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**PERFORMANCE EVALUATION OF THE ONGOING PROJECT AND PREPARATION OF  
A PROGRAMME SUPPORT DOCUMENT FOR THE DEVELOPMENT OF THE  
ESSENTIAL OIL INDUSTRY IN INDIA**

DP/IND/89/133/11-55

INDIA

**Technical report: Performance evaluation\***

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

*Based on the work of R. O. B. Wijesekera, chemical technologist*

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\* This document has not been edited.

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**ABSTRACT**

The Consultant spent two weeks in India with five days at the project site at Kannauj, and two weeks home-based work to complete the report. The consultant commenced the assignment on the 9th October. The programme of work adopted was as decided in consultation with the UCD and officials of the project.( Annex 3.) The consultant carried out the duties as described in the job description( Annex 1) and the briefing note sent by the project manager at UNIDO headquarters(Annex 2).

The progress of the project was evaluated in terms of achievement of objectives, outputs and completion of activities. More work is expected to be done after the commissioning of the pilot plant units. Discussions were held with representatives of industry associations, former UNIDO consultants, Flavour and Fragrance Development Centre(FFDC) panels of experts and other institutions supporting the industry both state and private, to ascertain the requirements of industries and identify the areas within the country where project activities could be initiated to promote employment and income generation.

Meetings were held with Government and UNDP officials, UCD and the UNIDO national expert who is preparing the UNIDO umbrella programme for Country Programme (CP) V to determine the priority areas that should be included in the project.

The report consists of firstly, a review of the ongoing activities of the FFDC and an assessment of the performance in respect of the outputs originally expected. All the major outputs have been delivered and the expectations realized.

The equipment assembles (Pilot Plant and Analytical Laboratory)are installed. The Pilot plant was only partly functional, but the consultant engineer was due to visit shortly to commission and start-up the other unit operations. The Analytical laboratory was fully functional. The Agronomic work was ongoing at a very satisfactory pace. Training aspects have been fulfilled. Services to Industry are being delivered by FFDC. The second part of the report takes cognisance of: the progress made by the project, an assessment of developments in the surrounding regions - especially the mint industry, and present Government of India (GOI) policy initiatives to develop the small scale sector (Industries). Accordingly a Programme Support Document has been formulated with three major thrusts:

- I. An expert working group meeting
- II. Development of a Second Phase of Kannauj.
- III. Servicing the R & D requirements of the rapidly developing essential oil industry centered in the mint-growing regions.

A draft Programme Support Document was prepared for the second phase of the project taking into account the infrastructural, training, experts, technology, and equipment requirements for a project of 4 to 5 years duration.

### **Project Manager's comments**

The consultant has prepared a comprehensive report and a programme support document incorporating the priorities of the government. As his mission time was very limited, he has not visited some regions identified to be involved with the FFDC in the second phase. He has therefore based his recommendations on a study of the mint oil industry which he visited. The requirements of the other two areas proposed can be somewhat different to those of the mint oil producers particularly in terms of selection of varieties and production and quality parameters. The establishment of three sub-units will result in the development of the essential oil industry in these areas resulting in the creation of employment and income generation.

In order to further clarify and get more feedback to finalise the second phase project document, the consultant has proposed a meeting of an Expert Working Group (EWG) which would also function as advisers during the project implementation. We agree with this proposal which should include experts representing different areas of the essential oil industry such as oil, fragrance, flavour and aromachemicals producers. Representatives of relevant professional and industry associations, agronomists involved with aromatic plant production, UNDP, UNIDO and FAO should also participate in the meeting.

The programme support document will have to be reformulated in the format of a DP project document incorporating the EWG meeting recommendations.

It is hoped that the activities of the FFDC will be continued without a break in the present project which will terminate by the middle of this year. The consultant has performed his duties very efficiently and made valuable recommendations. WE hope that these recommendations will be followed up soon.

## 1. INTRODUCTION

### 1.1 Background to the Project.

The Consultant was familiar with the beginnings of the project having taken some initial part in its formulation. The stated objective of the project was:

"to establish a Process and Product Development Centre at Kannauj, to assist the essential oil and perfumery industry, particularly of the Kannauj region, to modernise and upgrade its technological status, thereby helping the industry to become more productive and produce quality and newer products, and become more competitive both in the domestic and international markets".

Though the project was first proposed in 1998, the original project document had been signed on behalf of UNDP and the government of India in February 1990.

Its finalization had the assistance of a UNDP Consultant Dr Nithya Anand.

**The Cost-sharing financial commitment was:**

Contribution of UNDP	-	USD	632,000
Contribution of GOI	-	IRS	19,670,000

### 1.2 The Project Expectations

#### 1.2.1 The Identified Needs

In terms of the original project the needs to be addressed were stated as follows:

- i. to introduce modernization of the traditional distillation techniques used such as the "Bhapka" process without interfering with its special characteristics
- ii. to acquire facilities for quality assessment using modern methods of instrumental analyses
- iii. to develop new blends and perfumes
- iv. to introduce new packaging and storage techniques
- v. a central facility for process development and for loaning of production facilities for experimental lots of plants; mobile distillation stills; technical advice and industrial services; market awareness;
- vi. to increase local cultivation of important aromatic plants

#### 1.2.2 The End of Project Situation

The creation of a PPDC (Process and Product Development Centre) had been proposed and the end of project situation was defined as follows:

- a. A PPDC established with a Quality Control Laboratory for analysing quality of raw materials, essential oils, and perfumes/products prepared there from; certification schemes for products
- b. Modern distillation units (stills) providing higher recoveries and better quality products; better quality perfumes/fragrances flavours and oleoresins manufactured and marketed.
- c. A Pilot plant, so that industrialists could get raw material from an experimental plot distilled on a loan-time basis; mobile distillation still for processing of farm material on farm site.
- d. Increased local cultivation; New and improved varieties introduced; experimental demonstration of cultivation practices
- e. Improved packaging
- f. Information, Documentation, and Consultation service at PPDC. Information about markets and trends.

### **1.2.3 The Functions of the PPDC**

The following specific functions for the PPDC had been also identified.

- Function (a) provide analytical services for quality assessment of raw materials and products made therefrom
- Function (b) Help the industry to develop modern perfume blending techniques
- Function (c) Help to modernise the production of essential oils by providing process and engineering design and demonstrations (on its pilot plant) of improved process technology
- Function (d) Loan the use of the pilot plant to industrialists for distillation and extraction of raw material from experimental plots
- Function (e) Develop and demonstrate in its farm improved agro-technological practices and introduce new and improved varieties.
- Function (f) Disseminate information about recent national and international R&D in the field, arrange seminars, workshops and training courses;
- Function (g) Provide consultancy services to entrepreneurs

### **1.2.4 Outputs of the Project**

The following had been summarized as the expected outputs of the project.

- Output 1 An Operating R&D Centre dedicated to the needs of the Industry in Kannauj
- Output 2 An operating Quality Control Laboratory
- Output 3 An information and Documentation Centre



#### Output 4 An operating Agro-technology Extension Service

The time frame for commencement of progressive activities it was envisaged would be from the end of 1990.

The project had now been in progress for effectively over four years, given that the date of approval was October 1990 and the starting date was September 1991. The first Tripartite Review Meeting (TPR) took place in November 1992 and the last tripartite review meeting had been held in August 1996. The present mission was partly the outcome of this latter TPR meeting.

### 2. BRIEFING BY THE UNDP - THE SCENARIO

The Consultant had discussions with the Deputy Resident Representative, Mr Niels Maargaard, UNIDO Country Director (UCD), Mr W.S. Nanayakkara, and the Programme Officer, Ms Veronica Peris. The consultant gathered from the briefings the scope and limitations within which the second phase of the Kannauj project (which had been proposed during the recent TPR meeting) was to be formulated. The main concepts of the Country Cooperation Framework I (CCF 1) were the following:

- i. Technology Management Programme
- ii. Eco-based farming system programme
- iii. Employment creation for Industrial Development
- iv. Rural Energy Programme
- v. Poverty Alleviation Programme
- vi. Food Security Programme
- vii. Health Support Programme
- viii. Education Support Programme
- ix. Economic Reform Support Programme
- x. Development Information Programme
- xi. Sustainable Human Development(SHD) Umbrella Programme

Of these programme elements i, ii, iii and v had direct relevance to the activities of the Kannauj project.

Furthermore, "the promotion of rural industries based on local raw materials", had been identified as a strategy element within the Industrial Systems Programme of the CCF1. Further, the Technology Management Programme of the CCF1 had the objectives of inter alia.

- Promoting R&D (For poverty alleviation)
- Streamlining technology transfer processes
- Strengthening institutional infrastructures.

These elements too had a direct bearing on the activities of the present Kannauj Project.

Accordingly mindful of this scenario, and the concepts within which the Kannauj project was initiated, the consultant proceeded to Kannauj to conduct a performance evaluation of the Project.

However the proposed: "Needs Assessment of the Industry" a document that was to have been completed by a National Consultant, and which would have been a logical input towards the work of the present consultant, failed to materialise. As a result the present consultant was severely handicapped to the extent of having to make such an assessment himself with the assistance of officials, and publications of the industrialists largely supplied by the National Project Coordinator(NPC), Mr D.P.Singh and Mr Rasiklal Hemani of ICEOFF. (Vide Bibliography).

### **3. PERFORMANCE EVALUATION OF THE PROJECT**

#### **3.1 Approach and Method of Evaluation**

The approach to the evaluation, and the methodology used by the consultant, consisted of the following elements.

- Study of Documentation & Staff interaction
- Industry interaction
- Review of R&D Institutional linkages
- Interaction with national specialists
- Site visits & review of operations

##### **3.1.1 Documentation & Staff interaction.**

The consultant had one-to-one discussions with the members of the staff as well as community discussions. The list of staff members is in Annex 4. The consultant was also given a dossier prepared by the Director of FFDC and his staff and the contents of that dossier are listed in the Bibliography (Sect. 9)

The consultant perused these documents and requested further information where deemed needed from the members of the staff.

##### **3.1.2 Industry Interaction**

The consultant site visited the premises of selected industrialists in the area for one-to-one discussions with them. The industrialists discussed their problems and the consultant was able to discuss the status of these problems vis-a-vis the situation in 1990 when the consultant last visited them. The consultants personal notes taken at the time helped in this exercise. Outside of Kannauj, the consultant had discussions with the industrial representatives in Chandausi and Badaun when these two stations were site visited. The consultant had the opportunity to see at first hand the technologies used in the mint production and thereby formulate plans for the wider scope of the second phase of the project as required by the UNDP. The consultant also had discussions with some representatives of Perfume and Fragrance Association of India (PAFAI) and ICEOFF (Annex 5).

### 3.1.3 R & D Linkages

The consultant examined the R & D linkages that had been established by the FFDC with recognised institutions in India, as well as abroad via the training programmes instituted and implemented through the project. The benefits were evaluated.

### 3.1.4 Interaction with National specialists.

The designated national coordinator, Mr Sudhir Jain was unavailable and hence this was a drawback in terms of accomplishing the work of the mission. The Pilot Plant requirements were, it was learned, supplied by Mr Jain and the inspection of the fabricated plant was carried out by national UNIDO consultant Mr. M.B.Narasimha. Mr C.L.Tickoo of the Regional Research Laboratory(RRL) in Jammu was to have installed and started up the machinery which had been fabricated by Chemac Equipments Ltd in Bombay. There were no representatives present but the consultant had already had discussions with Mr Tikoo in Colombo prior to his arriving in India. Detailed assessments on the Pilot Plant situation could therefore not be carried out. Fortunately other experts known to the consultant, having been former UNIDO consultants came to the rescue as did the present consultants of the FFDC project. Some of these consultants were met in Delhi, and others in Kannauj, Kanpur(Annex 6 ).

The consultant also had the benefit of discussions with the specialists in Chandausi and Badaun. The consultant was able to assess the other aspects as the following sections will detail.

### 3.1.5 Site visit and review of operations

This was carried out over a couple of days where the consultant stayed over at the Kannauj campus. The laboratories for chemical work, organoleptic formulation, the pilot plant and the FFDC farm site were all site visited in the company of the responsible staff members. The consultant had therefore the opportunity to interact thoroughly with the personnel at Kannauj. The Pilot plant equipment had been installed but not yet started up. Hence the consultant was unable to assess its functioning. The installed equipment included the following:

- Steam distillation equipment for essential oils.
- Solvent extraction Unit for oleoresins and concretes.
- Reboiler for solvent removal.
- Fractionation Unit.
- Reaction vessel

The laboratories were however functioning for both analytical chemistry and sensory evaluation. The consultant had discussions with the staff of both units. The consultant observed that the R & D work had been initiated in regard to the following:

- the characterisation of Indian Rose oils
- the detection of adulterants in sandalwood oils
- Formulation of Quality Standards for Attars.
- Processing of concretes & Oleoresins.
- the formulation of products for aromatherapy based on ayurvedic concepts. (Ayuromatherapy).
- Agro-technology of essential oil bearing crops.

This was a commendable beginning, and the enthusiasm of the staff and their dedication was most evident. They showed interest and a willingness to seek advice. They were good scientific material, and at the present time there appeared to be good collaboration between the various units. The consultant

delivered a talk to the staff who were most interested. The consultants talk was based on the following:

- the original concept for UNIDO assistance
- the characteristic scientific features of the Kannauj industry
- the role of science and technology in enhancing product quality
- QA/QC methodology and standards
- developing Agro-technology
- information collation & dissemination

The consultant also discussed with the Director and the staff of the FFDC their perspectives on the development of the Kannauj Centre, and the Essential oil and Fragrance Industry around the region. The discussion gave useful information for the formulation of ideas for the future scenario.

The consultant was also able to identify a cultivar of Basil (*Ocimum sanctum* var. *americanum* = citral variety) some miles out of the Kannauj area, and initiated the chief of Analytical Division in a research endeavour to domesticate this variety in Kannauj as a source of citral. The initiative to seek improved chemotypes was well received.

### **3.2 Results - Delivery of Inputs and Outputs observed**

#### **3.2.1 Assessment of Performance**

Overall the project implementation can be regarded as most satisfactory.

Of the needs expressed in item 1.2 above, all except the first one had been addressed. It must be stated that although in the opinion of the present consultant at the time the item (i) viz the improvement and simulation of the Deg-Bhapka process seemed of great importance the industrialists were not so convinced that there could be a technological improvement on their characteristically traditional method. This is however a worthy research issue that has to be addressed. The consultant is aware that an Institute of the CSIR has addressed this but the solution is not fully satisfactory.

All the other needs have been addressed and solutions are either already accomplished or on the way. The packaging is yet to be fully solved. A pilot plant has been installed and awaits commissioning. A quality control laboratory is functioning and the industrialists expressed their satisfaction. They wished that FFDC would soon establish quality standards for their products so that imitators would be discouraged. So it may be stated that the needs as in 1.2 ii to v above have been addressed.

At the FFDC the functions as indicated above are being carried out. Functions (c) and (d) have yet to be initiated as the start-up of the Pilot Plant is to be initiated on the 4th November when the national consultant was due from RRL Jammu. At the time of the site visit by the consultant the following were installed:

- a set up for steam distillation.
- Solvent extraction and recovery (reboiler) facility.
- Fractionating column.

From the viewpoint of the consultant these units were semi-commercial scale and more than mere demonstration units. So the intent to loan their facilities to industrialists was a commendable one.

All the indicated inputs have been delivered. The experts have been fielded. The trainees have been sent for their training and this satisfactorily achieved. A QA/QC laboratory as well as an organoleptic facility for formulation and blending of perfumes has been set up and they are functioning. A custom

designed fragrance has been created for a "dhoop" manufacturing concern, which indicates technical competence as well as maturity. The consultant was impressed with the dedication of the FFDC team of scientists and they appeared to have made good use of their respective training.

The agro-technology is ongoing. The FFDC has utilised to the maximum the expertise of the two consultants from CIMAP Lucknow. The herbal farm at the Kannauj campus contains sample crops the cultivation of which in the originally dry land constitutes a commendable feat. The crops are: Citronella, Lemon grass, Palmarosa, Jamrosa, Basil, and jasmine (sambuc). Methods of plant propagation are being demonstrated in the farmsite not far from the Kannauj campus, where the same range of crops are cultivated in larger areas, and selected clones of planting material of several species are being issued to entrepreneurs with valuable income to FFDC. Most significantly the arid area has given rise to a profitable agro-industry and FFDC can claim to be the catalytic agent. The particular success factors can be identified as: the successful introduction of Basil, Lemon grass, palmarosa, jamrosa, vetiver, and citronella; the success of the new crops particularly the cultivation of *Matricaria chamomile*, and jasmine sambuc.

Field distillation technology is also being demonstrated. New information is being disseminated, and several informative booklets in English and the local Hindi language have been published for the guidance and information of interested entrepreneurs. Of particular value are the FIVE serial Technical Bulletins on: Cultivation & Distillation Technologies viz:

- No 1. Rose
- No.2. Geranium
- No.3. Citronella
- No.4. Chamomile
- No.5. Patchouli

In summary therefore and in reference to the project document all four outputs as indicated above have been delivered.

The Activities that have been initiated are the following:

- A. Agro-technology & extension services.
- B. Process Technology.
- C. Fragrance formulation.
- D. Quality Control & Standardization.
- E. Information & Documentation.
- F. Packaging & Marketing.

**A. Agro-technology and extension services:**

Propagation and cultivation of aromatic plant species commenced in and around the Kannauj region and in the land reclaimed by the UP Land Development Corporation. The FFDC has compiled literature for the benefit of farmers and entrepreneurs. Farmers meetings have been conducted. Planting material has been made available to farmers who have had the benefit of technical know-how from the FFDC, and thereby been able to develop a growing industry around the region of Kannauj. During the past year, practical training had been provided to farmers in the propagation of aromatic plants. The training involved 12 farmers.

The FFDC has introduced into planting new crops for the region such as, lemon grass and notably *Matricaria camomile*, generally regarded as a crop for the temperate climes. This had been introduced successfully, as a plantation crop, in addition to the existing plantations of Rose, Hina, Jasmine (sambuc), and *Tagetus* spp. in the surrounding regions of Kannauj. The FFDC is also making efforts to establish

linkages with the State extension systems through introducing the crops of aromatic plant species successfully tried out at the FFDC campus, in the districts of the UP Horticulture Cooperative Marketing Federation, and district administrations.

### **B. Process Technology**

The new pilot plant equipment has been installed but not yet started up. Meanwhile, process technology demonstrations in field distillation to farmers, and advice to entrepreneurs is being given but serious consultancy services and trials for producers await the start-up operations scheduled for November this year. Meanwhile the staff of the centre has undergone the requisite training at national as well as international centres and are well prepared for the installation and start-up, expected to be carried out by the end of the year.

### **C. Fragrance Development**

A laboratory for organoleptic work is functioning. . Specific fragrances for different uses are being formulated under the guidance of the consultants fielded under the project. A particular success is the fragrance formulated for "Dhoop" which has been sponsored by an entrepreneur and has been accomplished to the satisfaction of the client.

During the past year when the Fragrance formulation facility was served by a UNIDO National consultant they were successful in developing over 50 formulations of fragrances especially designed for hair oils, Dhoop, creams and shampoos, and toilet soaps. Many of these could be successfully commercialised in the near future. The Fragrance laboratory has also built up its stockpile of fragrance chemicals which includes over 500 raw materials from different companies as well as standard essential oils and aroma chemicals.

### **D. Quality Control and Standardization**

This facility became operational in 1992. It caters to the industry for analytical testing and has an impressive performance record.

Samples tested are as follows:

1992-93	134
1993-4	534
1994-5	874
1995-6 ongoing	862

Standardization and formulation of standards for the traditional Attars is in progress.

During the past year the FFDC provided training to industrialists in quality assessment and fragrance formulation. Four training courses ranging in duration from a week to three weeks, were carried out, with a total of 17 trainees which included 6 women. Fragrance formulation and sensory evaluation courses were similarly carried out and involved 20 trainees in total with 5 women.

### **E. Information & Documentation**

Booklets on the agro-technology of selected species have been prepared in English and Hindi and are being issued to farmers and entrepreneurs.

A Technology status study on the mint oil industry has been completed and awaits publication.

Advice on packaging and marketing is being given to industry but the aspect needs further development.

### 3.3 Benefits to the Industry

The project has benefitted the industry well beyond the original expectations.

The industry as it is now composed consists of several clans of industrialists who are mainly interested in manufacturing and trading in Attars in the traditional manner. There is still a demand for this type of perfumery agent. These traditional companies are satisfied with the quality assessments of the essential oils such as sandalwood oil which they purchase for their use. Only some of them distil their own. However they are all wary of newcomers who manufacture attars based on formulated fragrances and claim the original "Kannauj" authenticity, which also carries with it a higher price tag. The consultant was informed that there were around one hundred genuine perfumers making the authentic attars. There were however over four thousand suppliers of attars from Kannauj - with claims to "Kannauj quality". Other industries have cropped up which use fragrances for making incense-sticks viz "Agarbathi" and "Dhoop". These industries, eg. Rathore Pooja Products, were based on the utilisation of the waste marc after distillation of sandalwood and vetiver as the matrix for the agarbathi and dhoop, need formulated perfumes and the FFDC is servicing this aspect of the industry. In fact FFDC was forward funded for the formulation work, and in this line there may well be prospects for the future.

Many industrialists await the start-up of the pilot plant. Some are keen on simulating the technology particularly the solvent extraction and fractionation aspects. Some are keen on using the facility on a loan basis. The prospects are there and await the installation and start-up.

The revenue earned by the FFDC as a result of the services rendered to Industry during the past years is impressive for such a fledgling organisation.

Years	Revenue
1992-3	Rs 32,365.00
1993-4	Rs 217,997.00
1994-5	Rs 455,439.00
1995-6	Rs 942,133.00

### 3.4 Inimical factors

There are several inimical factors that warrant mention.

#### 3.4.1 Farm Site Capacity

The farm site was estimated as a 20 ha government contribution to the project. Only about 3.5 ha have been assigned and further area is now needed. The roadway to the farm is also in need of repair, and this matter was already pointed out to the authorities. The live herbarium at the campus as well as the farmsite will need constant attention from specialists and this matter is well understood. The distance to the CIMAP is a factor but the assignment of a specialist consultant from there will go a long way towards helping the FFDC until their own personnel become conversant with the needs.

The distance factor also mitigates against interaction by the staff with fellow scientists and technologists in the country. A mechanism to facilitate such contacts may be built into the operating system of FFDC. A two-way interaction is best where consultants from other laboratories come into Kannauj from

time to time. The building of a scientific community in such isolation has its own problems, but India with a vast scientific community can easily overcome this by, planned interaction.

### **3.4.2 Infrastructure**

There are also infra-structural obstacles. The power supply at Kannauj is unreliable. There are power failures regularly and power is only available 10 hours of the day. The voltage fluctuates it was stated between 100-300. Sophisticated instrumentation, and controlled processing cannot take place in such a milieu. A good generator of adequate capacity seems to be the obvious answer.

### **3.4.3 Financial Factors**

Financial factors are at the moment adequate but may give cause for concern. The central government annual grant during 1991-1996 has been Rs. 20m supplemented by the UP government grant of Rs. 10m. This has been augmented by the UNDP contribution of USD.632,000. Fees from industrialists have been good for this initial stage but this contribution will have to increase if the centre is to function adequately in the future. A mechanism to regularly obtain books, chemicals, solvents, instrument spares and accessories will have to be evolved. There will have to be a good stockpile of chemicals and reagents as Kannauj is comparatively isolated.

The FFDC has commenced conducting its own training courses and this brings income.

The training services included training for industrialists in Agronomy, Quality assessment, and in fragrance formulation. FFDC has also organised specialist work-shops utilising visiting consultants as well as their own specialists, to deliver the latest information to industrialists.

FFDC has ambitions to conduct international courses of on the spot training, following the lead of the Medicinal Plants Research Centre at the Anadolu University in Eskesehir, Turkey. While this is commendable it may be premature to consider this as the infra-structure is not available in Kannauj or nearby Kanpur. Furthermore assistance will have to be obtained from other institutions such as CIMAP, or even the private sector companies.

Other factors inimical to progress of the industry in Kannauj were concerned with the exist duties applicable. There was doubt here and some industrialists appeared to feel that modernisation would mandate them to pay higher duties, a position which needed clarification.

The need for consideration of a venture capital availability for industrialists has been addressed in a paper prepared for UNIDO-UNDP on the Industrial Systems Programme for the UNDP Country Programme V.(Murthy E.N. 1996).

The report states that " Till now all programmes and projects of the UN agencies were directed at the product sector. For the first time an attempt is being made to address itself to the problems of the Small Scale Sector(SSS) as a whole with a view to develop this sector as the strategy for poverty alleviation, generation of maximum employment, gender related issues, and environmental factors". The present consultant in developing the Programme Support Document which constitutes Part II of this report has taken cognisance of the factors in this document.



#### 4. POST-PROJECT DEVELOPMENTS IN THE ESSENTIAL OILS INDUSTRY

##### 4.1 The growth of the Mint Industry; Indigenous technology.

The post-project developments become important in the light of the need to extend the project into a second phase. Accordingly, the consultant site visited two of the mint growing centres viz CHANDAUSI and BADAUN. The approximate juxtaposition of these centres vis-a-vis the FFDC at Kannauj, and the neighbouring R&D centres, is displayed in the diagram (Annex 7).

The consultant had discussions with industrialists at Badaun at the premises of Prakash Chemicals, Anaj mandi, Badaun. The industrialists in the surrounding region were substantial producers of Mint, mainly *Mentha piperita*, and *Mentha arvensis*, and Basil, (*Ocimum basilicum*). There were a large number of plantation crops of these species, around the region of Badaun and Chandausi, within a radius of 100 km. The names of the plantation centres were Moradwabad, Pantnagar, Sambhal, Bareilly, Ramapur, and adjoining regions. In this entire region the industrialists contended that there were over 20,000 field distillation units, over 300 chilling plants for the cooling of the oils of mentha and the separation of menthol and de-mentholated oil, as well as about a hundred fractionating units for the separation of isolates and aroma constituents of the essential oils produced. There were some facilities for the production of aroma chemicals by small synthetic manipulations. The time frame of the mission did not permit the assessment of the capability developed except for the site visit to two factories. The first of these was the factory at nearby Badaun, where Basil oils, and mint oils were distilled and fractionated. (For an idea of the technological features referred to in the text, see Annexes 8 & 9).

At Chandausi the consultant was able to see some of the field distillation units. It was noticeable that almost a third of these units had still bodies that were Box-shaped, ie. with a square cross section as opposed to the usual cylindrical still body design. The industrialists were told by the consultant that the cylindrical body had several advantages over the box-type design the most important one being that the steam penetrated the charge of raw materia in uniform fashion avoiding the channelling at the four corners that was invariably prevalent in the box-type design. Another characteristic was that the industrialists preferred the water-cum-steam distillation method which they referred to as "hydro-distillation". This is the method that had the steam being generated *in situ* by passing the flu gases from a wood fired fire place through a coil set in the still body at the bottom over which a body of water was kept boiling. The method though satisfactory and widely employed did not enable strict control of the distillation process, but the cost factors and the fact that the spent marc after distillation could be utilised better by this method made the industrialists prefer this.

The consultant had discussions with a group of industrialists from the region under the leadership of Mr Phool Prakash, President of the UP Mentha Industries Association, and a vice-president of the Central Zone Essential Oils Association of India. Mr Prakash also functioned as an honorary member of the executive council of the FFDC at Kannauj.

The consultant learnt that the development of the mint oil industry in this region was largely a "post-Kannauj Project" feature, in that, it occurred after the UNIDO-UNDP technical assistance programme had been in place. The agro-technology for the cultivation of the essential oils bearing crops had been obtained initially from CIMAP, Lucknow and RRL, Jammu. The region had over a dozen gas chromatographs but the main use was for monitoring the fractionation of the oils. The need for one or more well established quality assurance and quality control centres in the region was very evident and this was strongly emphasized by the industrialists at both these centres. The region contributed substantially to India's growing dominance in the essential oils industry, particularly in establishing India as the second largest producer in the world with a potential to be the largest. It was stated that the present production ie for 1994-95 was in the region of 8,000 MT/annum. The FFDC at Kannauj had made a survey of the mint industry in the region and this would be a useful starting survey to the programme of extension of the aligned with the second phase of

the Kannauj project. (The report is to be published soon).

Several industrialists and national experts with whom the consultant interacted were convinced that the FFDC at Kannauj and its capability should be supplemented with QA/QC centres at Badaun and Chandausi.

#### **4.2 The Synergistic Effect of R & D**

In considering the spectacular development of the Essential oils industry in India Annex 10), and in particular the Mint Industry in the region under review, some salient factors emerge. These development were only possible because of the following :

- the availability of agrotechnological expertise.
- the ready availability of planting material of proven strains.
- the availability of research data and practical know-how in the various process technologies such as steam distillation, fractionation and crystallisation.

The industrial leap therefore can be directly related to the research and development efforts of the Indian laboratories notably, CIMAP, Lucknow, and, RRL, Jammu. Even in a small way the FFDC had also contributed towards the development of the industry nearer Kannauj. It was clear to the consultant that for sustaining this commendable growth of the industry the following were crucial:

- Ready access to R & D sources
- QA/QC facilities nearer the centres
- Further research with crop diversification.
- Market access and know-how.
- Training facilities.

The industrialists pledged their support towards any initiatives and were enthusiastic about any cost-sharing mechanism if the government and an external funding source would initiate the catalytic process.

It was therefore obvious that not only the facilities for QA/QC but the R & D linkages with the established institutions would have to be strengthened.

### **5. THE WIDER SCENARIO FOR DEVELOPMENT**

#### **5.1 The Kannauj -Badaun- Chandausi Region**

The present position within this region, and the future requirements have been discussed in the foregoing. The mint industry in the region appears to be well established. The same could be said of its extension to other essential oil bearing crops. Agro-technological expertise will enable this extension to be made, and the introduction of exotic crops as well such as Camomile, which has been experimentally grown in the Kannauj region. The region could be a major contributor to India's Essential Oils and Fragrance industry.

#### **5.2 Developments in the South**

During the consultant's stay in Kanpur for the meeting of the Governing Council the opportunity was afforded to have discussions with a representative from Tamil Nadu. The meeting was on the initiative of the Director, PPDC. The consultant had lengthy discussions with Mr S. Rajagopal of the Small Industries Product Promotion Organisation (SIPPO). It was stated that SIPPO had spice production facilities at KodicanaI-Madurai. The products made were Essential Oils, Oleoresins, of primarily spice crops such as

Cardamom, Turmeric, Ginger, Coriander, and Cumin. The SIPPO had links for R&D support at the Biotechnology Centre of the Madurai Kamaraj University. It was also learnt that the SIPPO was run on grants from the Government of India (25%), the Government of Tamil Nadu (25%), and private sector sponsorship. The SIPPO could also be a southern partner for a linkage with a countrywide essential oils and fragrance and flavours industry, given the support of a quality control facility.

### **5.3 Prospects for the North-East region**

In a similar vein it was noted that the North east region also had an essential oils industry with an R&D Centre at Jorhat, where agrotechnological expertise was available in the crops such as the Graminae eg. Vetiver, Citronella, and Lemon grass. Some initiatives with regard to this region and its linkage with the other regions will be of mutual benefit to sustain the essential oils industry in India at its present level and to set the stage for its further development.

## **6. PROPOSALS AND RECOMMENDATIONS**

### **6.1 The Scenario for a new initiative**

Based on the foregoing observations and rationale, the consultant would make the following recommendations. The recommendations are noted here in summary as these are incorporated in a PROGRAMME SUPPORT DOCUMENT that will form Part II of this report. These recommendations are in three categories.

- the second phase of Kannauj
- further centres and R&D linkages
- an expert working group meeting

It has been amply observed, in the foregoing sections that the technical assistance provided within the UNDP-UNIDO project at Kannauj has set in operation a growing awareness of the potential of the essential oils industry in the region, as well as and even more importantly, the fact that the scientific and technological intervention is able to make the products and processes more competitive. This is an important consideration in the planning of a second phase.

Another important consideration is the fact that this industry can extend down-stream onto the lucrative flavour and fragrance industry, where high technology in the form of synthetic production of aroma chemicals, and formulation of flavours and fragrances is a final feature. At the same time the industry has backward linkages that provide the basis of its appeal. The cultivation of plants with aroma-giving constituents provides a lucrative employment generation operation, at the grass roots level.

A significant feature of this is the substantial involvement of women in the planting, weeding, harvesting, and post-harvest phases. The operations are decidedly environment-friendly, and even the bio-degradable marc which is the left over refuse, can be utilised as fuel supplement or fertilizer. The management of the technology is an operation where the capability exists within the country and requires no foreign inputs except in the case of the familiarisation with modern technological and market trends.

The essential oils industry is capable of considerable expansion within the region of the Uttar Pradesh, as well as throughout India, given the wide range of climatic and geophysical features that India has. India has also the advantage, possessed by only India among the countries of South Asia, that it has developed a cultivation base including the agro-technology, as well as a Fragrance Industry with a capability in synthetic organic chemistry, which enables it to add value to the products of the essential oils industry in terms not only of developing aroma chemicals but going further in supplying the world market fully formulated fragrances. Already such formulated fragrances are being offered in the markets of the world

by Indian fragrance houses. So the network is set for a complete development of this industry, and given its obvious advantage in labour and the fact that Europe is meandering onto high technology of a different nature, India has the opportunity to forge ahead. It is in this scenario that the consultants recommendations are made.

A further factor in the evolution of the ideas expressed here were the policy initiatives stated by the Union Minister of Industries at the All-India Conference of State Ministers of Industry in April this year. The Minister had stated that "Special Plans will be devised to promote small and cottage industries to achieve the win objectives of growth and employment". He expanded that: "such programmes should ensure the generation of more employment, creation of assets, imparting productive skills and raising the incomes of the very poor so that a significant number is brought above the poverty line every year and the poverty, as we know it is abolished by the year 2005".

Following this and in the context of the UNDP CP V the UNDP had mandated a UNIDO Support Consultant Mr E.N.Murthy to prepare a discussion paper on the Industrial Systems Programme for the CP V. The UNIDO Support Consultants Report identified some of the significant issues relating to government policy and particularly the financing of the small scale sector (SSS). The ideas developed herein take cognisance of these issues and the measures recommended.

## **6.2. The second phase of Kannauj**

As argued earlier it could now be said that the FFDC at Kannauj is a fully installed outfit whose operations are in the initial phase. The second phase needs to strengthen the existing facilities, give them versatility, and build up a community of scientists and technologists capable of carrying on the operations with substantial contribution to the industry. Foremost in such a facility is the need to interact with the R&D centres associated in serving the industry.

The following are deemed necessary to accommodate such.

- Upgrading the agro-technology and widening its range.
- Strengthening the QA/QC facility
- Maximising the use of the Pilot plant and processing facility.
- Strengthening the capability for formulation of fragrances.

It is recommended accordingly that the following initiatives be included.

- 6.2.1 Expansion of the experimental cultivation (area and intensity) and continuation of the consultancy links with CIMAP and RRL, Jammu.
- 6.2.2 Further development of methods of plant propagation and microculture techniques.
- 6.2.3 Continuing experimental trials with exotic species of industrial utility.
- 6.2.4 Continuing the practice of supplying of quality planting material to industry.
- 6.2.5 Experimenting with oleoresins from crops readily available in the region eg. Garlic.
- 6.2.6 Acquisition of a fuller complement of instrumentation, as well as chemical glassware and reagents, solvents, and labware. ( Listed in Part II)
- 6.2.7 Acquisition of some demonstration stills for production of essential oils at the field level with improved designs. (Reference indicated).

- 6.2.8 Maintaining a staff training schedule and interaction with qualified national consultants in Agro-technology, Instrumental analyses, Fractional distillation, Chemical synthesis, and fragrance and flavour formulation.
- 6.2.9 Strengthening of the Library and information services and forging of a links with the National Science Information Institute of CSIR, New Delhi, for accessing of information.

### 6.3 Further Centres and R&D Linkages

As discussed in detail above, (Section 5), at least two or three other centres like the FFDC at Kannauj will have to be installed; one in the region neighbouring Chandausi, and two others possibly in the South and in the North East. The consultant did not have the opportunity of visiting the south or the north east and therefore cannot make a first hand judgement, but based on the information recorded above there is a case for consideration. There was no such doubt regarding the case for the Chandausi region as this would combine the requirements of Badaun as well and would supplement the work of Kannauj. It is not proposed that Kannauj be duplicated at the centre in Chandausi. Chandausi has well established installations for processing, that is:

- Steam distillation for the production of essential oils,
- Fractional distillation for the separation of the constituents of these oils, and
- the chilling operation for the separation of Menthol crystallisation.

However they need a fully equipped Quality Control laboratory with possibly some technology demonstration units in the processing area for up-grading their present technological capability.

**It is accordingly recommended that,(initially):**

A second centre be started at Chandausi on the model of Kannauj but with only the facilities for:

- QA/QC
- Agricultural expertise & Consultancy (Visiting experts)
- Technology consultancies (Visiting basis)
- Fragrance formulation/Chemical synthesis (Advisory service).

The centre may be equipped with the necessary hardware to carry out these functions but with a core of staff whose expertise will be augmented by regular visiting consultants from the nearest R&D institutions.

### 6.4 Expert Working Group Meeting

During the discussions at the UNDP with the participation of Mr Govind Kelkar Managing Director of S.H.Kelkar and Co Pvt. Ltd the largest Indian Fragrance House, cited in Bombay, (Mr Kelkar very kindly came over from Bombay), it emerged that an EXPERT WORKING GROUP MEETING could profitably be staged to extend the ideas formulated herein, and to make informed decisions in regard to the future trends in the essential oils industry India-wide.

This expert working group would meet for two days sometime during 1997. February was fixed as tentative date, and Mr Kelkar offered the premises of his company at Mulund as the venue. It would bring together a selected band of experts in agro-technology, Process technology, Instrumental analyses and fragrance chemistry, and would be expected to formulate a plan for the development of the industry around the UNDP-UNIDO initiative at Kannauj.

They would also :

- a. study the report of the consultant and the recommendations.
- b. select a list of plant species, (ten to fifteen) suitable for cultivation in India, based on present market considerations.
- c. select a further list of plants (ten species) that could be introduced to which contain the oils most likely to be required by India, in the future.
- d. select a third list of plant species that will be important from the point of view of their aromatherapeutic usage based on the principles of Ayurveda (Ayuromatherapy).
- e. identify regions suitable for the cultivation of the species selected.
- f. select a short list (roster) of national experts who could from time to time be recruited to assist in the development of the work of the centres at Kannauj , Chandausi or others.
- g. identify the support R&D Institutions within India, for the essential oils industry and the tasks they could be mandated to perform.
- h. identify initiatives that India could make in order to develop the Essential oils industry in the neighbouring countries.

The inputs for the proposed expert group meeting were identified as the following:

- i. A review paper on the ongoing agrotechnological experiences with aromatic plant species in India on a commercial cultivation basis. - to be prepared by Mr Suresh V.Vaze of S.H.Kelkar & Co.
- ii. A list of the aromatic plants of India - to be prepared by the FFDC.
- iii. A review of the present FFDC activities - to be prepared by the FFDC.
- iv. The report of the present consultant and the Programme Support Document.
- v. The "Current Status " report scheduled to have been prepared for the present mission but which had been delayed. - Dr Manthri.

The outputs expected from the Expert Working Group (EWG) Meeting would be " a report with a time-framed work-plan based on the programme support document and where necessary with redefined inputs and outputs. The EWG meeting will formulate a framework of policy initiatives to be implemented for the ensuing ten year period ie. until 2007.

## **7. WRAP-UP MEETINGS**

**7.1** The final meeting with the UNDP officials and the UCD was held on 23 October 1996. Present at the meeting were:

Mr W.S.Nanayakkara UCD,  
 Ms V Paris UNDP Programme Officer,  
 Mr S.R.Singh, Industrial Adviser. SIDO,  
 Dr D.P.Singh, Director, FFDC, Kannauj.

The consultant briefly outlined his observations and proposals, and these were discussed in some detail with the consultant.

### **7.2 Proposed collaboration with the FAO.**

At the request of Ms. Peris a brief meeting was arranged with the FAO country representative Mr P.Rossenegger to seek assistance in regard to the cultivation aspects of the proposals, and to determine if the FAO should be associated with the proposed Expert Group Meeting, and the future programme on the essential oils industry. The FAO representative seemed interested and offered to associate his agency with any proposals. However the consultant had his reservations. Given his long association with the

UNIDO programme on the Industrial Utilisation of Medicinal and Aromatic Plants of UNIDO, and the minimal involvement of FAO in this ( only the single instance of Nepal can be counted), and the fact that the FAO involvement in the same industrial sector in Bhutan where, despite displayed expertise in this sector UNIDO's collaboration was not solicited but a UNIDO consultant's services were used, the present consultant had reasons to doubt from the UNIDO standpoint, if involvement of the FAO was really needed at this stage. Though the present consultant participated in discussions with Mr Rossenegger, these reservations were expressed to the country director and to Ms. Peris.

However in the wider context, the FAO participation could be accommodated to conduct a review of the cultivation aspects of the aromatic plants based industry in India to provide an adequate supply of raw material for the increasing needs of the industry.

The terms of reference for such an FAO consultancy service for the programme may be based on the following elements.

- a. Review selected areas where plants are cultivated on a commercial basis and recommend initiatives for improvement, on the basis that these commercial cultivations provide the raw material for the growing Indian essential oils industry..
- b. Select new plant species for introduction into India on the basis of market potential and agrotechnological feasibility.
- c. Recommend regions with the appropriate geo-climatic features for the large scale production of the recommended species.
- d. Select appropriate planting material and establish model demonstration farms in typical regions.

In order to carry out these measures the FAO may be requested to provide the services of:

ONE International consultant for 2 man months ( Split missions if needed) and TWO national consultants to assist with the tasks.( a total of 6m/m may be needed.)

If the FAO participation is acceptable to all concerned it may be advantageous if the selected consultants be enabled to participate in the proposed Expert Working Group Meeting. Draft terms of reference for FAO participation by way of a sub-contract for provision of services is given in Annex 11.

## 8. ACKNOWLEDGEMENTS

The consultant extends his gratitude to the following for assistance, guidance and valuable information provided to the consultant, and the many courtesies granted to the consultant during the course of his mission.

- Mr Niels Maargaard, DRR
- Mr W.S.Nanayakkara, UCD
- Mr S.Ramamurthy, ARR
- Ms Veronica Peris, Programme Officer
- Mr S.R.Singh, NPD IND/89/133
- Dr D.V.Singh, NPC IND/89/133, Director, FFDC, Kannauj
- The Staff of the FFDC Kannauj.
- Mr Rasiklal Hemani of the ICEOFF and PAFAI
- Dr M.L.Maheshwari, former Consultant, UNIDO
- Dr Aparbal Singh, National Consultant

- Mr Govind Kelkar, Managing Director, S.H.Kelkar & Co.
- Dr C.K.Atal, former UNIDO Consultant.
- Dr Baldev Gulati, former UNIDO Consultant
- All the Industrialists mentioned in Annex 5, and experts in Annex 6.

## **9. BIBLIOGRAPHY**

- 9.1 Executive Summary Document (Prepared by Dr D.V.Singh).
- 9.2 Project Document DP/IND/89/133
- 9.3 Annual Reports of PPDC/FFDC: 1992-93, 1993-94, 1994-95
- 9.4 Governing Council Meeting Reports: Meetings No1, 7-10.
- 9.5 Minutes of the TPR meeting 12th August 1996
- 9.6 Indian Essential Oils- K.G.Satoskar (PAFAI)
- 9.7 Planning of the Essential Oils Industry - S.V.Vaze (PAFAI)
- 9.8 The Development of the Essential Oils Industry in India - Sudhir Jain (PAFAI)
- 9.9 Description of different marketing arrangements - Sudhir Jain (PAFAI)
- 9.10 National Programme for Cultivation & Processing of Aromatic and Medicinal Plants - Concept paper. D.P.Singh et al. FFDC
- 9.11 Ninth Five Year Plan for FFDC
- 9.12 India Country Paper -3rd UNIDO Workshop on the Essential Oils Industry, Eskesehir.- S.R.Singh
- 9.13 Geranium in Ultrakand & Jasmine in Uttar Pradesh - FFDC
- 9.14 FFDC Training Calendar
- 9.15 11th International. Congr. EOFF 1989 Report
- 9.16 Laboratory manual: Training in Fragrance Creation. S.V.Shukla, FFDC.
- 9.17 Guidelines for Programme Support Document - UNDP 1993
- 9.18 Discussion Paper on Industrial Systems Programme- E.N.Murthy, UNDP. UNIDO (1996).



**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION****JOB DESCRIPTION  
DP/IND/89/133/11-55/0730AO**

<b>Post title</b>	Chemical technologist
<b>Duration</b>	0.7 m/m (2 weeks in India {5 days in Kannauj and the rest in New Delhi} and one week home based)
<b>Date required</b>	5.9.96
<b>Duty station</b>	Kannauj, India
<b>Purpose of project</b>	The project seeks to extend the activities of the Fragrance and Flavours Development Centre (FFDC) for servicing, sustaining and upgrading the essential oils and perfumery industry in India.
<b>Duties</b>	<p>The consultant, in consultation with the NPD, Director of FFDC, the national expert and the project counterparts, will carry out the following duties:</p> <ul style="list-style-type: none"><li>- Evaluate the progress of the ongoing project and identify additional requirements for extending the activities of the FFDC.</li><li>- Discuss the requirements of the essential oil industry (oils, oleoresins, aromachemicals, concretes, absolutes and perfumes including attars) with the industry associations, FFDC panels of experts and other institutes supporting the industry so that these could be incorporated into the second phase of the project.</li><li>- Meet with Government and UNDP officials and the UCD to determine the priority areas that should be included in the project.</li><li>- Discuss with the UNIDO national expert who is preparing the UNIDO umbrella programme for CP V and obtain the necessary information to prepare the second phase to fall within the UNIDO umbrella programme.</li><li>- Identify the areas in the country where project activities could be initiated to promote employment and income generation.</li><li>- Prepare a priority list of plants to be cultivated in each area identified.</li><li>- Prepare a draft project document for a second phase with major emphasis on employment and income generation for submission to the Government/UNDP taking into account the infrastructural, training, experts, technology and equipment requirements for a project of 4-5 years duration.</li><li>- Submit a comprehensive report on his findings and recommendations and the draft project document (in a hard copy and on a diskette using Word Perfect 5.1/5.2).</li></ul>
<b>Qualifications</b>	A chemical technologist with over 10 years experience in the industrial utilization of aromatic plants.

**Briefing Note to Mr. ROB Wijesekera, Consultant DP/IND/89/133**

The Government of India and the UNDP needs a project as a continuation of the present project with main emphasis on employment generation in rural areas.

The proposal should make the FFDC in Kannauj the implementing host institute which will direct, supervise and provide all technical services to the regional centres that will be initiated to create processing facilities at field level.

The centre therefore should also be further strengthened to support activities such as quality control of oleoresins and flavours that are to be produced. Hence the necessity for a GC/MS and a HPLC to do pesticide residue and fertiliser residue analysis. An atomic absorption spec for heavy metal analysis and requirements for the determination of microbial contamination etc. Will also require equipment for initiating micropropagation and flavour development. The information unit at FFDC has to be strengthened to provide training. Hence video equipment and the other audio visual aids. Centre will also require at least two four wheel drive vehicles.

The duration of the project could be 4-5 years with a substantial budget

Training would be necessary for extension officers and the scientific staff at the FFDC so that they could function as trainers for the rural enterprises.

Another aspect will be to determine what the industry requires and provide those facilities at the centre. This aspect could be discussed with the industry associations. (essential oils/Spices/Aroma chemicals and isolates/Fragrances)

As the project has to be viable, links for the purchase of oils and oleoresins to be produced at the rural level should be established with the Industry associations or individual companies.

Promotion of new entrepreneurs have to be included where by industrial packages could be transferred to them. For this purpose you may have to study the present loan systems of rural banks and include promotion of such activity using national consultants.

A project coordinator is necessary with support from a visiting international adviser. As many local experts as necessary could be included in the project document and international support where required.

Initiation of cultivation could be done using present govt agricultural stations in areas selected for the project. However the development of good varieties and domestication if necessary will be done by the staff of the FFDC stationed in the areas selected for which purpose they will establish some experimental cultivation units.

Some products that are to be produced could be purchased by the FFDC which could rectify to add value and sell locally or export.

Production of aromachemicals at the FFDC and isolates at the field level can be included.

Formulation of fragrances for rural soap and other toiletries could also be considered as an output that could create rural employment.

The project should fit into the umbrella programme of the UNDP CP V. Hence please discuss this with the UCD.

Please discuss your draft proposal first with Mr. Ramamurthy and Ms Peris of the UNDP office and finally with ResRep / Deputy Res Rep.

These are some of the aspects that are to be considered while preparing the project document.

**PROGRAMME OF WORK**

Dates	Items of Work
October 09	Departure from Colombo
October 10/11	<p>Discussion with and briefing by UNIDO UCD and UNDP (Delhi) officials on:</p> <ul style="list-style-type: none"> <li>- the country corporation Framework 1 (CCF1) and the place of the Kannauj project within this</li> <li>- Planning of site visits with National Director and related officials</li> <li>- Study of documentation provided</li> <li>- Study of documentation provided</li> </ul> <p>Site visit to FFDC Kannauj</p> <ul style="list-style-type: none"> <li>- Interaction with selected industrialists</li> <li>- Interaction with staff of FFDC</li> <li>- Assessment of FFDC laboratories, pilot plant, and progress made</li> <li>- Returned to Delhi. Detailed discussions with National Project Director and Mr S R Singh.</li> <li>- Review of documentation provided at FFDC.</li> <li>- Visits to Chandausi and Badaun. Discussions with industrialists. Visits to Mint distilling Centres, Farms, and Menthol factories in the Badaun and Chandausi regions. Also Factory at Badaun (S.R. Varshney)</li> </ul> <p>Visit to Kanpur.</p> <p>Meeting of Governing Council of FFDC. Briefing of UNDP officials on interim observations. Discussion with Mr Singh (agronomist). Discussions with representatives of R&amp;D and Industry. (Mr. Rajgopal from Madurai) Return to Delhi.</p>
October 17-19	<p>Visit to UNDP. Discussions with Ms Paris re:</p> <ul style="list-style-type: none"> <li>- Programme support document requirements</li> <li>- Interim observations</li> <li>- CPV and CCF 1</li> </ul>
October 20	

Briefing by Ms Paris on scenario and scope.  
Study of documentation provided.

Outline of Report

Discussions with Messrs S.R. Singh & D.P. Singh

Preparation of draft outline of proposals. /  
report.

Discussions with Dr R K Bhandari (CSIR), re:  
CSIR laboratories related to herbal industrial  
products, then respective functions and siting.

Discussions with Mr Govind Kelkar, Managing  
Director S.H. Kelkar & Co. at UNDP, Bombay,  
re. prospects and proposals.

October 21

Discussions with R&D officials and National  
Director.

October 25

Discussions with Dr C.K. Atal (UNIDO  
Consultant)

October 25 - onwards  
(Home based Work  
phase)

Debriefing session UNDP-UNIDO Departure for  
Colombo.

Finalization of draft report and programme  
support document-on concept form.

Then further preparation of final documents of  
mission.

**PERSONNEL OF THE KANNAUJ (FFDC)**

S.NO	POST TITLE	NAME & SEX OF INCUMBENT	FULL OR PART TIME	ENTRY ON DUTY	QUALIFICATION	EXPERIENCE
01	Director	D P Singh (M)		April'94	M.Sc (Chemical Tech)	25 years. Technomanegerial in Chemical & Allied Field
02	Deputy Director (Chem.)	K N Dwivedi (M)	Full time	Sept.'93 (08.09.93)	B.Tech (Chem. Tech) P.G.Dip. in Project Management	1. 3 Yrs in Industrial Production. 2. 13 Yrs. in Govt. of India SIDO, Dept. engaged in consultancy and development of small scale industry 3. 3 Yrs at FFDC, Kannauj in processing of Essential oils
03	Asst. Director (Chem) (QC)	Alok Lehri (M)	Full time 11.11.91		M.Sc(Organic Chem.) Ph.D (Chem)	12 Yrs. 7 Yrs research experience in Mlinor Oilseeds, Neem (Azadiractta indica) Mohwa (Madhuca Longifolia), Karanja (Pangamia, globra), 5 Yrs as Inchargee of Quality Control of Essential Oils at FFDC
04	Asst. Director (Chem)	G.S. Chandaula (M)				
05	Asst. Director (Admin. & Security)	P.K Mukhopadhyay (M)	Full time Aug.'95	Aug.'95	B.A., LLB, IRI PM, MBAM, PG Dip. HRD	20 Yrs experience
06	Extn. Officer (Agro)	Sattram Singh (M)	Full time	13.08.93	M.Sc.(Ag.) (Agriculture Extn.)	2 years in marketing of Agro-chemicals in somanil chemicals. 3 Yrs and onward working in FFDC in Agro-tech. of aromatic crops (Total Exp. 5 Yrs)

07	Extn. Officer (Chem)	S.V Shukla (M)	Full time	04.05.94	B.Sc. (Hons) Chem. M.Sc. (Organic Chem.	2 1/2 yrs research in vegetable oils at HBTI, Kanpur. 1 1/2 yrs instrumentation & quality control of essential oil at FFDC 2 1/2 Yrs in Fragrance Creation at FFDC, Kannauj
08	Documentation Officer	P.C Singh (M)	Full time	05.05.94	M.A & Master Degree in Lib. & Information Science	6 Yrs. in House Keeping operation Library ii. Library automation in INSA, DESIDOC and Delnet, New Delhi iii. 2 yrs 5 months in house keeping operation in Library, Doc, work, Infor. and Marketing.
09	Scientific Asst	B.V. Shukla (M)	Full time	05.11.92	M.Sc. (Organic Chem.) Dip. in Chemical Process and Instrumentation	4 Yrs experience in Instrumental analysis and processing of Essential oil
10	Scientific Asst.	Nadeem Akbar (M)	Full time	02.12.92	M.Sc. (Organic Chem.)	1. One Yr. in quality assurance division in industry manufacturing Inorganic chemicals (Spray Dried Slica) 2. 4 Yrs. in Quality Control Division and processing of Essential Oils/Aroma Chemicals)
11	Scientific Asst	Lal Bahadur (M)	Full time	13.04.94	M.Sc. (Organic Chem)	14 mths research experience. Two years and 7 mths in chemical and instrumental analysis in FFDC. (Total 3 Yrs 9 mths)
12	Scientific Asst. (Plant Maintenance)	V.V Rama Rao (M)	Full time	Aug. '95	Dip. in Mechanical Eng.	1. 2 yrs in maintenance of D.G set, Steam generator and solvent extraction plant 2. One year in erection and installation of pilot plant

13	Accountant	A.N Sharma (M)	Full time	16.11.92		
14	Stenographer	Pradeep Kumar (M)	Full time	08.12.95		
15	Clerk-cum- Typist	Shravan Kumar (M)	Full time	28.12.91		
16	Driver	Vijay Singh (M)		28.12.91		
17	Watchman/ Sweeper	Dildar(M)	Full time	05.09.91		
18	Watchman/ Cleaner	J.P Pal (M)	Full time	16.11.92		
19	Peon	Ram Ujagir (M)	Full time	04.09.91		
20	Helper	Kamleshx Kumar (M)	Full time	08.12.95		
21	Helper	S.L Kushwaha (M)	Full time	18.12.95		
22	Electrician	Narendra Kumar (M)				

**INDUSTRIALISTS WITH WHOM THE CONSULTANT HAD DISCUSSIONS****Kannauj Region:**

1. Moradwaj Saini and Pramod Saini of Lala Pragdutt & Co.
2. Arun Mehrotra & Pankaj Mehrotra of Kummuel Products- Perfumers.
3. Subash Chandra Gupta of Ms Beni Ram Mool Chand.
4. S.K Rathore of Rathore Pooja Products.
5. J.P Parthak of Munnal Sons & Co.

**Badaun & Chandausi Region:**

6. Phool Prakash of Hindustan Chemicals & Allied Industries.
7. Prakash Chandra Gupta of Prakash Chemicals.
8. Vishal Rastogi of Vishal Chemicals, Bharat Essential Oils.
9. Members of the Essential Oils Association (UP)
10. Har Prasad Singh, of Sona Chemicals, Jabapur.
11. Mukul Rastogi, Nai Serai.
12. Rakesh Kumar Vaish of Khusboi Essential Oils.
13. Ashok Rastogi of RA Associates, Sayadwara.

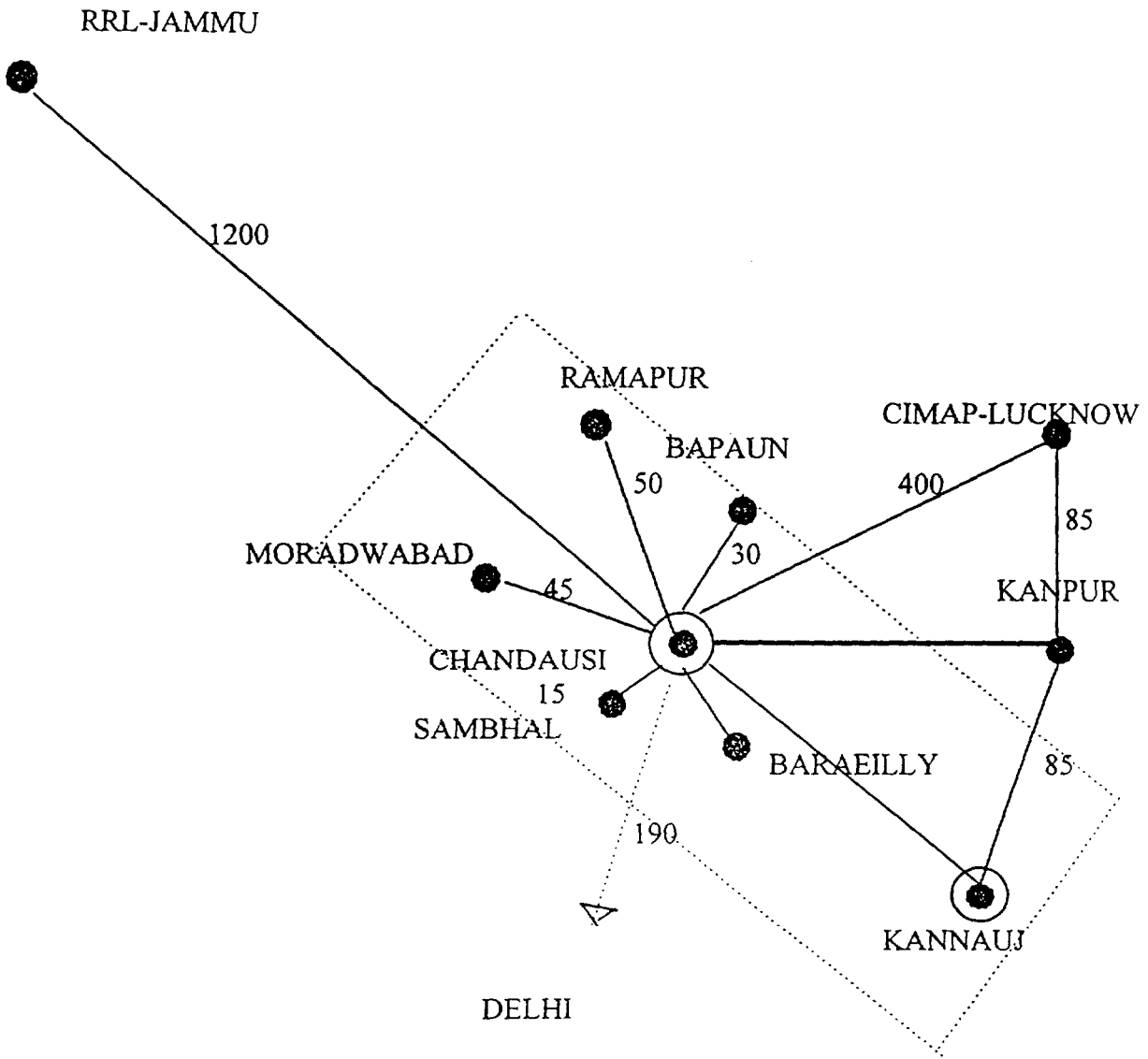
**Others:**

14. S. Rajagopal, Small Industries Product Promotion Organisation, Madras.
15. S. Krishnamoorthy, Hindustan Lever Research Centre. Mumbai.
16. Dr Baldev Gulati of BMV Fragrances Pvt Ltd. New Delhi.
17. Govind Kelkar, of S.H.Kelkar & Sons, Mumbai.
18. Rasiklal Hemani, Essential Oils Marketing Expert.



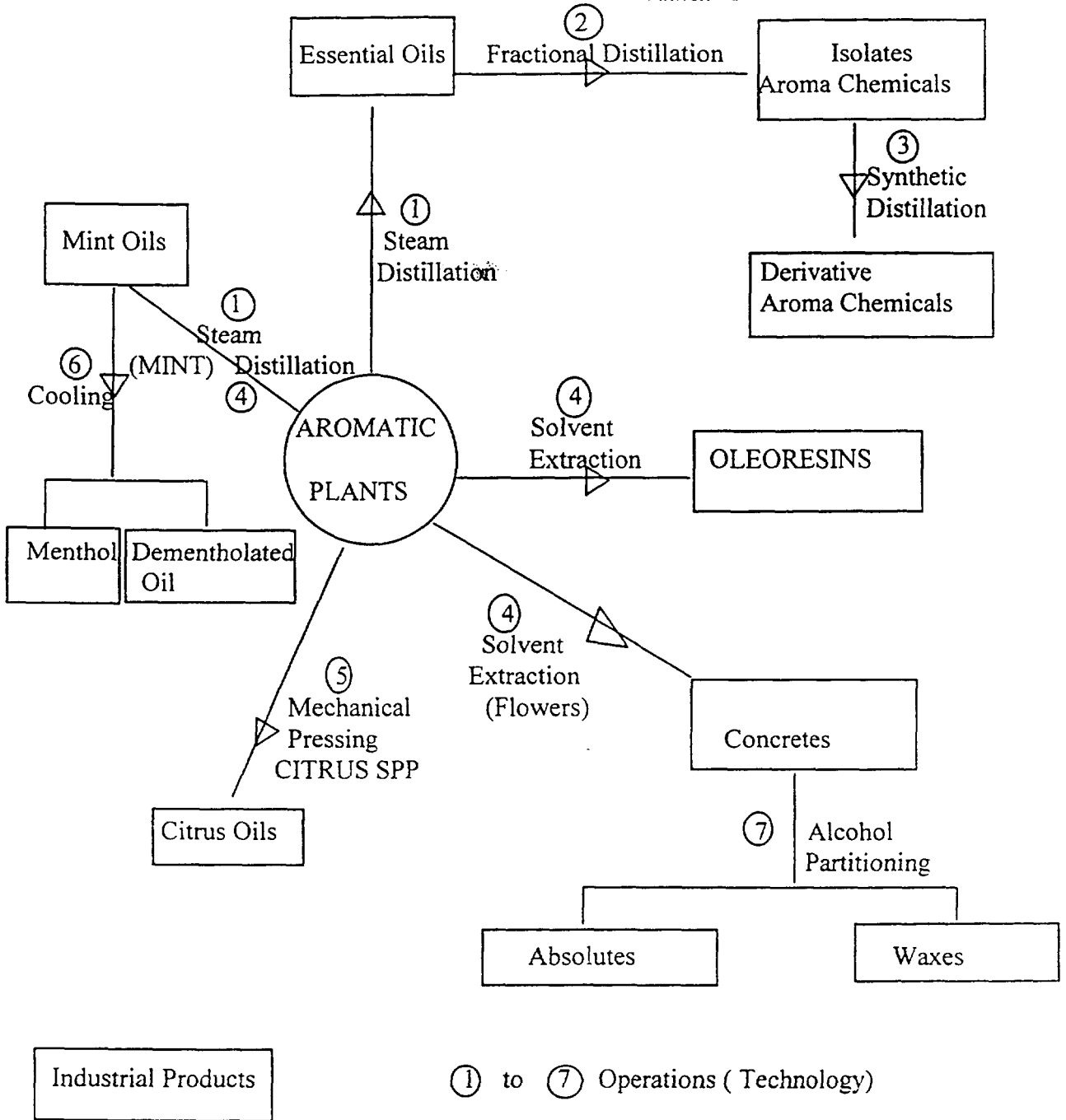
**NATIONAL EXPERTS CONSULTED**

1. Dr C K Atal, ex UNIDO Consultant.
2. G D Kelkar, Industrialist, Chemical Engineer.
3. Dr B C Gulati, Essential Oils, Technologist.
4. Dr G P Phandke, Director NISC-CSIR re information.
5. Dr D V Singh, Deputy Director CIMAP, Agronomist UP-LDC.
6. Dr Aparbal Singh, Agronomist Consultant.
7. S R Singh, Industrial Adviser, SIDO, New Delhi.
8. Dr M L Maheshwari, Vice President, EOA, India (NZ), Analytical Chemist.



— DISTANCES IN KM. APPROX.

AROMATIC PLANT CROP CENTRES IN U.P.



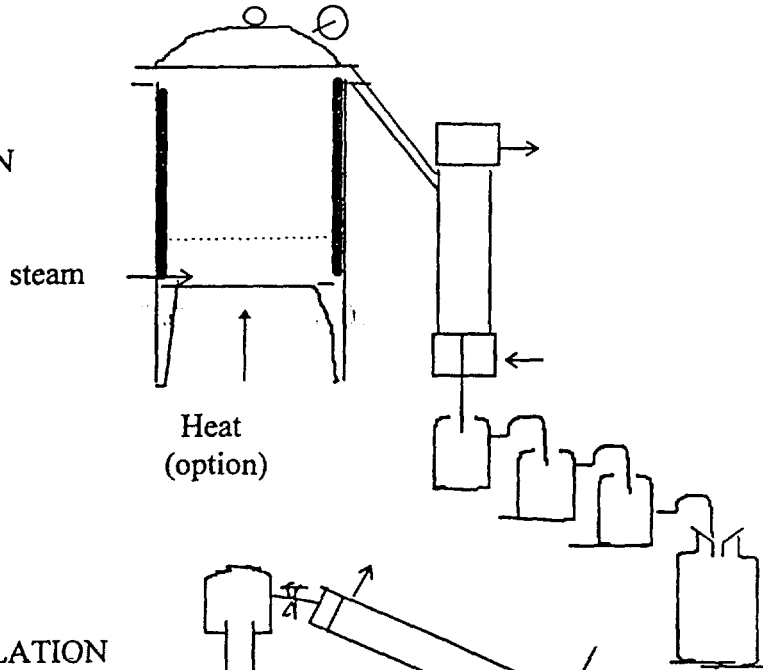
INDUSTRIAL PRODUCTS FROM AROMATIC PLANTS AND CORRESPONDING TECHNOLOGICAL OPERATIONS

**METHODOLOGY**

**1. STEAM DISTILLATION  
OR HYDRO**

Start: Raw Plant Material

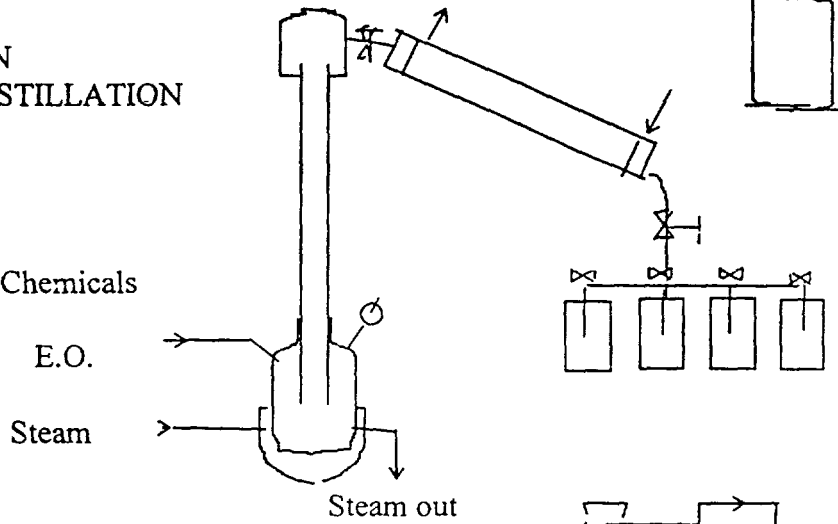
End: Essential Oil



**2. FRACTIONATION  
FRACTIONAL DISTILLATION**

Start: Essential Oil

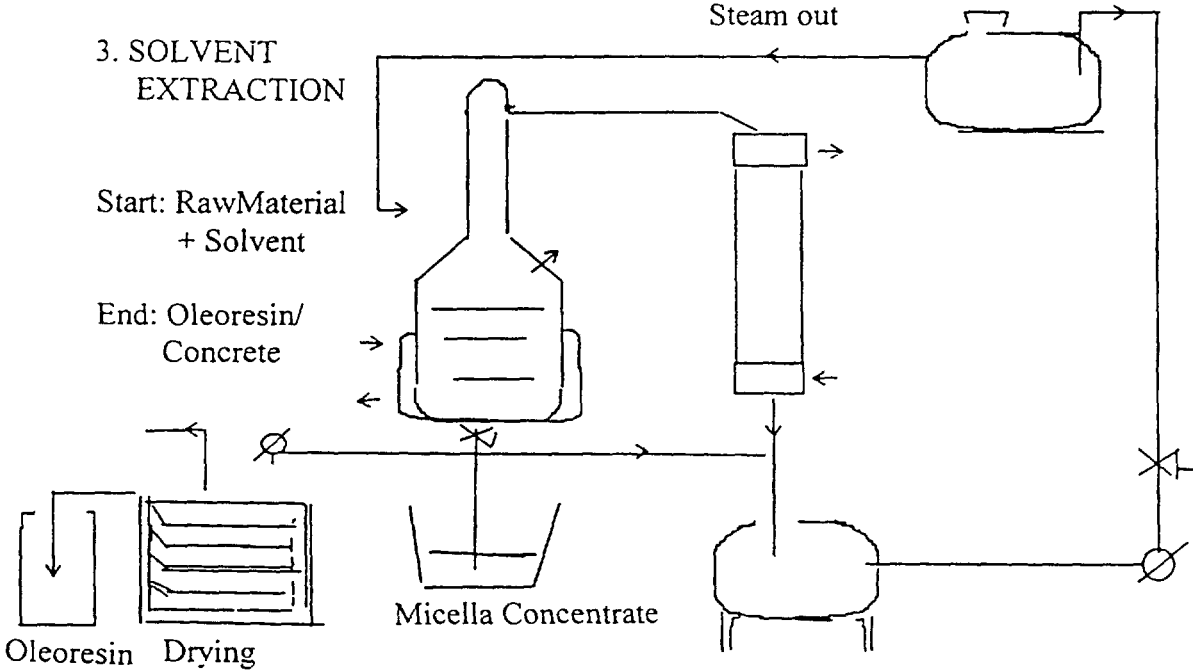
End: Isolates, Aroma Chemicals



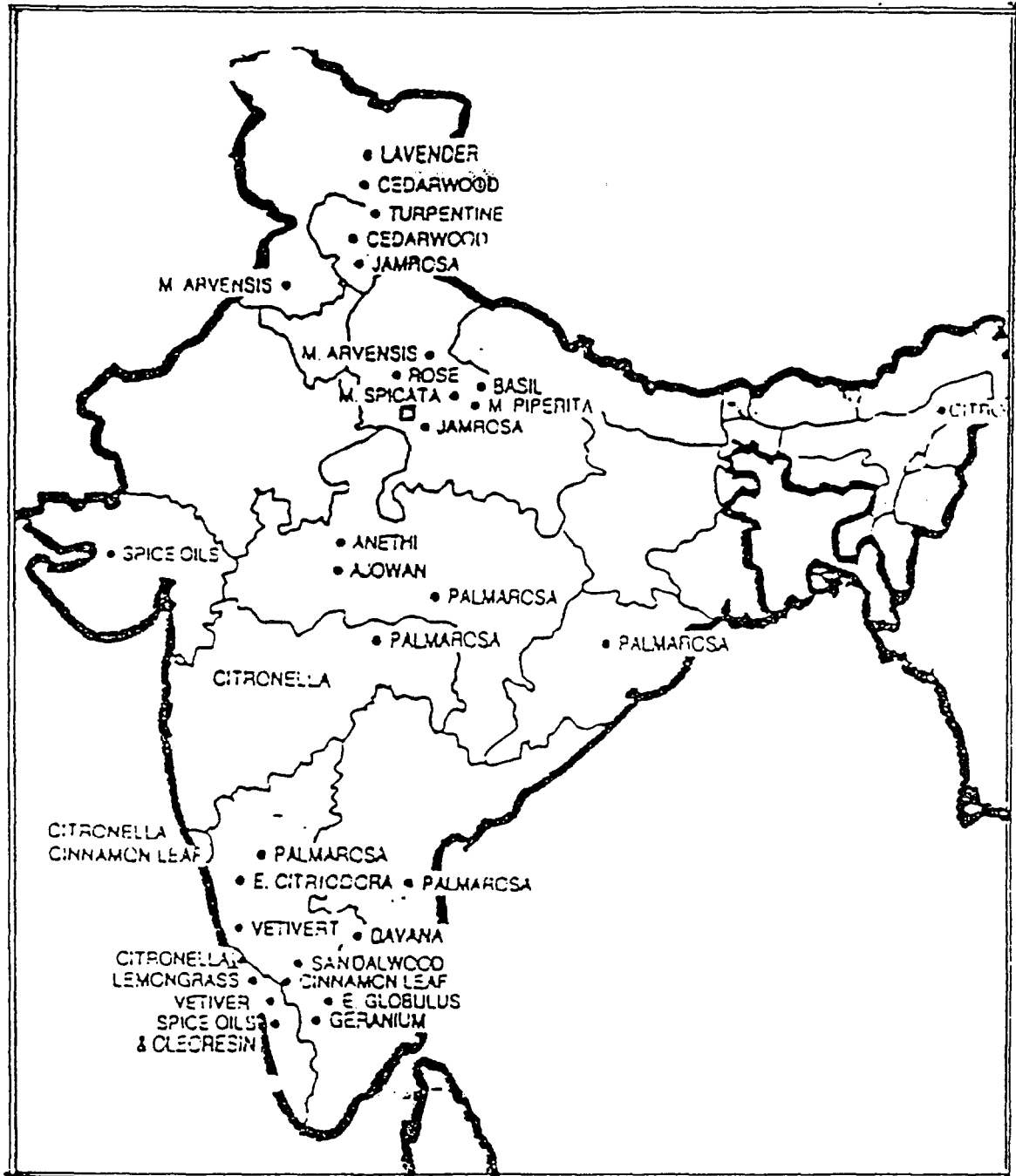
**3. SOLVENT  
EXTRACTION**

Start: RawMaterial  
+ Solvent

End: Oleoresin/  
Concrete



SKETCH OF PROCESS TECHNOLOGIES



Range of Essential Oil Production Centres throughout India (Courtesy PAFAI Journal)

**DRAFT TERMS OF REFERENCE FOR FAO PARTICIPATION  
BY WAY OF A SUB-CONTRACT FOR PROVISION OF SERVICES**

The FAO assistance will be to conduct a review of the large scale cultivation aspects of the aromatic plants based industry in India with respect to the role of providing the needed raw material for the industry.

The terms of reference for the consultancy services may be based on the following elements:

- a. Conduct a review of the selected areas where aromatic plants are cultivated for processing of essential oils; recommend initiatives for improvement on the basis that these cultivations will provide the raw materials for the growing Indian essential oils industry.
- b. Recommend new species of essential oil bearing plants that could be introduced for large scale cultivation within India, on the basis of market potential and agrotechnological feasibility.
- c. Recommend regions with the appropriate geoclimatic features for the large scale cultivation of the recommended species.
- d. Select appropriate planting material and establish model demonstration farms in typical regions; establish facilities for the micropropagation of species where applicable.

N.B.

In order to provide the services the FAO could be mandated to supply One or Two International Consultants for a Two man month split mission with two national consultants to assist with the tasks. The participation of the FAO consultant team in the proposed Expert Working Group Meeting will be productive.

A briefing on the exact nature of the tasks to be performed can be finalised following the Expert Working Group Meeting.

**PART II****PROGRAMME SUPPORT DOCUMENT**

**Number & Title:** DP/IND/97/XX- THE DEVELOPMENT OF THE ESSENTIAL OILS & FRAGRANCE INDUSTRY.

**UNDP Sector :** Industrial Development Support

**Government Sector :** Small Scale Sector

**Host Country Implementing Agency:** Small Industries Development Organisation

**Host Institution:** Fragrance and Flavour Development Centre, Kannauj

**Executing Agency:** United Nations Industrial Development Organisation ( UNIDO )

**Brief Description:**

The objective of the project is to enlarge the capability already established by the project DP/IND/89/133 and enable a wider range of participation of the rural sector in the essential oils industry and its development in india, thus increasing the wealth creation, and employment generating capacity of this sector.

## I. BACKGROUND & JUSTIFICATION

### 1. The Kannauj PPDC (FFDC)

In 1989 the UNDP responded to an Indian government request for assistance in developing the traditional fragrance industry in Kannauj. UNIDO was requested to send a mission to study the situation. This mission was carried out by two experts (UC/IND/86/016), an Essential Oils expert and an economist. Following the report of the experts UNIDO sent its Special Technical Adviser on a mission to evaluate the situation. The resultant project proposal based on the two-expert missions and the observations of UNIDO was later evaluated by a UNDP national consultant, and finally emerged as a project for the creation of a PROCESS & PRODUCT DEVELOPMENT CENTRE FOR ESSENTIAL OILS, (PPDC), in Kannauj. (DP/IND/89/133).

The PPDC subsequently re-named the FRAGRANCE & FLAVOUR DEVELOPMENT CENTRE, (FFDC), came into being in 1991. The Cost-sharing project had the following contributions :-

UNDP	USD	632,000
GOI	IRs.	10,670,000
GoUP	IRs	9,000,000

The Government of Ultra Pradesh (GoUP) provided the buildings and the present campus, the GOI provided the staff and items of equipment while the UNDP through UNIDO provided the international and national consultants, international training as well as the equipment and instruments.

Project implementation commenced in 1991 and in the course of the past period of five years, the following facilities have been installed at the FFDC.

- a. A Model Farm, a Level of Agro-technological expertise, and a capability to render extension services to industry.
- b. A Pilot Plant facility with a capability for the following unit operations.  
Steam distillation & oil recovery  
Solvent extraction.  
Solvent stripping  
Fractional distillation  
Chemical Reaction vessel
- c. A facility for fragrance formulation, and sensory evaluation.
- d. A Quality Assessment and Control QA/QC Laboratory with modern analytical instrumentation for standardization of products and raw materials.
- e. An Information and Documentation Centre with some expertise in packaging and market study.
- f. A trained and dedicated team of scientists and technologists whose skills though considerable have to be given the facility to gain further experience to be of the fullest service to the industry, and to the rural population that participates to a significant extent in the industry.

The project after review was extended from the original three to a five year period. After a



successful tripartite review in August 1996 the initiative for a preparatory assistance consultancy to develop a second phase was taken. The progress has been most satisfactory, and the impact on the industry considerable. (Vide: Consultant's report which forms Part I of this document.) Accordingly, this second phase must command a wider scope and involvement.

## **2 Government Policies and Initiatives**

In a wide policy statement the Union Minister of Industries addressing the All-India Conference of State Industry Ministers in August 1996 quoted the Common Minimum Programme of the United Front Government: "Special Plans will be devised to promote small and cottage industries to achieve the twin objectives of growth and employment". He stated that: "Such programmes must be re-designed to ensure generation of more employment, creation of assets, imparting productive skills, and raising the incomes of the very poor so that a significant number is brought above the poverty line every year"....

The GOI as a definite policy initiative has launched a major thrust to benefit the Small Scale Sector (SSS). The SSS accounts for around 30% of the exports from India. (Murthy 1996). The employment generation potential is high. It has a spread towards rural and away from the metropolitan areas. It is an effective instrument to create assets for the rural poor, to create clusters of industrial growth in backward areas, and engage women in entrepreneurship and productive employment.

As a manifestation of intent, the GOI has created a Small Industries Development Organisation (SIDO), headed by a Development Commissioner ranking alongside an Additional Secretary to the GOI. A separate unit of the Rural Bank of India called the Small Industries Development Bank of India (SIBI), has been created and a number of other units identified to act as lead institutions to generate the needed venture capital.

## **3 The requirements of the Aromatic Plants based Industry**

In former times India was best known for the supply of some key raw materials such as sandalwood oil, lemongrass oil, and Palmarosa oil to the outside world. The scenario has changed dramatically in the past two decades. Synthetics substitutes are competing with some of the more expensive natural substances. Diversification of crops as a response is paying dividends. China has emerged as a formidable competitor to all producers of a wide range of essential oils. The essential oils industry is agro-based and rural based. Its sequence of events can be graphically represented Fig 1.(See also Part I-Annexes 8&9)

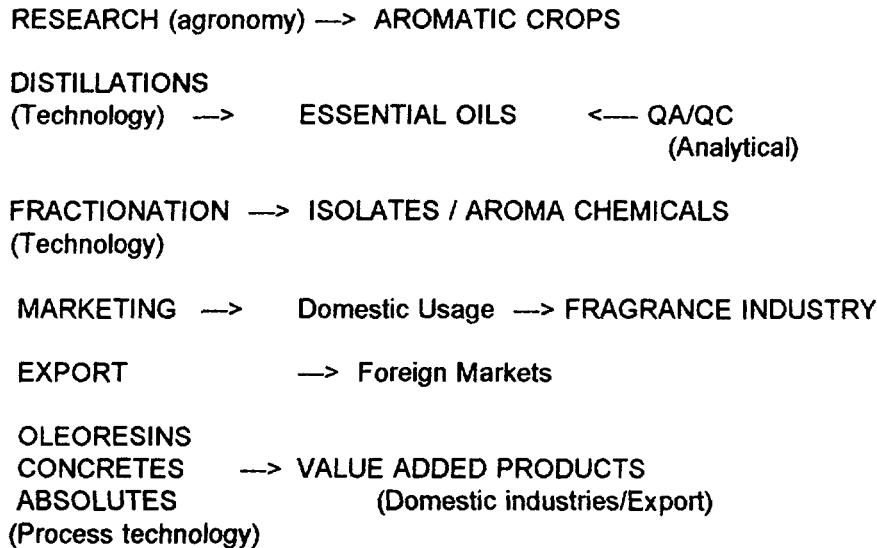
Accordingly, the industry utilises the services of the widest spectrum of social actors in: labourers, cultivators, entrepreneurs, distillers, technologists, scientific personnel market practitioners, exporters, bankers etc.

In this scenario, from being a producer of essential oils, India has become both a major producer of essential oils and their derived downstream products, as well as an industrial user. This is due to the development in India of a Fragrance and Flavour Industry of considerable significance. Accordingly India now needs to produce both for domestic utilisation as well as for export, in order to counteract the expense in importing such oils as are not grown in the country. Furthermore it needs to diversify still further and make use of the great diversity of the country's geo-climatic features to introduce into cultivation crops, hitherto not produced.(See: Annexes 1&2)

In order that this be carried out the requirements of the industry ( some features being common to the entire SSS), have been identified.

Figure 1

### THE SEQUENCE OF EVENTS IN THE ESSENTIAL OILS INDUSTRY



These requirements are summarised as follows:

- (i) The lack of capital in adequate quantum and timely flow. Venture capital not easily forthcoming.
- (ii) The need for information and the capacity to derive analytical benefit from it. The categories identified are:
  - a. Technology
  - b. Market information
  - c. Information on business methodology & entrepreneurship rights.
- (iii) The need for human resource development in all fields ranging from cultivation through technology to market prospecting, and management.
- (iv). Non-availability of key ancillary raw materials.
- (v). Infrastructural shortcomings.
- (vi) The mechanism to disseminate the scientific and technological know-how available, in agro-technology and plant propagation practices, and distillation technology to a wider circle of operators.
- (vii) The lack of price support mechanisms to render the industry competitive with other cash crops.

These factors have to be addressed and this could commence within the UNDP initiative which would act as a facilitator.

#### 4. Reaping the Benefits of R & D

The development of the essential oils industry in and around the U.P. region during the past decade is most impressive. This was observed during the site visits to the areas concerned by the UNIDO consultant in October 1996. In particular, the growth of a mint industry in the regions surrounding Kannauj, and in the regions centred around Badaun and Chandausi respectively, can be unequivocally attributed to the following factors:-

- the availability of scientific agrotechnological expertise.
- the ready availability of planting material of proven strains
- the availability of research data and practical know-how in the various process technologies viz: steam distillation, fractionation, and crystallisation.

This industrial leap therefore can be regarded as the direct benefit of the R&D efforts of Indian laboratories such as CIMAP (Lucknow), RRL ( Jammu), and to a lesser degree the fledgling laboratories of the FFDC Kannauj. The potential for the utilisation of research results has been amply demonstrated. It is therefore clear that for the future sustenance of the momentum gained, the following would be the crucial factors:-

- Enhanced access to R & D sources
- QA/QC facilities situated in reasonable proximity to centres of industrial activity.
- Further research with crop diversification.
- Market access and know-how.
- Facilities for training at several levels.

The industrialists are ready to support with their own contributions any efforts to facilitate further growth of the industry.

## II THE PROJECT

### 1. The Objectives of the Project:

The objectives of the project will be the following:-

#### 1.1 Objective 1

To formulate a coordinated policy, and strategy for the growth of the industry in accordance with the national policy objectives previously outlined.(Section 1.2 above).

#### 1.2 Objective 2

To further enhance the already established capability at the FFDC Kannauj so that it may serve as the R&D centre for the region supporting the industry with its own customised R&D, and information, as well as accessing for the industry, R&D results from other established national Institutions.

#### 1.3 Objective 3

To put into operation a practical model of Quality Assurance & Technology Diffusion Centres (QA/TDC), to service the clusters of the Industry that have developed in regions such as Badaun and Chandausi. The model QA/TDCs could be replicated at any three centres to begin with and the model's viability assessed after a period.

## **2. The Expected Outputs**

In accordance with the above objectives the following outputs would be expected at the end of the FIVE year period of the project.

### **2.1 Output 1**

A report covering the goals, policies and strategies of the assistance programme for the essential oils industry and the processing of downstream products for the domestic and export markets. All aspects ranging from plant crops propagation, through distillation technologies, to standardization, and packaging of products, will receive attention.

### **2.2 Output 2**

A modern facility at FFDC fully equipped to conduct customised R&D at Kannauj on the agro-technology, process technology, quality assurance, storage, marketing aspects of the industry, and the formulation of fragrances, for the industry. The FFDC to have developed the capability to access information and technological know-how on a customised basis for the industry from the acknowledged national centres.

### **2.3 Output 3**

Model Quality Assurance and Technology Diffusion Centres (QA/TDCs) set up in Chandausi, and two other selected regions. The selection criteria for centres, are recorded in the Annex No 3 to this document. (They may be reviewed in the report in Output 1.).

Each QA/TDC to have the capability to conduct Instrumental as well as Sensory evaluation of Raw materials and finished Products, develop standards for them, and provide services in, inter alia, agro-technology, process technology and market information.

## **3. PROJECT ACTIVITIES**

### **3.1 For output 1**

#### **3.1.1 Activity 1**

Organise an Expert Working Group Meeting (EWGM) in accordance with the Terms of reference outlined in Annex 4 of this document.(UNDP/UNIDO, and Mr G.D.Kelkar). The meeting to be staged at the Mulund Campus of S.H.Kelkar & Co. Field an International Consultant, if deemed necessary, to assist.

#### **3.1.2 Activity 2**

Publish and widely distribute the report of the EWGM to GOI and interested parties as a recommended policy document.(UNDP).

### **3.2 For Output 2**

#### **3.2.1 Activity 1**

Identify a complete list (roster) of national consultants and organise a meeting at the earliest date following the commencement of the project. (UNIDO and FFDC).

### **3.2.2 Activity 2**

A Panel of selected Consultants will together with the staff of FFDC review the list of hardware recommended, formulate the training schedules, and take all initiatives for the swift acquisition of the recommended equipment (Annex 5). (FFDC & NCs).

A realistic, time-framed Work-Plan will be drawn up and up-dated periodically by subsequent meetings of the Panel of Consultants and FFDC.

### **3.2.3 Activity 3**

Civil Works and other requirements will be put in place for installation of the equipment of the project. (FFDC).

### **3.2.4 Activity 4**

The Training schedule will be set in operation. A Time framed plan, revised from time to time should ensure timely completion of the training. (FFDC and UNIDO).

## **3.3 For output 3**

### **3.3.1 Activity 1**

The first model QA/TDC will be set up at Chandausi. An organisation to be set up to manage and implement the activities, with FFDC Kannauj participation. (GOI and UNIDO)

### **3.3.2 Activity 2**

Acquisition and preparation of suitable premises and installation of the equipment in Annex 6. (Governing Board of QA/TDC, and UNIDO).

### **3.3.3 Activity 3**

Drawing up of standard specifications for Mint raw materials and products, and other species such as basil, palmarosa grown in the region.(QA/TDC and FFDC). Organised testing services initiated.

### **3.3.4 Activity 4**

Formulation of Work Plan for QA/TDC as a programme for a three year period.(QA/TDC and FFDC).

### **3.3.5 Activity 5**

Review of overall plan drawn up by EWG Meeting ( Output 1) as far as concerns QA/TDC and formulation of detailed activities within the work-plan.(QA/TDC and FFDC).

### **3.3.6 Activity 6**

Review of performance of QA/TDC to date and adjustment of Work-plan and further inputs not delivered. (UNIDO via EWG meeting).

## **4. PROJECT INPUTS**

**4.1 Government Inputs: ( For all Outputs)**

GOI Cost Sharing Component:

Component (In Kind):

National Experts &amp; Staff

Buildings and Utilities

GoUP Cost Sharing Component:

Component (In Kind):

Land &amp; Civil Works

**4.2 Private Sector Industry inputs: ( For all outputs)**

Industry Cost Sharing Component:

Industry Component (In Kind):

Buildings,  
Farm Lands  
Labour.  
Field Distillation Stills.  
Utilities for Laboratory & QA/TDC.

**4.3 UNDP/UNIDO Inputs:****4.3.1 For Output 1**

International experts;

1 x Essential Oils expert 0.25 m/m

6 x National Experts 6x0.25m/m USD. 14,000.

Experts travel &amp; transport 10,000.

**4.3.2 For Output 2**

International Experts:

1 x Planning Consultant 1 m/m (split). USD. 8,000.

**4.3.3 Project Coordinator** 24 m/m USD. 48,000.  
(National Expert)

**4.3.4 Project Management Support**

Programme Coordinator 24 m/m USD. 24,000.

Secretary 24 m/m USD. 12,000

**4.3.5. National Experts:**

Agronomist.	12 m/m (split)	USD.	12,000.
Process Technologist	09 m/m (split)	USD.	9,000.
Organic Chemist	06 m/m (split)	USD.	6,000.
Analytical Chemist	06 m/m (split)	USD.	6,000.
Perfumer	03 m/m (split)	USD.	6,000.
Maintenance engineer	03 m/m (split)	USD.	6,000.
Sundry consultants	10 m/m	USD.	10,000.
	<b>Total</b>	<b>USD.</b>	<b>171,000.</b>

#### 4.3.6. Training Schedule

##### INTERNAL TRAINING ( within India).

Agronomy	4 x 6 m/m	= 24 m/m	
Organic Chemistry	4 x 6 m/m	= 24 m/m	
Analytical chemistry	2 x 3m/m	= 06 m/m	
Process technology	2 x 3 m/m	= 06 m/m	
Fragrance formulation	2x3 m/m	= 06 m/m	
Storage & Packaging	1 x 6m/m	= 06 m/m	
Fractionation	1 x 4m/m	= 04 m/m	
Total of:		= 76 m/m	USD. 114,000

##### EXTERNAL TRAINING (outside India).

FRANCE:	Fragrance formulation	= 06 m/m	
CHINA/HUNGARY:	agro-technology	= 03 m/m	
FRANCE/ROMANIA:	Packaging	= 03 m/m	
Total of:		= 12 m/m	USD. 60,000.
Total			USD. 174,000.

#### 4.3.7 Equipment

##### Consumables (Labware & Reagents).

QVF or Schott or equivalent industrial glass Chemical Reaction Assembly for synthesis of aroma chemicals.	USD.	400,000.
Reagents & chemicals (specialised)Annex 7	USD.	700,000

##### Non-consumable labware and pilot scale Equipment (Annex 5)

USD. 1,075,750

FOR OUTPUTS 1 AND 2 TOTAL = USD. 2,520,750.

#### 4.3.8 ESTIMATED COST OF OUTPUT 3

( i ) For the proposed QA/TDC at each Centre

Expertise (International)		
1 x Planning consultant 1 m/m	\$	8,000

<b>Expertise (National)</b>			
1 x Agronomist	6 m/m		
1 x Distillation technologist	6 m/m		
1 x Chemist/Fractionation of oils	6 m/m		
1 x Marketing expert	3 m/m		
	21 m/m	\$	31,500
<b>Equipment:</b>			
Consumables		\$	100,000
non-Consumables	(Annex 6)	\$	750,000
	<b>Total</b>	\$	<b>889,500</b>
<b>Pilot Installations:</b>			
For installation of a Solvent Extraction for the production of oleoresins of Spices, and concretes.			
		\$	120,000
	<b>TOTAL for each centre</b>	\$	<b>1,009,500</b>

**N.B.:**

Buildings and installations as well as utilities will it is assumed be the responsibility of the private sector industrialists participating in the programme. The exact nature and components should be determined during a second mission to Chandausi. A national consultant may be utilised in this.

The cost estimates of the land, buildings and utilities will have to be estimated and added to the programme budget. This is not within the scope of the present mission.

(ii) For similar QA/TDC s in the South of the Country and in the North East regions, a sum of 2m may be estimated, working on the above basis. For a more exact estimate a site visit to the centres concerned would be needed and could be carried out by a planning consultant either international or national.

Accordingly, a TOTAL OF USD 3.0 MILLION, may be estimated for the output 3.

THE TOTAL PROJECT ESTIMATED COST WOULD BE ESTIMATED AT 5,550,000 (Five million, five hundred and fifty thousand USD)

**III. PRE-REQUISITES/PRIOR OBLIGATIONS**

1. The participation of the GOI, the Go UP, the Private sector industrialists and the UNDP/UNIDO should be covered by means of a Memorandum of understanding which defines the inputs for which each party would be responsible.

2. There should be a mechanism whereby the funds needed for the programme would be made available up-front and deposited in a separate funding account prior to the commencement of the programme.



3. The national experts should be identified and committed by means of an agreement well in advance of the dates when their services will be required.

4. The trainees should be on board and the training programmes in place well in time.

#### **IV. MONITORING & MANAGEMENT**

The progress of the programme should be monitored after 12 months from the commencement of the programme and at least twice again with a separation of twelve months between each evaluation.

It would be profitable to use the services of an international consultant in this endeavour.

The end of project evaluation as well as the intermediate evaluations may be conducted by members of the expert group in Output 1. This group may be used to serve as the Steering Committee for the Management of the Programme and could give direction to the programme at all times.

The steering committee should meet at least twice a year, once with the principle programme personnel to discuss problems, and to give the programme leaders the necessary advice. They could from time to time up-date the work-plan.

**ESSENTIAL OILS PRODUCED ON A LARGE SCALE IN INDIA**

Agarwood oil, Ajowan oil, Anethi oil (Dillseed oil), Artemisia annua oil, Basil Oil, Calamus oil, Caraway seed oil, Cardamom oil, Cedarwood oil, Cinnamon leaf oil, Citronella oil (java), Cumin seed oil, Cyperus rotundus oil, Davana oil, Eucalyptus oil (Citriodora), Eucalyptus oil (Cineole var.), Geranium oil, Ginger grass oil, Ginger oil, Jamrosa oil, Juniper berry oil, Lavender oil, Lemongrass oil, Lime oil, Mentha citrata oil, Mentha piperita oil, Mentha arvensis oil, Rose oil, Nutmeg oil, Palmarosa oil, Black pepper oil, Sandalwood oil, Tagetes minuta oil, and Vetiver oil.

**ESSENTIAL OILS PRODUCED ON A MINOR SCALE**

Camphor oil, Bursera husk oil, Tangerine oil (Indian orange), Patchouli oil, Rosemary oil, Clary sage oil, and Davana oil.

**ESSENTIAL OILS IMPORTED INTO INDIA**

Oil	Estimated Annual Imports(Tonnes)
Bergamot *	12-15
Cananga	5-6
Cedarwood (chinese)	8-10
Clove leaf	120-150
Eucalyptus (Cineole)	40-50
Geranium *	30-40
Lavender/Lavandin *	40-50
Nutmeg	8-10
Orange (cold pressed)	80-100
Petitgrain *	8-10
Patchouli	80-100
Guaicwood	10-12

\* Synthetic equivalents

Source: S.V.Vaze: PAFAI Seminar on Indian Essential oil Industry, Lucknow, April 1996.

**TEN SELECTED ESSENTIAL OILS  
WORLD PRODUCTION & INDIAN PRODUCTION/DEMAND**

Essential Oil	World Production	Indian Production	Indian Demand
Citronella (Java)	4000-5000	300-350	500-600
Clove leaf	1500-2000	nil	100
Eucalyptus(Cit)	450-500	35-40	100
Eucalyptus	1500-2000	180-200	300-400
Geranium	100	4-5	25-30
Lemongrass	600-800	100-120	500-600
Patchouli	800-1000	nil	100-120
Mentha piperita	3500-4000	500-550	300-400
Spearmint	1000-1200	100-120	150-200
Vetiver	100-150	14-18	20-25

Figures in metric tonnes

Source            **Vaze S.V. PAFAI Seminar on The Indian Essential Oils industry,  
Lucknow, April 1996.**

**CRITERIA FOR SELECTION OF QA/TDC'S**

The following criteria should apply in the Selection of QA/TD Centres.

1. A displayed commitment by industrialists
2. Substantial cultivation and ongoing distillation activity
3. Substantial need to analyse products and assess quality in raw materials.
4. Market sensitivity to quality in products
5. A demand for diversified essential oil species, and products with commitment to value enhancement

**TERMS OF REFERENCE FOR THE EXPERT WORKING GROUP MEETING.**  
(Output 1)

An expert Working Group Meeting was mooted during the discussions between the UNIDO-UNDP Consultant R.O.B.Wijesekera, Mr G.D.Kelkar, and the UNIDO-UNDP representatives at the UNDP Office New Delhi on Wednesday 23 October 1996. The EWG meeting would bring together a selected band of multidisciplinary experts and representatives of the industry. They would meet for two days in Mulund at the premises of Messers S.H.Kelkar & Sons. They would be expected to formulate a plan for the development of the essential oils industry with the UNIDO-UNDP initiative at Kannauj as the catalytic starting point. The following terms of reference were drawn up accordingly, to guide the deliberations of the EWG.

- a. A study be made of the report of the UNIDO-UNDP consultant and the recommendations therein.
- b. Selection of a short list of aromatic plant species reckoned to be useful from the viewpoint of the industry, (present market considerations), and suitable for cultivation in different zones of India.
- c. Select a further short list for aromatic plant species that could be introduced for cultivation in India, that would generate oils most likely to be required by India in the future.
- d. Select a third short list of species that are suitable for cultivation in India from the viewpoint of their likely usage in Aromatherapy (Ayuromatherapy).
- e. Identify regions for the cultivation of the species in the three lists.
- f. Identify a roster of candidate-national experts in the various disciplines who could from time to time be recruited to carry out the programme identified in the proposal of the UNIDO-UNDP expert.
- g. Identify the role of support R&D institutions in India which could provide the R&D back-up to the programme proposed.
- h. Identify initiatives that India could make to assist the essential oils industry in the neighbouring countries.

Following the above guidelines develop a time-framed work-plan, and where necessary with re-defined outputs and inputs, for the proposed programme supported by the UNDP. The EWP will also formulate a framework of Policy initiatives and funding mechanisms to be implemented to facilitate the programme.

**RECOMMENDED LIST OF INSTRUMENTS & PLANT EQUIPMENT**  
**( Cost estimates are in USD., and approximate )**  
**For Second Phase of FFDC (Kannauj)**

1.	Precision Analytical balances & weighing scales.	2 x Nos	7,000
	0 - 100 mg range		
	0 - 2 g range		
	3-5 kg acc.0.01-0.1 mg	2 x nos	3,500.
	Industrial platform type		
	0 - 200 kg	1 x no	2,000
	300-600 kg	1 x no	3,000
2.	Blending Tanks. ss 304, 100 L, cone-shaped, with 200mm outlet at base, attached stirrer, & heating device.	2 x nos	3,000
3.	Small scale blending unit 100 L, with computerised automatic weighing and mixing facility.	1 x no	20,000
4.	IBM compatible computer and accessories	1 x no	5,000.
5.	Homogenisers	5 x nos	2,000.
6.	Vacuum Ovens	2 x nos	2,000.
7.	Mixer for fragrances	2 x nos	2,500.
8.	Tube sealing machine	1 x no	1,000.
9.	Bottle sealing machine	1 x no	1,500.
10.	Microwave oven	2 x nos	2,000
11.	Refrigerator 3 door 350 L	1 x no.	1,500
12.	Aerosol filling machine	1 x no.	1,000
13.	Transfer pump. ss. 1 HP	1 x no	1,000.
14.	Vacumetric filling up machine	1 x no	3,000.
15.	Volumetric filling machine double head.	1 x no	3,000

16.	Tanks: ss 50 l, 100l 200l	1 x no ea	1,000
17.	Bottle washing machine	1 x no	750
18.	Incubator with digital display	1 x no	1,500
19.	Vacuum pumps	2 x nos	1,000
20.	Spray drier (Lab-scale)	1 x no	25,000
21.	HPLC outfit complete	1 x no	50,000
22.	GLC outfit complete with data processor	1 x no	75,000
23.	TLC outfit with densitometer	1 x no	50,000
24.	GC-MS with all accessories	1 x no	350,000
25.	IR Spectrophotometer	1 x no	25,000
26.	UV-VIS Spectrophotometer	1 x no	20,000
27.	Digital refractometer	1 x no	20,000
28.	Digital densitometer	1 x no	15,000
29.	NIR moisture determination	1 x no	15,000
30.	AA - Spectrophotometer	1 x no	20,000
31.	Automatic titrator	1 x no	7,500
32.	Freezing point app. moisture Balance,	1 x ea	5,000
33.	Mobile field distillation unit, (local fabrication) with boiler unit	2 x nos	70,000
34.	Fractionating column 20 l (Fisher Type)	1 x no	110,000
35.	General Labware and scaffolding		20,000 100,000
		TOTAL	1,075,750

**LIST OF NON.CONSUMABLE ITEMS RECOMMENDED FOR QA/TDC's**

NB: The cost estimates are very approximate and would have to be revised prior to commencement of project.

1. Precision Analytical balances & weighing scales 0-100mg range, 0-2g range, 3-5kg acc. 0.01-0.1mg industrial platform type, 0-200kg, 300-600kg	15,000
2. IBM Compatible computer and accessories	5,000
3. Vacuum Ovens	2,000
4. Homogenisers	2,000
5. Tube sealing machine	1,000
6. Bottle sealing machine	1,500
7. Refrigeration Chamber	15,000
8. Bottle washing machines (2 nos)	1,500
9. Incubator (2 nos)	3,000
10. Vacuum pumps (4)	3,000
11. Spray Drier(Atomiser),Semi-commercial,complete	80,000
12. HPLC Outfit complete	50,000
13. GLC Outfit complete with data procesor	75,000
14. TLC outfit complete with densitometer	50,000
15. IR Spectrophotometer	25,000
16. UV-VIS Spectrophotometer	20,000
17. Digital refractrometer	20,000
18. Digital densitometer	15,000
19. NIR moisture content determination apparatus	15,000
20. AA Spectrophotometer	20,000
21. Freezing point apparator	5,000
22. Fractionating column (Fisher type) 20L cap.	110,000
23. Fractionating column (Local fabrication)	30,000
24. General labware (Glass equipment extractors, reaction vessels etc.)	50,000
25. Agronomic equipment	36,000
26. Pilot processing equipment for trials and demonstration of unit processes: distillation, crystallisation (local fabrication)	100,000
	----- 750,000 =====



**LIST OF RECOMMENDED CONSUMABLE MATERIALS**

1.	Standard aromatic chemicals for analytical work.	\$	100,000
2.	Solvents and chemicals	\$	250,000
3.	Specialised chemicals for synthetic work.	\$	150,000
4.	Laboratory glassware	\$	150,000
5.	Laboratory hardware	\$	50,000
	Total	\$	700,000

N.B. Detailed lists and cost estimates to be formulated for all of the items listed above, at a later date.

**JOB DESCRIPTIONS OF EXPERTS PRESCRIBED FOR PROGRAMME****(a) NATIONAL EXPERTS****1. Agronomist: Duration 12 m/m split mission**

An Agronomist with at least FIVE years active involvement in the cultivation and propagation of essential oils bearing plants on a commercial scale. Should be conversant with the latest techniques of micropropagation.

**2. Organic Chemist: Duration 6 m/m split mission.**

A post-doctoral organic chemist with about five years experience in chemical synthetic work preferably in the terpenoid field. Should have experience with laboratory-scale, bench-scale as well as pilot-scale synthetic work. Should have experience in imparting research techniques in this field.

**3. Process technologist: Duration 9 m/m split mission.**

A chemist preferably with post doctoral experience in the commercial scale production of essential oils, fractional distillation technology, and crystallisation, and purification methods and methods of separation. Should be able to impart practical know-how to graduate level trainees.

**4. Analytical chemist: Duration 6 m/m split mission.**

An analytical chemist fully familiar with the routine instrumental methods of analyses such as: UV, IR, NMR, GC-MS, TLC-densitometry, GLC, and HPLC. A familiarity with the application of instrumental methods in the compositional analysis of essential oils and the quality assessment of essential oils, aroma chemicals, and products such as oleoresins will be needed.

**5. Fragrance formulation expert: Duration 3 m/m split mission.**

A chemical perfumer with a full knowledge in the formulation of fragrances and flavours. Must be able to teach perfumery methodology. Experience in industrial fragrance formulation will be a necessary qualification.

**6. Maintenance engineer: Duration 3 m/m split mission.**

An engineer with experience in the maintenance and operation of commercial scale process equipment notably equipment for steam distillation, solvent extraction, fractional distillation under reduced pressure, solvent stripping, freeze drying, spray drying, etc. The engineer should be able to train the users of the pilot plant assembly in the operation as well as maintenance of the process equipment.

**7. Project Coordinator. (Director). 24 m/m duration.**

A senior scientist with experience in one or more of the disciplines associated with the essential oils industry. Should possess some knowledge of the chemistry and technology associated with the industry. Must possess a proven track record of the management of a research group or equivalent industrial operation. N.B. ( This position cannot be held by a bureaucrat or manager without the necessary scientific and technological experience.)

**8. Programme Management support:**

**8.1. Programme coordinator: 24 m/m duration**

This is a position of a liaison officer between the Project Coordinator (Director), the UNDP who will be monitoring the project and the GOI/GoUP. A senior officer at management level with experience of UNDP projects their implementation and monitoring, will be suitable.

**8.2 Secretary: 24 m/m duration**

This is a secretarial position to 8.1 above. The candidate should be a qualified secretary/or junior scientist/manager, with computer literacy, and ability to handle data-bases, to access information and to maintain computer records of operations.

**(b) JOB DESCRIPTIONS OF INTERNATIONAL EXPERTS**

**(i) Essential oils expert (Planning Consultant).**

An expert with substantial experience in R & D pertaining to the Essential Oils Industry, and with considerable industrial experience. Should be familiar with UNDP supported programmes in the sector, and the many facets that constitute such a programme. A chemical technologist, post doctoral, with the necessary technological background would be suitable.