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UNITED REPUBLIC OF TANZANIA

**Technical report: Feasibility of establishment of
essential oils industry in Zanzibar***

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

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* This document has not been edited.

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ABSTRACT

The mission took place between 24th February and 3rd April, 1996 during which time the consultant worked with the National Consultant, the International Advisor and other project counterparts in Dar es Salaam, Unguja and Pemba.

The consultant exhaustively covered all aspects of his mission as set out in the job description. (Annexure I).

The consultant carried out the following functions:-

- Determined the land under cultivation and the land that could be utilized for cultivation of aromatic plants.
- Assessed the feasibility of small scale field processing of clove leaves.
- Determined the requirements for the establishment of viable rural processing units for essential oils which could provide supplementary income to farmers and women.
- Assessed the training needs of the farmers and women involved in income generating activities relating to aromatic plants.
- Analyzed the cost benefit analysis for such units.
- Selected the areas for cultivation and determine the infrastructural, service and training facilities and equipment required for such a project.
- Prepared a draft project document for project on essential oils as a cottage industry for income generation.
- Recommended other activities that could augment the income of the farmers.

I. INTRODUCTION

Zanzibar has been struggling to broaden its economic base through diversification, particularly in the rural areas. Traditionally most of the local population rely on the cultivation of cloves which are sold to the Government owned Zanzibar State Trading Corporation (ZSTC) at designated collection centres. Due to over supply in the world markets, peasant farmers receive an inadequate price for raw cloves. The clove industry in Zanzibar needs to move towards more flexibility and responsiveness to developments in the world markets and maximize value addition from clove related products.

As such the Government of Zanzibar which had established a distillery for essential oils in Pemba requested assistance from UNDP/UNIDO for its rehabilitation and successfully launched a programme for value added essential oil products such as clove bud oil, clove stem oil, lemongrass oil, basil oil and vetiver oil.

The distillery is now a source of additional revenue for the local farmers supplying the inputs for processing and also for the Government of Zanzibar.

Through the programme of work undertaken at the distillery under the UNDP/UNIDO assisted project, potential has been established for the cultivation and distillation of quality products, competitive in price from a variety of essential oil bearing plants such as lemongrass, vetiver, basil and cinnamon.

Given the present demand in the world market, considerable scope exists for the extension of cultivation of these essential oil bearing plants, particularly lemongrass and vetiver and for the distillation of their essential oils which can be done by the farmers at the field level in small scale stills.

Unlike other major clove growing countries such as Madagascar and Indonesia, the farmers in Zanzibar do not distil the essential oil from clove leaves which are shed by the clove trees throughout the year and are available as a by-product during the harvesting of cloves and are also available from diseased clove trees which are no longer productive.

The project envisages the establishment of field distillation stills as a cottage industry at the level of the farmers to enable the farmer to distil the clove leaf oil by himself and thereby generate revenue from a readily available raw material which is at present going waste. This activity will directly add to the income of the farmer and provide him with year round remuneration. The field distillation stills will be designed in such a manner that they can be fabricated locally if required and will require minimal repair and maintenance.

The leaf oil produced at the field level by farmers, women and co-operatives will be transferred to the clove oil distillery of ZSTC at Chake Chake, Pemba for the purposes of grading, bulking and standardization of quality to make it suitable for the international market. The ZSTC will, along with the standardization of quality, also arrange for export packaging and despatch to international markets for which full facilities and expertise exist as a result of previous UNDP/UNIDO technical assistance targeted at upgrading the technical competence of the distillery. This entire infrastructure and expertise will be available to the farmers to buy process and export their produce.

Incomes of the farmers could be improved through the cultivation of other species of essential oil bearing plants and subsequent distillation. Production of crude oil can be done successfully at the level of the farmer and rural workers with technologies that are easy to assimilate and equipment that is easy to fabricate. Through small scale distillation, crude essential oils would then be produced in the villages and further refined, packaged and exported by the ZSTC distillery. The farmers involved in the crude oil distillation/production would have a ready market at the distillery.

The research and development and quality control facilities created at the distillery as a result of previous UNDP/UNIDO assistance will become the focal point for the transference of technology and technical backup to the farmers engaged in such activities.

The Government accordingly requested the UNIDO to provide technological support by way of an International Consultant and hence the mission through the Technical Support Services (TSS-2) facility.

II. FINDINGS, OBSERVATIONS AND WORK PERFORMED

1. Determination of land under cultivation of aromatic plants (including cloves)

It was found that cloves remain the main source of cash income on Pemba but are no longer important in Unguja as far as cash income is concerned. In terms of production, Pemba provides 75 to 80% of the clove crop and Unguja provides the rest.

It was found that the three main areas of clove production are on Pemba i.e., the Northern, Central and Southern parts of the island.

The Northern area extends from Konde South to Wete and from the Western coast east to Shumba Viamboni.

The smallest central area lies on both sides of the main Chake Chake - Wete road from Mzambaraoni south to Ziwani.

In the south the largest and the most important area extends from Chake Chake South to Mkoani and from the western coast east to Ukutini.

With the help of the local authorities, a valid estimate of the number and acreage of clove trees was made:

District	No. of trees	Area (hectares)
1. Micheweni	250,000	1575
2. Wete	500,000	3100
3. Chake Chake	340,000	2100
4. Mkoani	760,000	4800

The cultivation of other aromatic plants namely lemongrass, basil, vetiver and cinnamon is confined to the two locations managed by the Pemba distillery:

a) 40 hectares plot of land owned by the distillery located at Mgone (Chake Chake) where lemongrass, basil, vetiver and cinnamon are being cultivated.

b) 8.25 hectare plot of land rented by the distillery located at Shingejuu where Vetiver is being cultivated.

There is no cultivation of these aromatic plants on Unguja which is worth noting.

2. Determination of land that could be used for cultivation of aromatic plants (including cloves)

The bulk of the land in the four districts of Micheweni, Wete, Chake Chake and Mkoani is covered by clove trees.

However, from 1987 to 1994, some 20% reduction in the numbers of clove trees has taken place due to sudden death, acute dieback, other diseases and abandonment of trees which are diseased and effectively lost to production with consequent decrease in the area under clove trees as shown in the table below:

District	1987 area (hectares)	1994 area (hectares)
1. Micheweni	1970	1575
2. Wete	3400	3100
3. Chake Chake	2600	2100
4. Mkoani	6000	4800

The area thus released from clove cultivation amounts to 2395 hectares, only a fraction of which has been taken under cultivation of crops such as fruits, vegetables and cassava.

This area which lies within the overall limits of clove plantations, is in sight of villages and is generally available for alternate crops. Within the limits imposed by lack of irrigation, lemongrass, basil, vetiver and cinnamon can be cultivated as rain fed crops.

Another viable alternative for the authorities to consider is the cultivation of Black Pepper as an intercrop which can be grown in the immediate vicinity of the villages using the existing trees of Jackfruit, Breadfruit and Coconut as supports.

3. Assessment of the feasibility of small scale field processing of clove leaves

It was found that unlike Madagascar and Indonesia, the two other major producers of cloves, there is no small scale field distillation of clove leaves, thus depriving the farmer of year round cash remuneration.

In order to be able to determine the feasibility of small scale field processing of clove leaves, a survey of the entire island was made with visits to the District Commissioners. With the co-operation of the local officials, visits were made to villages and village co-operatives consisting of mixed as well as exclusively women's co-operatives.

Upon survey of the clove lands as well as discussions with the villagers, the following facts were established:

- Land in the clove growing areas of Pemba is held under family ownership, private ownership or as three acre plots. Ownership of land is represented by and includes ownership of trees including clove trees.
- The practice of other farmers planting food crops under clove trees or other perennial crops is common. No rent is charged and such intercropping which includes weeding is generally seen by owners as beneficial to cloves.

It was found that most of the clove areas were not maintained and weeds and secondary forest trees had grown at an alarming pace in the last 7-8 years.

It was found that dry clove leaves which had fallen to the ground as a natural process were available in abundance.

Upon discussions with the farmers, women and co-operatives, it was found that the co-operatives would be the most suitable vehicle to launch the clove leaf distillation project as the members of the co-operatives themselves along with their family members would engage in the basic effort of collection of leaves thus obviating the need to hire outside labour which would render the whole project unviable and uneconomical.

Upon discussions the following emerged as the salient features of the project on which the viability would be based:

- There are well organized co-operatives in every district, both women's as well as mixed whose members are primarily engaged in agriculture and fishing.
- The members are needy and hence are willing to put in whatever physical effort that is required to make a success of the project. This is particularly important from the point of view of collection of dry leaves from the clove lands.
- All co-operatives that were visited are located in villages which are surrounded by at least 20,000 to 50,000 clove trees within an accessible distance over a manageable terrain.
- Since the gathering of leaves would necessarily entail clearing of weeds and secondary forest leading to better maintenance and hence elimination of disease from the clove trees, all without exception welcomed the project and foresaw no problem in collection of leaves or any objection from the actual owners of the clove trees.
- The production on an average working day would be based on the following parameters.
- A single charge of 400 kgs. dry leaves distilled in a still of 1000 liters capacity resulting in a 2% yield of oil amounting to 8 kgs. per batch priced @ USD 1.50 per kilo which is 50% of the net FOB value realizable today.
- Three batches being taken every day resulting in a total production of 24 kgs. per day worth USD 36.00 or T.shillings 20,000.

This is far in excess of what the farmers are able to earn today.

- The primary factor in favour of the feasibility of the project i.e., the component of contribution of labour being well accepted by the farmers, the provision of the following one-time inputs was identified as being complementary to the component of labour and hence essential to make the project feasible.
- A galvanized iron sheet shed to house the still.
- A field still incorporating a furnace to boil the water and produce steam insitu.
- A polyethylene water tank to store water drawn from the village well to replenish water in the distillation system on a daily basis, the need for replenishment being minimized by recycling of water to the maximum limit.
- Gunny bags to collect the leaves.

- Pitchforks to aid the gathering and handling of leaves.
- Polyethylene jerry cans to store the oil produced.

Similarly the feasibility of the project was also found to be contingent upon the provision of the following components by the farmers/women/co-operatives:

- Free labour.
- Leaves for distillation.
- Fuel for firing the still - exhausted leaves and agricultural waste would be the primary fuel supplemented by firewood when necessary.
- Free land for installing the still.
- Source of sufficient water.

4. Quality control and marketing aspects

It was found that the Pemba Distillery of ZSTC which has been a past recipient of UNDP/UNIDO assistance (DP/URT/86/026) is a successful producer and exporter of clove bud oil and clove stem oil because of the technical and marketing expertise imparted to it as a result of the aforementioned project.

Clove leaf oil to be produced by the farmers/women/co-operatives is subject to the same stringent quality requirements as clove bud oil and clove stem oil and as such the Pemba distillery is ideally suited to collect, bulk, grade and standardize and export the clove leaf oil.

It was found that there was no need to duplicate the quality control and export shipment facilities already existing at the Pemba distillery and the same could easily be utilized for the purposes of collection, bulking, grading and standardization and eventual exports.

It is pertinent to note the following in the context of the issue of feasibility of the project:

- There is no domestic market for clove leaf oil.
- Clove leaf oil is traded in the international market as per standard specifications and oil being sold must conform both in terms of quality as well as packaging.
- It is a volume oil and small quantities cannot be traded.
- The nature of the target beneficiaries demands a very short gestation period and as such apart from the field stills, all other pre-existing infrastructure facilities must be utilized in full.

Upon discussions with the Government authorities, this approach was found to be acceptable.

It was found that considering all the factors enumerated above, the project to distil clove leaf oil as a small scale cottage industry to be operated by farmers/women/co-operatives was eminently feasible provided the following methodology of execution was followed:

- The distillation stills and the related accessories/equipment should be provided, installed and commissioned by UNDP/UNIDO working through appropriate counterparts and

International and National Consultants.

- The farmers/women/co-operatives after due training and work experience should work independently to produce crude clove leaf oil.
- The Pemba Distillery should provide technical backup as and when necessary i.e., for repairs and maintenance and for production related trouble shooting.
- The crude oil should be collected, graded, bulked, standardized and exported using facilities existing as on today.

5. Determination of the requirements for the establishment of viable rural processing units for essential oils which could provide supplementary income to women and farmers

It was found after a survey of the clove growing areas and meetings with farmers, women and co-operatives that the following requirements must be met to enable the establishment of viable small scale rural processing units:

- Around 25 to 30 co-operatives, representing the private sector at the grass roots level, mixed as well as exclusively those of women, should be available to take on the responsibility of becoming the producers of clove leaf oil in the clove growing districts of Pemba and Unguja.
- That the members of these co-operatives should themselves organize the collection of dry leaves without resorting to the employment of paid labour.
- The said farmers, women and co-operatives must be located in villages surrounded by a minimum 20,000 clove trees within an accessible distance over a manageable terrain.
- The weeds and secondary forest surrounding the clove trees must be cleared as the process of collection of dry leaves goes on so as to expose the ground clearly resulting not only in larger and faster collection of leaves but also protection of clove trees from disease.
- The basic parameters of the still should be as under:

Volume	:	1000 liters
Charge	:	400 kgs.
Furnace	:	Inbuilt
Fuel	:	Exhausted leaves, agricultural waste and firewood
Condenser	:	Still water type
Cohobation	:	Manual
Average yield	:	2% of the charged weight

Average price realization by the farmer	:	USD 1.50 per kilo ex-village which at current world market prices is equal to 50% of the net FOB value.
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Average No. of batches	:	3 per working day
Working days in a year	:	200 days

Total production
per still per
annum : 4800 kgs.

The following one-time inputs should be provided along with the still:

- A galvanized iron sheet shed to house the still.
- 1/ polyethylene water tank of 2000 liters capacity.
- Gunny bags - 100 Nos.
- Plastic jerry cans - 25/30 liters capacity - 25 Nos.
- Pitch forks - 15 Nos.
- The farmers should provide the land on which the still will be installed.
- The farmers should provide the well from which water will be drawn for the still.
- The farmers should arrange for the fuel to fire the furnace of the still.

The Pemba distillery of the ZSTC should provide technical and commercial backup including the following:

- Repair and maintenance services to the stills.
- Trouble shooting at the time of production problems.
- Collection of oil from the villages.
- Grading, bulking and standardization of oil as per accepted international standards.
- Despatch of oil to international markets in export worthy packaging.

6. Assessment of training needs of farmers and women involved in income generating activities relating to aromatic plants

It was found that the interest of the farmers, women and co-operatives was kindled when the following income generating activities were suggested to them during the visits:

(a) Cultivation of New Aromatic Plants.

The positive interest came from farmers who owned land as well as from those who cultivated Government land. People were familiar with both lemongrass and vetiver since both grow wild all over the island.

However upon survey it was found that land was not available in large open stretches except in the northern east. As such since it is economically feasible to do so, the farmers were advised to plant lemongrass and vetiver on small patches of land wherever available and then distil the herbage/roots at a central point in the village after harvesting the same.

The Pemba distillery offered to supply planting material free of cost and to purchase the oil thus produced.

Needless to say the execution of this is contingent upon distillation facilities being made available to the farmers and women.

In the Northern east of the island, the soil is sandy and fit for the cultivation of Vetiver only. The Pemba distillery has rented 8.25 hectares of private land and planted Vetiver which is now due for harvest.

(b) Distillation of Clove Leaf Oil.

Without exception, everyone welcomed a project of this nature because they themselves saw the two-fold advantage inherent in the activity:

- Generation of additional income from a natural resource currently going waste.
- Consequential benefit to clove trees which are the main stay of their economy, because of arrest of neglect.

These two income generation activities were considered in conjunction because they are likely to be adopted by the same beneficiaries simultaneously. The training needs of the farmers and women whether acting individually or as part of a cooperative were considered and are detailed below:

- Farmers to be trained in the correct method of preparing land for planting various aromatic plants.
- Farmers to be trained in the correct method of multiplying planting material and subsequently replanting the same to extend the area under cultivation.

Since the feasibility of providing inputs such as irrigation, pesticides and fertilizer does not exist, no reference is being made to these in this part of the report.

Farmers to be trained in the correct method of field distillation including the following:

- General features of the still with regard to its construction and maintenance.
- Correct method of charging the still.
- Correct method of operating the still including manual cohobation.
- Correct method of collecting the oil distilled - both heavy and light phases and mixing of the two.
- Correct method of storage of oil.
- Correct method of cleaning the still if change over to a different essential oil is required.
- Correct method of drying the exhausted plant material for reuse as fuel. This will include drying and storage of general agricultural waste available in the fields and villages.
- Correct method of handling and storing water so as to minimize consumption.

7. Cost benefit analysis of such units

Upon the establishment of the feasibility of a project to distil essential oils on a small scale as a cottage industry in the villages, a cost benefit analysis was done taking a hypothetical unit as a model.

Cost in USD**- Fixed Assets**

Field Still	6000.00
Shed	1000.00
Water Tank	500.00
Cost of Land	0.00
Cost of Water Source	0.00
	<hr/>
	7500.00

Depreciation @ 10% p.a.	750.00
Interest @ 10% p.a.	750.00

- Consumables

Sunny Bags	200.00
Jerry Cans	150.00
Pitch Forks	200.00
	<hr/>
	2050.00

- Running Costs

Cost of collection of dry leaves	0.00
Cost of fuel	0.00

- Benefit in USD

Annual production per unit = 4800 kgs.	
Value @ 1.50 per kilo	7200.00

- Profit p.a.	<u>5150.00</u>
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NOTE:

The cost of interest and depreciation will actually not be borne by the co-operatives since the cost of the fixed assets are to be borne by the funding agency. Furthermore the consumables are being written off in the first year of operation but will actually last for 2 to 3 years.

The production figure of 4800 kgs. is based on the still working 3 times a day for 200 days in a year which is a realistic figure.

The benefit of value realization against cost invested is thus found to be very attractive and capable of adding substantial income in the hands of farmers and women. (See Annexure II).

8. Requirements for the proposed project

(a) Selection of areas for cultivation

Based upon the survey of the island and discussions held with the farmers and authorities, the following details are given:

- Selection of areas for cultivation

The areas released from clove cultivation due to disease and neglect amount to 2395 hectares in the districts of Micheweni, Wete, Chake Chake and Mkoani.

District	Area Available (Hectares)
1. Micheweni	395
2. Wete	300
3. Chake Chake	500
4. Mkoani	<u>1200</u>
	2395
	====

This area lies within the overall limits of clove plantations, is in sight of villages and available for alternate crops such as:

- Lemongrass
- Basil
- Vetiver
- Cinnamon

(b) Determination of infrastructural facilities and services required for the project

- A network of 25 to 30 co-operatives spread over the clove growing districts of Pemba and Unguja, duly registered with the Government authorities, having bank accounts and the full complement of office bearers to shoulder the responsibilities.
- The said co-operatives should have sufficient members to be able to collect dry clove leaves by themselves.
- The co-operatives must be located in villages which have in the immediate vicinity at least 20,000 clove trees.
- The clearing of weeds and secondary forest from the clove areas must be organized to expose the ground on which the dry leaves are lying.
- A galvanized iron sheet shed to house the still.
- A polyethylene water tank to store water for daily operations.
- 100 Nos. gunny bags per unit to collect dry leaves.

- 25 Nos. plastic jerry cans per unit to store the distilled oil.
- 15 Nos. pitchforks per unit to gather the leaves and charge and discharge the stills.
- Land for installation of the still.
- A source of water such as a well located close to the still as the distillation relies on water as an integral ingredient.
- Sufficient fuel to fire the furnace in the form of exhausted leaves, agricultural waste and/or firewood.
- Repair and maintenance facilities by way of a mechanical workshop.
- Technical expertise for production related trouble shooting.
- Facilities for the collection of distilled oil from the villages.
- A fully equipped quality control laboratory to support grading, bulking and standardization operations as per international specifications.
- Export packaging and shipping facilities to international ports.

(c) Training facilities required for the project

An agronomist must be available to train the farmers to:

- Prepare the land properly.
- Multiply planting material properly.
- Plant the desired crop properly.
- Harvest the crop properly.
- An essential oils technologist (International Consultant) supported by a National Consultant must be available to train the farmers in the technology of essential oils distillation particularly with regard to:
 - General design of construction of the still and its maintenance.
 - Correct method of charging and discharging the still.
 - Correct method of operating the still with manual cohobation.
 - Correct method of fully collecting the heavy and light phases of the distilled oil.
 - Correct method of storage of the distilled oil.
 - Correct method of cleaning the still to changeover to the distillation of a different essential oil.

- Correct method of drying the exhausted plant material to render it suitable for use as a fuel.
- Correct method of handling and storage of water so as to minimize its consumption.

Such an essential oils technologist will be required to work in collaboration with a National Project Co-ordinator who will act as the interface between the farmers and the essential oils technologist. The said National Project Co-ordinator must himself be a person with a professional background in the field of essential oils.

(d) Equipment needed for such a project

The field still for the small scale distillation of essential oils is required to have the following characteristics:

- Type : Hydro-distillation unit with still water condenser with provision for manual cohobation.
- Volume : 1000 Liters
- Charge : 400 Kgs.

Material of Construction:

- Main still body : Mild Steel
- Lid of main still body : Stainless Steel 316
- Condensing coil : 3 meters long made of stainless steel 316
- Water tank for Condensing coil: 400 liters volume made of mild steel provided with a funnel to reach the bottom of the tank.
- Receivers : 2 Nos. made of stainless steel 316
- Furnace : Built into the main still body capable of operating on spent leaves, agricultural waste and firewood.

This type of still is a compromise between the two extremes of all mild steel construction resulting in low initial capital investment and short life and an all stainless steel construction resulting in high initial capital investment and indefinite life.

More sophisticated designs are possible but the ease of operation has been kept as the paramount requirement in mind.

9. Preparation of a draft project document for a project on essential oils as cottage industry for income generation

As required a draft project document as per the standard proforma has been prepared.

10. Recommendation of other activities that could augment the income of the farmers

It was found that due to the extensive tourist industry in Zanzibar, the demand for spices is very high.

Since spices overlap the area of aromatic plants and also food, they are the most logical choice for diversification by the farmers.

It was found that at present there is only a very meager cultivation of spice crops.

After a study of the climate, land available and the cropping pattern and practices of the farmer, it was found that the cultivation of the following crops should be taken up as intercrops on a larger and more extensive scale.

- Black pepper
- Cinnamon
- Ginger
- Turmeric
- Chilies

V. CONCLUSIONS

1. It was concluded that as a result of reduction in the number of clove trees, cultivable land had become available which could be utilized for the cultivation of lemongrass, cinnamon, vetiver and basil.

It was further concluded that the sandy lands in the Northern East part of the Pemba island which were not under cultivation could be specifically used for Vetiver plantations as is already being done by the distillery.

It was also concluded that Black Pepper which grows as a vine should be introduced as an intercrop in the villages and their vicinity using the existing jackfruit, breadfruit and coconut trees as supports.

2. It was concluded after a survey of the field situation that the small scale field distillation of dried clove leaves currently going waste was eminently suitable and feasible for the establishment of a cottage industry to raise the income levels of farmers, women and co-operatives without impinging upon the productive work being already done by them and that the income thus generated would be available round the year in sharp contrast to the income from cloves which was seasonal and unpredictable.

Further, it was concluded that the process of gathering the leaves would consequentially result in the clearing of weeds and secondary forest from the clove areas which would in turn ensure control of diseases of the clove trees and hence extension of their productive life.

It was concluded that if the proper type of equipment, infrastructure, services and training was provided to the farmers, women and co-operatives, then the establishment of the proposed cottage industry would become a reality.

3. It was concluded that the following requirements for the establishment of viable rural processing units for essential oils particularly clove leaf oil, were already available:

- Farmers, women and co-operatives willing to labour and operate the stills.
- Availability of sufficient number of clove trees around the villages and thus the required raw material.
- Land for installing the still.
- Water for operating the still.
- Repair and maintenance facilities.
- Grading, bulking and standardization facilities.
- Export packaging and shipping facilities.

However the following facilities were required to be created to implement the project:

- Field distillation stills and related accessories.
- Handling equipment.
- Shed to house the still.

It was further concluded that if the requirements as detailed are provided in full, then the project for the establishment of viable, small scale cottage industry level field distillation units could be implemented as desired by the Government.

4. It was concluded after an assessment of the training needs of farmers and women involved in income generating activities relating to aromatic plants that an agronomist, an essential oils technologist, a national consultant and a national project co-ordinator would be required to instal the equipment and conduct comprehensive training to enable the farmers to undertake the following activities:-

- Cultivation and distillation of aromatic plants such as lemongrass.
- Distillation of clove leaf oil.

5. It was concluded after a cost benefit analysis of the project that there was a very substantial potential for year round income generation at the level of farmers, women and co-operatives and that from the economic point of view, there was no hindrance to the establishment of the project.

6. It was concluded after the study that the areas of Micheweni, Wete, Chake and Mkoani in Pemba and the Northern districts in Unguja should be selected for the cultivation of lemongrass, vetiver, basil and cinnamon.

7. It was concluded after the study that except for the field, distillation unit, its accessories, miscellaneous handling equipment and an open shed, all the other required infrastructure and service facilities already existed.

8. It was concluded after the study that for the distillation of clove leaves and other aromatic plants, a 1000 liter hydro-distillation unit with still water condenser with provision for manual cohobation and an inbuilt furnace would be required.

9. It was concluded after the study that the farmers should undertake the intercropping of spices as a serious activity to augment their income.

VI. RECOMMENDATIONS

1. It is recommended that the land that has become available as a result of reduction in the number of clove trees should be utilized for the cultivation of lemongrass, vetiver, basil and cinnamon.

It is further recommended that the sandy lands in the Northern East part of Pemba which are not under cultivation should be specifically used for Vetiver plantations.

It is also recommended that Black Pepper which grows as a vine should be introduced as an intercrop in the villages and their vicinity.

2. It is recommended that the small scale field distillation of clove leaves as cottage industry to generate year round income for the farmers, women and co-operatives should be taken up on priority as it is a feasible activity and directly in line with UNDP's changed focus towards private sector development, sustainable human development and the Government policy of generating income at the level of the rural poor resulting in poverty alleviation.

The project is further recommended because it has the added virtue that it will lead to maintenance of clove lands and arrest the decline in the number of clove trees.

It is further recommended that the proper type of equipment, infrastructure, services and training be provided to the farmers, women and co-operatives to aid the establishment of the project.

3. It is recommended that the requirements for the establishment of viable rural processing units for essential oils, particularly clove Leaf oil should be made available in full, in particular the distillation unit, related accessories, handling equipment and open shed so as to realize the full potential of the requirements and facilities already existing such as labour, raw material and quality control and export facilities.

4. It is recommended that the training needs of the farmers be met in full by providing the services of an agronomist, an essential oils technologist, a national consultant and a national project co-ordinator to train the farmers and women in cultivation and distillation of aromatic plants.

5. It is recommended that in view of the favourable cost-benefit analysis, the project for the distillation of clove leaves as a small scale cottage industry should be implemented in full so as to provide year round income to the farmers and women.

6. It is recommended that the available areas in Unguja and in the districts of Micheweni, Wete, Chake Chake and Mkoani in Pemba be planted with lemongrass, vetiver, basil and cinnamon.

7. It is recommended that the required equipment as detailed be provided to the farmers and women and the same co-ordinated with the existing infrastructure and facilities.

8. It is recommended that for the distillation of clove leaves and other aromatic plants, a hydro-distillation unit with still water condenser and provision for manual cohobation and an inbuilt furnace be provided to selected farmers, women and co-operatives.

9. It is recommended that farmers should undertake the intercropping of Black Pepper, Ginger, Turmeric, Chilies and Cinnamon to augment their income.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION
NU/URT/94/003/61-10

Post title: International Consultant

Duration: 1.5 m/m

Date required: ASAP (November, 1995)

Duty station: Zanzibar, Tanzania

Purpose of project: To determine the requirements for setting up of small scale processing units for the production of essential oils as viable units for income generation for the farmers.

Duties: The International Consultant will work in collaboration with the National Consultant, the Technical Adviser and other project counterparts parts in carrying out the following:

- Determine the land under cultivation or land that could be utilized for the cultivation of aromatic plants.
- Assess the feasibility of small scale field processing of clove leaves.
- Determine the requirements for the establishment of viable rural processing units for essential oils which could provide supplementary income to farmers and women.
- Assess the training needs of the farmers and women involved in income generating activities relating to aromatic plants.
- Analyze the cost benefit analysis for such units.
- Select the areas for cultivation and determine the infrastructural, service and training facilities and equipment needed for such a project.
- Prepare a draft project document for a project on essential oils as a cottage industry for income generation.
- Recommend other activities that could augment the income of the farmers.

The Consultant is expected to prepare a report giving his findings and recommendations and a draft project document for an income generation project on essential oils.

Language: English

Qualification: An Essential Oils Technologist with over 10 years experience in processing, cultivation and marketing of products from aromatic plants.

**AN ESTIMATE OF INCOME AND EMPLOYMENT GENERATION POTENTIAL
BY RURAL ESSENTIAL OILS DISTILLATION**

The potential for the generation of rural income and employment has been established as a result of feasibility study carried out by the UNIDO through its Consultants.

ESSENTIAL REQUIREMENTS FOR THE ESTABLISHMENT OF A VIABLE PROJECT:

The feasibility of the project is dependent on the following necessary inputs/services to be provided by project counterparts/ consultants:-

PROJECT COUNTERPARTS - COMMERCIAL SUPPORT SERVICES

- Guarantee of purchase of oil produced.
- Guarantee of export of oil produced.

PROJECT COUNTERPARTS - TECHNICAL SUPPORT SERVICES

- Training of farmers in methods of production.
- Supervision of production and trouble shooting.
- Quality control and standardization.
- Provision of planting material for aromatic plants for crop diversification.

INTERNATIONAL CONSULTANT

- Design of distillation still and its specifications.
- Optimization of process parameters.
- Initiation of clean production with optimum efficiency and quality.

The details of the benefits to be derived by the host country and its people involved in the project versus the costs to be incurred by the donor country/agency are as under:

EXPENSES/COSTS (IN USD) INCLUDING CONSULTANCY

- Number of stills to be installed	25 Nos.	
- Cost per still	6.000	
- Total investment in stills		150.000
- Cost of project vehicle		13.000
- Cost of tin shed per still	1.000	
- Total cost of sheds		25.000
- Total cost of accessories per still	1.050	
- Total cost of accessories		26.250
- Miscellaneous expenses		20.000

Total cost of equipment		234.250
- Cost of International Consultants		155.000
- Cost of National Consultant		33.600
- Cost of National Project Co-ordinator		33.600
Mission costs		12.000

Total project cost	US\$	468.450

EMPLOYMENT GENERATED

- Average No. of farmers/women directly engaged per still	20
- Total No. of farmers/women engaged in 25 stills	500
- Estimated indirect employment	500

ANNUAL INCOME GENERATED

- Average No. of working days per annum	200
- Batches per day	3
- Production per batch	8 kgs.
- Price received by farmer per kg.	USD 1.50
- Production per still p.a.	4,800 kgs.
- Total production of 25 stills	120,000 kgs.
- Total income generated by farmers (on the basis of 50% of net FOB price)	USD 180,000
- Total income generated p.a. per farmer	USD 360
- Total income generated by Pemba Distillery (on the basis of the balance 50% of net FOB income)	USD 180,000
Total income generated per annum	USD 360,000

It can be seen therefore that the total investment made can be recovered as net income in 16 months provided that the production is maintained at an optimum level.

Expenses/costs, employment generation and income generation enumerated above are on the basis of approx. 1000 beneficiaries being involved in the project. For every additional 1000 beneficiaries that the Government of Zanzibar involves in the project the cost will increase in multiples of 368,450 and income in unit multiples of USD 360,000.

Additional income generation opportunities can be created with the initiation of lemongrass, basil and vetiver which are indigenous to Zanzibar and grow wild. Distillation of the oils can be carried out in the same equipment. The quantum of income will depend on the land made available to the farmers.