



**THE UNIVERSITY
OF THE
WEST INDIES**
ST. AUGUSTINE CAMPUS

**MANUFACTURING
PROFILE 3B:
ESSENTIAL OILS AND
OLEORESINS PART 2
OF 2**

The Development of Project Profiles for the
Manufacturing Sector of T&T

ABSTRACT

This profile relates to the development of an Essential Oils industry in Tobago. In developing the profile, it is first recognized that there is an un-utilised 80 acre Bay Leaf Tree plantation which could supply the raw material to produce Bay Oil by extraction of the oil from the leaves as the base product.

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1 Description of the Opportunity

This potential opportunity seeks to capitalise on the growing demand for essential oils and oleoresins. The food, cosmetics, health food and supplement industries have been so fraught with processed products containing large amounts of chemicals, that there is now a trend wherein consumers are turning away from prepared products and exhibiting a preference for purchasing oils and creating their own cosmetics for hair care and skincare. Oils find increasing use in areas such as nutraceuticals, phytomedicine, cosmeceuticals, hair care, skincare, fragrances, aromatherapy, insect repellents, flavourings and colourants.

Caribbean islands are significant global producers of raw materials required for four (4) areas identified by Seaforth and Tikasingh (2005) as having good potential for industrial development. These include *bayleaf* (Dominica), *nutmeg* (Grenada), *pimento* (Jamaica) and *vetivier* (Haiti). However, all of the plants identified in Table 1, flourish in the region and it is argued therefore that T&T could take a lead role in producing the oils for commercialisation including branding and sale to consumers or for use in other value added downstream industries which will benefit the country or region economically.

Table 1: Oils with Proven Commercial Value

OIL	PROVEN INDUSTRIAL USE
Bayleaf	Hair care, cosmetics
Carapa seed	Cosmetics, soaps, insect repellent
Cascarilla	Fragrance
Castor	Health care, hair care

Cocoa butter	Cosmetics, food
Coconut	Virgin, wet milled with heat – health food, hair and skin care
Ginger	Flavour, fragrance
Lemongrass	Fragrance, aromatherapy
Nutmeg	Health care, flavour
Pimento	Flavour, fragrance
Pumpkin	Health care
Turmeric (rhizome)	Nutraceutical, cosmeceutical, flavouring, colour
Vetiver	Fragrance

1.1 Summary

This profile looks at the production of essential oils and oleoresins by Supercritical Fluid Extraction (SFE) in Tobago. Professor Emeritus David Mc Gaw of the UWI and his team have done considerable research in this and are willing to form a partnership whereby the team provides technical support and lab services for the venture. As such, this profile consists of a partnership with the team from UWI who lay claim to significant intellectual property concerning this opportunity.

In the profile it is recognized that there is an existing 80 acre bay tree plantation, which can be used as the base of the business by producing bay oil for the global market. It is further proposed that this be supplemented by the production of vetiver oil supplied by contract farmers to the processing plant.

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The processing operation which will be located on the Cove Estate will comprise a SFE facility with three 1000L extractors. The provision of the three units will allow for efficient management of the operation to produce the two products at the same time, or alternatively the three units could be operated with either bay leaves or vetiver in accordance with available supplies.

Plant raw material requirements are projected to be 300 tonnes of bay leaves and 1,200 tonnes of vetiver root. Bay oil production at the expected 4% recovery will be 12,000 kg and vetiver oil production at the reported 1.5% recovery to be 4,050 kg. The global selling price for bay oil is quoted to be US\$120 per kg and that for vetiver US\$170 per kg. A total annual revenue of US\$4.5m has therefore been projected.

The order of magnitude capital cost has been estimated to be US\$7.5m, mainly for the purchase of the plant equipment and the requisite buildings. Operating costs for agricultural production, crop processing, marketing and administration were estimated to be US\$1.79m annually. The venture proposed in this profile is summarised in Table 2.

Table 2: Essential Oils and Oleoresins Part 2 Summary

INVESTMENT (IN MILLION USD)	PAYBACK PERIOD	5 YEAR NPV (IN MILLION USD)	5 YEAR IRR
9.29	5 Years	1.64	17%

1.2 Product Mix

The Caribbean has a long history of essential oil production, albeit limited in the range of products. Thus, bay oil has been produced in Dominica since the 19th century and lime oil was produced in a number of the islands for many years. More recently, Pimento Oil production has been introduced in Jamaica, and Nutmeg Oil in Grenada, Anise Oil in Trinidad and Bay Oil in Tobago. Even though these industries are small by international standards, they contribute significantly to the economy in the small islands of Dominica and Grenada. In the case of Trinidad and Tobago, Anise Oil, was produced on old sugar lands at Orange Grove by the Pernod company for some years before being closed down a few years ago, and a Bay Oil facility was installed in Tobago in the 1970's to exploit a mature bay tree plantation, but not operated continuously. Basil and Patchouli oil also received consideration.

This opportunity will focus on vetiver and bay oils as shown in Figure 1. It should however, be stressed that the process plant is entirely flexible, and therefore suitable for use to produce any other essential oils or oleoresins in accordance with market requirements. In addition, the operation described in this proposal would only be the first step in the development of the industry, with the value added opportunities for the production of consumer products and downstream processing to be introduced later.

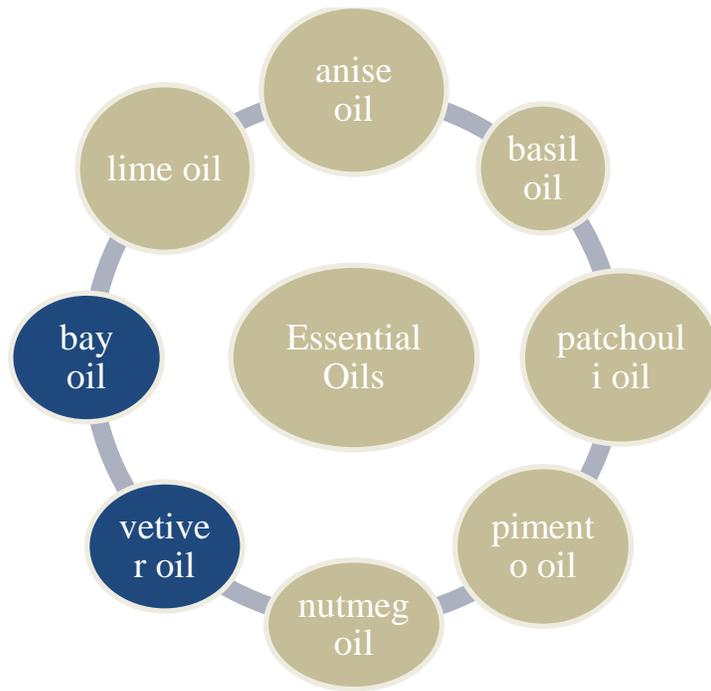


Figure 1: Major Essential Oils in the Caribbean Oil Industry

1.3 Description of Activities

Supercritical fluid extraction (SFE) can be used to extract both essential oils and oleoresins, thereby making it much more flexible than the traditional methods. In SFE, carbon dioxide at close to atmospheric temperature is pressurized to a supercritical condition and passed through the bed of plant material. The extract is taken up into the carbon dioxide stream and after exiting the vessel, the pressure is dropped back to atmospheric pressure whereby the carbon dioxide reverts to a gas from which the extract liquid can be easily separated. Carbon dioxide is readily available in T&T as a by-product in ammonia manufacture.

The advantage of using supercritical fluid extraction is that it can be used to extract both essential oils and oleoresins, thereby making it much more flexible than the traditional methods. The drawback is that the capital cost is greater. It has however effectively replaced solvent extraction to extract oleoresins in modern extraction systems, because there is no solvent contamination in the final product.

It is important to note that both of the extraction technologies projected for commercial use have the flexibility to process different raw materials at different times. The only issue in operating with that approach, is the ability to flush out the equipment completely before the change of product.

After drying and milling, the raw materials will be charged to the processing unit where the oils will be extracted. A diagram of the SFE process is shown in Figure 2. It is a batch process whereby the raw material is charged into a basket close to the extraction vessel and when full the basket is hoisted up and deposited on a perforated grid at the base of the vessel. The top lid is then closed down and clamped after which carbon dioxide at high pressure is passed to the underside of the grid. The carbon dioxide then passes through the plant material taking up the extracted oils from the material. The production of oils is highest at the beginning of the run but as the plant material's oil content reduces with time, the oil production rate drops off until the material is exhausted.

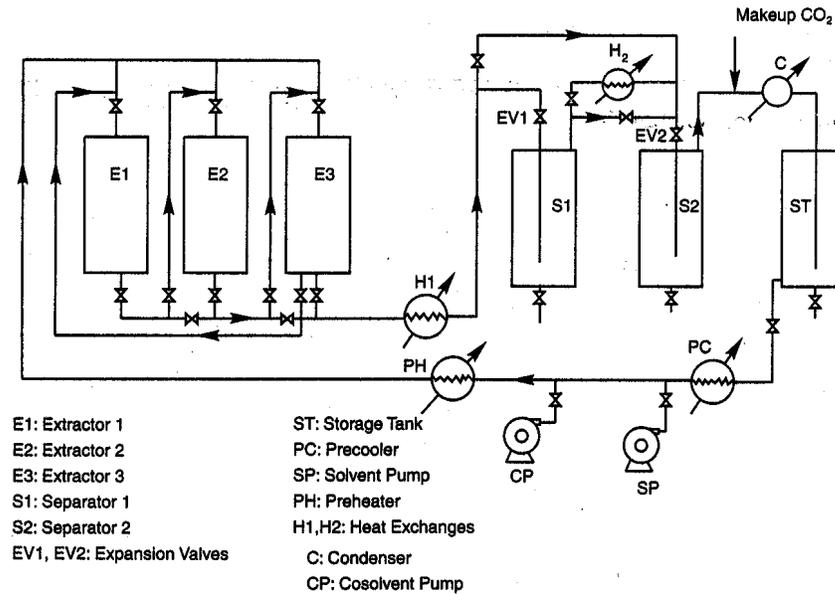


Figure 2: Semi-Continuous SFE Process

When the rate of production drops off to a low level, the flow of carbon dioxide is stopped. The top lid is then opened up and the basket removed. The spent material is taken out of the basket and a new charge introduced. The process is then repeated. It is proposed to compost the spent leaves, with the compost produced to be utilized in the agricultural production.

2 Industry Overview

2.1 Industry Description

A market analysis has determined that the annual bay oil market is around 30 tonnes with 60% being supplied by Dominica. The proposal projects the production of 12 tonnes per year of bay oil from the plant, this being the remaining 40%. The vetiver market is much bigger, so it is projected that the remainder of the plant capacity would be filled by vetiver oil production.

Grand View Research (2015) estimated the global essential oil market to be approximately US\$5.5b in 2014. They stated that increasing essential oil penetration in aromatherapy, coupled with rising demand for fragrances and flavours in food and beverages, is expected to remain a key driving factor for the global market. In terms of final consumer products, Shukla (2012) estimated the global fragrance and flavour market to be approximately US\$21b.

Growing consumer preference for natural products has led to the development of novel applications in personal care and beauty products. Rapid industrialization and growing disposable incomes, particularly in emerging economies such as China, India, Vietnam and Thailand, are some of the macro factors steering growth.

In addition, rising application scope on account of growing consumer awareness regarding health benefits, and negligible side effects associated with the use of essential oils, is

expected to spur their demand in the medical industry. Growing demand for aromatic flavours and fragrances in cosmetics, perfumes, as well as spa and relaxation applications is also expected to fuel demand in the coming years.

Specifically, Grand View Research (2015) estimated that the US essential oil market revenue will double from US\$2.0b in 2015 to more than US\$4.0b in 2022, with breakdowns being given for the top 10 oils. The European market was valued at US\$2.4b in 2014, but growth was expected to remain stagnant in that market.

Oleoresins are basically used in food flavours, natural pharmaceuticals, and various other products such as security sprays. Market Research.com (2014) carried out an in-depth analysis of the Global Oleoresin Industry dated August 2014, this study incorporating up and downstream evaluations, giving industry development trends as well as providing background for New Project Feasibility Analysis. Details are only available on purchase of the study, but it is clear that there should be significant potential for expansion particularly in the pharmaceutical area. However Grand View Research (2015) estimated world trade in oleoresins to be US\$1.14b in 2014, and they expected it would rise to US\$1.69b by 2022.

The structure of the industry is complex, as analysed by Weiss (1991). As a new producer, it would be appropriate to have a marketing strategy which starts simply, and evolves as the company expands, but especially when it moves the processing downstream to produce directly for the relevant industries example flavour industries, and ultimately to consumer products.

It would therefore be appropriate to market initially through the brokers. In order to make the financial projections, product prices were essential. These are listed by the ITC (International Trade Centre - joint agency of the World Trade Organisation and the United Nations) in their monthly newsletter. Bay Oil is not listed, but the price is quoted from time to time by the Dominican Essential Oils Cooperative. This was given as US\$120 per kg before a hurricane destroyed their main plant in August 2015. The price for vetiver oil in the December 2015 ITC newsletter was quoted to be \$180 per kg.

2.2 Incentives

A number of incentives are available for investors. In addition to general incentives, there are incentives related to manufacturing as well as agro-processing. (All values for incentives are in \$TT where US \$1. = TT \$6.74 on 17 August, 2016)

- ***The Fiscal Incentives Act***, offers a waiver of income tax on dividends or other distributions, other than interest, out of profits derived from manufacture of approved products.
- ***Total Relief from Value Added Tax*** on imports for highly capital intensive enterprises.
- ***The Customs & Excise Act*** offers investors duty free importation of plant, machinery, equipment, components and raw materials, as specified in the Third Schedule of the Customs Tariff.

- ***The Foreign Investment Act*** allows a foreign investor to purchase land not exceeding one acre for residential purposes and five acres for commercial purposes without obtaining a license. In order to purchase land in excess of these amounts, a foreign investor must apply for a license from the Minister of Finance. Additionally, foreign investors are allowed to purchase up to 30 per cent of the cumulative shareholding in a public company.
- ***Agro-processing Incentives*** offered by the government including rebates of:
 - 50% of the cost of establishing approved facilities for Agro-Processing of approved commodities to a maximum of \$50,000
 - 50% of the cost of refurbishing of approved facilities for Agro-Processing of approved commodities to a maximum of \$20,000
 - 50% towards the cost of packaging material to a maximum of \$15,000 annually
 - 40% of the cost of Hazard Analysis and Critical Control Points (HACCP) upgrade to a maximum of \$40,000

3 Stakeholder Analysis

The various stakeholders were analysed using Mitchell, Agle and Wood’s Power Legitimacy Urgency model. The Power, Legitimacy, Urgency model results in eight different stakeholder groups. These groups are defined by which of the three (3) attributes each individual stakeholder group possesses. Each of the stakeholders in this study was rated on a scale from 1 to 5 for degree of possession of each attribute where 1 was lowest and 5 was highest. The stakeholder was deemed to possess the attribute of power, legitimacy or urgency when given a ranking of 3 or higher. The results of the stakeholders’ assessment are shown in Figures 3 and 4 and Table 3.

RAW MATERIALS	PRODUCTION	SUPPLY CHAIN (MARKETING AND DISTRIBUTION)	AGENCIES, ETC.
<ul style="list-style-type: none"> •Farmers •Labourers •Cooperatives •Suppliers <ul style="list-style-type: none"> •Plastic Bottles •Bottlecaps •Cartons •Glass Bottles 	<ul style="list-style-type: none"> •Manufacturers •Operators •Employees •Equipment Suppliers 	<ul style="list-style-type: none"> •Website Designer/Manager •Health Food Stores - Local •Health Food Stores - Foreign •Supermarkets - Local •Supermarkets - Foreign •Salons •Herbal Stores •Pharmacies •Internet Service Provider 	<ul style="list-style-type: none"> •Customs And Excise •E-Teck •Cariri •CFDD •Ministry of Health •UWI •CHBA •Cardi •Carapa •IICA •UG •InvesTT

Figure 3: Key Stakeholder Groups

Each of the thirty-one (31) stakeholders in this study was rated on a scale from 1 to 5 for degree of possession of each attribute where 1 was lowest and 5 was highest. The stakeholder was deemed to possess the attribute of power, legitimacy or urgency when given a ranking of 3 or higher. The result of this preliminary analysis is summarized in Table 3.

Table 3: Stakeholder Analysis: Essential Oils and Oleoresins

STAKEHOLDERS	POWER	LEGITIMACY	URGENCY	TOTAL
University of Guyana	2	4	2	8
UWI (St. Aug, Mona and CaveHill)	2	4	2	8
CARAPA	2	3	2	7
Suppliers - Bottle caps	2	3	2	7
Suppliers – Cartons	2	3	2	7
Suppliers - Plastic Bottles	2	3	2	7
Ministry of Health	5	5	2	12
Labourers	5	3	2	10
Supermarkets – Foreign	4	3	2	9
Supermarkets – Local	4	3	2	9
Suppliers - Glass Containers	4	3	2	9
Equipment Suppliers	3	2	4	9
CARDI	2	4	4	10
CARIRI	2	4	4	10
Caribbean Herbal Business Ass'n	2	3	4	9
Chemistry Food and Drugs Division	5	5	3	13
Customs and Excise	5	5	3	13
Farmers	5	4	3	12
Cooperatives	4	4	4	12
Employees	4	4	4	12

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Operators	4	4	3	11
Salons	4	3	4	11
Health Food Stores – Foreign	4	3	3	10
Health Food Stores – Local	4	3	3	10
Herbal Stores	4	3	3	10
Pharmacies	4	3	3	10
INVESTT	3	5	5	13
E-Teck	3	4	4	11
IICA	3	3	4	10
Website Designer/Manager	3	3	4	10
Manufacturers	3	3	3	9

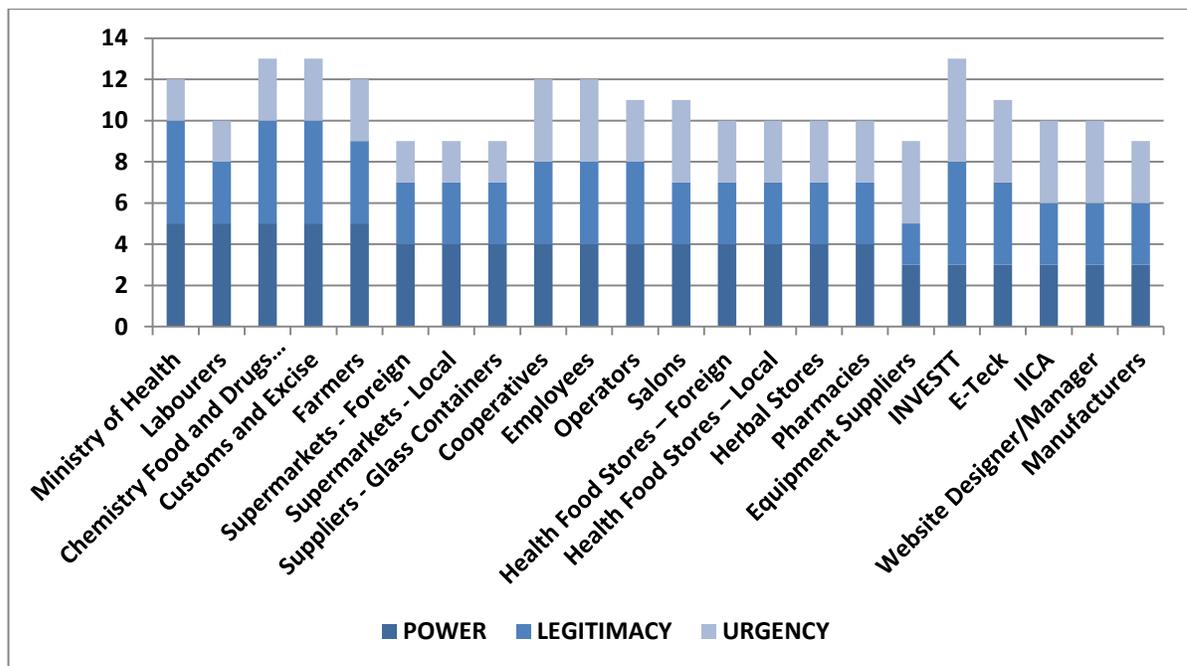


Figure 4: Major Stakeholders in the Manufacture of Oils

4 Environmental Scan

4.1 External Analysis

PESTLE

The environmental scan started with an evaluation of the external environment for essential oil production. This was done using the PESTLE tool where Political, Economic, Social, Technological, Legal and Environmental (physical) benefits or concerns regarding the venture were identified and their potential impact individually assessed. See Table 4.

Table 4: PESTLE Analysis for Essential Oils and Oleoresins

CATEGORY	SITUATION	POTENTIAL IMPACT
Political	Governments in the region have not selected this area for special attention.	In order for this industry to be viable, CARICOM members would have to regulate the industry. For example, the world's largest producer of a key ingredient in fragrance exists in the region but the foreign customers extract and use the oil with the local population generally unaware of its use or value. A national programme to educate populations of the value of these extracted oils and careful regulation of its use is required.
Economic	Consumers view these oils as more valuable than products with additives and are prepared	Sales at a premium price are assured in this market.

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	to pay more.	
	The oils, sold in industrial and consumer markets may be more valuable than any products created from them.	The combined effect of less processing and higher prices, mean higher margins. In this growing industry, less processing may be better.
Social	Use of fragrance in cosmetics is declining.	This would negatively affect the demand for certain oils used specifically for their fragrance. For example, oils traditionally used in soaps, shampoos and deodorants. However, these products are among the cheaper and lower value added products in which essential oils are used.
	Significant customers are now choosing to make their own 'products' at home.	There is increased demand for pure oils instead of 'products' for hair care and skin care, particularly in the multi-billion-dollar black hair care market.
Technological	Basic technology required. Just screw and/or hydraulic presses are the major pieces of equipment needed.	Barriers to entry are low – once the raw material is available, other producers can enter the same industry. Branding and integrity are key in the 'pure' oil market.
Legal	Individuals sometimes consume these oils for various health reasons and this could result in legal issues for the investor(s) if problems arise.	Negative publicity could result from adverse effects due to individuals wrongly consuming oils or using them on their body. This could be managed somewhat by proper labelling and packaging. The problem arises when individuals believe anything natural must be harmless.
Environmental	This industry has the potential to consume certain agricultural products rapidly.	Sustainability issues need to be addressed pro-actively.
	The region north of Trinidad is vulnerable to hurricanes.	This is a serious consideration for an industry based on fragile agricultural products. Hurricane

		Ivan impacted Grenada's nutmeg industry negatively in 2004.
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PORTER'S 5 FORCES

The second part of the external analysis examined the competitive environment. For this analysis Porter's 5 Forces (P5F) was used. P5F looks at the rivalry among existing competitors, the threat of new entrants, the threat of substitute products, the bargaining power of suppliers and the bargaining power of customers. Using the P5F tool is superior to simply identifying competitors in the marketplace and assessing their potential threat. Because it allows for the analysis of potential threats from other products or ventures that may not be identical or even operate in the same industry but which are threats nonetheless. This analysis can be seen in Table 5.

Table 5: Major Competitive Issues in Essential and Pure Oils

FORCE	SITUATION	THREAT
Existing Rivalry	There are few manufacturers of high value oils in many of the areas cited, however there is strong competition in certain areas from larger countries such as India and Africa from where some of the same, (e.g. vetivier) or competing (shea butter which competes with cocoa butter) originate.	MEDIUM
Threat of new entrants	Even though the availability of raw materials and the indigenous knowledge in the industry may limit competition somewhat, the actual manufacturing is basic and new entrants could easily enter	HIGH

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	especially with a willing strategic partner to circumnavigate disadvantages.	
Threat of substitutes	Substitute products include preparations which have sometimes been found to have little to none of the essential oils they claim to possess. However, these are sold at a much lower price point and are affordable in mass markets. The industry proposed should capitalise on this by developing product lines, with a distinctly different image which capitalises on this ‘budget’ market so as to participate and gain sales from different levels of customers.	HIGH
Bargaining power of customers	Bargaining power of customers in this industry is high since knowledge is share peer-to-peer via YouTube and social media groups and these are the most trusted media for information sharing. The customers in the industry are not overly swayed by advertisements etc. but value the opinion of their peers much higher.	HIGH
Bargaining power of suppliers	Bargaining power of suppliers is moderate since there will be many different suppliers. This is despite the fact that the industry is based on achieving a good raw material supply.	MEDIUM

4.2 Internal Analysis

This exercise simply lists some of the major strengths, weaknesses, opportunities and threats in the manufacture of oils for non-energy purposes. The next phase of the report would feature the actual analysis, based on empirical research, on how some of these should be dealt with. See Table 6.

Table 6: SWOT Analysis of Essential Oil Production

<p>STRENGTHS</p> <ul style="list-style-type: none"> • Raw material is available throughout the region for this sub-sector. • Research institutions and labs exist with expert staff. • The UWI and UTT produce scientists and engineers who are capable of assisting to take this industry to the next stage. • The technology required for this industry is well understood and basic by T&T's standards. 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Raw material supply may vary unless properly managed. • Capital must be sourced for R&D as this would lead to industrial upgrading • Strong knowledge of marketing is necessary. • There is low knowledge and acceptance of lean manufacturing in the region.
<p>OPPORTUNITY</p> <ul style="list-style-type: none"> • There is a movement towards using plant based oils for purposes of healthier food and skin and hair health, primarily • Consumers are trending towards blending their own products rather than buying chemical laden products from the supermarket or beauty store. • Consumers are choosing cosmetics with 	<p>THREATS</p> <ul style="list-style-type: none"> • There is a main culture in the Caribbean that continues to view agriculture negatively and as a poor career choice for talented individuals. • Quality technical human resources for the industry need to be made available. UWI and UTT may be key in stepping up to the challenge of

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<p>medicinal benefits as derived from products such as those mentioned in this profile.</p> <ul style="list-style-type: none">• The multi-billion-dollar global black hair care industry is trending towards natural hair and among the major products are pure oils.• There is the opportunity for developing value added products from some of these oils for everything from insect repellents to fragrances.• There is the opportunity to become lead producers in local, regional and global value streams for products derived from these oils.	<p>having a special programme in essential and other oils.</p> <ul style="list-style-type: none">• Training in hygiene factors is not widespread in T&T in the manufacturing industry. This can cripple the industry if not properly implemented and managed.• The climate of the region may be an issue. Hurricane Ivan negatively affected the nutmeg industry in Grenada a decade ago.
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5 Sub-Sector Assessment

The Essential Oils and Oleoresins Plant, was assessed on various criteria including market demand, raw material cost and availability, energy use, investment value, finished product value and availability of labour. This was based on a factor rating method developed by subject-matter experts. On each of the criterion, the venture was given a rating from 1 to 10. These were weighted according to the relative importance of the criteria and a final score calculated. The final score for the Essentials Oils and Oleoresins Plant was 7.001 out of a possible 10, which was above average among the potential investment opportunities. See Table 7.

Table 7: Subsector Assessment of Essential Oils and Oleoresins

CRITERIA	ASSESSMENT	WEIGHT	RATING	SCORE
			1-10	
Demand	Large market size, high growth	19.6%	7	1.372
Finished product value	High, in comparison to inputs	17.4%	8	1.392
Raw material (availability)	There are issues with availability for all the raw material in T&T but this opportunity is actually multi-faceted so a creative approach could be taken	13.0%	4	0.52
Raw material (cost)	Low with respect to finished product value	13.0%	7	0.91
Legislation/regulation/government focus	No special legislation for or against the opportunity. Average support for industry	10.9%	5	0.545

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Energy	Relatively low utilisation of energy	8.7%	8	0.696
Labour market	Job-ready employees available. The technology is well known in T&T's industries and relatively basic	8.7%	9	0.783
Investment value	Less than 5m USD in investment for the different processes e.g. distillation, pressing, screw type oil expeller	6.5%	9	0.585
Technology	Familiar technology as compared to local existing capability	2.2%	9	0.198
Job creation	Not a largely labour intensive manufacturing operation	0.0%	2	0
		100%	68	7.001

6 Identification of Value Added Services

Value Stream Map (VSM) has its genesis in the Toyota Production System of Lean Manufacturing. It essentially shows, on a single page, how value is created along the extended value chain from suppliers to customers for a single product type. When the value stream is mapped and assessed, opportunities for improvement may only then be identified. The value stream indicates other services that will be necessary for the successful realization of the venture. This can be seen in Figure 5.

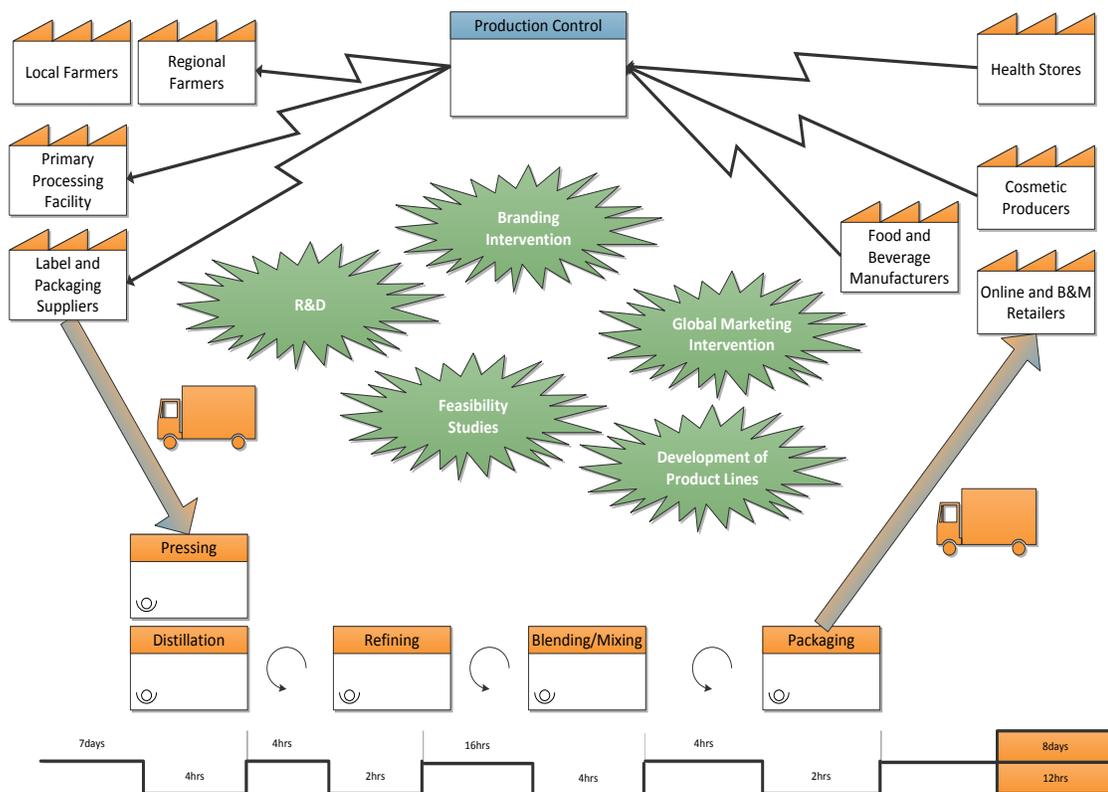


Figure 5: Value Stream Map for the Oils Industry

6.1 Supply Chain Issues

Proper farming techniques:

The growing and harvesting of the plants necessary to produce these oils must be done with care and to a standard that meets international recommendations. This would require offering training to workers as well as the purchase of proper farming technology. This represents an investment that needs to be made for the organization to operate.

Sourcing professionals:

For this profile to be successful, professionals and persons skilled in the area of agriculture must be employed to work in the factories. However, a career in agriculture currently has a poor image in the minds of persons in Trinidad and Tobago, thus shrinking the possible pool of persons who would study in this particular area. This could be resolved in part by working with tertiary institutions to encourage studies in this area as well as recruiting students already in the system.

Requires lean manufacturing vs batch:

The volume and quality of the product being created in this industry requires lean manufacturing and does not match the regular production model used in this country, that being batch manufacturing. For this profile to be successful, training is needed for the persons employed to help them understand this new process and implement it correctly.

7 Financial Analysis

7.1 Infrastructure

An order of magnitude estimate of the fixed capital investment is shown below, which effectively assumes the development of a green field site. This estimate incorporates land development, the installation of the process plant operation, as well as the construction of a small office building to house the administrative staff. The basic assumptions used in making up are listed in Table 8.

The main supplier of commercial size Supercritical Fluid Extraction systems in the USA has given an estimated price of such a system with a maximum operating pressure of up to 500bar of **US\$6.3m**. A floor area of approximately 200m² was assumed for the administration facilities.

Table 8: Infrastructure and Preparation Cost

DESCRIPTION	COST (USD)
Site Preparation Development	50,000.00
Process Buildings	80,000.00
Administration Facilities (to house GM, Sales, Fin. Controller, Support Staff, Board Room)	140,000.00
Auxiliary Buildings (incl. QC lab, control room, stores, garage & workers facilities)	40,000.00
Office Equipment	20,000.00
Construction, Installation & Inspection	80,000.00

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Consultant's Fee	80,000.00
Contractor's Fee	40,000.00
Legal Costs	10,000.00
Freight & Insurance Fees, Duties	40,000.00
Contingency	50,000.00
Waste Disposal	20,000.00
Distribution & Packaging	50,000.00
TOTAL	700,000.00

7.2 Utilities

The recurring utilities necessary would be water, fuel and electricity. The subtotal for these utilities is US\$160,000 is shown in Table 9.

Table 9: Annual Utilities Costs

DESCRIPTION	COST (USD)
Fuel	100,000.00
Electricity	40,000.00
Water	20,000.00
TOTAL	160,000.00

7.3 Salaries

The Marketing and Sales efforts are important for this opportunity to realize its potential. The total cost for their salaries is US \$330,000/yr. All other major salaries are shown in Table 10.

Table 10: Positions and Annual Salaries

POSITION	TOTAL ANNUAL SALARY (USD)
General Manager (Process Eng.)	40,000
Office Supervisor	5,000
Accounting Assistant	15,000
Sales Assistant	10,000
Driver/Messenger/cleaner (2)	20,000
Supervisor	25,000
Operating Labour (2 per shift)	100,000
Handymen- 3 off	25,000
Laboratory Technician/Storekeeper	15,000
Maintenance technician	15,000
Security (4-5)	60,000
TOTAL	330,000

7.4 Operational Costs

The annual estimated operating cost is US\$1,790,000. Most of the figures are self-explanatory, but some explanation of the figures for the agricultural side of the operation is approximated. An annual rental cost of US\$100,000 is assumed for the bay tree estate and the Cove operation. The projected annual supply of bay leaves is 300 tonnes. This could be supplied by contract labour. If a price of 75 cents per kg is applied, the annual cost of the

bay leaf supply would be US\$225,000. The projected annual supply of vetiver from farmers is estimated to be 1200 tonnes. If a price of 75 cents per kg is paid to farmers, the annual cost of the vetiver supply would be US\$900,000.

Table 11: Operational Costs

COST CENTRE	COST (USD)
Land Rent	100,000.00
Cost of Raw Material (delivered to factory)	1,125,000.00
Safety & Protection Equipment	3,000
Maintenance & Repairs	2,000
Contract Services	2,000
Chemicals & Lab Equipment	5,000
Miscellaneous	3,000
Office Supplies	2,000
Engineering & Legal	2,000
Office Utilities	2,000
Communications	2,000
Licenses (Software etc.)	1,000
Office Maintenance	1,000
Marketing/Advertising	10,000
Insurance	5,000
Customs Costs	5,000
Transportation (1 container/mth)	30,000
TOTAL	1,300,000

7.5 Equipment

A packaged system is proposed with 3 extraction vessels each of 1000L together with 2 separators. The carbon dioxide will be recycled to minimize carbon dioxide use. The main supplier of commercial size Supercritical Fluid Extraction systems in the USA has given an estimated price of such a system with a maximum operating pressure of 500bar of US\$6.3m.

Table 12: Equipment Costs

EQUIPMENT	COST (USD)
Field Equipment	50,000
SFE Plant Package	6,300,000
Drier/size reduction equipment	200,000
Scale and Mobile unit to load and offload raw materials	200,000
TOTAL	6,750,000

7.6 Financial Analysis

Operating with two stand-alone stills gives the flexibility to process two crops simultaneously, or both on one crop at any time. Projected annual crop acquisition of each of the chosen crops, oil production and anticipated revenues are given in Table 13.

Table 13: Cost of Acquisition of Raw Materials

CROP	CROP ACQUISITION TONNES/YR	OIL PRODUCTION KG/YR	REVENUE US\$/YR
Bay	300	12000	1,440,000
Vetivier	1200	18000	3,060,000

Analysis of this profile based on the production of vetiver oil and bay oil showed that for an investment value of US\$9.29m, the payback period is 5 years, the NPV after 5 years is US\$1.64million and the 5 year IRR is 17%. It must be emphasized that even though these two oils are used for this scenario, the option exists to process other oils mentioned in the profile. Table 2 shows a summary for Part 2 of the essential oils and oleoresins.

8 Human Resources

8.1 Organisation Chart

The organisation would permanently employ seventeen (17) employees with one (1) Marketing Assistant, one (1) Accounting Assistant and eleven (11) individuals in Production. In charge would be a General Manager who would ideally be an Industrial Engineer, as would the Production Manager. They should both be familiar with Lean Production and Total Productive Maintenance. See Figure 6.

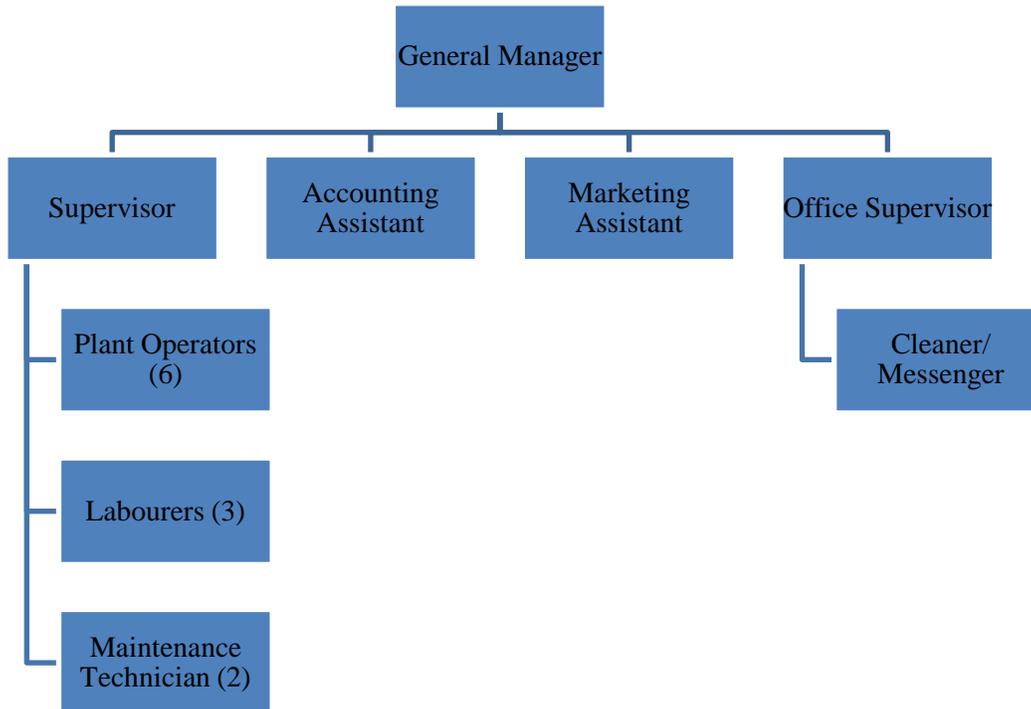


Figure 6: The organizational structure of the Essential Oils and Oleoresins

8.2 Job Descriptions for Key Positions

Brief descriptions for the key permanent positions in the Essential Oils and Oleoresins Plant are in Table 16.

Table 14: Job Descriptions

POSITION	DESCRIPTION
General Manager	The General Manager, an engineer, will assume overall responsibility for the management and operations of the organization. Included would be product

Manufacturing Profile 3b: Essential Oils and Oleoresins Part 2

	development, business development, operations, production, financial control, quality control, and training of employees in all aspects of the operation.
Office Supervisor	Responsible for managing the office, document management and internal communication.
Factory Supervisor	Responsible for ensuring that all processes that are supposed to be carried out per shift are done in a timely manner and assigning duties to plant operators, labourers and maintenance technician.
Maintenance Technician	The maintenance technician is responsible for preventative measures as well as troubleshooting processes and diagnosing mechanical, hydraulic and pneumatic problems associated with process equipment.
Accounting Assistant	The processing of bills, invoices, accounts payable and receivable, etc.
Marketing Assistant	Planning, advertising, public relations, product development and distribution. The sales officer is the point of contact between the company and the customer and is required to establish and maintain strong relationships between both parties.
Plant Operators	Responsible for operating the equipment to make the products, set-up, keeping the work area clean and tidy and basic machine maintenance.
Labourers	The labourers ensure smooth operation by performing duties such as cleaning, packing, forklift drivers, storage, etc.
Cleaner/Messenger	The primary duty of this staff member would be to transportation and courier services for the venture. Clean up functions on-site will also be required.

8.3 Labour Availability

Table 15: Potential labour pools for proposed positions

CATEGORY	UNEMPLOYED	EMPLOYED	POTENTIAL EMPLOYMENT
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Manufacturing Profile 3b: Essential Oils and Oleoresins Part 2

POOL			
Professionals <ul style="list-style-type: none"> • Accounting assistant • Office Supervisor • Factory Supervisor • Marketing Assistant 	900	36700	Graduates from any of the sixteen (16) Universities of the West Indies Open Campus locations in the Caribbean, and/or any of UTT campuses in Trinidad.
Legislators, senior officials, managers <ul style="list-style-type: none"> • General Manager 	400	61300	Sourced from the existing pool of unemployed and employed persons through interviews and the subsequent process of filtering.
Technicians <ul style="list-style-type: none"> • Plant Operators 	1500	69300	Can be sourced from several training centres in Trinidad registered under the Accreditation Council of Trinidad and Tobago (ACTT)
Labourers/ Cleaners	600	57700	E.g. Crane Safe Technical Institute, Advanced Solutions Technical Institute and Technical Institute for Learning, just to list a few.

9 Location

This venture would be located in the Cove Eco-Industrial Park in Tobago. The raw material for these oils would all be available in Tobago. Table 18 depicts a general assessment of locations in T&T. It is followed by a list of the best general locations which may be used as a guide to find alternative locations to the recommended, if necessary.

Table 16: A general assessment of Locations in T&T

	Weight	Trinity	Aranguez	Central	Diego Martin	South	Arima	Tobago			
Availability of services and supplies	0.048	80	80	80	80	80	80	60		540	0.078763
Environmental considerations	0.010	75	75	75	75	75	75	90		540	0.078763
Infrastructure - land availability	0.095	65	70	90	60	60	75	60		480	0.070012
Infrastructure - land/construction costs	0.105	60	60	80	50	60	60	40		410	0.059802
Infrastructure - roadways/access	0.124	80	80	60	70	70	80	50		490	0.07147
Labor availability experience/skills	0.067	90	70	75	75	80	80	80		530	0.077305
Labour cost	0.048	75	75	75	75	75	75	65		515	0.075117
Proximity to emergency services	0.000									0	0
Proximity to port	0.086	80	80	80	80	70	75	60		525	0.076575
Proximity to raw materials	0.057	80	80	80	60	60	60	50		470	0.068553
Utilities - electricity	0.105	90	90	90	90	90	90	90		630	0.09189
Utilities - gas	0.086	90	90	90	90	90	90	80		620	0.090432
Utilities - telecom	0.086	90	90	90	90	90	90	90		630	0.09189
Utilities - water	0.086	75	75	70	60	75	70	50		475	0.069282
Total	1.000	1030	1015	1035	955	975	1000	845		6856	

Best Locations based on rankings

- 1) Central Trinidad: 1035
- 2) Trinity: 1030
- 3) Aranguez: 1015
- 4) Arima: 1000
- 5) South: 975
- 6) Diego Martin: 955
- 7) Tobago: 845

10 List of Potential Investors and Partners

Table 19 gives a list of potential investors and partners, together with contact information.

The list is not exhaustive.

Table 17: List of Potential Investors and Partners

POTENTIAL INVESTOR/PARTNER	CONTACT
Biolandes	40420 LE SEN / FRANCE Tel. +33 (0)5 58 51 00 00 Fax. +33 (0)5 58 51 07 00 Purchasing / Subsidiaries : Benoît LEMONT Products / R&D : Philippe COUTIERE Sales : Cécile COUTIERE https://www.biolandes.com/contact.php?lg=en#
DoTerra	Global Headquarters dōTERRA International LLC. 389 South 1300 West Pleasant Grove, UT 84062 Monday-Friday 9:00am - 5:00pm (MST)
Ungerer and Company	U.S. Headquarters 4 Bridgewater Lane Lincoln Park, NJ 07035 P: 973-628-0600 F: 973-628-0251
Essential Oils of New Zealand	46 Waiora Lane PO BOX 591 Rangiora New Zealand

Manufacturing Profile 3b: Essential Oils and Oleoresins Part 2

	<p>Telephone 03 313 8032 Fax +64 3 313 8032 Email: sales@essentialoil.co.nz</p>
Falcon and Ungerger Limited	<p>Lincoln Park Headquarters 4 Bridgewater Lane Lincoln Park NJ 07035 Telephone: 610 868 7266</p>
Farotti Essence	<p>Via Coriano, 58 47900 Rimini Italy +390541384728</p>
Young Living Essential Oils	<p>Thanksgiving Point Business Park 3125 Executive Parkway Lehi, UT 84043 1-800-371-3515</p>
Lystra Ali Valley Blossoms	<p>Arouca Trinidad (868) 482-2732 valleyblossoms@hotmail.com</p>
Cher Mere Caribbean	<p>868-285-9053 info@chermerecaribbean.com</p>
Genethics Pharmaceuticals	<p>Address: Lot 14 O'Meara Industrial Estate, O'Meara Road, Arima, Trinidad, W.I. Telephone: (868) 646-1948 Fax: (868) 642-0588 E-mail: sales@genethics-tt.com or info@genethics-tt.com</p>

11 Concluding Remarks

This profile concerns the production of essential oils in Tobago using Supercritical Fluid Extraction technology. The initial products are bay oil and vetiver oil, however the technology is very flexible and capable of delivering a wide variety of essential oils and oleoresins as the market demands, and as raw material is available. Professor Emeritus David Mc Gaw of the UWI and his team who have done considerable research in this area, would be providing technical support and lab services for the venture. While the analysis shows the venture to payback over a 5-year period despite the significant projected investment in equipment, quotations based on the actual design of the facility would be necessary to determine the final investment value. As with all the other profiles, a pre-feasibility followed by a complete feasibility study should be done before a decision is made on the project.

12 References

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13 Appendix

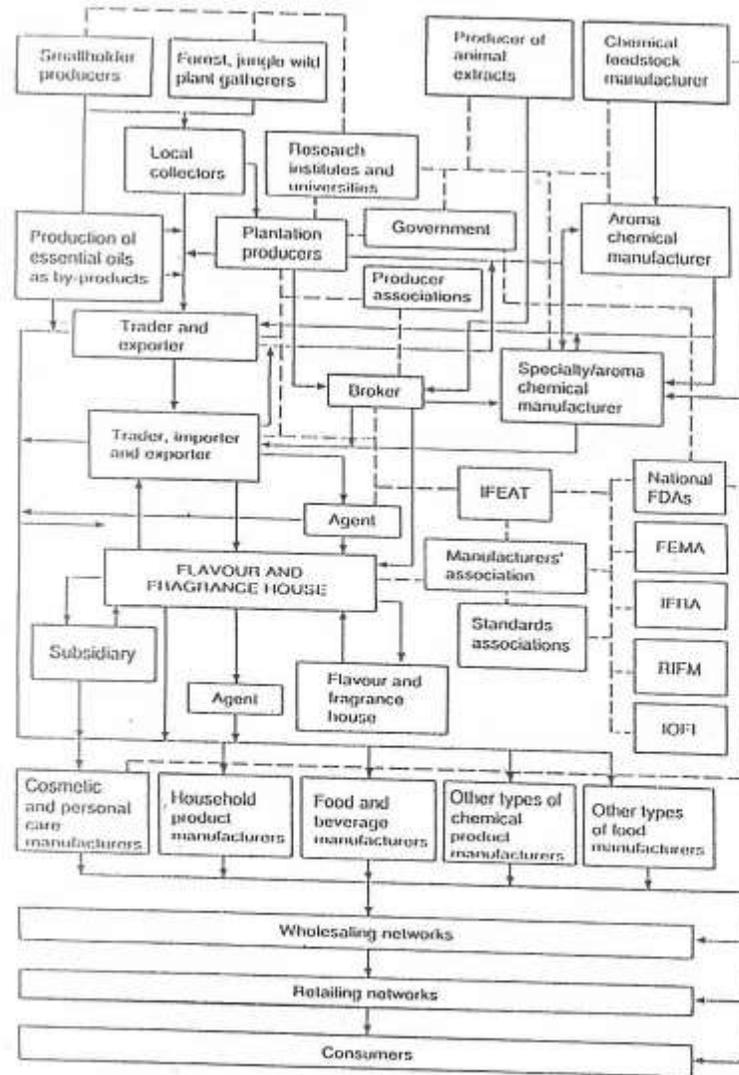


Figure 2.1 Structure of the International Flavour and Fragrance Industry

NFDA, National Food and Drug Administration; IFEAT, International Federation of Essential Oils and Aroma Traders; IFRA, International Fragrance Association; RIFM, Research Institute for Fragrance Materials; IOFI, International Organisation of Flavour Industries