Pre-Feasibility Study For

FLORICULTURE

FARMING, PRODUCTION, PROCESSING AND MARKETING

May 2006




Prepared by

IN CONSULT (Pvt.) Limited

Study Commissioned by

Employment & Research Section,

Planning & Development Division,

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1st Floor, P.I.D.C. House, MT Khan Road, Karachi.

nmc@super.net.pk

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The purpose and scope of this Pre Feasibility Study is to introduce the Project and provide a general idea and information on the said Project including its marketing, technical, locational and financial aspects. All the information included in this Pre-Feasibility is based on data/information gathered from various secondary and primary sources and is based on certain assumptions. Although, due care and diligence have been taken in compiling this document, the contained information may vary due to any change in the environment.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ANNEXURE- 1 PAKISTAN - A PROFILE

ACRONYMS

ASEAN	Association of South East Asian Nations
BOO	Build Operate Own
BOT	Build Operate Transfer
CAA	Civil Aviation Authority
CAGR	Compound Annual Growth Rate
CAM	Complimentary & Alternative Medicine
CNG	Compressed Natural Gas
CO2	Carbon dioxide
ECO	Economic Cooperation Organisation
EIZ	Eastern Industrial Zone
EO	Essential Oil(s)
FDI	Foreign Direct Investment
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GNP	Gross National Product
HACCP	Hazard Analysis and Critical Control Point
HDIP	Hydrocarbon Development Institute of Pakistan
ISO	International Organization for Standardization
km	Kilometre
KPT	Karachi Port Trust
NAHA	National Association of Holistic Aromatherapy
NHA	National Highway Authority
NPC	Natural Personal Care Products
NPK	Nitrogen-Phosphorus-Potassium
NWFP	North West Frontier Province
OEM	Original Equipment Manufacturer
PIA	Pakistan International Airlines
PNSC	Pakistan National Shipping Corporation
PTA	Pakistan Telecommunication Authority
PTCL	Pakistan Telecommunication Limited
R&D	Research & Development
SAARC	South Asian Association for Regional Cooperation
UAE	United Arab Emirate
UHT	Ultra Heat Treated
UK	United Kingdom
USA	United States of America
WTO	World Trade Organization

EXECUTIVE SUMMARY

INTRODUCTION

- in Pakistan due to poor farming practices; shortage of plant / seed bulbs; low yields; post-harvest losses; sub-standard quality; inadequate facilities for grading, packing and marketing; lack of reefer containers, cold storages and cool chain; limited space and high transit time via air; and poor linkages with potential importing countries, the harvesting, packing, transporting and marketing of fresh flowers (cut or potted) is not viable. However, a distinct opportunity exists in the flower extracts sectors, especially essential oils.
- The objective of this pre-feasibility study is to assess the viability of establishing essential oil extraction units in Pakistan.

MARKET/ NEED ASSESSMENT

- New entrants like Pakistan in the global fresh flower trade need to make substantial investments in supporting infrastructure and develop internal coordination mechanisms between various players and stakeholders in order to succeed in the short and long term.
- It is recommended that the focus of the floriculture sector of Pakistan need not be on fresh flowers rather, the focus should be on flower extracts and other by-products such as aromatic and essential oils, hydrosols and hydroflorates and dried flowers and potpourri which do not require the extensive supporting infrastructure and internal coordination demanded by the fresh flower sector.
- Over the last 50 years, the demand for essential oil products from plants has gradually increased because of a number of factors. Demand for flavoring, perfumery, and aromatherapy materials has risen because of the steep rise in the world population and a desire for greater variety in their food by the people of the industrialized countries.
- The US, Western Europe and Japan are the main consumers of essential oil products (flavor, fragrance and therapeutic) and account for approximately 78%

of total world consumption. The forecast of annual growth for these products is 3.5% to 4% for the next few years.

- Pakistan is blessed with an excellent climate and a fertile soil. Both these factors contribute to the opportunity of production of highest-grade essential oils. The local consumption of essential oils is estimated at 100,000 kg. Results of the primary data analysis indicate that there is no organized essential oil production in Pakistan. Almost all of the local demand and consumption of essential oils is met by imports from China, Brazil and France.
- Primary data analysis suggests that in the foreseeable future the local consumption, production and export potential of Eucalyptus, Peppermint, Menthol (Mentha) essential oils will increase.

TECHNICAL EVALUATION

- Taking into account the amount of local consumption, monetary value, cost of production and export potential, it is recommended that the proposed unit produce the following essential oils and its related by-products:

No.	Essential Oil	Base Material	Parts Used	By-Product(s)
1	Peppermint Oil	Mentha Arvensis	Leaves and stem	Distillate
2	Mentha Oil	Mentha Peperita	Leaves and stem	Distillate
3	Eucalyptus Oil	Eucalyptus	Leaves and stem	N/A

- Approximately, 200 kg of Mentha Arvensis and Mentha Peperita would be needed to produce 1 kg of Peppermint and Mentha Oil respectively with a 0.5% rate of recovery or extraction. With a 0.3% recovery or extraction rate, approximately 300 kg of Eucalyptus leaves and stems would be required to produce 1 unit of Eucalyptus Oil.
- The Peppermint varieties will be cultivated on the project site, Eucalyptus leaves and stems which are abundantly available throughout the country will be procured free of cost from plantations found in great abundance on roadsides across Sindh.

- Considering the cost of the technology, local availability of components and the flora of the country, a Steam Distillation Unit would be most appropriate for extracting Peppermint, Mentha and Eucalyptus essential oils.

GOVERNANCE AND MANAGEMENT STRUCTURE

- The total manpower requirement for the project is approximately 74 personnel.
- The sponsors of the project may find it preferable to own and operate the business through a private limited company.

FINANCIAL EVALUATION

- The total cost of the project is estimated at Rs. 40 million including working capital of Rs. 5 million. Financial operating results for the first five years is given below and presented in detail in Chapter 5.

EARNINGS FORECAST

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Sales Revenue	28,800	31,680	34,560	37,440	40,320
Gross Profit	22,668	28,944	31,575	34,206	36,838
Operating Profit	14,213	20,002	22,139	24,268	26,388
Net Profit	7,343	11,107	12,496	13,879	15,257

CONCLUSION

- In order to enhance the feasibility of the recommended essential oil production unit, it is recommended that the Government of Pakistan take the following steps:
  - Restrict the import of Peppermint, Mentha and Eucalyptus oils in Pakistan
  - Upgrade laboratories at PCSIR or HEJ Institute of Chemistry, equipping them to handle the requirements of essential oil gradation and quality assessment
- The investors may wish to diversify into Rose Oil extraction. Rose Oil is a high priced product locally where it is price is approximately Rs. 500,000 / kg. Its local demand is very high while it is scarcely available in the country.

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Floriculture is a discipline of horticulture concerned with the cultivation of flowering and ornamental plants for gardens and for floristry. Floriculture crops include bedding plants, flowering plants, foliage plants, cut cultivated greens, and cut flowers.

Driven by high-tech production technologies, floriculture is capital as well as labour intensive. Cost of capital and labor critically affect competitiveness within the industry and determine profitability at the enterprise level. Competition is between the grower exporters in the low cost production regions, such as the high tropics; and the high cost, intensive production units of the temperate countries. The recent fall in price of imported flowers and the higher cost of airfreight are improving the competitiveness of the domestic producers in temperate countries which are also major markets. In most cases, such as the Netherlands, local producers have the advantage of selling their flowers within 12 hours from cutting as opposed to 36 to 40 hours for imported flowers. Since production sites in major flower producing countries, such as the Netherlands, are often located quite close to auctions and since ambient temperatures are low, cold stores are not needed at production sites.

Hence, due to the above and other reasons in Pakistan, such as poor farming practices; shortage of plant / seed bulbs; low yields; pests / diseases especially fruit fly and viruses; post-harvest losses; sub-standard quality; inadequate facilities for grading, packing and marketing of flowers; lack of reefer containers, cold storages and cool chain; limited space; high transit time via air and poor linkages with potential importing countries, the harvesting, packing, transporting and marketing of fresh flowers (cut or potted) is not viable. However, a distinct

opportunity exists in the flower extracts sectors. In Pakistan, according to IUCN, about 5,700 species of flowering plants have been reported and almost 400 of these are endemic species. The Northern Areas of Pakistan harbour some of the richest plant communities in the region. Particularly, the transition zone between alpine and moist temperate biomes of the western Himalayan highlands (upper Diamer District) is considered rich in plant diversity and endemism. The plant communities are diverse, with a number of progenitors of economically useful crops including wild cumin, thyme, pine nuts, apricots, walnuts and a host of medicinal plants with potentially useful pharmaceutical values. Thus there is potential in exploiting this rich diversity of plants, flowers, herbs and spices in Pakistan to create high value products such as essential oils for local consumption and export purposes.

1.2 OBJECTIVES AND SCOPE OF STUDY

The objective of this pre-feasibility study is to assess the viability of setting up a unit for producing plant extracts such as hydrosols and essential oils. The study has been designed and conducted with the specific aim of drawing-in interest from potential investors for making investments in such a unit. More specifically, the purpose of this study is to develop a conceptual and practical foundation for a more in-depth feasibility study to be conducted at a later stage.

After need assessment, the project concept and type is suggested, followed by its ideal size, in terms of capital, land and manpower requirement. Subsequently, the unit's technical and infrastructural requirements have been highlighted and their financial viability examined.

1.3 METHODOLOGY

Data collection methodology adopted for this study is described below:

- Data from secondary sources was collected and analyzed. Various Government as well as international publications were consulted and relevant data compiled. In addition, data from the internet was also used.

- Primary sources were also identified and contacted for collection of un-published information. The method for primary data collection was semi-structured interviews. A number of such interviews were held with floriculturists and growers and exporters of flowers and flower extracts.

1.4 THE STUDY TEAM

A team of our experts including a market analyst, technical expert and financial analyst, coordinated by a team leader collected and analyzed data for examining the technical as well as the financial viability of the proposed project. Support staff included a field surveyor, data tabulator and computer operator.

CHAPTER 2

MARKET/ NEED ASSESSMENT

2.1 GLOBAL TRADE IN FRESH FLOWERS

Flowers are grown on a global scale and their global trade is estimated at US $ 50 billion. Presently more than 10 countries are engaged in floriculture. The acreage under various flower crops is increasing constantly. The biggest flower-growing nations are the Netherlands, Colombia, Kenya and Israel but other countries like South Africa, Ecuador and Malaysia are also becoming significant players in the industry. The floriculture industry has been the monopoly of a few western countries, mainly the Netherlands, the largest trader of floricultural products, with a lion's share of 70% followed by Columbia and Israel with 12% and 6% share respectively of the global floriculture trade. Pakistan's neighbor India is also becoming active in the global floriculture trade where its earnings were at US $30 million in 2004-2005.

Japan, North America and Europe have a great demand for floriculture products. Germany followed by the USA with 36% and 22% shares respectively of the global import, make the maximum import of floriculture produce. The per capita consumption of the flowers is globally the highest in Norway (US $146), followed by Switzerland (US$ 126) and Germany (US $88), though the maximum consumption of flowers is in the USA (US $12,500 million) followed by Japan (US $5,465 million) and Italy (US $4,270 million).

The success of western nations in the global floriculture trade is due to a variety of reasons such as strategic location, access to markets, weather, availability of supporting infrastructure, well developed transport links. The case of Netherlands - the world's largest grower and exporter of fresh flowers is quite instructive in this regard. Local producers have the advantage of selling their flowers within 12 hours from cutting as opposed to 36 to 40 hours for imported flowers. Since the production sites in the Netherlands are often located quite close to the auctions

and the ambient temperatures are low, cold stores are not required at the production sites. Producers can take their flowers to the auction every evening, place them on the special auction trolleys that can be conveniently hauled into the cold stores for over night storage and taken out the next morning. The trolleys can be passed across the clock for auction. The money is deposited into the grower's bank account after deducting all charges which include auction and handling costs. In this marketing sequence, the locally grown flowers are sold much fresher than the imports and therefore get a premium. The payment for all sales through the auctions is fully assured.

A study by the Indian Institute of Management, Hyderabad, highlighted a number of elements necessary for success in the fresh flowers industry:

- Low production costs
- Most optimal use of the highest cost resources - such as land in the Netherlands, so the law requires hydroponic cultivation and commercial considerations demand high yields per hectare, expensive labour necessitates automation
- Cost of controlling climate to create quality through plastic or glass houses versus the price received
- Vigilance to detect changes in consumer demand and ability to respond quickly.
- Capacity to innovate and experiment with new varieties and growing techniques - new products fetch better prices way above the average. In some cases the price difference could be several times
- Closeness to the market.
- Growers who have consistently delivered high-quality produce fetch higher prices than little known or irregular suppliers
- Availability and reliability of air connections
- Share of air freight in total cost
- Share of air freight in marketing, handling, and packaging cost

- Physical infrastructure of high quality
- Good infrastructure including proper transport between farms and airport – good roads, refrigerated trucks
- Temperature and humidity controlled transportation at all stages of the movement to ensure that the flowers arrive at their final destination in good condition
- Efficient organization ensuring continuous attention to the cargo and the speediest delivery of flowers to the destination without delay lest they spoil
- A "cold chain" from producer to retailer, including cold storage at the airport - storage and handling at low temperatures close to 0°C and 95 per cent relative humidity
- Good quality water to prolong vase life
- A clean handling and storage environment to prevent bacterial growth which blocks flower stems, or fungi growth, which infects flower blooms
- Avoiding large temperature fluctuations, careful handling (to prevent damage) and good air circulation to reduce the risk of fungi and other diseases.

It is evident from the above that new entrants in the global fresh flower trade need to make substantial investments in supporting infrastructure and develop internal coordination mechanisms between various players and stakeholders in order to succeed in the short and long term. In Pakistan infrastructure issues, as in other developing countries, pose a serious problem. Poor roads, irregular power supplies, lack of reefer transportation, absence of cold storage facilities at airports, and problems of cargo space on the air flights will prove to be serious impediments. Further, as evidenced in the local horticulture industry, internal coordination between various stakeholders such as harvesters, scientific and research bodies, processors of horticultural products, Government bodies, suppliers of credit remains weak at best.

In light of the above, it is recommended that the focus of the floriculture sector of Pakistan should not be on fresh flowers, rather, the focus should be on flower

extracts and by-products such as aromatic and essential oils, hydrosols and hydroflorates and dried flowers and potpourri which do not require the extensive supporting infrastructure and internal coordination demanded by the fresh flowers sector. Moreover, the flower extracts and by-products sector is a high value added sector which is starting to flourish globally.

2.2 ESSENTIAL OILS INDUSTRY

2.21 GLOBAL OVERVIEW

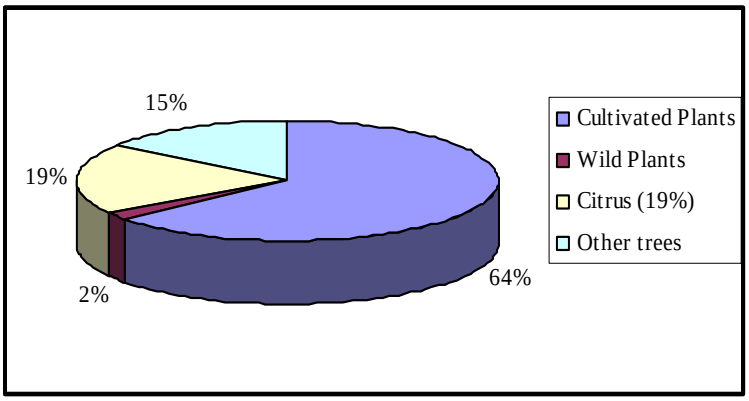
The major producers of essential oils are Brazil, China, USA, Egypt, India, Mexico, Guatemala and Indonesia. All of them, with the exception of USA, are developing countries. The major consumers are the USA (40%), Western Europe (30%) and Japan (7%).

Ten major essential oil crops account for 80% of the world market for essential oils. The major essential oil crops are: citrus (USA, Brazil, Mexico); mint oils such as peppermint (USA), spearmint (USA) and cornmint (China, India, South America); and lemon fragrance oils such as citronella, lemongrass and may change (China, India, South America). Eucalyptus oil is produced in Brazil, China and South Africa, as well as in Australia. Cedarwood oil is confined to North America as a by-product of the timber industry. The clove industry is confined to Indonesia. The remaining 20% of the world essential oil market comprises of over 150 crops. Figures 1 and 2 give the breakdown of essential oil production by value and tonnage according to species. Most current essential oil producing countries, apart from the USA, have low labor costs.

FIGURE - 1

BREAKDOWN OF WORLD PRODUCTION (USD VALUE)

ACCORDING TO SPECIES

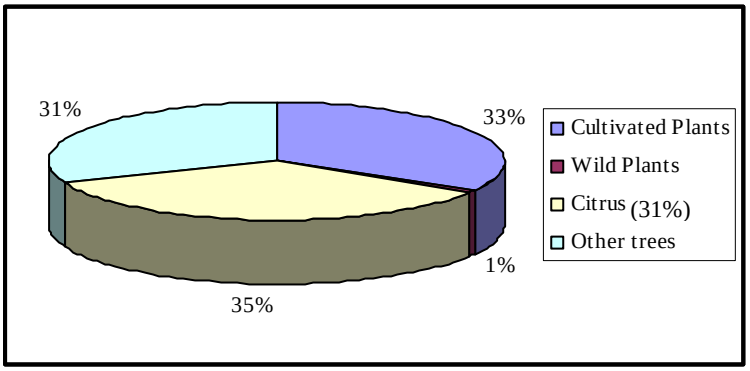


Source: A Study on the Therapeutic Essential Oil Industry, Government of Alberta Canada.

FIGURE - 2

BREAKDOWN OF WORLD PRODUCTION (TONNAGE)

ACCORDING TO SPECIES



Source: A Study on the Therapeutic Essential Oil Industry, Government of Alberta, Canada.

Over the last 50 years, the demand for essential oil products from plants has gradually increased because of a number of factors. Demand for flavoring, perfumery, and aromatherapy materials has risen because of the steep rise in the world population and a desire for greater variety in their food by the people of the industrialized countries. The increased concern for the environment and for the

safety of food and the general difficulty in manufacturing synthetic alternatives has also contributed to the continued growth in demand for plant based essential oil products.

It is not only in the human health area that interest is gaining in essential oils. In poultry flocks in France, “antimicrobials” are used as preventive and control measures for antibiotic and medication resistance programs. Essential oil therapy has been used in French “label” chicken flocks. Alternative therapies are being studied as solutions to such treatment issues, in a limited way, in agricultural feed.

The US, Western Europe and Japan are the main consumers of essential oil products (flavor, fragrance and therapeutic) and account for approximately 78% of total world consumption. The forecasted annual growth for these products is 3.5% to 4% for the next few years.

The therapeutic oil industry is dwarfed by the fragrance and flavor industry. Broker houses that sell to the larger companies are not looking for unusual oils but the more commonly produced oils as they can import them in large volumes at low prices. The fragrance and flavor industries need a consistent product whether it is 100% natural is not a concern.

2.2.2 GLOBAL MARKET

Rising health concerns and the search for natural alternatives to modern medicine has driven the usage of essential oils for alternative healing and human well-being. This has fueled the growth of herbal remedies and now aromatherapy, blurring the boundary between cosmetics, toiletries and medicines as consumers seek new means of relieving the stress of pressurized lifestyles. Initially regarded with skepticism among the mainstream medical community, aromatherapy has achieved more widespread acceptance.

According to a recent Datamonitor report, the market for aromatherapeutic / essential oil products in France, Germany and the UK was valued at US $523.3 million. The aromatherapeutic market in the USA has grown from US $316 million in 1996 to US $454 million in 2001. The compound annual growth rate (CAGR) for aromatherapy sales in the US for 1996-2001 is 7.5%.

Aromatherapy is gradually moving away from its niche market origins as a number of major multinationals and supermarkets enter the market. From small-scale production and distribution to health and specialty outlets, the rapid growth of the aromatherapy market has now attracted larger operators, such as Coty, Lancôme, and L'Oréal. This has seen a proliferation in the range of mass-market and private-label products offered, and has made aromatherapy more accessible to the consumer, both in terms of distribution and familiarity with trusted brand names. The growth of the Internet offers another potential distribution channel, enabling smaller manufacturers to expand consumer base. According to a survey by the National Association of Holistic Aromatherapy (NAHA), the last half-decade has seen tremendous growth in aromatherapy product sales, as consumers have become increasingly savvy about the healing powers of essential oils. The survey further revealed that aromatherapy is big business for lots of small companies. Despite the "aromatherapy" sections that have cropped up in numerous chain retail stores (usually featuring fragrant lotions, soaps, shampoos), the real aromatherapy market i.e. the wholesalers and retailers of true essential oils and related products and services, remains in the hands of smaller operators.

NAHA pins the popularity of aromatherapy on, among other things, a growing disillusionment with today's high-cost health care industry, combined with consumers' desires to return to a more natural lifestyle using natural personal care products (NPC). The NPC market in the USA grew to $4.1 billion in consumer sales in 2002 or 11% of the 37.3 billion U.S. health and beauty care market. The market (in the USA) for natural personal care products will reach $7.5 billion in

2006. Datamonitor estimates that products with aromatherapeutic principles constitute 3% to 5% of the total personal care market.

2.2.3 MARKET TRENDS

The following are some of the market trends pushing the essential oils and flower extracts sector:

- Consumer trend is towards health and well-being
- Pull factors: aging population and increased health awareness – people aged over 50 years own more than 70% of the US net wealth. Such a trend is witnessed globally. Seniors are the fastest growing market segment
- Push factors: manufacturer, media and retailers boosting growth of wellbeing trend
- Trend is neither gender nor age specific – it is a “consumer group”
- Americans spend more than twice as much on anti-depressants as in Europe
- Skincare category is the major user of natural active ingredients derived from essential oils or herbs – as the base of skin care products tend to be oil based which are good carriers for essential oils or herbs
- Essential oils are mainly used by practitioners and a small group of consumers who religiously use these products as an alternative to synthetic medicine
- Personal care companies such as Body Shop and Coty employ the term “aromatherapy” beyond niche status
- Home décor trends – candles – giftware
- Aromatherapy with essential oils has been adopted by many as a method of relaxing, recuperating and recharging or improving total well-being. The market drivers for natural personal care are highest in the US, UK and Germany
- According to the 2003 Health and Wellness Trends Report offered by the Pennsylvania-based Natural Marketing Institute, aromatherapy is used by an average of 34.4% of the total population, with 46.9% under the age of 35, suggesting growth opportunities as the population ages

- The consumer has a *desire* for 'natural products'. Consumers today are seeking a way to achieve balance, harmony, health and peace in an increasingly stressful world

2.3 PAKISTAN – RICH IN PLANT DIVERSITY

Pakistan is spread over an area of 87.98 million hectares. The country is situated between latitude 23° and 37° North and longitude 61° and 76° East. The annual rainfall ranges from 125 mm in the South to 875 mm in sub-mountainous and northern plains. About 70% of the rain falls during the monsoon season (July-September). However, occasional showers also occur during the winter. The summer months, except in mountainous areas, are very hot, while the winter months are mild in the plains and extremely severe in hilly regions.

The state-owned forest area, under the control of the Forest Department, is 4.58 million hectares, only 5.2 % of the total area of Pakistan and Azad Jammu and Kashmir. Annual production of timber and fuelwood is 0.482 million m^3 and 0.234 million m^3 respectively. A survey of the naturally available plant wealth of Pakistan shows that medicinal plants grow in abundance in Hazara, Malak and Kurram Agency, Murree Hills, Azad Kashmir, Northern Areas and Baluchistan, or are cultivated on farmlands in Punjab, Sindh, Baluchistan, North West Frontier Province and Kashmir. According to the surveys carried out by the Pakistan Forest Institute (1989), 500 tons of medicinal plants are produced in Hazara and Malakand, 16 tons in Murree Hills, 38 tons in Azad Kashmir and about 24 tons in Northern Areas. These plants are collected from the wild, dried and processed and sold in the local markets or exported to other countries.

A variety of medicinal plants grow in the temperate hilly regions of Pakistan. These plants gained importance in the allopathic system of medicine after Europeans investigated into their curative values. Plants such as *Digitalis purpurea*, *Atropa belladonna*, *Colchicum sp.* (Suranjan talkh), and many others were used in British and American pharmacopoeias, while a number of life-saving

drugs are currently in use. A survey conducted by the Food and Agriculture Organization of the United Nations revealed that a variety of medicinal plants were naturally available and grown in the Kashmir forests, North Western Frontier Province and Baluchistan. These species are highlighted in Table 1:

TABLE - 1

SPECIES OF MEDICINAL PLANTS IN KASHMIR FORESTS, NWFP & BALUCHISTAN

Plant names	Parts used	Approximate Annual Yield (tons)
Aconitum chasmanthum	Roots	5
Aconitum heterophyllum	Roots	1
Acontium sp.	Leaves	7
Adianthum capillus	Whole plant	120
Angelica glauca	Roots	7
Artemisia vulgaris	Leaves/ shoots	148
Atropa acuminate	Roots	74
Berberis lyceum	Roots	300
Dioscorea deltoidea	Rhizome	148
Dioscorea deltoidea	Twigs	233
Geranium wallichianum	Roots	18
Myrtus communs	Fruits	45
Paeonia emodi	Rhizome	99
Podophyllum emodi	Rhizome	55
Polygonum amplexicauler	Roots	27
Rheum emodi	Roots	259
Saxifraga ciliate	Roots	37
Thymus serphyllum	Leaves	7
Valeriana wallichii	Rhizome	148
Zizyphus vulgaris	Fruits	30

Source: A Study by Food & Agricultural Organization of the United Nations on Medicinal, culinary and aromatic plants in Pakistan

In Pakistan, when it comes to flowers, the market is flooded with roses, because roses are used in all types of ceremonies, as well as in perfume industry and in

many Auravedic and Greek medicinal preparations. Other flowers commonly available in Pakistan include orchids, tulip, lily, Jasmine and gladioli.

Pakistan is blessed with an excellent climate and agriculture land quality. Both these factors contribute to the opportunity of producing of highest-grade essential oils. The local climatic and soil conditions alter the chemotype (chemical composition) of essential oils in plants and making these essential oils most desirable.

2.4 TREND OF USING PLANT EXTRACTS, ESSENTIAL OILS AND MEDICINAL PLANTS IN PAKISTAN

Pakistan has a very rich tradition in the use of medicinal plants for the treatment of various ailments, based predominantly on the Unani system of medicine, which dates back to the Indus Valley Civilization. This traditional medicine sector has become an important source of health care, especially in rural and tribal areas of the country. Most of the medicinal plants are found in the temperate climates and subtropical forests of northern Pakistan[1]. Around 70–80% of the population, particularly in rural areas, uses complimentary and alternative medicine (CAM)[2]. In addition to other CAM systems such as Ayurvedic and homeopathic, the Unani system has been accepted and integrated into the national health system. Pakistan is the only country in the eastern Mediterranean region where formal Unani teaching institutions are recognized. There has been significant movement at the policy level in terms of CAM regulation. The government of Pakistan has in place a number of organizations and initiatives aimed at strengthening and coordinating various aspects of the sector, supplemented by non-government and private sector initiatives.

As for herbal medicine, Pakistan is slowly emerging as a leading exporter of medicinal plants, however, a great potential for further development exists in this

[1] Rahman AU. *Bioprospecting of Medicinal and Food Plants: Pakistan* 2003;New York UNDP Special Unit for South–South Cooperation

[2] Hussain SA, Saeed A, Ahmed M, Qazi A. Contemporary role and future prospects of medicinal plants in the health care system and pharmaceutical industries of Pakistan

sector. There are 45,000 traditional healers, of whom about three-quarters are practicing in rural areas[3]. The presence of these practitioners in rural areas may be regarded as a source of health care delivery for the rural majority of Pakistan. Approximately 52,600 registered Unani medical practitioners are practicing both in the public and private sector in urban and rural areas. About 360 tibb dispensaries and clinics provide free medication to the public under the control of the health departments of provincial governments.

Pakistan obtains more than 80% of its medicaments from higher plants. Medicinal plants are used as:

- Health care products in traditional medicine (either as raw, single herb preparations or as manufactured finished products, including substances of psychotropic and ritual/religious value);
- Raw material for the pharmaceutical industry for extraction of essential oils, fixed oils, tannins, gums and resins, and pharmacologically active constituents like alkaloids, glycosides, flavonoids, etc.;
- Culinary additions, spices and colourings;
- Natural cosmetics and perfumes
- Health foods either distributed through pharmacies under prescription or as "over-the-counter" medicines.

The natural and herbal products industry has some very big players in the Pakistan market, Hamdard and Qarshi Industries being the most notable. Qarshi Industries for instance is one of the largest natural products companies in Pakistan with 6 International certifications / accreditations including ISO 9001, ISO 14001 and HACCP. Qarshi manufactures hundreds of items in the categories of consumer products, natural medicine and juice and farm products with sales exceeding Rs. 1 billion in 2004-2005. The organization's continued growth and profitability in Pakistan indicates the Pakistani consumer's inclination towards

[3] Gilani A. Phytotherapy—the role of natural products in modern medicine *J Pharm Med* 1992; 2

natural products and remedies. Similarly, Hamdard is another large market player in the natural and herbal products industry having an annual sale exceeding a billion rupees.

2.5 ESSENTIAL OIL PRODUCTION & EXPORT POTENTIAL OF PAKISTAN

According to a study conducted by the Food and Agricultural Organization of the United Nations, the actual supply and demand of herbs and medicinal plants in Pakistan is in the range of 20,000 tonnes per annum. Recent data was unavailable, however, data from 1989-1990 indicates that about 14,000 tonnes of herbs were imported whilst about 106 tonnes of herbs and 3,083 tonnes of medicinally useful plants were exported in that year. Essential oils of Anise, Caraway, Coriander, Fennel, Lavender, Spearmint and Rosemary are extensively used as flavors for domestic consumption and for export.

Consumption of essential oils in Pakistan has been estimated by the Agricultural Development Bank of Pakistan as shown in at Table 2.

TABLE - 2

ANNUAL CONSUMPTION (KG) OF ESSENTIAL OILS IN PAKISTAN

Products	Consumption (kg)
Eucalyptus oil	10,000
Pepper mint oil	10,000
Menthol	25,000
Lemon oil	15,000
Orange oil	15,000
Herbaceous oils	1,000
Other oils	10,000
Total	86,000

Source: A Study by Food & Agricultural Organization of the United Nations on Medicinal, culinary and aromatic plants in Pakistan

Results of the primary data analysis indicate that there is no organized essential oil production in Pakistan. The only notable producers are those who are in the citrus fruit juice extraction industry where orange and lemon oil are the by-products of the extraction process. One such plant is known to be operating in Sargodha, Punjab. Almost all of the local demand and consumption of essential oils is met by imports from China, Brazil and France. Mainly wholesalers, who also happen to be importers, control the domestic market of essential oils. Essential oils are imported for perfumery, pharmaceutical, cosmetics, toiletries, and confectionery industry. Multinational companies import essential oil themselves and through major wholesalers. The two major wholesale markets for essential oils in Pakistan are Lahore and Karachi.

The approximate local wholesale rates of the major essential oils produced and consumed in Pakistan are described in Table 3 below:

TABLE – 3

LOCAL WHOLESALE & INTERNATIONAL MARKET RATES OF MAJOR ESSENTIAL OILS OF PAKISTAN

Essential Oils	Local Wholesale Rate / Unit (Rs.)	International Market Rate / Unit
Eucalyptus oil	300 – 400 / kg	$5 - $6 / kg
Peppermint oil	1000 – 1200 / kg	$24 / kg
Menthol	1000 – 1500 / kg	$16 / kg
Lemon oil	350 - 450 / kg	$5 - $6 / kg
Orange oil	350 - 450 / kg	$5 - $6 / kg

Primary data analysis suggests that in the foreseeable future the local consumption, production and export potential of Eucalyptus, Peppermint, Menthol (Mentha) essential oils will increase.

2.6 PROJECT BRIEF

The proposed project presents an investment opportunity for setting up an essential oil extraction unit alongside a facility to harvest essential oil raw

materials. The various essential oils, extracts, oleoresins, concretes, absolutes, resinoids, and tinctures produced at the extraction unit will be marketed locally and internationally. Critical production issues for the above products include site selection, adaptability, seedbed preparation, seeding, fertilization, weed control, harvesting, storage and processing. These and other technical, environment and regulatory issues will be discussed in later.

CHAPTER 3

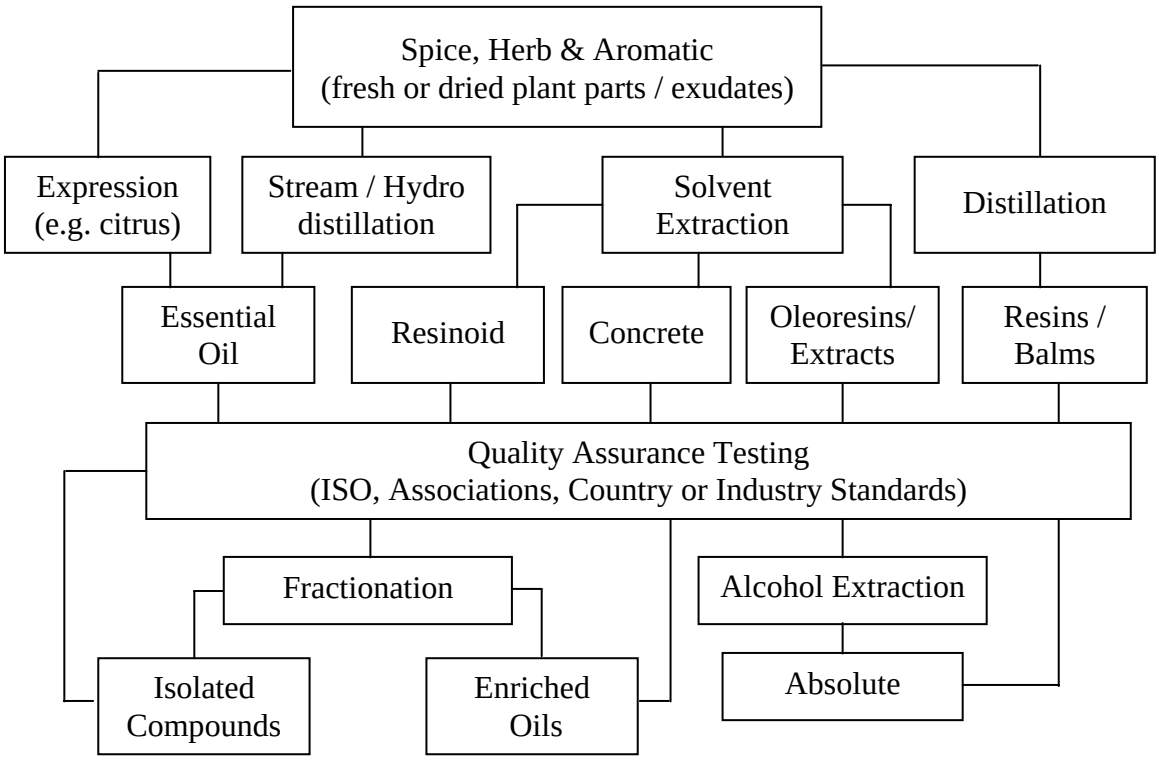
TECHNICAL EVALUATION

3.1 PRIMARY & SECONDARY PRODUCTS

The primary products harvested for spice or essential oil production can be broadly divided into six categories: seeds and fruits, leaves and stems, flowers and buds, roots and rhizomes, and bark, wood and resins. The secondary and derived products are many and varied but the most common are spice mixtures such as curry powders and compounds extracted from the plant material such as essential oils or oleoresins. The plants for food, beverage, or industrial use may come from different extraction processes and these pathways are outlined in Figure 3.

FIGURE - 3

EXTRACTION PROCESSES USED & PRODUCTS FROM SPICE, HERB & AROMATIC PLANTS



The primary products to be harvested are two varieties of Peppermint (known as Podina locally). These varieties are unavailable in the local market, however, they can be easily grown in Sindh near the Thatta and Badin districts (ideally besides the Indus river bed) where the temperatures remain below 40^{o}C. The above mentioned districts' land is well drained with sandy loom soil which is very suitable for growing Peppermint varieties. The two recommended Peppermint varieties include:

- Mentha Arvensis (to produce Peppermint Oil)
- Mentha Peperita (to produce Mentha Oil)

Both varieties mentioned above are successfully cultivated on a large scale in India for Mentha oil production. As such, their seeds are very inexpensive and can be imported from either India or China. After first cropping, importing seeds would not be needed as the locally cultivated crops would provide the seeds for the next season. The cropping seasons for Mentha Arvensis and Mentha Peperita are between February – June and August – January. Approximate yields per acre are highlighted below:

TABLE - 4

PEPPERMINT YIELD PER ACRE

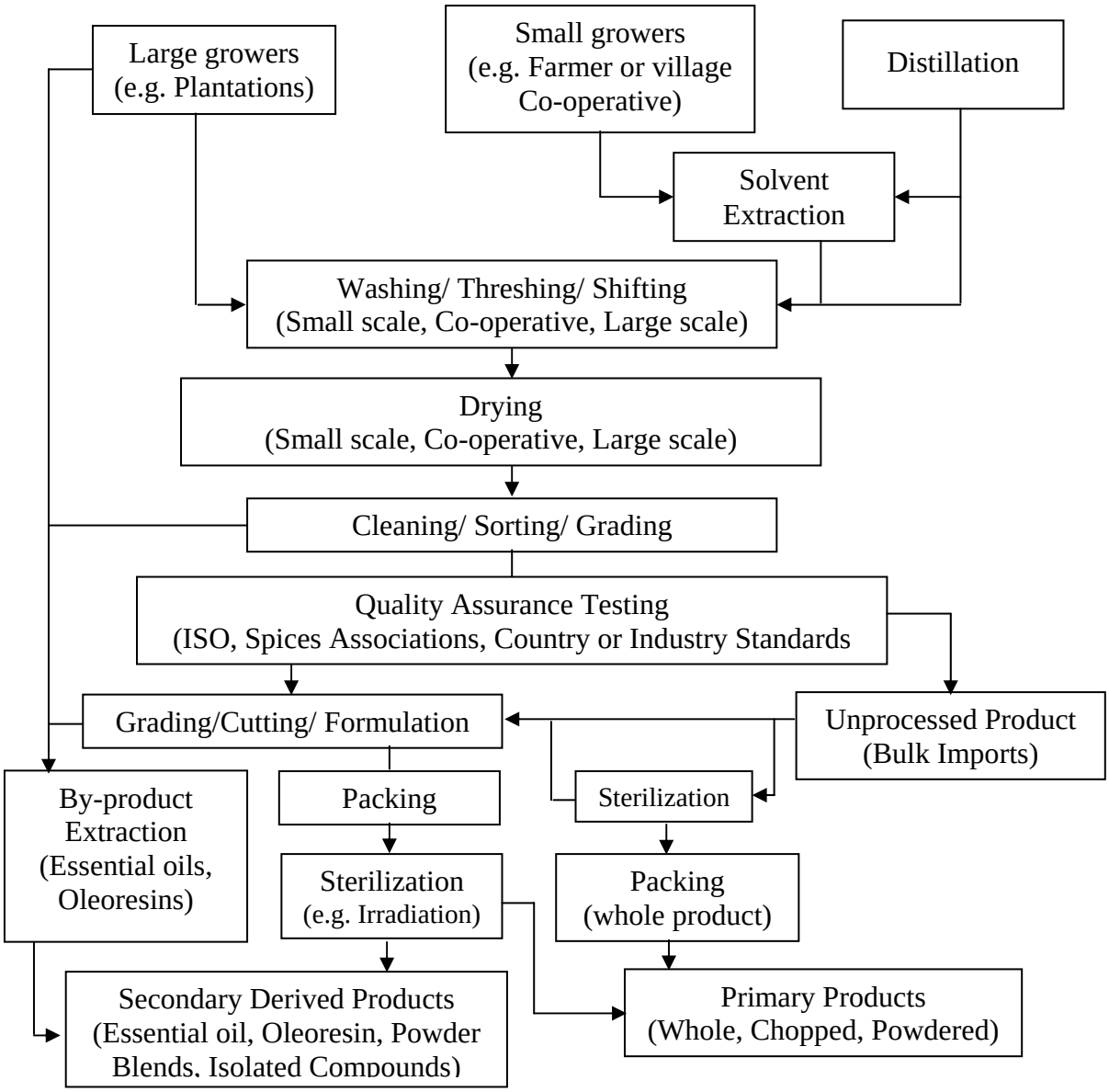
Time of Plantation (Crop)	Time of Plantation	No. of Harvest	Oil Yield Per Acre
Mentha Arvensis	January 2nd week to Feb. Last	2	60kgs to 90kgs
Mentha Piperita	Dec. Last week to Jan. Last	2	40kgs to 60kgs

3.2 POST-PRODUCTION OPERATIONS

Crop cultivation for essential oils can be sub-divided into a number of activities, and although there is a route to market through by-product extraction, most plants and herbs have a series of post-harvest operations, which follow a logical sequence. The post-harvest processing tree (see Figure 4 below) show each stage in the process.

FIGURE - 4

POST HARVEST PROCESSING & PRODUCTS FROM SPICES & HERBS



3.3 PRE-HARVEST OPERATIONS

It is in the interests of the grower, and the industry, to produce a high quality product that will attract a premium market price. Pre-harvest operations involve the preparation of the facilities for the harvest material, which will ensure that the crop is stored and dried quickly under hygienic conditions. The main reasons for low quality product are harvesting the crop when it is not mature; poor drying

systems where there is a high risk of moisture retention and microbial contamination (dirty floors); and frequent rain during the drying process, which upsets the drying process. Many growers of spices use traditional methods due to which high moisture retention, microbial contamination, and contamination with extraneous matter become common processing problems.

International sanitary and phytosanitary agreements define measures to be taken to protect against risks arising from additives, contaminants, toxins or disease causing organisms in food or foodstuffs. In particular, there are problems with mould, high moisture contents and aflatoxin contents. Difficulties in reducing these problems to a low level are due to poor weather conditions at harvest associated with low cost processing technology; poor storage facilities and small-scale production units. Poor storage facilities and unhygienic and improper storage methods also contribute to contamination with mammalian and other excreta, as well as moulds or other microbes. In order to overcome these problems completely, capital investment is necessary, particularly for mechanized handling after harvest.

All personnel (including field workers) involved in the propagation, cultivation, harvest and post-harvest processing stages of plant production should maintain appropriate personal hygiene and should have received training regarding their hygiene responsibilities

3.4 HARVESTING

Harvesting is the primary process of collecting the target crop from the field, where it is open to the vagaries of the climate and the growing environment, and placing it in controlled processing and stable storage conditions environment. The harvesting requirements will differ for the final product sought, and there are specific needs such as maturity and evenness, that will dictate the harvesting management and timing.

Plants should be harvested during the optimal season or time period to ensure the production of plant materials and finished spice products of the best possible quality. The time of harvest depends on the plant part to be used. Detailed information concerning the appropriate timing of harvest is often available in published standards, official monographs and major reference books. However, it is well known that the concentration of biologically target active constituents varies with the stage of plant growth and development. The best time for harvest should be determined according to the quality and quantity of biological target constituents.

During harvest, care should be taken to ensure that no foreign matter is mixed with the harvested plant materials. When possible, plant parts should be harvested under the most favorable conditions, avoiding dew, rain or exceptionally high humidity. If harvesting occurs in wet conditions, the harvested material should be transported immediately to a drying shed to expedite drying in order to prevent any possible deleterious effects due to increased moisture levels, which promote microbial fermentation and mould. Cutting devices, harvesters, and other machines should be kept clean and adjusted to reduce contamination from soil and other materials. They should be stored in an uncontaminated dry place, free from insects, rodents, birds and other pests, and inaccessible to livestock and domestic animals.

Soil can have a high microbial content, and contact between the harvested crop and the soil should be avoided so as to minimize the microbial load on the harvested plant materials. Where necessary, large drop cloths, preferably made of clean muslin, may be placed on the soil surface as an interface between the harvested plants and the soil. If the underground parts (such as the rhizomes / roots) are harvested, any adhering soil should be removed from the plant material as soon as possible. Mechanical damage or compacting of raw plant materials as a consequence of overfilling or stacking of bags may result in fermentation composting or rot damage and should be avoided. Rotting plant materials should

be discarded during harvest, post-harvest inspections and processing, in order to avoid contamination and loss of product quality[4].

3.5 RAW MATERIALS & PRODUCTS

Taking into account the amount of local consumption, monetary value, cost of production and export potential, it is recommended that the unit produce the following essential oils and its related by-products (see Table 5):

TABLE - 5

ESSENTIAL OILS & BY-PRODUCTS TO BE PRODUCTED

No.	Essential Oil	Base Material	Parts Used	By-Product(s)
1	Peppermint Oil	Mentha Arvensis	Leaves and stem	Distillate
2	Mentha Oil	Mentha Peperita	Leaves and stem	Distillate
3	Eucalyptus Oil	Eucalyptus	Leaves and stem	N/A

Approximately, 200 kg of Mentha Arvensis and Mentha Peperita would be needed to produce 1 kg of Peppermint and Mentha Oil respectively with a 0.5% rate of recovery or extraction. With a 0.3% recovery or extraction rate, approximately 300 kg of Eucalyptus leaves and stems would be required to produce 1 unit of Eucalyptus Oil. Whilst, the Peppermint varieties will be cultivated on the project site, Eucalyptus leaves and stems which are abundantly available throughout the country will be procured free of cost from Eucalyptus plantations found in great abundance on roadsides across Sindh. The quantity of raw material, batch size, approximate oil extraction percentage, total essential oil production from one batch and final product extraction time are described below (see Table 6):

[4] Modified from the WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants

TABLE – 6

PRODUCTION OF ESSENTIAL OILS

No.	Essential Oil	Batch Size	% Extraction	Total Produce	Production Time
1	Peppermint Oil	3000 kg	0.5%	15 kg	48 Hours
2	Mentha Oil	3000 kg	0.5%	15 kg	48 Hours
3	Eucalyptus Oil	3000 kg	0.3%	9 kg	48 Hours

3.6 PROJECT REQUIREMENTS

3.6.1 LAND & BUILDING

A number of issues with regards to the location must be considered:

- Availability of adequate water
- Energy source: electricity, boiler fuel
- Easy transport access
- Availability of skilled and unskilled labor
- Close proximity to plant material
- Access to fabricators and machine shop for repairs
- Environmental zoning, plant waste and waste water discharge

Approximately 100 acres of land would be required for this project ideally in the Thatta / Badin Districts. A 1000 square yard piece of land would be required for housing the distillation units and the offices whilst another piece of land measuring approximately 3000 square yards would be required for the store room for equipment, storage areas for the produce, laboratory, refrigeration unit and packaging unit. This piece of land would be part of a 100 acre agricultural field which would be used for growing the two Peppermint varieties discussed earlier i.e. Mentha Arvensis & Mentha Peperita.

3.6.2 EXTRACTION UNIT

Considering the cost of the technology, local availability of components and the flora of the country, a Steam Distillation Unit would be most appropriate. When

designing / purchasing a distillation system a number of issues must be considered:

Amount of plant material that can be processed in a single cycle

- Size of the still
- Plant species and oil content
- Daily volume and condition of plant material and frequency of supply
- Distance of the plant material production to still and how it will be transported
- Required pretreatment (chopping, crushing, powdering, maceration)
- Time taken to charge and discharge the still
- Storage capacity of plant material prior to distilling incase of poor weather
- Disposal of waste plant material after distillation

Still

- Design determined by distillation method; seek professional advice
- Ideally constructed of stainless steel
- Size determined by capacity of boiler
- Distillation time affected by height of the charge, flow rate and pressure of steam
- Easy to charge and discharge

Boiler

- Should produce enough steam to adequately remove the oil from the plant material
- Low pressure (saturated steam) or pressurised (dry steam)
- Best to measure output of home made or commercial boiler (condensing steam for set time) to determine capacity
- Seek professional advice on design and access for repairs and maintenance

Condenser

- The role of the condenser is to change the oil and water vapour back to a liquid
- Two main types: coiled tube or multitube
- Multitube is difficult to make, needs running water, but has good heat transfer, efficient water use and no pressure build up
- Coiled tube easy to make, just needs a tank of water and sparse use of running water, but has poor heat transfer, risk of high pressure build up during distillation and poor use of water

Oil Separator

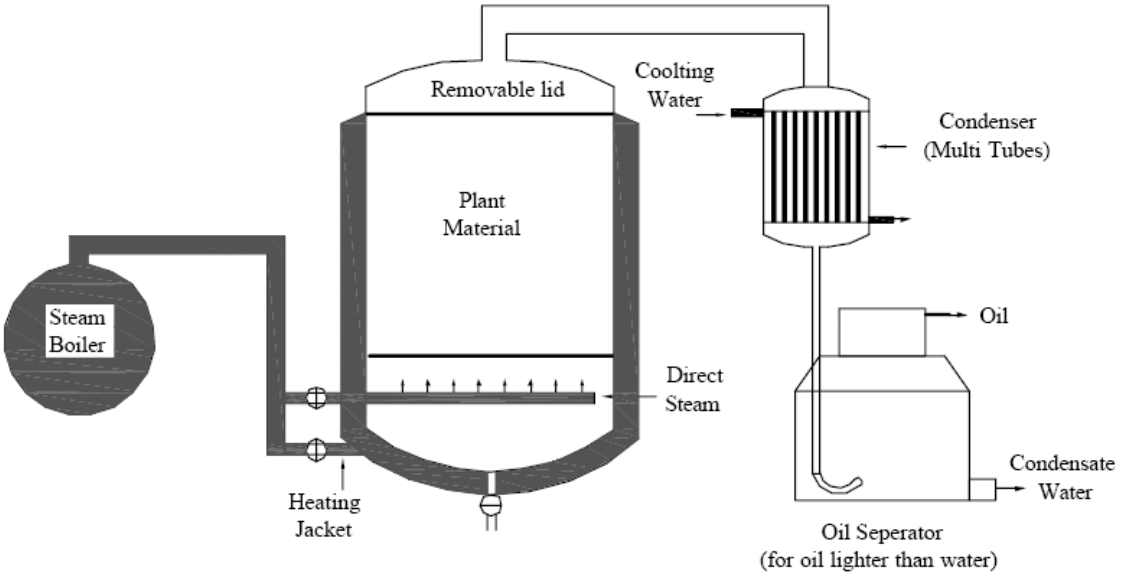
- Design of separator depends on density of the oil (if <1, oils are lighter than water and float; if >1, oils heavier than water and sink). Only a few wood and root oils are heavier than water
- Large enough capacity to allow the oil particles to form droplets and readily separate from the water (recommended at least a 4 minute retention time in the separator before out flow)
- Controlled temperature can be used to improve separation
- Seek professional advice on design as poor separation affects the effort of distillation to extract oil

Storage

- System to filter separated oil
- Storage in suitable containers that exclude light
- Method to remove dissolved water (filtered bed of anhydrous sodium sulfate or chilling)
- Removal of residual still notes and dissolved oxygen (bubbling stream of nitrogen or allow oil to breathe and topping drum to over flowing to remove all air)

Where possible the still vessel condenser and separator should be fabricated from stainless steel. In Pakistan access to specialist fabricators, and equipment and skills for maintenance and repair, should be of primary consideration in the design of the distillation system. Seeking professional advice is also critical.

FIGURE - 5
DIAGRAMMATIC REPRESENTATION OF
A STEAM DISTILLATION UNIT



A 'steam generator' and a 'De-ionizing Plant' would accompany the distillation unit to complete the system. De-ionizing plant is important, for generating steam for distillation; water, which has ion percentage of less than 1%, is required. A 'steam generator', which can generate a pressure of 4 bar would also be needed. It is recommended that a locally fabricated and assembled water / steam distillation unit with a batch capacity of 3000 kg be procured, the cost of which is approximately Rs. 1.5 million. The project feasibility is set on 5 such units.

3.6.3 FERTILIZER

For Peppermint cultivation, locally available urea (white crystalline solid containing 46% nitrogen) would be suitable.

3.6.4 WATER

Water is a necessary input for the steam distillation unit, the steam generator as well as for the plants grown and harvested for extraction purposes. Availability of clean water is therefore necessary. Installation of a water pump maybe needed.

3.6.5 EQUIPMENT & FARM TOOLS

An electricity generator; refrigeration unit; pruning, cutting and other related equipment; weighing scale; and carriage carts for transporting harvested plants from the field to the distillation unit would be needed. Besides these major items, requirement for certain minor items may come up at the time of actual commencement of project.

3.6.6 STORAGE & PACKAGING

Processed essential oils should be packaged as quickly as possible to prevent deterioration of the product and as a protection against exposure to pest attacks and other sources of contamination. Amber / dark green bottles of various capacities, ranging from 5-15 liters, maybe used for packaging the extracted essential oils. Continuous in-process quality control measures should be implemented to eliminate substandard materials, contaminants and foreign matter prior to and during the final stages of packaging. All packaging materials should be stored in a clean and dry place that is free from pests and inaccessible to livestock, domestic animals and other sources of contamination.

A label affixed to the packaging should clearly detail the product name, the plant name, the place of production, the harvest date and the names of the grower and the processor, and relevant quantitative information. The label should also contain information indicating quality approval and compliance with other national and/or regional labeling requirements. The label should bear a number that clearly identifies the production batch. Additional information about the production and quality of the plant materials may be added in a separate certificate, which is clearly linked to the package carrying the same batch number. Records should be

kept of batch packaging, and should include the product name, place of origin, batch number, weight, assignment number and date. The records should be retained for a period of three years or as required by national and/or regional authorities.

3.6.7 LABORATORY

A laboratory is to be setup at the project site, adequately equipped to check the quality of the unit's produce in terms of specific gravity, refractive index, concentration levels of the main ingredient, unit weight and volume. The laboratory would also be responsible for ongoing quality control and process improvements helping the unit comply with international standards. For more detailed testing, samples of the unit's produce maybe taken to Government research laboratories such as PCSIR and HEJ Institute of Chemistry.

3.7 APPROXIMATE COMPLETION SCHEDULE

The activities related to the overall establishment of the unit are expected to take 20 months. The breakup of the activities is presented in Table 7:

TABLE – 7

PROJECT COMPLETION SCHEDULE

No.	Activity / Stage	Time (months)
1.	Techno-Economic Study	3
2.	Financing *	6
3.	Procurement of Land *	3
4.	Master planning & design	3
5.	Civil works & installation of unit	12
6.	Operations Planning *	2
	Total Duration	**20**

* Activity occurs in parallel with preceding activity

CHAPTER 4

GOVERNANCE AND MANAGEMENT STRUCTURE

4.1 GOVERNANCE

A special purpose company may be established to own and operate the Project. The Project will be managed by a Board of Directors to be headed by a Chairman. Board will be assisted by a Managing Director who in turn will be supported by a General Manager Technical, General Manager Operations and Managers of Finance, Administration and Marketing as shown below in Figure 6:

FIGURE - 6

ORGANIZATIONAL CHART

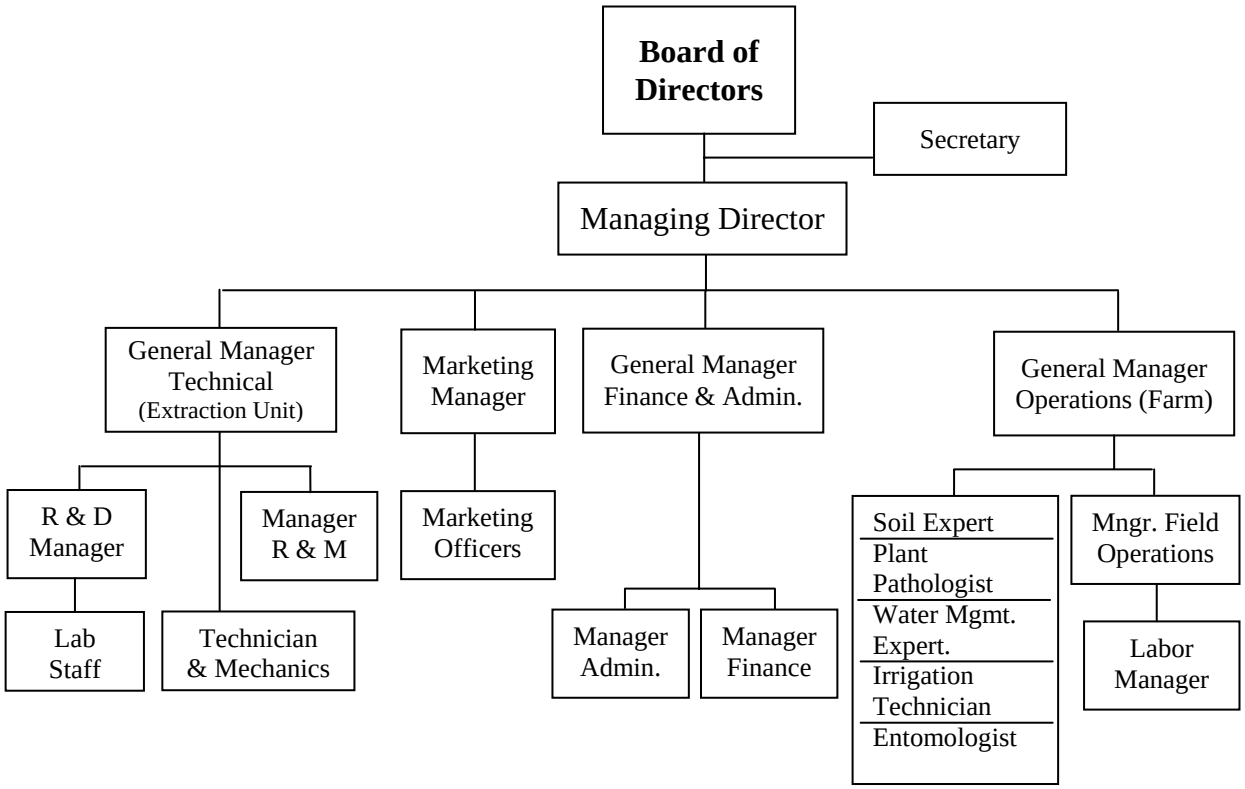
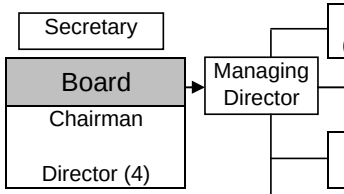


FIGURE - 7
MANPOWER REQUIREMENT



	Senior Management					Farming									Unit						Common							
	Chairman	Directors	Managing Director	Secretary	General Managers	Manager Field Operations	Irrigation Technician	Water Management Expt.	Entomologist	Storekeeper W. Assistants	Plant Pathologist	Soil Expert	Labour Manager	Labour Assistant	R&D Manager	Manager Repairs & Maintenance	Foremen	Technicans/Mechanics	Storekeepers + helpers	QA & Lab Staff	Manager (Admin)	Manager (Finance)	Manager Marketing	Admin Staff	Accountants	Marketing Officers	Labours	**TOTAL**
Technical (Extraction Unit)	-	-		-	-	-	-	-	-	-	-	-	-	-	1	1	5	1	3	4	-	-	-	-	-	-	-	**15**
Managing Director	1	6	1	1	2	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	**11**
Operations (Farming)	-	-		-	-	1	1	1	1	2	1	1	1	3	-		-	-	-	-	-	-	-	-	-	-	-	**12**
Finance & Adminstration	-	-		-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	1	1		3	2	-	25	**32**
Marketing	-	-		-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	1	-	-	3	-	**4**
TOTAL	**1**	**6**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**3**	**1**	**1**	**5**	**1**	**3**	**4**	**1**	**1**	**1**	**3**	**2**	**3**	**25**	**74**

4.2 CORPORATE STATUS OF THE PROJECT

The sponsors of the project may find it preferable to own and operate the business through a private limited company (to be incorporated in Pakistan under the Companies Ordinance 1984). Although the option of incorporating a public limited company is also available to them, investors are not accustomed to this type of company being listed on the stock exchange and proper response may not be received on flotation of shares

CHAPTER 5
FINANCIAL EVALUATION

This chapter evaluates various financial aspects of the project (cost of project, earnings forecast, rates of return, payback period, cash flow, balance sheet, etc.). Wherever calculations, workings, etc. are voluminous, a summarized version is presented.

5.1 COST OF PROJECT

Total project cost is estimated at Rs. 40 million as shown below in summarized form.

TABLE - 8

COST OF PROJECT

(Rs in 000)

S.#	DESCRIPTION	AMOUNT
1.	Land (100 acres @ Rs. 10,000 / per acre)	1,000
2.	Land development & infrastructure	3,000
3.	Building & Civil Works	3,500
4.	Plant & Machinery for the distilation units	10,000
5.	Farm Equipment & Tools	7,000
6.	Laboratory	1,000
7.	Office Equipment, Computers & Telephones	500
8.	Backup Generator	1,000
9.	Furniture & Fixture	500
10.	Vehicles	5,000
11.	Contingencies	2,500
12.	Working Capital	5,000
	TOTAL	**40,000**

5.2 PROJECTED PROFIT AND LOSS ACCOUNT

Projected profit and loss accounts for 5 years are given as under.

TABLE – 9

PROJECTED PROFIT AND LOSS ACCOUNTS

(Rs in 000)

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Sales	28,800	31,680	34,560	37,440	40,320
Cost of Good Sold	6,133	2,736	2,985	3,234	3,483
Gross Profit	**22,668**	**28,944**	**31,575**	**34,206**	**36,838**
Admin & Related Expenses	8,455	8,942	9,436	9,938	10,450
Operating Profit	**14,213**	**20,002**	**22,139**	**24,268**	**26,388**
Depreciation	2,915	2,915	2,915	2,915	2,915
Net Profit Before Tax	**11,298**	**17,087**	**19,224**	**21,353**	**23,473**
Income Taxes (35%)	3,954	5,981	6,728	7,473	8,215
Net Profit after Income Tax	**7,343**	**11,107**	**12,496**	**13,879**	**15,257**

5.3 RATES OF RETURN

On the basis of the earnings forecast and related projections, rates of return for the project are calculated below:

TABLE - 10

RATES OF RETURN

(Figures in Percentages)

RATIOS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Net Profit% on Equity (RoE)	18.36	27.77	31.24	34.70	38.14
Net Profit % to Sales	25.50	35.06	36.16	37.07	37.84
Operating profit % to Sales	49.35	63.14	64.06	64.82	65.45
Gross Profit % to Sales	78.71	91.36	91.36	91.36	91.36

5.4 PAYBACK PERIOD

Payback period for the project is calculated below.

TABLE – 11

PAYBACK PERIOD

(Rs. in 000)

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Net Profit	7,343	11,107	12,496	13,879	15,257
Add: Depreciation	2,915	2,915	2,915	2,915	2,915
Total	**10,258**	**14,022**	**15,411**	**16,794**	**18,172**

Total Investment	Rs. 40 million
Pay back period	3 years

5.5 CASH FLOW

Projected cash flows of the project for 5 years are shown hereunder.

TABLE – 12

PROJECTED CASH FLOW

(Rs. in 000)

Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
EXPECTED CASH INFLOW						
EQUITY CONTRIBUTION	40,000	-	-	-	-	-
OPERATING PROFIT	-	14,213	20,002	22,139	24,268	26,388
Total	**40,000**	**14,213**	**20,002**	**22,139**	**24,268**	**26,388**
EXPECTED CASH OUTFLOW						
CAPITAL INVESTMENT	40,000	-	-	-	-	-
PAYMENT OF TAXES	-	-	3,954	5,981	6,728	7,473
Total	**40,000**	**-**	**3,954**	**5,981**	**6,728**	**7,473**
SUMMARY						
EXPECTED CASH INFLOW	40,000	14,213	20,002	22,139	24,268	26,388
EXPECTED CASH OUTFLOW	40,000	-	3,954	5,981	6,728	7,473
Net Cash Flow	**-**	**14,213**	**16,048**	**16,159**	**17,539**	**18,914**
Cumulative Cash Flow	**-**	**14,213**	**30,261**	**46,419**	**63,959**	**82,873**

5.6 BALANCE SHEET

Balance sheets for the first five years of operation are shown below:

TABLE – 13

PROJECTED BALANCE SHEET

(Rs. in 000)

Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
CAPITAL						
Equity Contribution	40,000	40,000	40,000	40,000	40,000	40,000
Accumulated Profit & Loss Account	-	7,343	18,450	30,946	44,825	60,082
Total Capital	40,000	47,343	58,450	70,946	84,825	100,082
LIABILITY						
Long Term Liability	-	-	-	-	-	-
Tax Payable	-	3,954	5,981	6,728	7,473	8,215
Total Liabilities	-	3,954	5,981	6,728	7,473	8,215
TOTAL EQUITY & LIABILITY	**40,000**	**51,298**	**64,431**	**77,674**	**92,299**	**108,298**
ASSETS						
Capital Investment	40,000	37,085	34,170	31,255	28,340	25,425
Cash & Cash Equivalent		14,213	30,261	46,419	63,959	82,873
TOTAL ASSETS	**40,000**	**51,298**	**64,431**	**77,674**	**92,299**	**108,298**

CHAPTER 6
CONCLUSION

In order to enhance the feasibility of the recommended essential oil production unit, it is recommended that the Government of Pakistan take the following steps:

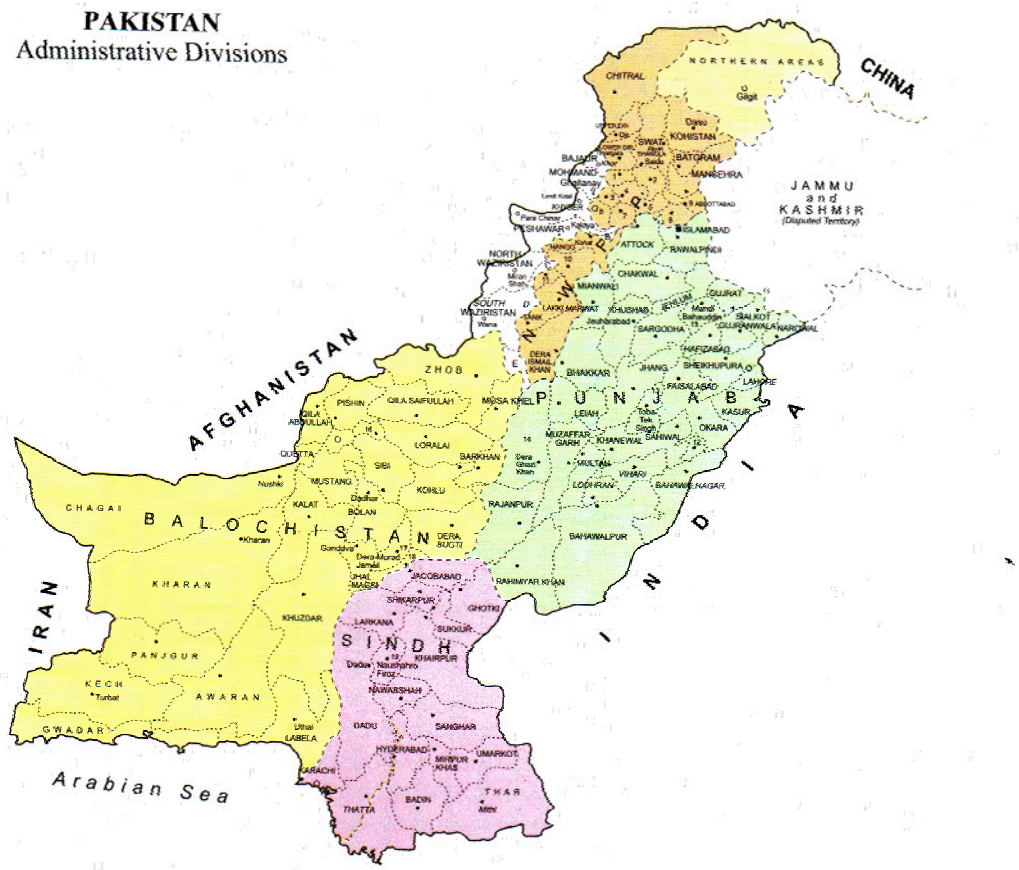
- Restrict the import of Peppermint, Mentha and Eucalyptus oils in Pakistan
- Upgrade laboratories at PCSIR or HEJ Institute of Chemistry, equipping them to handle the requirements of essential oil gradation and quality assessment.

In order to further enhance the project feasibility, the investors may wish to diversify into Rose Oil extraction. High quality Rose is harvested in both the provinces of Sindh and Punjab and is ideal for oil extraction. 1 kg of Rose Oil is priced around Rs.. 500,000 locally and according to primary data collection, remains in high demand throughout the year where it has extensive uses in the local flavor and fragrance industries. Rose oil is imported in Pakistan from Turkey where the technology for oil extraction is available. Research indicates that extraction units needed for Rose Oil extraction are very similar to steam distillation units, hence the cost of technology should not be very high.

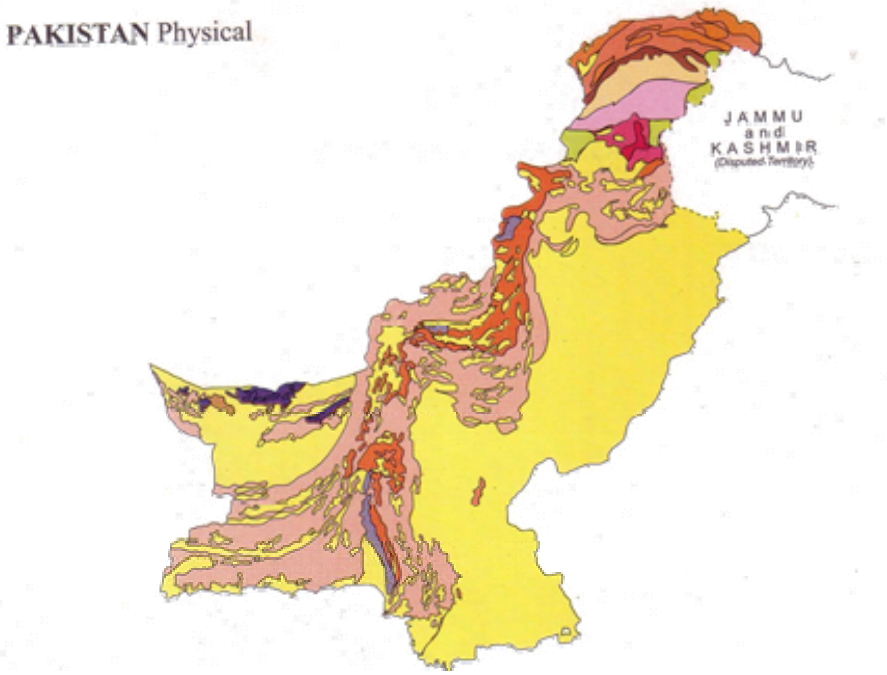
ANNEXURE 1

PAKISTAN - A PROFILE

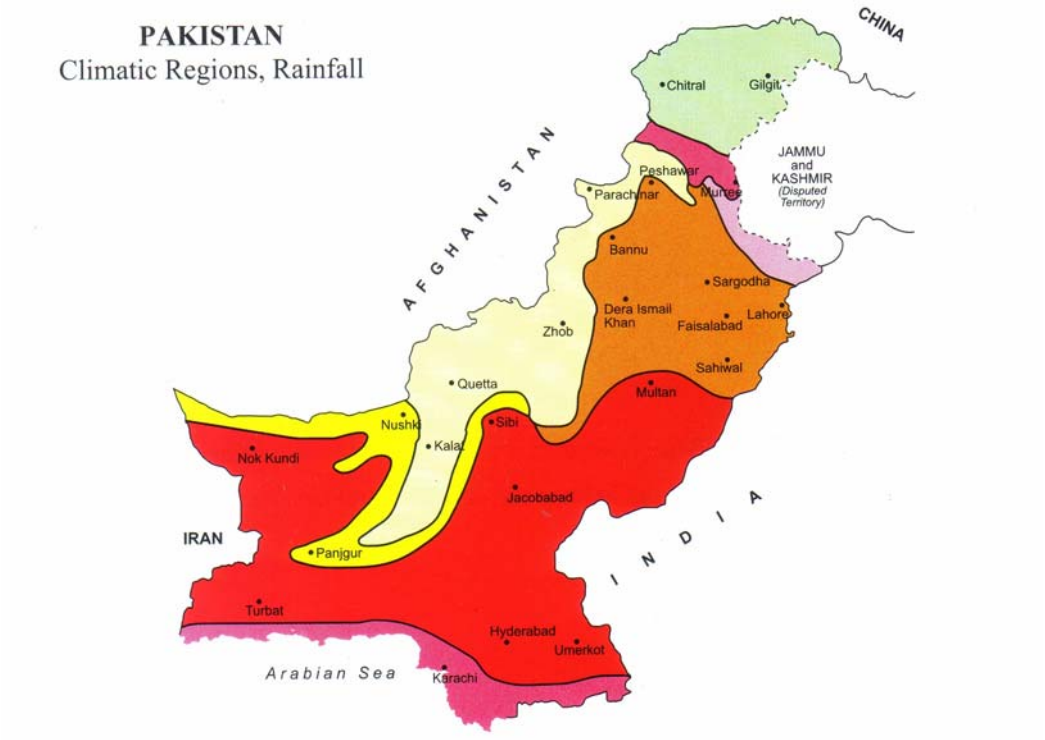
INTRODUCTION



Pakistan is located in South Asia. It borders Iran to the southwest, Afghanistan to the northwest, China to the northeast and India to the east. The Arabian Sea marks Pakistan's southern boundary.



The total area of Pakistan is 796,095 square kilometers and the country is divided administratively into four provinces – Balochistan, North-West Frontier Province, Punjab and Sindh – and numerous federally administrated areas. The disputed territory of Azad Jammu & Kashmir lies to the north of Punjab.



Pakistan has a diverse array of landscapes spread among nine major ecological zones from north to south. It is home to some of the world's highest peaks including K-2 which at 8,611 meters above sea level is the world's second highest peak. Intermountain valleys make up much of the North-West Frontier Province, while the province of Balochistan in the west is covered mostly by rugged plateaus. In the east, irrigated plains along the Indus River cover much of Punjab and Sindh. In addition, both Punjab and Sindh have deserts, Thal, Cholistan and Thar deserts respectively.

Most of Pakistan has a generally dry climate and receives less than 250 mm of rain per year. The average annual temperature is around 27^{o}C, but temperatures vary with elevation from -30^{o}C to -10^{o}C during cold months in the mountainous and northern areas of Pakistan to 50^{o}C in the warmest months in parts of Punjab, Sindh and the Balochistan Plateau. Mid-November to February is dry and cool; March and April bring sunny spring, May to July is hot, with 25 to 50% relative humidity; Monsoons start in July and continue till September; October- November is the dry and colourful autumn season.

Pakistan had an estimated population in 2005 of 160 million, 40% of this population was less than 15 years of age. The major cities of Pakistan and their estimated populations are; Karachi (16.0 million), Lahore (8.0 million), Faisalabad (6.0 million), Rawalpindi (5.0 million), Multan (4.5 million), Hyderabad (3.0 million), Gujranwalla (1.8 million) Peshawar (1.6) and Quetta (0.85). Islamabad, the Capital of the country, has a population of around 750,000.

According to the 1973 Constitution, Pakistan is governed under a federal parliamentary system with the President as head of state and a Prime Minister as head of government. The legislature, or parliament, consists of the Lower House (National Assembly) and the Upper House or Senate. Members of the National Assembly are directly elected for five-year terms.

Executive power lies with the President and the Prime Minister. The Prime Minister is an elected member of the National Assembly and is the leader of the majority party in the

National Assembly. An electoral college consisting of members of the national and provincial legislatures elects the president for a five-year term.

After the events of 9/11, Pakistan has become a key US ally in the war against terror. This alignment is totally in-line with the views of the majority of Pakistanis who practice and preach a moderate version of Islam. The Government of Pakistan fully realizes the need for promoting Islam as a modern progressive religion. The Government has chosen the difficult option of fighting the war against terror by clamping down on Taliban and Al-Qaeda remnants along the border with Afghanistan. The people of Pakistan fully support the Government in its efforts to promote the true face of Islam.

The US Government fully backs and supports Pakistan in this war against terror. US Aid which was stopped after the 1998 Nuclear Test has been restored and Pakistan will receive US$ 3.0 billion over the next 5 years, divided equally between economic and military aid.

Pakistan follows a very active policy of regional alliances for trade and economic development. It is an active member of the South Asian Association for Regional Cooperation (SAARC) which groups Pakistan, India, Bangladesh, Sri Lanka, Nepal, Bhutan and the Maldives. It is also an active member of the Economic Cooperation Organization (ECO) comprising of Turkey, Iran, Pakistan, Afghanistan, and the six Central Asian Republics. Pakistan has an observer status at the Gulf Cooperation Council (GCC) as well as ASEAN and Shanghai Cooperation Organization. Being a member of WTO it conforms to most of the international trade regimes.

ECONOMY

Pakistan's economy has made significant progress in the last six years. This has been possible because of the Government's policy of initiating growth through domestic and foreign direct investment. The GDP growth rate has increased from 1.8% per annum in 2001 to 8.4% per annum in 2005. Despite the devastating earthquake in October 2005, the economy is expected to grow at over 6.6% in 2006. Pakistan's GDP in 2005 was

estimated at US$ 385.2 billion and its per capita GDP was US$ 2,400. The Country's credit rating has been upgraded by Moody's from Caa1 in 2002 to Ba3 i.e. "stable" in 2006.

Pakistan has over 3.5 million laborers working in various countries of the Middle East. In addition, Pakistani technical and professional manpower is engaged in lucrative pursuits in USA, UK, Canada, Malaysia, etc. These non-resident Pakistanis annually send over US$ 4.0 billion in foreign remittances.

The Government of Pakistan's policy of encouraging Foreign Direct Investment (FDI) has seen it grow from a mere US$ 376.0 million in 1999 to more than US$ 1.5 billion in 2005 which is expected to grow to over US$ 3.0 billion in 2006.

In addition to Foreign Direct Investment, low domestic interest rates have meant that there has been an upsurge in domestic investment; the weighted average rate of lending has fallen from 16% in 1999 to approximately 8% in 2005.

The Government's economic policy has seen foreign currency deposits rise from US$ 1.7 Billion in 1999 to now US$ 13.0 billion in 2006; this has led to both low rates of inflation and to a stable exchange rate.

With the Government of Pakistan targeting annual growth in the economy at 7.5% per annum in the next 5 years, Pakistan is the country of choice for foreign and domestic investors.

INFRASTRUCTURE

The National Highway Authority (NHA) has the responsibility for 17 of Pakistan's major inter provincial links called the National Highway including the Motorways, which are access controlled and tolled highways. Total length of roads, under NHA, currently stands at 8845 Kms.

These roads account for only 3.5% of Pakistan's entire road network but cater for 80% of the commercial road traffic in the country. Improvement and extension of the existing network is, therefore, essential to develop remote areas and provide better connection between the economic centers of Pakistan. In addition a first class road network is essential if Pakistan is going to connect its all-weather Arabian Seaports with the landlocked Central Asian Republics and Western China. The Government has initiated work on the North-South Trade Corridor with planned investment of over US$ 60 billion.

In order to further speed up the development of the road network, the Government is actively seeking the participation of the private sector to implement road projects on a Build-Operate-Transfer (BOT) basis. A number of projects are currently being implemented under the BOT concept and others are in the identification stage. These BOT projects cover the construction of new roads as well as the upgrading of existing roads.

Pakistan has about 1062 km of coastline on the Arabian Sea running from the Indian border to the Persian Gulf. The Karachi Port is the premier port of Pakistan and is managed by the Karachi Port Trust (KPT). Karachi port handles about 75% of the entire national cargo. It is a deep natural port with a 11 km long approach channel to provide safe navigation up to 75,000 DWT tankers, modern container vessels, bulk carriers and general cargo ships. The Karachi Port has 30 dry cargo berths including two Container Terminals and 3 liquid cargo-handling berths. KPT intends to cater for 12-meter draught ships, which are the most widely used container vessels. In order to facilitate accommodate and fast turnaround time of mother vessels, the KPT is offering to the private sector the opportunity to develop a terminal on BOT basis. In addition KPT has plans to develop a Cargo Village on 100 acres. This Cargo Village shall serve as a satellite to the port, integrating container, bulk and general cargo handling as well as providing processing plants for perishable exports. With direct connection to the National Highway Network, as well as National Railways Network the cargo village shall also alleviate the problem of upcountry trade with cost effective storage/handling services in the vicinity of the port. A master plan is under preparation and all the units within the

village shall be allocated to the private sector on BOT and Build-Operate-Own (BOO) basis within the next year.

Pakistan's second Sea Port, Port Qasim is located 50 kilometers to the South East of Karachi. It is the Country's first industrial and multi-purpose deep-sea-port. Currently it is handling 23% of Pakistan's sea trade. Port Qasim has attractions and advantages for investment both in port facilities and port-based industrial development. Port Qasim Authority from the very beginning has actively sought the help of the private sector in the development of its port structure. Some of the projects which have been completed with private sector involvement include; dedicated oil terminal developed in private sector on BOO basis at a cost of US$ 87 million to cater for oil imports with a handling capacity of 9 million tons per annum, a container terminal developed by P&G Group, Australia, at a cost of US$ 35 million on BOO basis, for chemicals imports a facility in collaboration with Vopak of Netherlands on BOT basis at a cost of US$ 67 million. Some of the projects which the Port plans to develop with the private sector on the basis of BOT include; establishment of a second oil jetty, establishment of a dedicated coal and clinker/cement terminal and the establishment of a marine workshop and dry dock facilities.

To encourage industrial development the Port Qasim Authority has reserved 300 acres of land on a prime location in the Eastern Industrial Zone (EIZ) for allotment of plots to Overseas Pakistanis to induce and encourage foreign investment and provide them an opportunity to establish small size industries in Pakistan. Each plot is measuring 100 square yards at a very low cost on attractive terms and conditions. This is in addition to existing 1,200 acres of industrial zone which houses a number of auto assemblers such as Toyota, Suzuki, Chevrolet and the Textile City spread over 1,250 acres.

The Pakistan Merchant Marine Policy 2001, has deregulated the shipping sector and aims to attract investment; both local and foreign, public and private, by offering a range of incentives. The new policy in addition to offering duty-free import of ships, offers many new incentives to local and foreign investors including Income Tax exemption till 2020.

Pakistan's annual seaborne trade is about 45 million tons, just 5 per cent of which is carried by the national carrier Pakistan National Shipping Corporation (PNSC), the country's annual freight bill surpasses staggering $ 1.5 billion which is causing a colossal drain on foreign exchange resources, the marine policy aims to reverse this situation to some extent.

The Shipping Policy aims to revive and augment national ship-building/capacity to meet 20 per cent ship construction requirements of the country merchant marine and entire requirements of support and ancillary crafts. The policy also aims to rejuvenate and expand the ship repair potential to undertake the entire range of repairs and maintenance of 50 per cent of Pakistani Flag ocean-going vessels and all ancillary sectors. The new Shipping Policy offers many financial incentives for potential investors. It offers tax exemptions and concessional tax measures backed by assurances. It also aims at simplifying the rules by deregulating the sector.

To begin with, ships and floating crafts — tugs, dredgers, survey vessels, and specialized crafts — purchased or bareboat chartered by a Pakistani entity flying the Pakistani flag will be exempt from all import duties and surcharges till 2020. The policy accords shop-building and ship-repair the status of an industry under the investment policy which is entitled to all incentives contained therein.

To attract foreign investment, all port and harbor authorities in Pakistan will allow all ships and floating crafts 10 per cent reduced berthing rates when the same are berthed for purposes of repair and maintenance. Under the Policy, ships and all floating crafts are considered bonafide collateral against which financing can be obtained from Banks and Financial Institutions subject to policy of the financial institution.

There are 42 airports in the country managed by the Civil Aviation Authority (CAA). Out of these, five airports; Lahore, Karachi, Islamabad, Peshawar and Quetta are international airports. The CAA is planning to develop a new international airport at Islamabad for

which land has been acquired and it is planed to fund the US$ 250-300 million on BOT basis.

The Pakistan International Airlines (PIA) is the national flag carrier flying to 46 international and 36 local destinations. Other Pakistani airlines in the private sector include, Aero Asia, Air Blue, Shaheen Air International and Pearl Air. In addition to direct flights from most parts of the world, Pakistan can also be accessed through the regional hubs of most international airlines, which operate through airports in the Gulf countries.

The Pakistan Railways provides an important nation-wide mode of transportation in the public sector. It contributes to the country's economic development by catering to the needs of large-scale movement of freight as well as passenger traffic. Pakistan railway provides transport facility to over 70 million people and handles freight above 6 million tons annually.

The Pakistan Railways Network was based on a total of 11,515 track kilometers (including track on double line, yard & sidings) at the end of 2001-2002. This network consists of 10,960 kilometers of broad-gauge and 555 kilometers of meter gauge.

Pakistan Railways has launched modernization activity with rehabilitation and improvement plan both for its infrastructure and rolling stock including prime mover. The ongoing schemes worth over US$ 500 million are progressing satisfactorily and have brought a radical improvement in service. The railways is gearing up to the challenge of providing improved connectivity to Iran, India, and link the upcoming Gwadar Port to Afghanistan and onward to Turkmenistan.

Pakistan Telecommunication Limited (PTCL) dominated Pakistan's telecommunications market for the fixed-line services. Today the Pakistan Telecommunication Authority (PTA) has the role of a regulatory body and is responsible for implementing the telecom deregulation policy. For a long time, Pakistan lagged behind in the region as far as

telecom access is concerned. With cellular mobile revolution taking place, Pakistan's tele-density currently stands at 10.37%, with gross subscribers base of fixed (5.05 million) as well as mobile subscribers (10.54 million) touching 15.59 million for a population of 160.0 million.

The Telecomm Sector has attracted the largest FDI in Pakistan with approximately US$ 1.5 billion having been invested in 2005.

At the moment there are six companies providing mobile phone services in Pakistan, with the largest of them, Mobilink (owned by Orascom Telecom) with nearly 50% of the market share, other foreign players include MCE, Telenor and Warid.

In addition Wateen Telecom, a subsidiary of UAE-based Al Warid Telecom, has launched a US$ 75.0 million project to lay an optic fiber optic backbone across the Country. The first segment of the project of 800 kms would stretch from Karachi to Rahimyar Khan and would be further linked with the rest of the country up to Peshawar through 63 cities. When completed the backbone would be 5,000 kilometers, long spanning the length and the breadth of Pakistan and would facilitate both the corporate and residential segments, providing voice and high-speed data services on a converged wireless network.

Pakistan in 2005 had 70 operational providers of internet services across 1,900 cities and towns of the Country catering to about 2 million subscribers. In addition the Government has reduced bandwidth rates for high speed board band internet connections and the number of subscribers in this category is expected to grow to 200,000 by end of 2006.

AGRICULTURE

Agriculture accounts for nearly 23 percent of Pakistan’s national income and employs 42 percent of its workforce. Nearly 68 percent of the population lives in rural areas and is directly or indirectly dependent on agriculture for their livelihood. Livestock is the single largest contributor 47 percent share in the national income. The major crops; cotton,

wheat, sugarcane and rice contribute 37 percent to agriculture while the minor crops like oilseed, spices, onion and pulses contribute another 12 percent.

Pakistan is the fifth largest producer of milk in the world. The per capita availability of milk at present is 185 liters, which is the highest among the South Asian countries. Milk production in Pakistan has seen a constant increase during the last two decades. The production has increased from 8.92 million metric tons in 1981 to 28 million metric tons in 2005. There is a large and untapped potential in the dairy industry. With a population of 160 million, a significant demand for dairy products exists in Pakistan. There is a need for establishing modern milk processing and packaging facilities based on advanced technology to convert abundantly available raw milk into high value added dairy products. In addition, with improved conditions for milk pasteurization, availability of chilled distribution facilities and consumer preference for the low cost pasteurized milk, the sector provides unique opportunity for investment in establishing pasteurized milk production plants.

There is also great scope for establishing related industries in the form of an efficient milk collection system and refrigeration & transportation facilities. The sector offers opportunity to foreign investors for establishing a joint venture for the production of dairy products, particularly dried milk and infant formula milk for which great demand exists in the neighboring countries like Afghanistan, Iran, UAE and Saudi Arabia.

Out of the 28 million tons of milk produced per annum in Pakistan, only 2.5 to 3 per cent reaches the dairy plants for processing into variety of dairy products. Pakistan’s dairy industry produces Ultra Heat Treated (UHT) Milk, Pasteurized Milk, Dry Milk Powder, and Condensed milk. Other major milk products produced by the dairy industry include butter, yogurt, ice cream, cheese, cream and some butter oil. Approximately half of the 0.3 million tons of milk available to the industry is processed into UHT milk, 40 percent into powdered milk, and the remaining 10 percent into pasteurized milk, yogurt, cheese and butter etc. Major players in the sector include Nestle, Haleeb and Engro Foods.

Pakistan produced 1.1 million tons of beef, 740,000 kgs of mutton and 410,000 kgs of chicken meat in 2005; in addition it also produced approximately 5 billion eggs in 2005. Processed meat is exported to Saudi Arabia, UAE, Oman, Bahrain, Qatar and Kuwait in the Middle East and Malaysia in the Far East. Pakistan exports around 40,000 live animals and 2.83 million kg of meat to the Gulf.

Cotton is an important non-food crop and a significant source of foreign exchange earning. It accounted for 10.5 percent of the value added in agriculture and about 2.4 percent of the GDP in 2005. Pakistan in 2005 produced about 14.5 million bales of cotton.

Rice is a high value added cash crop and is also a major export item, it accounts for 5.7 percent of the total value added in agriculture and 1.3 percent of the GDP. Production of rice in 2005 was about 5 million tones. In 2005 rice became the second largest export from Pakistan when the country exported rice worth US$ 934 million. In addition to high value Basmati rice, Pakistan also exports IRRI 6 parboiled rice and IRRI rice to Africa.

Sugarcane is an intensive cash crop and serves as the major raw material for production of white sugar and gur. Its share in the value added in agriculture is 3.6 percent and 0.8 percent in the GDP. The total sugarcane crop in 2005 was estimated at 45 million tones.

Wheat is the leading food grain of Pakistan, and being the staple diet of the people, it occupies a central position in agricultural policy. It contributes 13.8 percent to the value added in agriculture and 3.2 percent of the GDP. The size of the wheat crop in 2005 was estimated at 21.0 million tons.

In addition to the above, Pakistan also produces bajra, jowar, tobacco, barley, oilseed, pulses, potato, onion, chillies etc.

The Government of Pakistan has launched a plan to promote Corporate Agriculture Farming and has offered a number of incentives to develop the sector including the provision of land and other facilities.

MANUFACTURING

In the post quota regime, total exports of textile increased from $ 6.5 billion in 2004 to $ 7.4 billion in 2005. Pakistan textiles are poised to achieve $ 10 billion exports by June 2006. This growth is largely driven by the continuity of government policies, positive macroeconomic indicators, tariff rationalization, removal of sales tax on textile chain, deregulation, lower interest rates, increased market access, public-private partnership programs and the creation of a hassle free environment by the government.

The Government of Pakistan continues to take steps to further develop the textile sector focusing on bridging the skills gap promoting research and development activities, facilitating an increase in the number of women employees, outsourcing of specialized work and simplification of procedures. To facilitate value addition in the textile sector, world class departments in various disciplines related to textile industry are being set up in three universities. These departments will have linkages with corresponding foreign departments of high repute.

In the past 5 years, approximately US$ 5.5 billion have been invested in the textile sector with the major investments being in spinning ($ 2.6 billion), weaving ($ 1.5 billion), and textile processing ($ 600 million). A Rs.10 billion, Pakistan Textile City facility located on 1,250 acres of land near Karachi is in the process of being set-up. This will have its own desalination plant, effluent treatment plant, a self-power generation plant and all the other modern facilities required for industrial production. It is expected that the Textile City will lead to an increase in exports of US$ 400 million and provide jobs to 60,000 workers

Pakistan’s leather exports in 2005 were US$ 883 million which is the second largest export sector after textiles. It is expected that exports will cross the US$ 1 billion mark in

2006. Major exports include finished leather; both for garments and footwear, finished leather garments, leather work gloves, and other leather products. The major centers for the manufacture of leather and leather products are; Karachi, Lahore, Sialkot and Kasur, it is estimated that there are more than 700 tanneries operating in Pakistan employing more than 100,000 persons, in addition another 150,000 workers are employed in the value addition sectors. In order to promote the industry, the Government has zero-rated the sales tax on the leather sector and is working to ensure that the industry conforms to international waste management standards.

Pakistan's light engineering sector consists of twenty-eight sub-sectors including consumer durables and other industrial products. The surgical instrument manufacturing sector which forms part of light engineering sector is clustered around Sialkot and exports 95% of its production. There are about 2,500 large, medium and small sized units with the industry employing about 50,000 skilled and semi-skilled workers. The surgical goods sector produces both disposable and reusable instruments. The product range consists of more than 10,000 different items.

The cutlery industry which in 2005 exported goods worth approximately US$ 31 million is mainly concentrated in the locality of Wazirababd, Nazimabad and Allahbad in Gujranwalla district. There are approximately 300 units and 25,000 people are directly or indirectly employed by the industry. The industry has great export potential and requires better marketing strategies.

The auto parts sector consists of more than 1,200 vendors who are supplying to about 84 Original Equipment Manufactures (OEM) massive capacity increase in Pakistan. The total investment in the vendor industry exceeds Rs.10 billion and employs more than 40,000 skilled and semi-skilled workers and also brings in more than US$ 160 million in the form of export earnings.

With the local auto assemblers planning to increase production to 500,000 units by 2008 from the 2006 production figure of 170,000 units, the vendor industry is gearing up for.

Although the industry has made considerable progress on its own, the need is for joint collaboration with foreign companies which will not only bring production techniques but also help in marketing the production of the local vendor industry.

There are a total of 42 assemblers of motorcycles in Pakistan who between them manufacture 600,000 motorcycles a year, it is expected that the production will increase to 1 million units a year in the next two years. The main manufacturers of motorcycles in Pakistan are; Honda, Yamaha and Suzuki who between them command more than 80% of the domestic market

There are 11 Fertilizer units operating in Pakistan with an installed capacity of 6 million tones out of which nitrogenous fertilizer has a capacity of 4.9 million tons and phosphatic fertilizer has a capacity of 1 million tons. Wheat being the most important crop 45% of the total fertilizer consumption is in this Sector. Cotton consumes 21%, rice 10%, sugarcane 8% while the remaining 16% is consumed by other crops.

Out of a total of 24 cement plants, currently 22 units are operative, 17 companies being listed on the Karachi Stock Exchange. The country, at present, has an installed capacity of producing 17.55 million tons of cement per annum, mainly Portland cement. It is envisaged to increase installed capacity (also by expansion) to 28.21 million tons per annum by 2008. New projects as well as capacity increases in existing units should boost production capacity to about 7 million by 2007.

The demand for cement is expected to be robust, as the Government of Pakistan has initiated a massive reconstruction drive in the earthquake hit regions of Northern Pakistan and Azad Kashmir. In addition large quantities of cement will be required for the mega construction projects initiated by the Government of Pakistan including the construction of large dams and road projects. Also the industry has good prospects for exporting cement to Afghanistan where reconstruction work is on-going on in that Country.

Pakistan is the twelfth largest producer of sugar in the World; it ranks fourth in sugarcane production and holds seventh position in yield, which is about 50 tons per hectare.

The sugar industry has 76 units installed mostly in Punjab and Sindh. The total capacity of the industry is estimated at 5 million tones per annum. In order to provide incentives to the growers, the Government determines a support price keeping in mind the production costs and profits of other crops. The Government and the Industry are trying to increase cane yield to ensure an increase in the total production of sugar.

The demand for Steel has undergone a dramatic increase in 2005; the total consumption of steel in 2005 is estimated at 5 million tons as against a domestic production of only 3.2 million tones. The biggest producer of domestic steel is the Pakistan Steel Mills with a capacity of 1.1 million tones per annum. In addition to the Pakistan Steel Mills there are approximately 350 steel re-rolling mills in the country, which mainly cater to the needs of the construction industry.

The demand for steel is expected to further surpass production because of increased demand due to economic activity and construction of large dams and infrastructure projects in the Country. The Government is encouraging the private sector to come forward and invest in mini steel mills and in the mining sector. The Government in an effort to increase production, is in the process of privatizing major light and heavy engineering concerns.

OIL, GAS & ENERGY SECTOR

The Pakistani economy is expected to grow at a rate of 7 to 8 percent over the next five years. In order to sustain the growth momentum a rise in levels of income and increased availability of goods and services, the country is following a policy to increase the supply of and the conservation of energy.

In 2005 the consumption of petroleum products in household and agriculture exhibited sharp decline to the tune of 16.8 and 16.2 percent, respectively. The decline in the use of

petroleum products was mainly on account of the availability of alternative and relatively cheaper fuels in the form of natural gas and LPG

Historically, the country is dependent on oil imports. The crude oil import for 2005 was about 8.3 million tons, equivalent of US$ 2,606 million. The import of petroleum products import was 5.7 million tons, an equivalent of US$ 1,998 million. The total annual import bill for the year 2005 was US$ 4,604 million. Due to increase in international prices of crude oil, the import bill in 2006 is expected to be US$ 5,500 million. Pakistan has five refineries, namely, National Refinery, Pakistan Refinery, Bosicor, Pak Arab Refinery and Attock Refinery; annual oil refining capacity is 12.82 million tons. In the downstream oil marketing business, the main players are; Pakistan State Oil (100% owned by the Government of Pakistan), Caltex, Shell and Total.

Pakistan has an interesting Geo-dynamic history of large and prospective basin (onshore and offshore) with sedimentary area of 827,268 sq. km. So far about 844 million barrels crude oil reserves have been discovered of which 535 million barrels have already been produced. A Prognostic potential of total endowment of hydrocarbons has been estimated as 27 billion barrels of oil. To date various national and international exploration and production companies, resulting in over 177 oil and gas discoveries, have drilled more than 620 exploratory wells. Indigenous production of crude oil during the year 2005 was 66,079 barrels per day. The main companies in the upstream chain include; BHP Petroleum, Lasmo Oil, Shell, OMV Pakistan etc.

Pakistan is among the most gas dependent economies of the world. Natural gas was first discovered in 1952 at Sui in Balochistan province that proved a most significant and the largest gas reservoir. After successful exploration and extraction, it was brought to service in 1955. This major discovery at Sui followed a number of medium and small size gas fields in other parts of the country.

So far about 52 TCF of gas reserves have been discovered of which 19 TCF have already been produced. Natural gas production during 2005 was about 3.7 billion cubic feet per

day. Pakistan has well developed and integrated infrastructure of transporting, distributing and utilizing natural gas with 9,063 km transmission and 67,942 km of distribution and service lines network, developed progressively over the last 50 years.

Natural gas sectoral consumption during 2005 was: power (43.7%), fertilizer (16.4%), cement industry (1.2%), general industry (19.5%), domestic (14.8%), commercial (2.3%) and Transport (CNG; 2.1%).

Gas importation projects envisage about 1500 to 2000 km long pipelines connecting regional gas supply sources such as Turkmenistan, Iran and Qatar to the domestic pipeline network bringing in more than 1.5 billion cubic feet gas per day. With further extension, the imported gas can also reach the Indian market.

Pakistan started using Compressed Natural Gas (CNG) as transport fuel through establishment of research and demonstration CNG refueling stations by the Hydrocarbon Development Institute of Pakistan (HDIP) at Karachi in 1982 and at Islamabad 1989. CNG is now fast emerging as an acceptable vehicular fuel in place of oil. Pakistan is third largest user of CNG in the world after Argentina and Brazil. As many as 835 CNG stations have been set up in the country by December 2006 and 200 stations were under construction. With 850,000 CNG vehicles on the road, the CNG sector has attracted Rs.20 billion investment while another Rs.2 billion is in the pipeline, providing 16,000 jobs.

Large diesel vehicles (buses and trucks) being the major consumer of HSD are now the next target for substitution by CNG for economic and environmental reasons. Meanwhile a private company has imported some CNG diesel dual-fuel buses for Karachi and plans are also underway for local manufacturing of these buses.

The total power generation capacity of Pakistan is 19,540-mw. In order to sustain a higher GDP growth rate of 7–8 percent, the Government is planning to increase its power generation capacity by 143,000-mw in the next 25 years, to 162,590-mw.

The 25-year Energy Security Plan (ESP 2005-2030) approved recently by the Government envisages increase in nuclear power generation by 8,400-mw to 8,800-mw by the year 2030 from current nuclear power of 400-mw. The ESP envisages the share of nuclear power to increase to 4.2 per cent of country's total energy mix from the current rate of 0.8 per cent. The current energy mix has (highest) 50 percent share of gas, 30 percent oil, 12.7 per cent hydel, 5.5 per cent coal, 0.8 per cent nuclear and zero percent renewable energy.

The additional 143,053-mw would include 8,400-mw of nuclear power, 26,200-mw hydel-power, 19,753-mw coal based energy, 9,520 mw renewable energy, 1,360-mw oil based and 77,820-mw gas based power production.

By the year 2010, the country would have an additional power of 7,880-mw and hence total capacity would reach 27,420-mw. This additional power would not include any new plant in the nuclear sector, but hydel generation would increase by 1,260-mw, coal based increase of 900-mw and renewable energy increase of 700-mw. A minor increase of 160-mw would take place in the oil-based generation while gas based power production would increase by 4,860 mw.

IMPORTANT CONTACTS

Deputy Chairman,
Planning and Development Division,
Ministry of Planning & Development,
Govt. of Pakistan,
Block P, Pakistan Secretariat,
Islamabad.
Office Tel: 92 (51) 9211147, 9202783
www.mopd.gov.pk

Secretary,
Planning and Development Division,
Ministry of Planning & Development,
Govt. of Pakistan,
Block P, Pakistan Secretariat,
Islamabad.
Office Tel:92 (51) 9211147, 9202783
www.mopd.gov.pk

Secretary,
Ministry of Finance,
Govt. of Pakistan,
Block Q, Pak. Secretariat,
Islamabad.
Office Tel: 92 (51) 9201962
Fax No: 92(51) 9213705
www.finance.gov.pk

Secretary,
Ministry of Industries, Production & Special Initiatives,
Govt. of Pakistan,
Block A, Pak. Secretariat,
Islamabad.
Office Tel: 92(51) 9210192, 9211709
E-mail:secretary@moip.gov.pk
http://www.moip.gov.pk

Secretary,
Ministry of Communication,
Govt. of Pakistan,
Block D, Pak. Secretariat,
Islamabad.
Office Tel: 92 (51) 9201252

Secretary,
Ministry of Commerce,
Govt. of Pakistan,
Block A, Pak. Secretariat,
Islamabad.
Office Tel: 92(51) 9208692,
www.commerce.gov.pk

Secretary,
Ministry of Health,
Govt. of Pakistan,
Block C , Pak. Secretariat,
Islamabad.
Office Tel: 92(51) 9211622
Fax No: 92(51) 9205481

Secretary,
Ministry of Food, Agriculture and Livestock,
Govt. of Pakistan,
Block B, Pak. Secretariat,
Islamabad.
Office Tel: 92(51) 9203307,9210351
Fax No: 92(51) 9210616

Secretary,
Ministry of Ports & Shipping,
Govt. of Pakistan,
Block D , Pak. Secretariat,
Islamabad.
Office Tel: 92(51) 9215354
Fax No: 92(51) 9215349

Secretary,
Ministry of Tourism,
Govt. of Pakistan,
Block D , Pak. Secretariat,
Islamabad.
Office Tel: 92(51) 9213642
Fax No: 92(51) 9215912
Email:secretary@tourism.gov.pk

Governor,
State Bank of Pakistan,
I.I. Chundrigar Road,
Karachi. Pakistan.
Phone: 111-727-111 Fax: (+92-21) 9212433-9212436
www.sbp.org.pk

Chairman,
Board of Investment,
Govt. of Pakistan,
Attaturk Avenue,
Sector G-5/1,
Islamabad.
Tel: 92(51) 9207531, 9206161
www.pakboi.gov.pk

Chairman,
Pakistan Telecommunication Authority,
Head Quarter Sector F-5/1,
Islamabad.
Tel: 92-51-2878143,9225326,
Fax: 92-51-2878155
E-mail: chairman@pta.gov.pk
www.pta.gov.pk

Chairman,
Oil & Gas Regulatory Authority,
Tariq Chambers, Civic Center,
Melody Market, Sector G-6,
Islamabad.
Tel: 92-51-9221705
Fax: 92-51-9221714
Email: chairman@ogra.org.pk
www.ogra.org.pk

Chairman,
Pakistan Electronic Media Regulatory Authority,
Green Trust Tower,
6th Floor, Jinnah Avenue, Blue Area,
Islamabad
Phone#:0092-051-9222320/26/32/40/42
E-Mail: ctv@pemra.gov.pk
www.pemra.gov.pk

Chairman,
Securities and Exchange Commission of Pakistan,
National Insurance Corporation Building,
Jinnah Avenue,
Islamabad-44000,
Telephone: 92-51-9207091 (3 lines)
Fax: 92-51-9204915
Email: enquiries@secp.gov.pk
www.secp.gov.pk

Chairman,
Export Promotion Bureau,
Govt. of Pakistan,
5th Floor, Block A
Finance & Trade Centre,
Shahrah-e-Faisal.
Karachi.
Tel: 92-21-9206462-70
Fax: 92-21-9206461
www.epb.gov.pk

Chairman,
Engineering Development Board,
Govt. of Pakistan,
5-A, Constitution Avenue, SEDC Building (STP), Sector F-5/1,
Islamabad,
Tel: 92-51-9205595-98
Fax:92-51-9205595-98
Email: edb@edb.gov.pk
www.engineeringpakistan.com

Chairman,
Alternative Energy Development Board,
Govt. of Pakistan,
344-B,Prime Minister's Secretariat,
Constitution Avenue,
Islamabad.
Phone No: 92-51-9223427, 9008504
Fax No: 92-51-9205790
E-mail: support@aedb.org
www.aedb.org
Chairman,

Small & Medium Enterprise Development Authority,
6th Floor, LDA Plaza, Egerton Road,
Lahore.
Tel: 92-42-111-111-456
Fax: 92-42-6304926
E-mail helpdesk@smeda.org.pk
www.smeda.org.pk

Managing Director,
Private Power and Infrastructure Board,
50 Nazimuddin Road, F7/4,
Islamabad, Pakistan.
Tel: 92-51 9205421,9205422
Fax: 92-51 9215723,9217735
Email: ppib@ppib.gov.pk
www.ppib.gov.pk

CEO,
Competitiveness Support Fund,
House No. 53,
Street 1, F-6/3,
Islamabad.
Cell: 92-300 856 5277
Email: arthur.bayhan@telefonica.net
www.competitiveness.org.pk

Chairman,
Pakistan Software Export Board,
2nd Floor Evacuee Trust Complex
F-5, Aga Khan Road
Islamabad - 44000
Tel: 92-51-9204074
Fax: 92-51-9204075
www.pseb.org.pk

Managing Director,
Karachi Stock Exchange (Guarantee) Limited,
Stock Exchange Building, Karachi.
Tel: 92-21-111-001122
Fax : 92-21-241 0825
Email: info@kse.com.pk
www.kse.com.pk
Chairman,

Karachi Cotton Association,
The Cotton Exchange,
I.I Chundrigar Road,
Karachi, Pakisan.
Tel : 92-21-242-5007, 241-2570,
Fax : 92-21-2413035
Email: contact@kcapak.org
www.kcapk.org

President,
Federation of Pakistan Chambers of Commerce and Industry,
Federation House,
Sharea Firdousi, Main Clifton,
Karachi.
Tel: 92-21-5873691,93-94
Fax : 92-21-5874332
Email : fpcci@cyber.net.pk
info@fpcci.com.pk
www.fpcci.com.pk

President,
Karachi Chamber of Commerce Industry,
Aiwan-e-Tijarat Road,
Off Shahrah-e-Liaquat,
Karachi.
Tel: 92-21- 241 6091-94
Fax : 92-21- 241 0587
Email: info@ karachichamber.com
www.karachichamber.com

President,
Lahore Chamber of Commerce Industry,
11, Shahrah Aiwan i Tijarat,
Lahore. Pakistan.
Tel: 92-42 -111-222-499
Fax : 92-42 -636-8854
www.lcci.com.pk

President,
Rawalpindi Chamber of Commerce and Industries,
Chamber House, 39 - Mayo Road
(Civil Lines),
Rawalpindi.
Tel: 92-51-5111051-54
Fax: 92-51-5111055
E-mail : rcci@isd.wol.net.pk
www.rcci.com.pk

Secretary,
Overseas Chamber of Commerce and Industries,
Chamber of Commerce Building,
Talpur Road, P.O. BOX 4833,
Karachi.
Tel: 92-21-2410814-15
Fax: 92-21-2427315
E-mail: info@oicci.org

Study Commissioned by:
EMPLOYMENT & RESEARCH SECTION,
PLANNING & DEVELOPMENT DIVISION, GOVERNMENT OF PAKISTAN,
PAKISTAN SECRETARIAT, P- BLOCK, ISLAMABAD
Tel: (92-51) 921 2831, Fax: (92-51) 920 6444