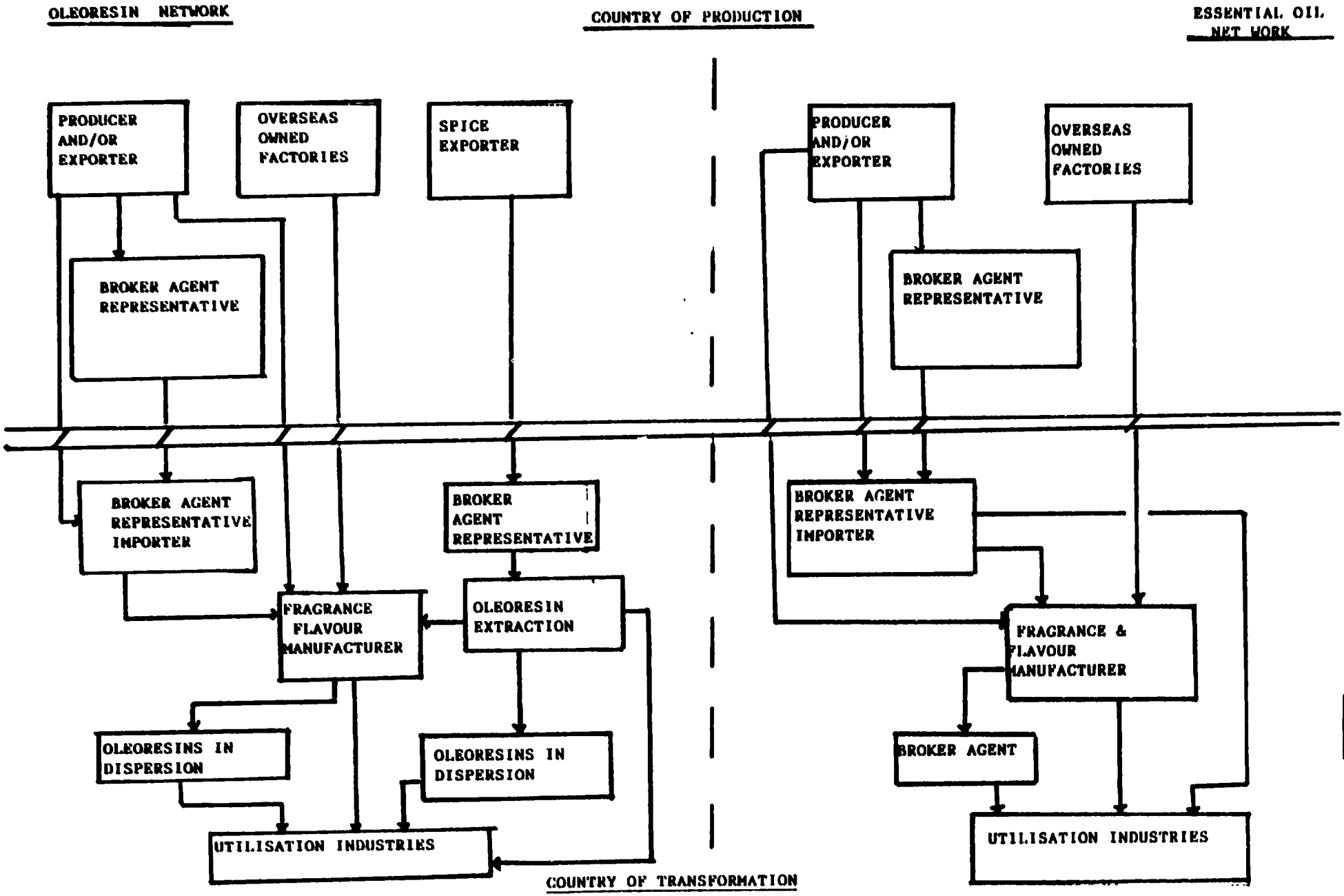
OLEORESIN NETWORK
COUNTRY OF PRODUCTION
ESSENTIAL OIL NET WORK
PRODUCER AND/OR EXPORTER
OVERSEAS OWNED FACTORIES
SPICE EXPORTER
PRODUCER AND/OR EXPORTER
OVERSEAS OWNED FACTORIES
BROKER AGENT REPRESENTATIVE
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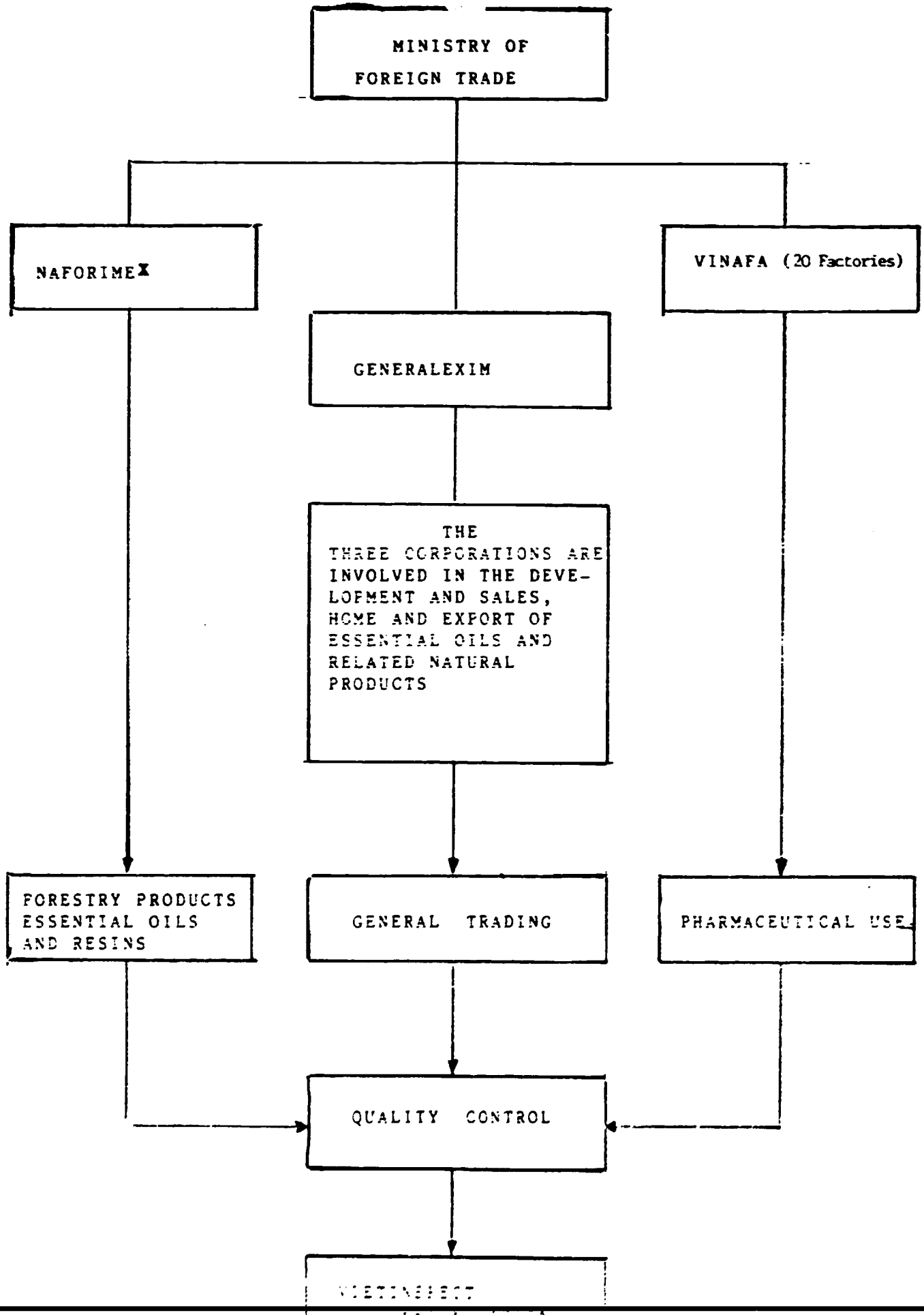
FRAGRANCE FLAVOUR MANUFACTURER
OLEORESIN EXTRACTION
FRAGRANCE & FLAVOUR MANUFACTURER
OLEORESINS IN DISPERSION
OLEORESINS IN DISPERSION
BROKER AGENT
UTILISATION INDUSTRIES
UTILISATION INDUSTRIES
COUNTRY OF TRANSFORMATION

ANNEX XII

TRADITIONAL PATHWAY FOR EXPORT OF PRODUCTS
(NOW TO BE SUPERCEDED BY ANNEX VII)



ANNEX XIII

CITRONELLA
1986-1990

1. Key-point: District Bo Trach, Province Binh Tri Thien.

2. Soil: Sandy, humus rich, on hilly areas, Altitute: 1-1,5m, PH: 4-6

3. Climate: Under monsoon regime, from North-East: Sept.-Feb. & South-East: March-August.
Rainy season: Sept.-Jan., dry season: Feb. - August.
Temerature: Min. 15-18oC, max. 30-35oC, average: 22-25oC
Sunlight: 200-220h/month
Rainfall: 2000-2200mm/year
Moisture: 70-80%

4. Extent: 86:200ha, 87: 500ha, 90: 2000 ha

5. Farming scale: State nursery-garden + cooperatives

6. Land preparation: In part mechanized (small bulldozers and tractors)

7. Watering: to be mechanized (ponds, trenches and turnstile batteries)

8. Cultivars: Cymbopogon winterianus Jowitt, Selected (NCSR-control), Planting interavals: 100 x 50cm, Planting time: Jan. & July.

9. Fertilizers: Manures: 20mt/ha, year, Chemicals: 500kg/ha, year (urea 200kg, K 100Kg, P 200 Kg)

10. Pesticides: As required.

11. Transpost: Herbs 4.000 mt 86, 10.000 mt 78, 40.000mt 90.

12 Field-stills: Planned for 90 80 stills
Still capacity 500mt herbs/year (1 still/25ha)
Fuel in coal 20mt coal/still, year

13. Workmanship: Agricultural work 600 working-days/ha
distillation 5 workers/still, team

14. Expected earnings: Crops 20mt Herb/ha, year
oil 140kg oil/ha, year (By average yield 0.7% oil)

ANNEX XIV

VETIVER

1. Key-point: District Tien Hai, Province Thai Binh

2. Soil: Sandy, humus rich, in coastal areas, Altitude 0.5-1m, Ph: 5-6

3. Climate: Under monsoon regime, from North-East: Sept.-Feb. & from South-East: March-August.
Rainy season: April-Sept., dry season: Oct. - Dec. (Jan-March: Spring drizzle).
Temperature: min. 12-15oC; max 36-38oC; average: 26-28oC.
Sunlight: 200-210h/month
Rainfall: 2200-2500mm/year
Moisture: 80-90 %

4. Extent: 86:7ha 10ha 90:300ha

5. Farming scale: State nursery-garden + cooperatives

6. Land preparation: Manual, to be mechanized

7. Watering: Manual, to be maechanized

8. Cultivars: Vetiver zizanoides stapt, selected (NC: -control), Planting intervals 50 x 50 cm, Planting time: Jan. & July.

9. Fertilizers: Manures: 10mt/ha, year, Chemicals: 500kg/ha, year (urea 200kg, K 100kg, P 200kg)

10. Pesticides: As required.

11. Transport: Dry roots 20mt 86; 600mt 90

12. Field-stills: Planned for 90 1 still, still capacity 300mt roots/year (vol. 3000l, load 1000kg roots/ope , working-pressure: 2 kg/cm2, working time 10h.

13. Workmanship: Agricultural work 600 working-days/ha
Distillation 5 workers/still, team

14. Expected earnings: Crops: 2mt cry roots/ha, each 2 years
oil: 40kg oil/ha, (by average yield 2% oil).

ANNEX XV

MINT AND BASIL
1986-1990

1. Key-point: District Chau Gian, Province Hai Hung

2. Soil: Alluvial, humus rich, in delta area, Altit.de: 1,5-2m, PH. 5 - 6.

3. Climate: Under monsoon regime, from North-East: Sept.-Feb. & from South-East: March-August.
Rainy season:Apr.-Sept, dry season: Oct.-Dec. (Jan-March: Spring drizzle).
Temperature: min. 12-15oC, max. 36-38oC, average 26-28oC.
Sunlight: 200-210h/month
Rainfall: 2200-2500mm/year
Moisture: 80-90%

4. Extent: 86:mint 10 ha, basil type eugenol 10 ha basil type methyl-chavicol 10 ha.
90: mint 100 ha, basil type eugenol 80 ha basil type methyl-chavicol 20 ha.

5. Farming scale: State nursery-garden + cooperatives

6. Land preparation: Manual, to be mechanized

7. Watering: Manual, to be mechanized

8. Cultivars: Mentha arvensis, Ocimum gratissimum, Ocimum basilicum, Seclected (NCSR-control), Planting intervals: 40 x 20 cm, Planting time Jan & July.

9. Fertilizers: Manures 20mt/ha, year,, Chemicals (urea 200kg, K 75kg, P 100kg) ha, year.

10. Pesticides: As required

11. Transport: Leaves and flowers, suma 2500mt/year 90

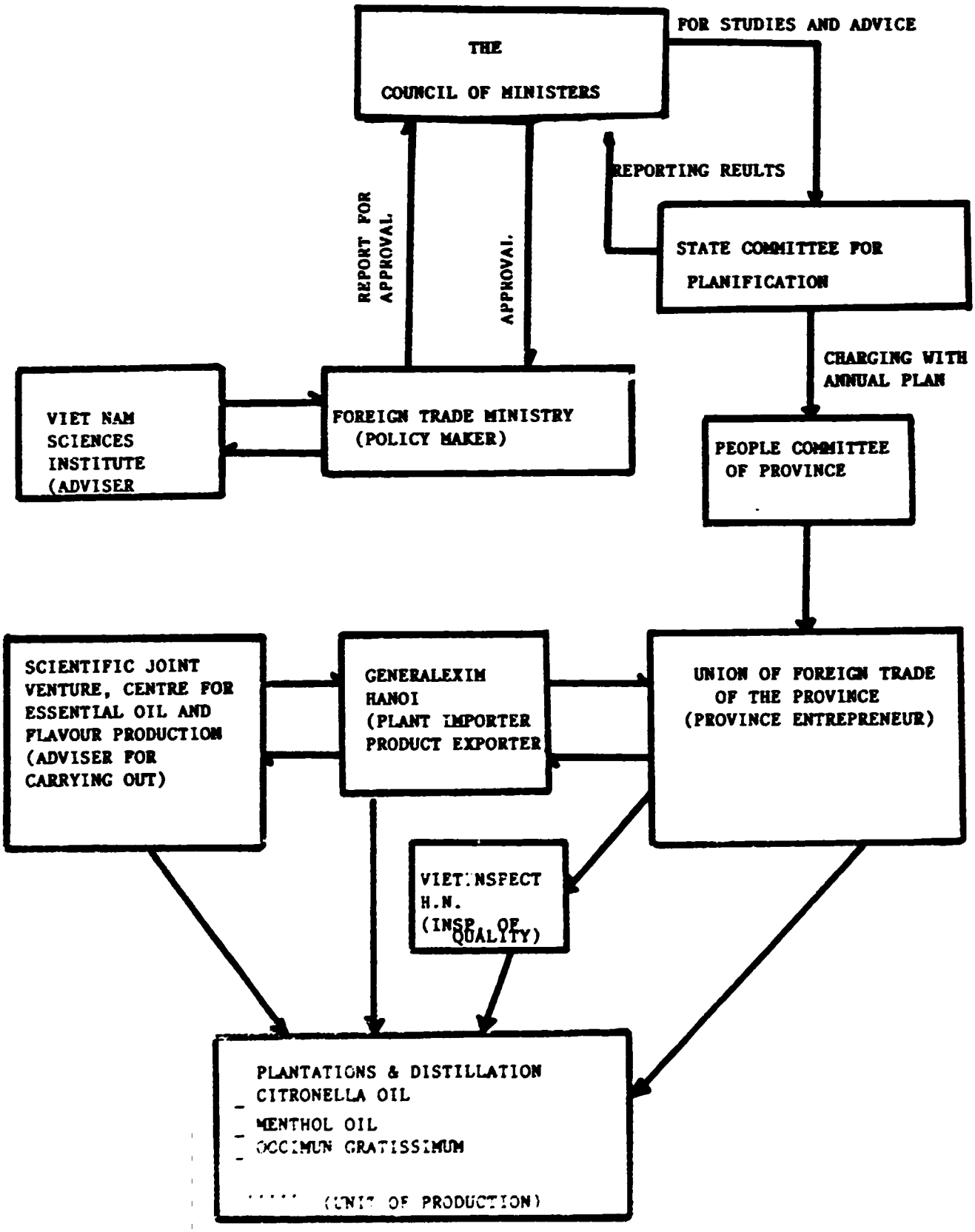
12. Field-stills: Planned for 90:10 stills, still capacity:250mt raw materials/year (average 1 still/20hrs)

13. Workmanship: Agricultural work 600 working-days/ha
Distillation: 5 workers/still, team

14. Expected earnings:
Crops: M. Arvensis 20 tons leaves & flowrs/ha, year,
O. Gratissimum 15 tons leaves & flowers/ha year,
O. basilicum 15 tons leave & flowers/ha year
Oil: Mint 160kg oil/ha, year (by average yield 0.8%)
Basil type eugenol 105kg oil/ha, year ?bu average yield 0.7%) or 90kg (by yield o.6%)
Basil type methylchavicol 105kg oil/ha,year (by average yield 0.7%).

PATH WAY - PRODUCTION OF MARKETING

ESSENTIAL OILS AND PLANT EXTRACTS - VIET NAM



ANNEX XVII

NCSR staffing:

1. Depart. Development
   1 Economist
   1 Ph.D.
   4 Chemist/technologists

2. Depart. Nat. Prod. Chemistry
   Team Essential Oils:
   1 Ph.D.
   9 Chemists
   Team Bioactive Substances:
   4 Ph.Ds.
   4 Chemists
   Team Organic Synthesis
   1 Ph.D.
   10 Chemists

3. Institute Chemistry
   Team Chemical Technology:
   2 Ph.Ds.
   2 Chemists/technologists

4. Equipment Centre
   Team Chemical Engineering:
   5 Engineers

5. Depart, Geography Nat. Res.:
   Team Geobotany:
   1 Ph.D.
   2 geobotanists

6. Depart. Ecology Nat. Res.:
   Team Plant Resources:
   1 Ph.D.
   5 Physiologists/ecologists
   5 Chemists/biochemists