Chapter - I

ECONOMIC VALUATION OF MEDICINAL PLANTS IN TIRUNELVELI DISTRICT

Introduction

Natural products have always fascinated human cultures since centuries. For several thousand years, the plants and herbs are being used in traditional systems of medicine in India and China. Today, Ayurveda co-exists with modern systems of medicine, and is widely used and practiced. India is bestowed with a wealth of medicinal and aromatic plants, majority of which are being traditionally used as most popular systems of healers for generations. Medicinal plants have their existence in almost every part of the country and the globe, under a well defined, value added biodiversity group. These herbs are the symbolic representatives covering diverse disease scenario in the healthcare sector with the total communities. These herbs, therefore, form the most active ingredient in the formulations of pharmaceutical drugs.

Medicinal plants, since times immemorial, have been used in virtually all cultures as a source of medicine. The widespread use of herbal remedies and healthcare preparations, as those described in ancient texts such as the Vedas and the Bible, and obtained from commonly used traditional herbs and medicinal plants, has been traced to the occurrence of natural products with medicinal properties. The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed by the United Nations Educational Scientific and Cultural Organisation (UNESCO, 1996). Furthermore, an increasing reliance on the use of medicinal plants in the industrialized societies has been traced to the extraction and development of several drugs and chemotherapeutics.
from these plants as well as from traditionally used rural herbal remedies (UNESCO, 1998). Moreover, in these societies, herbal remedies have become more popular in the treatment of minor ailments, and also on account of the increasing costs of personal health maintenance. Indeed, the market and public demand has been so great that there is a great risk that many medicinal plants today, face either extinction or loss of genetic diversity.

Valuation of biodiversity is desirable, as this not only highlights the contribution of biodiversity to society but also helps in developing an efficient conservation strategy for this precious natural resource. Economic valuation of biodiversity and its different components in terms of use and option values induces efficiency in decision making criteria. Medicinal plants and herbs are one of the crucial components as far as the contribution of biodiversity to society is concerned. With a progressive loss of biodiversity all over the world, especially in the tropics, society is not only losing present benefits from current use but is being deprived of the option of future availability known as option value. Medicinal plants provide meaningful inputs for drugs. Their loss through extinction could lead to considerable loss to the society. Hence monetization of the components of biodiversity such as for medicinal plants in a cost–benefit framework helps to understand how the conservation of biodiversity affects the level of human welfare. Medicinal uses of plant and animal species have been practiced for centuries in many parts of the world but valuation of such benefits by economists has commanded attention in the last two decades possibly due to the alarming rate of species extinction. Valuation can also help in devising a proper public policy for its conservation and sustainable use. Monetary benefits of biological resources through economic valuation in the context of bio-prospecting are a small part of total benefits.
Anthropogenic activity has been exploiting the nature for various uses from time immemorial. Out of 25 million species of plants worldwide, only 20,000 have so far been listed as being of known medicinal value and only 5,000 have been studied in detail. According to World Health Organization (WHO), about 25 percent is being prescribed for human medicines are derived from plants with medicinal value, containing specific pharmacological activity, which depends on traditional system of medicine? India is repository of over 45,000 different plant species out of which around 15,000 are medicinal plants. The Indian systems of medicine have identified 1,500 medicinal plants, out of which around 500 species are used in preparation of drugs. Millions of rural households use medicinal plants in a self-help mode. Around two million practitioners of the Indian systems of medicine in the oral and codified streams use over 7,500 species of plants for preservative, primitive and curative applications. As per latest record in the Indian scenario about 860 botanicals are in greater demand with high market value, and annual domestic turnover has been to the tune of Rs.4,000 crores with the export potential of around Rs.400 crores/year. In order to revitalize the bio-resources in their ecological niche and to get out of the alarming situation associated with declining healthcare resources, awareness for the bio-resource conservation and utilization has to be given priority. The Botanical Survey of India has classified the plant kingdom to highlight that 47 percent of flowering plants and 41 percent of lichens have medicinal properties.

The world trade in Medicinal plants sourced as Non-Timber Forest Products (NTFPs) is estimated as US$ 16 billion per annum (Lambert, 1997). Conservation estimates indicates that annually medicinal plants valued at Rs.1000 crores are traded in India. Export of raw drugs from India is about US$ 53 million per annum. The percentage share of India in the value of drugs and pharmaceuticals imported by major
importing countries are like Germany, United States America (USA), Japan, Italy, and France. India accounts for 17,500 species of higher plants, over 2,000 documented species having medicinal value around 1,100 species used in different systems of medicine. Out of these 600-700 species are used much in the country and 150 species with commercial usage, 95 per cent of the plants are obtained from wild sources and not cultivated.

The world herbal market according to report published by U.K. based consultancy McAlpine Thorpe and Warrier, stands at $14.2 billions or Rs.51,210 crores (Business India, November 17-30, 1997). This presents a big opportunity since India’s share is currently Rs.280 crores against China’s figure Rs.18,000 crores. The Center for Monitoring the Indian Economy (as referred in EXIM report, 1997) estimated that India exported plant based drugs and pharmaceutical products worth of Rs.2800 million and imported plant based drugs worth of Rs.1000 million per month during 1995-96. Exports during 1995-96 grew by 34 percent over 1994-95. The average increase in value of imports of plant based drugs was around 30 percent per year.

The Center for Biological Diversity reports that about 15,000 medicinal plants across the globe are at risk from habitat destruction, over harvesting, and big business. People around the world use between 50,000 to 80,000 flowering plants for medicinal purposes, according to the 2008 report “Medicinal Plants at Risk,” published by the Center for Biological Diversity. Emily Robertson, the report’s author, states that in the United States alone, at least 118 of the top 150 prescription drugs are based on natural sources, including plants (74%), fungi (18%), bacteria (5%), and vertebrate species such as snakes and frogs (3%).
Not surprisingly, wild plant species used for medicinal purposes are receiving ever increasing attention from the scientific community and commercial enterprises. At the same time, these species continue to support indigenous and local communities that have relied on them for centuries in their traditional medicines. But a number of factors now threaten medicinal plants, including habitat destruction, over harvesting, and big business.

According to the British Broadcasting (BBC) News article “Medicinal Plants Facing Threat,” published January 19, 2008, five billion people rely on traditional plant-based medicines as their primary form of health care, and such factors as deforestation are putting those plants at risk. “Cures for things such as cancer and HIV may become ‘extinct before they are ever found.

The BBC News article also reports that over-collection contributes to the threat to medicinal plants. Robertson concurs. Not only does over harvesting affect people’s access to traditional medicines, but also threatens commercially valuable wild species. Indeed, over harvesting is threatening the extinction of about 15,000 medicinal plants worldwide.

Wild plant species are used for a number of important drugs. For example, the bark from yew trees forms the basis for paclitaxel, one of the world’s most widely used cancer drugs, according to the BBC News article. However, as Robertson pointed out, several years species are now in need of protection from over harvesting as a result of international trade.

The risks from habitat destruction and over harvesting have not prevented businesses from seeking out their share. Undoubtedly, medicinal plants are very profitable. Even back in 1995, according to Robertson, a new plant-derived drug was
worth an average of $94 million to drug companies. In addition, U.S. sale ranges from $1.5 to $5.7 billion annually for nonprescription medicinal plants and $24.4 billion worldwide.

The WHO estimated that 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs. Also, modern pharmacopoeia still contains at least 25% drugs derived from plants and many others which are synthetic analogues built on prototype compounds isolated from plants. Demand for medicinal plant is increasing in both developing and developed countries due to growing recognition of natural products, being non-narcotic, having no side-effects, easily available at affordable prices and sometime the only source of health care available to the poor. Medicinal plant sector has traditionally occupied an important position in the socio cultural, spiritual and medicinal arena of rural and tribal lives of India.

Medicinal plants as a group comprise approximately 8000 species and account for around 50% of all the higher flowering plant species of India. Millions of rural households use medicinal plants in a self-help mode. Over one and a half million practitioners of the Indian System of medicine in the oral and codified streams use medicinal plants in preventive, primitive and curative applications. These are estimated to be over 7800 manufacturing units in India. In recent years, the growing demand for herbal product has led to a quantum jump in volume of plant materials traded within and across the countries. An estimate of the EXIM Bank puts the international market of medicinal plants related trade at US$ 60 billion per year growing at the rate of 7% only. Though India has a rich biodiversity, the growing demand is putting a heavy strain on the existing resources.
While the demand for medicinal plants is growing, some of them are increasingly being threatened in their natural habitat. For meeting the future needs cultivation of medicinal plant has to be encouraged.

According to an all India ethno biological survey carried out by the Ministry of Environment & Forests (MoEF), Government of India (GoI), there are over 8000 species of plants being used by the people of India. It is evident that the Indian people have a tremendous passion for medicinal plants and use them for a wide range of health related applications from a common cold to memory improvement and treatment of poisonous snake bites to a cure for muscular dystrophy and the enhancement of body’s general immunity. In the oral traditions local communities in every ecosystem from the Trans Himalayas down to the coastal plains have discovered the medical uses of thousands of plants found locally in their ecosystem. India has one of the richest plant medical cultures in the world. It is a culture that is of tremendous contemporary relevance because it can on one hand ensure health security to millions of people and on the other hand it can provide new and safe herbal drugs to the entire world. These are estimated to be around 25000 effective plant based formulations used in folk medicine and known to rural communities all over India and around 10000 designed formulations are available in the indigenous medical texts.

Around 70% of India’s medicinal plants are found in tropical areas mostly in the various forest types spread across the Western and Eastern Ghats, the Vindhyas, Chotta Nagpur plateau, Aravalis & Himalayas. Although less than 30% of the medicinal plants are found in the temperate and alpine areas and higher altitudes they include species of high medicinal value. Most of the macro studies shows that a larger
percentage of the known medicinal plants occur in the dry and moist deciduous vegetation as compared to the evergreen or temperate habitats.

Analysis of habits of medicinal plants indicates that they are distributed across various habitats. One third is trees and an equal portion shrub and the remaining one third herbs, grasses and climbers. A very small proportion of the medicinal plants are lower plants like lichens, ferns algae, etc. Majority of the medicinal plant are higher flowering plants. Of the 386 families and 2200 genera in which medicinal plants are recorded, the families Asteraceae, Euphorbiaceae, Lamiinaceae, Fabaceae, Rubiaceae., Poaceae, Acanthaceae, Rosaceae and Apiaceae share the larger proportion of medicinal plant species with the highest number of species (419) falling under Asteraceae. About 90% of medicinal plants used by the industries are collected from the wild. While over 800 species are used in production by industry, less than 20 species of plants are under commercial cultivation. Over 70% of the plant collections involve destructive harvesting because of the use of parts like roots, bark, wood, stem and the whole plant in case of herbs. This poses a definite threat to the genetic stocks and to the diversity of medicinal plants if biodiversity is not been adequately used.

Crude drugs are usually the dried parts of medicinal plants (roots, stem wood, bark, leaves, flowers seeds, fruits, and whole plants etc.) that form the essential raw materials for the production of traditional remedies of Ayurveda, Siddha, Unani, Homeopathy, Tibetan and other systems of medicine including the folk, ethno or tribal medicines. The crude drugs are also used to obtain therapeutically active chemical constituents by specialized methods of extraction, isolation, fractionation and purification and are used as photochemical for the production of modern allopathic medicines or herbal/photo-medicines. Several medicinal plants have been assessed as
endangered, vulnerable and threatened due to over harvesting or unskillful harvesting in the wild. Habitat destruction in the form of deforestation is an added danger. The GoI has put 29 species in the negative list of export which are believed to be threatened in the wild.

India has 15 agro climatic zones and 17000-18000 species of flowering plants of which 6000-7000 are estimated to have medicinal usage in folk and documented systems of medicine, like Ayurveda, Siddha, Unani and Homoeopathy. About 960 species of medicinal plants are estimated to be in trade of which 178 species have annual consumption levels in excess of 100 metric tones.

Medicinal plants are not only a major resource base for the traditional medicine & herbal industry but also provide livelihood and health security to a large segment of Indian population. The domestic trade of the Ayurveda, Yoga & Naturopathy, Unani, Siddha & Homeopathy (AYUSH) industry is of the order of Rs.80 to 90 billion (1US$ = Rs.50). The Indian medicinal plants and their products also account of exports in the range of Rs.10 billion.

There is global resurgence in traditional and alternative health care systems resulting in world herbal trade which stands at US$ 120 billion and is expected to reach US$ 7 trillion by 2050. Indian share in the world trade, at present, however, is quite low.

The National Medicinal Plants Board (NMPB) set-up in November 2002 by the GoI has the primary mandate of coordinating all matters relating to medicinal plants and support policies and programmes for growth of trade, export, conservation and cultivation. The board is located in the department of AYUSH of the Ministry of Health & Family Welfare.
The researcher has found enough to value the extinct medicinal plants in Tirunelveli district because this district consists of seven hills in southern block, five hills in central block and three hills at Northern block. These hills are naturally covering plenty of medicinal plants. Besides, people living in non-hills area are cultivating medicinal plants in different eleven places. They sell the medicinal plants in three unorganized medicinal plant markets. Nearly five manufacturing companies are manufacturing drugs by using the medicinal plants which are turned in to highly economic value. These medicinal plants are exported to different countries. Under this circumstance, the researcher is intent to understand the economic value of medicinal plants and how far those plants would be conserved for future needs the society from existing threat.

Objectives of the study

1. To study the demand and supply position of Medicinal Plants in general and the available medicinal plants in particular in the study area.

2. To study the important diseases cured by each medicinal plants and its various drugs produced.

3. To estimate the economic valuation of the available medicinal plants in the study area.

4. To study the challenges and strategies of marketing of Medicinal plants in the study area.

5. To suggest some policy measures in order to conserve medicinal plants and plant based herbs.
Methodology

The study was based on both primary and secondary data. Primary data has been collected through interview schedule. For the primary data, the researcher has selected eleven hills and eleven non-hills areas. The interview schedules were based on availability of medicinal plants, total cultivating areas, number of cultivators, expenses for cultivating medicinal plants, quantity of manufacturing, and the selling price of medicinal plants in the local and global markets. The researcher would also like to find out the number of drugs manufacturing companies using the medicinal plants, the manufacturing cost, and the market price of the drugs. Besides it extended to find out the medicinal plants exporters, their purchasing cost of the medicinal plants, and the economic value of exports. The Secondary data were collected on various places, like Government Sidha medical College Tirunelveli, District Sidha Association Tirunelveli, Department of Statistics Tirunelveli, Department of Statistics Thoothukudi, Survey of Medicinal plants research unit Tirunelveli, Survodaya Tirunelveli, Various Manufacturing Units, Associations, and Exporting companies. The literature review were collected from book, International and national journals, monographs, working papers and various reports of International and national organizations. Other than the secondary sources the researcher has visited and collected the relevant literature from Sidha Medical College Tirunelveli, Agricultural University Killikulagm, Madurai Kamaraj University Maduri, Madras Institute of Development Studies (MIDS) Chennai, M.S.Swamynathan Research Foundation Centre Chennai, Madras School of Economics (MSE), Chennai, Institute of Social and Economic Change (ISEC), Banglore, and Institute of Economic Growth (IEG), New Delhi.
In addition, the researcher has collected information from the selected ayurvedic drug manufacturing sector of selected medicinal plants from the study area. From the selected units, data regarding the following sources were gathered.

- Plant/plants used
- Quantity/value of important plants purchased from the local market or from the indigenous people (e.g. tribal people)
- Unit purchase prices of important medicinal plants

The personal interview method has adopted while data collection. Firstly, the researcher has comprised and contacted the managing directors, marketing managers, other persons in the marketing department, purchase managers, workers in the manufacturing unit and accounts department of the drug firms. The practicing ayurvedic doctors were also often consulted.

Each unit was personally visited on an average of 10 to 15 times and has obtained the desired information. Every firm was enthusiastically cooperating while doing survey and rest was little reluctant to provide information. The study has adopted simple arithmetic tools like percentage analysis and weighted averages. The growth of consumption of medicinal plants is estimated by annual compound growth rate based on the exponential function. This data has been analysed with the help of SPSS package and other econometric models. There data were collected from the following stakeholders as given below:

Medicinal Plant Collectors: The survey was done in different villages of Tirunelveli district villages like Panpozhli, Elangee, Courtalam, Tenkasi, Meelaragam, Alangulam, Pavoorchantram, Ariyapuram, Rahumaniyapuram and Azathnagar.
**Medicinal Plant Cultivators:** The required data were collected from the following village cultivators such as Alavanthankulam, Keela Thengalam, Kuppakurichi, Manur, Nallammalpuram, Pallamadai, Paryathiyarpuram, Tenkalam, Therkku Cheliyanallur, Vengalapottal.

**List of Pharmacies were consulted by the researcher namely,** Arvind Herbals, Gandhiji Vaidyasalai, Selvanthan Vaidyasalai, Rajah Ayurvedi Herbals and Kerala Vaidyasalai.

**Weighted Average Price**

For each of the medicinal plant, it will be calculated as:

\[
P_w = \frac{\sum q_i p_i}{\sum Q}
\]

Where,

- \(\sum Q\) = Total quantity of ith medicinal plant procured by the sample pharmacies
- \(p_i\) = Price per unit of the ith medicinal plant, and
- \(q_i\) = Quantity of the ith medicinal plant procured

**Price Index**

Price index of major medicinal plants will be calculated as:

\[
\text{Price index} = \frac{P_a \times 100}{P_w}
\]

Where,

- \(P_a\) = Price paid by the individual pharmacy for each medicinal plant, and
- \(P_w\) = Weighted average price of the medicinal plant
**Coefficient of Variation**

Though the pharmacies in Tirunelveli district is mainly depending on the traders for procurement of the raw materials, the price paid by the sample pharmacies for a particular plant shows wide variations among the pharmacies. To estimate the extent of variation in the price of major medicinal plants, coefficient of variation is to be analysed as follows:

\[
\text{Coefficient of variation} = \frac{\text{S.D.} \times 100}{\text{Pa}}
\]

where, \(\text{S.D.}\) = Standard deviation of the price of ith medicinal plant, and

\(\text{Pa}\) = Average price of the medicinal plant.

**Price Elasticity of Demand**

Price Elasticity of demand will be work out to understand the relationship between the price and quantity demanded. It will be calculated as:

\[
\text{Price elasticity of demand} = \frac{(Q_2 - Q_1)}{(Q_2 + Q_1)} \times \frac{(P_2 - P_1)}{(P_2 + P_1)}
\]

where,

\(Q_1\) = Quantity purchased at price \(P_1\) during 2009-2010 and

\(Q_2\) = Quantity purchased at price \(P_2\) during 2010-2011

**Scarcity Ratio for Medicinal Plants**

The increase in the real price of a resource over a period of time, indicates that the economic scarcity of the resource (Suneeta, 1998). Considering this rule, the scarcity ratio of medicinal plants will be estimate by using the following formula:
Scarcity ratio = \((\frac{SPt}{CPI-SP0}/SP0)\)*100

Where,

\[SP0 = \text{Selling price of the medicinal plant in 2006}\]
\[SPt = \text{Selling price of the medicinal plant in 2011 and}\]
\[CPI = \text{Consumer Price Index for 2011 with base 2006}\]

If the scarcity ratio will be positive, it will infer that there is an economic scarcity for that medicinal plant.

**Sampling Areas**

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<tr>
<th>S. No.</th>
<th>Cultivating Villages</th>
<th>Collection Villages</th>
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<tr>
<td>1.</td>
<td>Alavanthankulam</td>
<td>Ariyapuram</td>
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<td>2.</td>
<td>Keelathenkalam</td>
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<td>3.</td>
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<td>4.</td>
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<td>5.</td>
<td>Nallammalpuram</td>
<td>Meelagaram</td>
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<td>6.</td>
<td>Pallamadai</td>
<td>Pavoour Chatram</td>
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<td>7.</td>
<td>Parthiyapuram</td>
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<td>8.</td>
<td>Tenkalam</td>
<td>Ponpoozhli</td>
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<td>9.</td>
<td>Therkkuchelyanallur</td>
<td>Rahmaniyapuram</td>
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<td>10.</td>
<td>Vengalapottal</td>
<td>Tenkasi</td>
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Limitation of the Study

This study is basically depends upon the field based study in the selected areas during the period of 2009 to 2011 based on secondary sources retrieved from the different stakeholders of the medicinal drug manufacturing firms within the Tirunveli district of TamilNadu for selected drugs.

Outcome of the Study

The use of plants in medicine is one aspect of plant exploitation for which there are data that can be used to help forecast future financial benefits forfeited when we lose the biodiversity. Plants have always had an important role in medicine and public health. In developing countries, more than 80 percent of the population depends upon traditional plant-based medicine, and even in USA, for example, more than a quarter of
western drugs are derived from natural sources. Morphine and codeine (from Papaver somniferum), quinine (Cinchona bark), and aspirin (developed from Salix alba) are famous examples, but less well known are reserpine from Snake root (Rauwolfia Serpentina), papain for Papaya diosgenin form the wild yam (Diosorea villosa), used as the nucleus to derive many steroids. The sustainability and environmental impact of the exploitation of plants is not forgotten. As observed by Vogel (1970), Indians have believed from time immemorial that nature provides cures for all illnesses and the curatives are derived from plants. Over a million practitioners of the traditional system of medicines in India, use around 7500 species of plants in the preventive and curative applications, in the codified and oral streams. In addition, millions of households use medicinal plants in a self-help mode. A recent trend which is becoming more and more discernible is the interest shown in not only India, but elsewhere (including the West) by those associated with modern medicine, in plant based curatives. A cumulative effect of these trends has been a quantum jump in volumes of plant materials extracted and traded within the country and exported outside. Conservative estimates place the economic value of medicinal plant related trade in India to be of the order of Rs.100 billion a year. Apprehensions are being expressed that trends are pointing towards an inexorable monetization and commercialization of medicinal plants economy (GoI, 1997). The demand on medicinal plants, on the one hand, is increasing sharply and supplies on the other hand, are dwindling rapidly. Two serious consequences of the widening gap between demand and supply are: (a) suppliers taking advantage of gaps in understanding correct identity of plants and making available incorrect plants and (b) suppliers resorting to adulteration of medicinal plant parts by similar looking plant parts which are not known to be of medicinal value. It is therefore
essential to provide scientific background to establish correct identity of plants and to
document diagnostic features to identify and sort out spurious plant parts.

**Conclusion**

Studies on valuation of medicinal plants have progressed significantly in the last
one and a half decades. In all the valuation studies, the area and locations are different,
so are the success rates (hit rate) of finding a useful drug and this makes the comparison
of the value somewhat difficult. Most of the dataset have been taken from the US
pharmaceutical industry; the source of phytochemicals has been found in the flowering
plants alone, they do not give a comprehensive view of the whole scenario. Many
developing countries like China, India, Brazil and Argentina have well-developed
pharmaceutical R&D capabilities and they have a different cost structures. In a nutshell,
studies on medicinal plants valuation signify its economic importance and biodiversity.
A local or area-based study taking into account its features of species and genera and its
ecological function should be the preferred approach. For example, in India, instead of
a thumb rule study for the entire country, valuation of species in a particular landscape
or habitat like Western Ghats or North-East Himalayas give better insights. This will
help to provide a meaningful direction to the policy makers for efficient use of
medicinal plants. Valuation studies will need more refined ecological data such as
detailed taxonomic information on plants and animals and R&D information such as
real costs and transfer pricing data that can enhance the quality of the estimate and
make the policy recommendations more convincing and meaningful.
CHAPTERISATION

FIRST CHAPTER deals with an introduction of Medicinal Plants in general, objectives of the study, research methodology, Limitation of the study, and Outcome of the research.

SECOND CHAPTER portrays all relevant Literature with regard to Medicinal plants and plant based herbs.

THIRD CHAPTER deals with base line survey of different stakeholders of medicinal plants in Tirunelveli District

FOURTH CHAPTER deals with demand and supply position of Medicinal Plants.

FIFTH CHAPTER estimates the economic valuation of Medicinal plants in Tirunelveli District

SIXTH CHAPTER discusses the challenges and strategies of Medicinal plants and marketing

SEVENTH CHAPTER draws summary, findings and policy conclusions.