CHAPTER 3

LITERATURE REVIEW – II
UNDERSTANDING PROCESS OF TRADING AND MANUFACTURING, WITH REGARD TO PROSPECTS, AND PROBLEMS FACED BY AYURVEDA INDUSTRY

As we homogenize the habitats in which these plants evolved, and as we increase the pressure for products that they are in a position to supply (usually unwillingly), we threaten their - and our own - genetic heritage.
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CHAPTER 3
LITERATURE REVIEW – II
UNDERSTANDING PROCESS OF TRADING AND MANUFACTURING, WITH REGARD TO PROSPECTS, AND PROBLEMS FACED BY AYURVEDA INDUSTRY

3.0 Trading And Traders Problems

Introduction: Trade Of Medicinal Plants In India

Adjectives that most readily come to the mind while attempting to describe the nature of the medicinal plants trade in India are ‘extremely complex’, ‘secretive’, ‘traditional’, ‘confusing’, ‘badly organized’, ‘highly under-estimated’ and ‘unregulated’. There is no macro level data/information available for assessing the nature and extent of the trade; whatever is available comprises ‘guesstimates’ or extrapolations based on micro studies. There is no systematic local, regional or national level data regarding number of species traded, volumes, prices etc. with any one agency. Most of the data is disjointed, scattered, grossly inadequate and incomparable. Estimates vary a lot. (India Country Sub-study 1998 ITCOT 1999).

3.1 Identification Crisis: Co-Relation Of Trade Name And Botanical Name

There are no all-India inventories of medicinal plants; there are local and regional inventories, but no national level inventory. Identification of plants in trade is complicated by the fact that there is no reliable system of matching trade names to botanical names. In the trade, a species is known by its local name, which can change from one market to another, or from one region to another. A species which is identified by a particular name by the collectors, might be traded under a totally different name. On the other hand, the same trade name may be used for more than one species, often representing a set of species belonging to the same genus or including very different species used for similar purposes. For instance, for the trade name ashok there are two botanically different species, Saraca indica (syn. Saraca asoka) and Polyalthia longifolia. Similarly, for the trade name chirayata the two botanical species are Andrographis paniculata and Swertia chirata. Another example is the name safed musli, which traders assign to a variety of species including Chlorophytum borivillianum and C. tuberosum. Yet establishing the correct botanical identity of traded species is a prerequisite to studying those species in the field. This presents a major problem in identification as soon as the species leaves its natural habitat.
The medicinal plants are harvested and traded in their raw form, whether as leaves, fruit, flower, seeds, gum/resin, roots, rhizomes, stems, bark or the whole plant. Since most raw drugs are traded in dried forms, long after their harvest, only the most experienced people in the trade (most often not a botanist, researcher or a forester) are able to recognize the species by their parts used. This is one of the reasons why it is very difficult to study, monitor or regulate the extraction and trade of medicinal plants. Assessment of the species extracted from the wild, and their quantities, is also extremely difficult. (TAMICSS)

3.2 Distribution Of The Medicinal Plants Trade Across The Country

There are 6 major, 21 medium and 37 minor markets of medicinal plants spread across the country (see Table 3.1). A major market is taken to be one that has more than 25 big traders of medicinal plants with an individual turnover of Rs. 5 million or more per annum; a medium market is one where there are 25 to 50 big traders whose turnover ranges between Rs. 2.5 to 5 million per annum; the rest of the centres with smaller numbers of big, exclusive traders and lower turnover are classified as minor markets. The minor markets also include centres that have a greater volume of trade but where only a few species are traded, like Dhamtari in Madhya Pradesh where a few species such as Aonla, Harra and Beheda are traded in huge volumes. The major centres, located at the heads of the routes taken by the medicinal plants, are big cities, including the four metros. Centres like Raksal, Sidhpur, Unjha, Thrissur, Shivpuri, Dhamtari, Neemuch, Katni, Virudhunagar, Tuticorin, Tanakpur and Siliguri are specifically medicinal plants markets. Major export takes place from Delhi, Mumbai, Chennai and Tuticorin. The supply channel runs from the minor to the medium to the major markets before being exported. (TAMICSS)

A general representation of a supply channel is shown in Figure 3.1.
Figure 3.1: General Representation Of Supply Chain

Table 3.1: Zone And State-Wise Classification Of Important Medicinal Plants Market In India

<table>
<thead>
<tr>
<th>Zone</th>
<th>State</th>
<th>Name of cities/towns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Major</td>
<td>Medium market</td>
</tr>
<tr>
<td>Northern</td>
<td>Delhi</td>
<td>Delhi,</td>
</tr>
<tr>
<td>Kashmir</td>
<td>Jammu</td>
<td>Baramulla</td>
</tr>
<tr>
<td>Himachal</td>
<td>Pradesh</td>
<td>Patna, Raksal</td>
</tr>
<tr>
<td>Bihar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uttar</td>
<td>Pradesh</td>
<td>Dehradun, Lucknow, Kanpur, Tanakpur</td>
</tr>
<tr>
<td>Haryana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Punjab</td>
<td>Amritsar</td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>Madhya Pradesh</td>
<td>Raipur, Shivpuri, Dhamtari, Neemuch, Katni</td>
</tr>
</tbody>
</table>
These markets do not have any formal organized body for transactions of business, or any authority that regulates the trade at any point. Only estimates are available about the trade that takes place at each level. Right from the mandis at the minor market levels, the traders are extremely well organized, though in an informal way. They are well aware of the prices and trends in the markets and have very strong business networks. There is also no data regarding the number of people engaged in this trade at various levels.

<table>
<thead>
<tr>
<th>Region</th>
<th>State 1</th>
<th>City 1</th>
<th>City 2</th>
<th>City 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern</td>
<td>Andhra pradesh</td>
<td>Hyderabad</td>
<td>Visakhapatnam,Kakinada</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Karnataka</td>
<td>Bangalore</td>
<td>Mysore, Bijapur</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kerala</td>
<td>Thrissur</td>
<td>Thiruvananthapuram, Palghat,Ernakulam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tamil Nadu</td>
<td>Chennai</td>
<td>Madurai,Virudhnagar, Tuticorin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dharmapuri, Pudukottai</td>
<td></td>
</tr>
<tr>
<td>Eastern</td>
<td>Assam</td>
<td></td>
<td>Kokrajhar,Barpeta Road, Dibrugarh,Guwahati</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Orissa</td>
<td></td>
<td>Bhubaneswar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meghalaya and other northeastern states</td>
<td></td>
<td>Shillong</td>
<td></td>
</tr>
<tr>
<td>Western</td>
<td>Gujarat</td>
<td>Sidhpur, Unjha, Ahmedabad</td>
<td>Palanpur, Mehsana</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mumbai</td>
<td>Nagpur</td>
<td>Ratnagiri, Vashi (New Mumbai), Pune</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>6</td>
<td>21</td>
<td>37</td>
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Source: TAMICSS-28
In order to understand the geographical distribution of the markets, the country can be divided into 5 zones depending on the catchments or the main areas of medicinal plant source from the wild.

### 3.2.1 Northern Zone

The major market is located in Khari Baoli, Delhi is the biggest medicinal plants market both in terms of volume as well as value. More than 500 species are traded here but with considerable price variation. This could well be one of the biggest regional markets in south Asia, with raw material from Nepal, Bhutan, Bangladesh, Pakistan and Afghanistan finding its way here. Each of the states falling in this zone has its own medium and minor markets, which feed into the major market of Delhi. Uttar Pradesh and Bihar are also transit routes for the material imported into India from Nepal. An estimated 98 per cent of the entire medicinal plants collected in Nepal are exported to India (Olesen and Hellens 1997).

### 3.2.2 Southern Zone

The major southern market is located in Chennai, Tamil Nadu, and the port of Tuticorin, also in Tamil Nadu, is one of the major export points for medicinal plants. A lot of smuggling of medicinal plants is routed through this place. (especially banned items like Drosera peltata, a red-listed species) The main areas from where medicinal plants are collected are the south Western Ghats, the Javadi Hills in the Eastern Ghats and the Nilgiris. Bangalore is one of the medium sized markets trading around 400 to 500 species.

### 3.2.3 Central Zone

The central zone comprises the densely forested (almost 33 per cent forest cover) state of Madhya Pradesh, which has one major market at Raipur; four medium sized markets at Shivpuri, Dhamtari, Neemuch and Katni; and two minor markets at Indore and Dewas. Two other minor markets, at Ajmer and Jaipur in the adjoining state of Rajasthan, are also included in this zone. These act mainly as transit markets rather than a source of medicinal plants, except for a few arid zone species like Acacias. In Madhya Pradesh, the Bundelkhand area, Chindwara and Bastar are densely forested and rich in medicinal plants. Another significant aspect about Madhya Pradesh is that it has one of the highest percentages of tribal population in the country. A large proportion of the tribals in Bastar region are reported to be solely dependent on collection of medicinal plants for their incomes. The role of non-wood forest products, especially medicinal plants, in enhancing livelihoods, therefore assumes great significance.
3.2.4 Western Zone

The main centre in the western zone is Mumbai. It has the largest number of exporters of medicinal plants as well as the maximum value of imports as compared to the other markets. The majority of the raw material is collected in the mega-biodiversity ‘hot-spot’ of the Western Ghats. Other important markets that feed into this include Nagpur, Sidhpur, Unjha and Ahmedabad. The minor markets are located in Ratnagiri, Vashi and Pune, all in Mahashratra.

3.2.5 Eastern Zone

The main centre for the medicinal plants trade is located at Kolkata. A considerable bulk of raw material collected from eastern Nepal, Bangladesh and Bhutan is traded here. Most of the medicinal plants traded in the major market of Madhya Pradesh travel further north to Delhi or westwards to Mumbai, depending on their proximity to these centres. Assam, with its four minor markets, Guwahati, Dibrugarh, Kokrajhar and Barpeta, is an important regional market. Interestingly, the material that originates from the north-eastern Himalayas finds it way first to Kolkata (through the regional markets) before returning back to the retailers and traders of Assam and adjoining states.

3.3 Parameters Governing Sales Volume And Sales Value Of Medicinal Plants Across Four Major Markets

In terms of total volume traded, Mumbai tops the list with about 3,300 tonnes, followed by Delhi with about 2,000 tonnes. As compared to these two major markets, the volumes traded in the medium market of Bangalore are quite small at around 400 tonnes.

1) The volumes traded are directly proportional to the prices of the raw material, which in turn are proportional to the abundance/availability of the species.

a) Low price species show high volumes of trade across the four markets.

b) The connection between the part used and prices is evident. Those species that are destructively harvested are more expensive. Chlorophyntum borivillianum (roots), Commiphora wightii (resin), Embelia ribes (seeds), Nardostachys grandiflora (roots), Picrorrhiza kurroa (roots), Rauwolfia serpentina (roots), Swertia chirata (whole plant) are all high value species, because once uprooted, plant resource is lost forever thus yielding only once and new plantation needs to be done to regularize the supply every year.

c) High altitude species such as Nardostachys grandiflora, Picrorrhiza kurroa, Swertia chirata are also high value species. More the distance of the market from the source where
the raw material is collected, the higher is the price due to the addition of transport cost in the final price. For example, Nardostachys grandiflora or Jatamansi, which originates in Nepal and adjoining areas, is costliest in the southern markets. In general, the prices in Mumbai are the highest (except for the high altitude species which are traded at higher prices in the southern markets), probably because it is the largest and one of the most organized markets, thus accounting for higher and more stable prices. Sourcing the medicinal plants from many different biogeographic zones within India, tracing the supply chains of all the species in trade is a tough task and may produce a most complicated web across the country. There is a long chain between primary collectors and end-users, and the supply channels for each species are different, depending on availability of the individual species and many other factors. However, the following set of players involved in the supply channels can be identified:

1. Collectors
2. Local traders or agents
3. Commission agents at the state level
4. Commission agents in the major markets (like Delhi, Mumbai etc.)
5. Wholesale merchants in the major markets
6. Retailers in the major markets
7. Exporters and industrialists

The difference between remuneration paid to primary collectors and the market rate of the product is considerable and varies from species to species. For example, the middlemen in Panna, Satna, Sagar and Damoh districts of Madhya Pradesh distribute cash/kind advance to the gatherers at Re. 0.75–1 per kg for green aonla as against the prevailing market price of Rs. 3 per kg. In Sheopur, Madhya Pradesh, middlemen offer an advance of Rs. 5–8 per kg of dry aonla during July-August. After the collection starts in November, the market price goes to Rs. 20–25 per kg. While aonla matures in December, the middlemen encourage villagers to collect from October onwards. Apart from premature harvest, the fruits are almost completely harvested, mostly by lopping and pollarding of branches. In addition, 15–20 per cent of trees are actually felled to collect maximum aonla fruit. This practice is also prevalent for chironji, where fruits are collected before they ripen. In the case of safed musli, one of the most expensive medicinal plants, it is totally uprooted leaving little in the soil for future regeneration.(TAMICSS)
3.4 The Supply Chain
3.4.1 Collectors

Collectors are usually tribals and the rural poor, who are most dependent on the forests for their basic needs like fuel and fodder. Most often, those who go into the forests for fuel wood and fodder collection also collect seasonal medicinal herbs except for a few species. Collection from wild or ‘wild crafting’ is a labour intensive activity, often involving entire families. Studies show that women and children form the major chunk of the rural poor and are most actively involved in herb collection from the wild. For example, in a study conducted in the Great Himalayan National Park in Himachal Pradesh, it was found that in 70–85 per cent of rural households involved in collection of medicinal plants, most of the collectors were women and children (Tandon 1996). It is also seen that women largely carry out the collection of leaves, fruits and flowers whereas men generally collect roots and bark and the species that are difficult to collect (like in some high altitude species). Generally, in tribal pockets like Bastar in Madhya Pradesh, collection and sale of medicinal plants is the only source of cash income. Apart from such tribal pockets, this activity provides supplementary incomes to the families involved and is not generally a fulltime economic activity. As stated earlier, the rates paid to the collectors of herbs are extremely low, often just a fraction of the price paid by the final consumer. Payment to the collectors seems to be based upon the prevalent daily wage rate (or a slightly higher amount) in the area, for whatever quantity and number of species of medicinal plants are collected. The agent who engages the collectors, based on the perceived availability of the species and current wage rate, fixes the price for different species, which at the end of the day generally totals to a day’s wages. This rate has usually no correlation with the final rate of the raw material paid by the consumer. On an average, the share of the collectors in the final price paid by the consumer ranges between 10 and 58 per cent. For most species, the share of the collectors is lower than 33 per cent. Unless a mechanism is put in place to secure the stake of the collector, their interest in sustainable harvest and conservation of these plants will remain doubtful. The connection between rural poverty and the potential for generating livelihood security through collection and growth of medicinal plants has to be understood in order to be able to formulate strategies for the conservation and sustainable use of medicinal plants. To illustrate the enormous potential for generating incomes for the local communities:
e.g.1 - A study conducted in the eco-development zone of the Great Himalayan National Park (GHNP) revealed that medicinal plants formed the biggest component of the non wood forest products traded by the households in the area and earned them over Rs. 7,000 per household per year—despite the fact that they received only a fraction of the final price paid by the consumer (FRLHT 1997).

e.g.2- A study in Mandi district of Himachal Pradesh reveals that for rural households engaged in medicinal plants collection, the average annual income from this came to about Rs 16,600 (ISST 1996 quoted in Tandon 1996).

Consequences of commercialization of medicinal plant extraction has resulted in large scale, indiscriminate harvesting of the resource by the rural poor, whose main interest is obviously to earn additional income.

Two important interventions which can address the issue of ensuring fair share for the collectors are:

a) Organizing the collectors and

b) Collective bargaining by the organized body of collectors.

3.4.2 Local Agents/Traders

The second in the supply chain after the collectors are the local agents or traders who buy the raw material from a number of collectors in the village and often operate in a group of villages simultaneously. Local agents and traders are always men, mostly belonging to the Vaishya caste or a scheduled tribe. In south India, Muslim traders control a considerable proportion of the trade. Different kinds of procurement and payment arrangements are evident at this level.

1. One is where the local shopkeeper (there are often just one or two in a village), who supplies the general stores, also deals in medicinal plants on a seasonal basis. During the lean season, when the poor villagers are cash strapped, he provides supplies on credit or sometimes even lends cash to them. Later, through the rest of the year, the villagers pay back their credit, often in kind, including medicinal plants collected from the wild. It is important to emphasize the hold that the agent/trader exercises over the villagers by virtue of the credit facility that he is able to extend during the lean season. For this reason any intervention that aims at removing the middlemen from the supply chain makes it a difficult task to handle. The problems of rural indebtedness and lack of access to micro-credit by the
poor are inextricably woven into the overall picture of medicinal plants collection and trade.

2. In the second instance, an agent who receives an advance order from a commission agent at the state level organizes the collection through the villagers, by advancing a part of the payment in turn. Yet another modality is that the collectors bring the raw material to the local ‘haat’ or weekly village markets, where along with other agricultural products and vegetables, fresh medicinal plants are also sold, from where the agents make bulk purchases. This is a fairly common method by which the agent procures raw material.

3.4.3 Stockiest Or Agents At State Level
The agents, referred to as stockiest, operate from major/medium markets or mandis in the state and are the proverbial ‘big fish’ in the supply chain. They are well organized and it is at this level that the trade takes on truly commercial shape. The agents are aware of the rates across the different mandis as well as in the final markets. This is a specialized business, although even at this level medicinal plants might be just one of the commodities that they deal in. The stockiest or the agent at the state level is often in touch with his counterpart in the major markets like Delhi, and may specialize in supply of a certain set of medicinal plants. The secrecy regarding the prices, quantities traded, profits made and the quality of material supplied makes the market impenetrable from this level onwards. Information is shared only with those who are considered as insiders in the trade. The local agent/trader sells all the available medicinal plant raw material to the stockiest at a specified rate (depending on the market). The stockiest then ‘brokers’ a deal with his counterpart in the major market for which he charges a commission. He receives the full payment once the raw material is sold to the commission agent in Delhi. None of the transaction is carried out with written contracts; everything is informal, on mutual trust. The stockiest generally have storage facilities to store the raw material, which they procure in bulk and keep brokering the deals throughout the year as and when they get good prices.

3.4.4 Commission Agents
Commission agents are located in the major markets at Delhi, Mumbai, Chennai and Kolkata and buy the raw material from the stockiest located in the medium/state level markets. They are extremely well organized and often have their own storage facilities.
Many of the Delhi commission agents, for example, own their own cold storage facilities, which is an indicator of how lucrative the trade is. They supply the raw materials to exporters, manufacturers and wholesale dealers.

### 3.4.5 Suppliers
These are mainly found in the major centers and specializing in supplying to one or two major manufacturers like Dabur or Zandu. They procure raw material from the commission agents or the stockiest and then supply to a single large manufacturer.

### 3.4.6 Wholesale Traders
Wholesale traders are located at the final major markets in the big cities like the four metros of Delhi, Mumbai, Kolkata and Chennai and make the final purchases before supplying to the manufacturers and retailers in the cities, and other sub traders. In fact, they are often the initiators of the business, in the sense that their placing the orders with the commission agents results in a backward chain of reactions reaching up to the collector level.

### 3.4.7 Exporters
Often wholesale dealers and commission agents are also exporters. At times even some exporters who deal in other items export medicinal plants/products on demand.

### 3.4.8 Manufacturers
The manufacturers can be classified into the small, medium and large industries; apart from thousands of cottage level production units. The practitioners and the general public are the consumers of the finished product brought out by the manufacturers.

### 3.4.9 Summary Of Stakeholders
There is no inventory of the number of people at each level that are involved in this trade. However, Table 3.2 gives a rough estimate of the number of players at the Delhi and Mumbai markets.(TAMICSS)

**Table 3.2: Estimate Of Number Of Players In The Medicinal Plants Trade In Delhi And Mumbai**

<table>
<thead>
<tr>
<th>Players</th>
<th>Delhi</th>
<th>Mumbai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commission agent</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Exporter</td>
<td>15–20</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Wholesale dealer</td>
<td>0–35</td>
<td>30–35</td>
</tr>
<tr>
<td>Trader</td>
<td>30–35</td>
<td>30–35</td>
</tr>
<tr>
<td>Retailer</td>
<td>&gt;100</td>
<td>About 100</td>
</tr>
</tbody>
</table>
1) Information flow between the different players in the supply chain is linear with no direct contacts between the collectors/growers and final consumers.

2) Apart from a few species like Aloe vera or Tinospora cordifolia, which are generally used fresh, all other species reach the final consumer through one or more middlemen.

3) The collectors are usually unaware of the prices (other than what is offered by the local agent), the final destination of the material, the final value of the material, or the form that the medicinal plant takes. In other words, they are unaware of the wealth (in monetary terms) that is stored in medicinal plants.

4) Each level of middleman holds on to its privileged information and operates on a secretive and suspicious mode.

5) They are not formally organized and personal profit is the sole motivating force.

6) As a rule, there is no awareness or concern whatsoever about the issues related to the medicinal plants, conservation, sustainable use, etc., though most of them agree that it is becoming more difficult to find medicinal plants in the wild.

7) They accept that demand, and hence prices for many species, has seen a phenomenal increase in the last decade.

3.5 Scope For Semi-Processing

1) Semi-processing of raw materials at the village level would not only ensure better returns to the primary collectors and growers, but also has the potential to generate wage employment for women.

2) There is less demand for semi processed products in domestic market but there is huge demand in international market providing tremendous scope for export.

Some of the measures are discussed below.

3.5.1 Cleaning And Grading

i) Cleaning and grading are simple measures that can be easily undertaken at the level of the collectors, which would enhance the price as well as quality of the raw material.

ii) There is tremendous scope for negotiating a higher price if the raw material is cleaned and graded.

iii) Cleaning involves washing and drying or simply removing mud and other impurities depending on the part extracted.
iv) Collectors do not carry out even these simple steps because they are unaware of the possibilities of negotiating higher prices; they often have absolutely no idea about the actual value of the raw drug.

v) Grading involves separating the different quality classes.

vi) Grading can greatly enhance the price received. For instance: the price of safed musli or Chlorophytum borivillianum roots ranges from Rs. 200 to Rs. 1800. Such a wide range is due to the fact that there are varying qualities of safed musli available in the market and the rate depends on the grade of the raw drug. Broadly, three grades of musli are available:
   A) 3–4 inch long roots called badi (bigger) musli that get the highest price.
   B) 3 inch and smaller roots called choti (or smaller) musli that get intermediate prices.
   C) Broken fragments or chura that get the lowest price.

vii) If the harvested material is sold as it is, with all the grades mixed together, the collectors get a much lower return. This is what happens in practice.

viii) One of the major difficulties faced after harvesting the medicinal plant part, is to protect it from fungal infection during the process of cleaning, grading and drying before sale.

ix) Many species are harvested during the monsoon months, and the moisture in the atmosphere makes the harvested raw material susceptible to fungal attacks.

x) Using fungicide for protection is not advisable as it could adversely affect the drug quality.

xi) Currently there are no facilities or methods that would prevent the raw drug from a fungal attack and often the infected material is used as it is in the final formulations. This problem needs to be addressed for improving the shelf life of the raw drug.

3.5.2 Value Addition

Even though there is huge demand for value added raw material in exports, currently, there seems to be limited scope for semi-processing/value addition, as far as medicinal plants are concerned. The main reasons for this are discussed below.

1. The production processes involved in making the formulations include drying, powdering, making aqueous extracts, boiling, distilling and cooking. Most of these are done in sequence and are logistically best done in a central place.
2. If semi-processed material in the form of powders, extracts, pulp, etc. is purchased, it will be very difficult to ascertain the quality (whatever little quality standards are being maintained) of the raw drug being used.

3. There is little difference in terms of cost-effectiveness; hence there is little incentive for manufacturers to explore such an arrangement.

Table 4.3 lists possible semi-processing that might be suitable at the collector level, provided there is an assured buy-back arrangement with an industry or exporter. However, there seems to be more scope for promoting semi-processing catering to the herbal cosmetic industry as compared to the pharmaceutical industry. Hair conditioners like henna powder, face packs, scrubs, soap nut powder for washing hair are all traditional beauty care products which have come to command a huge market worldwide. However, even simple activities like drying / cleaning in hygienic conditions are difficult in many villages. The poorest families engaged in medicinal plant collection often live in cramped conditions that make it impossible for them to even carry out the most primitive processing activities.

Table 3.3: Semi-Processing/Value Addition For Selected Species

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Trade name</th>
<th>Part used</th>
<th>Semi-processing/ value addition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aloe vera</td>
<td>Ghee kunwar</td>
<td>Whole plant</td>
<td>Cutting the succulent leaves into 2 inch pieces. Extracting juice out of the leaves.</td>
</tr>
<tr>
<td>Chlorophytum borivillianum</td>
<td>Safed musli</td>
<td>Rhizome</td>
<td>Washing, cleaning, peeling , the skin drying , grading</td>
</tr>
<tr>
<td>Commiphora wightii</td>
<td>Guggul</td>
<td>Gum/resin</td>
<td>Cleaning, grading</td>
</tr>
<tr>
<td>Embelia ribes</td>
<td>Baibaranga</td>
<td>Seeds</td>
<td>Cleaning, drying, grading</td>
</tr>
<tr>
<td>Emblica officinalis</td>
<td>Aonla/Amla</td>
<td>Fruit</td>
<td>Washing, boiling, de-seeding,</td>
</tr>
<tr>
<td>Nardostachys Jatamansi</td>
<td>Jatamasi</td>
<td>Root</td>
<td>Washing, drying</td>
</tr>
<tr>
<td>Picrorrhiza kurroa</td>
<td>Kutki</td>
<td>Root</td>
<td>Washing, drying</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Part Used</td>
<td>Preparation</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>Rauwolfia serpentina</td>
<td>Root/seeds</td>
<td>Cleaning, drying, grading</td>
<td></td>
</tr>
<tr>
<td>Saraca indica</td>
<td>Bark</td>
<td>Cleaning, drying, grading</td>
<td></td>
</tr>
<tr>
<td>Swertia chirata</td>
<td>Whole plant</td>
<td>Washing, cleaning, drying, grading</td>
<td></td>
</tr>
<tr>
<td>Terminalia chebula</td>
<td>Fruit/bark</td>
<td>Washing, cleaning, drying, grading</td>
<td></td>
</tr>
<tr>
<td>Withania somnifera</td>
<td>Root</td>
<td>Washing, cleaning, drying, grading</td>
<td></td>
</tr>
</tbody>
</table>

Source – TAMICSS, p-50

3.6 Understanding Market And Marketing Of Medicinal Plants

3.6.1 The Demand Supply Gap

The demand supply gap is widening and it is endangering some of the species found in the wild. There is widespread use of traditional medicines in India and this is predicted to increase. Internationally, western Europe, USA, Japan and south east Asia represent significant markets, and there is sizeable potential for increase. However, the requirement for registration, based on clinical trials, obstructs the potential for export of formulations, and many medicinal plants are exported in their crude form or as food supplements. The absence of standardization of methods is adversely affecting growth in exports.

3.7 Demand Trends In Trade

3.7.1 Domestic Market

It is estimated that seventy per cent of India’s population uses traditional medicine (ITCOT 1999), and the rural poor, particularly tribal and other forest-dependent populations have little or no access to other systems of medicine. The success of Dabur, Baidyanath, Himalaya Drugs and Zandu bear testimony to the growing demand for Ayurvedic medicines (see Table 3.4). The Ayurvedic industry has witnessed a steady increase in market share during the last two decades. The major reasons for the expanding domestic market are continuous use by the ever-increasing population and, to a certain extent, a revival of faith in traditional and natural Ayurvedic concepts.
### Table 3.4: Growth In Sales Of Major Manufacturers

<table>
<thead>
<tr>
<th>Company</th>
<th>Sales (Rs. Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dabur India Ltd.</td>
<td>2610</td>
</tr>
<tr>
<td>Zandu Pharmaceuticals</td>
<td>390</td>
</tr>
<tr>
<td>Himalayan Drugs Co.</td>
<td>310</td>
</tr>
<tr>
<td>Baidyanath Ayurved Bhawan</td>
<td>–</td>
</tr>
<tr>
<td>Ajanta Pharmaceuticals</td>
<td>170</td>
</tr>
</tbody>
</table>

**Source: ITCOT 1999**

A 1991 survey conducted by Vaidya Khadiwale of Pune estimated that 509.4 tonnes of raw drugs of 120 species were required for the state of Maharashtra. With an annual growth rate of 18 per cent, the industry figure works out to 8,655.72 tonnes for the year 2000.

Arya Vaidya Sala, Kottakal, the most popular of one of the 1,000 odd pharmacies of Kerala, has an annual demand of 3,000 tonnes of raw material comprising 700 species of medicinal plants worth Rs. 300 million.

The Medicinal Plants Farm Project, a feasibility study done by the Agricultural Finance Corporation in 1995, estimated the raw drug requirement of Kerala to be 92,994 tonnes per annum; this was expected to double by the year 2000.

Chemxcil puts the demand estimates at 31,689 tonnes per annum for 55 species for the whole of India.

Ayurved Drug Manufacturers Association (ADMA) estimates demand of 29,413 tonnes of 110 species for the whole of India. Large variation in the figures from different agencies makes the estimation of demand of medicinal plants at the national level a difficult task, re-affirming the need for a systematic survey.

#### 3.7.2 International Market

The World Health Organization estimates that over 80 per cent of the world’s population relies on traditional plant-based medicine for their primary health care needs (Bannerman et al 1983). During the last decade the demand for medicinal plants has grown significantly in Europe and elsewhere. The international market for medicinal plant-based products is estimated to be US$ 60 billion (Kamboj 2000) and is growing at the rate of 7 per cent per annum.
In Germany and France many herbs and herbal extracts are used as prescription drugs and their sales in the European Union were around US$ 6 billion in 1991 (and probably over US$ 20 billion). In USA, herbal drugs are currently sold in health food stores and had a turnover of around US$ 4 billion in 1996, which was anticipated to double by the turn of the century.

**Table 3.5 Annual Percentage(%) Growth Rates By Region Of The Medicinal Plant Market**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>European Union</td>
<td>10</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Rest of Europe</td>
<td>12</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>South East Asia</td>
<td>15</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Japan</td>
<td>18</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>India/Pakistan</td>
<td>12</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

Source- TAMICSS,p-55

Nutraceuticals (nutritionally or medicinally enhanced foods with health benefits) are in great demand in the developed countries particularly USA and Japan. The nutraceutical market in USA alone is about US$ 80–250 billion, with a similar market in Europe. The Japanese market is worth US$ 1.5 billion (Brower 1998). Such huge markets have arisen because of the Dietary Supplement Health Education Act passed by USA in 1994 that permits unprecedented claims to be made about food or the dietary supplements’ ability to bring health benefits including prevention and treatment of diseases. The annual Herbal Supplement Usage Study for 1997 found out that one in five adults in USA takes herbal supplements (Wood 1997).

### 3.7.3 Export Trends And Potential

The global demand scenario provides a sizeable market potential for the Indian Ayurvedic industry. The major exports from India take place in crude forms. Herbal medicine can be sold in processed form only if the formulation/medicine is registered in the country of import.
Table 3.6: Herbal Medicine Sales In Major Consumer Countries

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Herbal Medicine Sale (US$ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe (1991)</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>3.0</td>
</tr>
<tr>
<td>France</td>
<td>1.6</td>
</tr>
<tr>
<td>Italy</td>
<td>0.6</td>
</tr>
<tr>
<td>Others</td>
<td>0.8</td>
</tr>
<tr>
<td>Europe (1996)</td>
<td>~10.0</td>
</tr>
<tr>
<td>USA (1996)</td>
<td>4.0</td>
</tr>
<tr>
<td>India (1996)</td>
<td>1.0</td>
</tr>
<tr>
<td>Other countries (1996)</td>
<td>5.0</td>
</tr>
<tr>
<td>All countries (1998)</td>
<td>~30.0–60.0</td>
</tr>
</tbody>
</table>

Source-TAMICSS,p-56

Registration requires technical and clinical evidence, which is a lengthy and costly process—hence most Ayurvedic drugs are either sold as para-medicine or food supplements. During 1986–87 India exported crude drugs valued at about Rs. 660 million. During the last decade exports reached the value of Rs. 4.5 billion. A recent Planning Commission report estimates can be raised to Rs. 30 billion by 2005 and to Rs. 100 billion by 2010 (Planning Commission 2000). USA, Germany, UK, France and China/Taiwan are major importers of Indian medicinal plants, together accounting for 75 per cent of total exports (see Table 3.7). The total export value of medicinal plants products in 1991/92 was US$ 3.56 million and in 1994/95 US$ 4.38 million (APEDA 1995). However, these statistics do not account for a huge volume of undocumented illegal medicinal plant trade. The crude Ayurvedic plant species being exported are covered mainly under the heading of ‘vegetable drugs’ in the monthly statistics of Foreign Trade of India.
Table 3.7: Value Of Exports Of Indian Medicinal Plants To Top Eleven Destinations (In Million Rs.)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>11.7</td>
<td>15.5</td>
<td>21.0</td>
<td>8.7</td>
<td>2.07</td>
</tr>
<tr>
<td>China/Taiwan</td>
<td>69.4</td>
<td>131.0</td>
<td>96.6</td>
<td>105.0</td>
<td>54.5</td>
</tr>
<tr>
<td>France</td>
<td>50.9</td>
<td>53.5</td>
<td>58.7</td>
<td>55.6</td>
<td>55.5</td>
</tr>
<tr>
<td>Germany</td>
<td>90.7</td>
<td>124.0</td>
<td>127.0</td>
<td>88.7</td>
<td>130.0</td>
</tr>
<tr>
<td>Italy</td>
<td>16.0</td>
<td>16.4</td>
<td>29.8</td>
<td>22.2</td>
<td>32.6</td>
</tr>
<tr>
<td>Japan</td>
<td>48.4</td>
<td>49.3</td>
<td>36.8</td>
<td>36.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Pakistan</td>
<td>36.3</td>
<td>28.9</td>
<td>45.9</td>
<td>51.6</td>
<td>31.9</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>18.2</td>
<td>34.0</td>
<td>330.0</td>
<td>150.0</td>
<td>11.4</td>
</tr>
</tbody>
</table>


Although India can boast of being one of the biggest reservoirs of plant resources as well as home to a number of traditional health care systems, its share of the world herbal market is quite insignificant. The reason can be largely attributed to -

1) The lack of organization both at cultivator/collector as well as industry level.

2) The absence of standardization methods of both the plants and formulations is adversely affecting the growth of exports. The state of Indian exports can be gauged from the fact that while India earned a meager Rs. 4.5 billion from exports, countries like China and Thailand were exporting to the tune of Rs. 220 billion and Rs.100 billion respectively.

Exports were further affected by a Government of India notification, issued in 1998, banning the export of 53 plants or their parts or formulations, as it was perceived that the exports of these was resulting in their destruction. This was a step towards conservation of these endangered species. However, now the list of plants banned for export as raw drug has been reduced to 29 species, and export of formulations using these species has been allowed.

3.8 The Supply Crisis

The increasing demand for Ayurvedic formulations, both domestically and internationally, is putting considerable pressure on the existing resource base. Various studies have indicated the risk of extinction of valuable species due to industrial demand. Jain (1987) identifies 120 medicinal plants as endangered or rare. FRLHT 1997 has identified a priority list of 285 medicinal plant species of south India; Gupta and Chadha (1995) list 35
important endangered species among the medicinal and aromatic plants of India (quoted in Lambert, Srivastava and Vietmeyer 1997).

The North West Himalayas, an important source of medicinal plants, are under considerable pressure due to high demand. Commercial exploitation is cited as one of the significant reasons for extinction of many species in this area since many species are endemic to the region and grow in specific agro climatic conditions, the possibility of meeting the demand from other regions remains bleak.

Unabated exploitation of medicinal plants, and its effect on the supply-demand cycle is becoming apparent to the industries. The export market can influence the demand for a certain species drastically. Species which are exclusively extracted for the export market are often high value-high risk items and extremely vulnerable to fluctuation. They also have very high impact on the availability of the species in the wild.

3.8.1 Coping with the Demand Supply Gap

Efforts are being made by traders, industry, government as well as non-government organizations to cope with dwindling supplies and the threat of extinction. These include attempts to enhance supplies, both in-situ and ex-situ; reduce demand by using substitutes; diversify the supply base by resorting to imports; and regulate exports.

A) Using Sustainable Harvesting Methods

Evolving sustainable harvesting methods is much easier for species whose flowers, fruits or leaves are used. However, in common practice even these species are indiscriminately harvested, mainly due to ignorance and lack of awareness towards conservation issues.

Simple measures like leaving behind one third of the roots/rhizomes collected; leaving the smaller, new bulbils while extracting rest of the plant, for regeneration (as in Aloe vera); collection of fruits only when ripe and not destroying the trees in the process (Emblica officinalis); and not removing all the flowers, could enhance sustainability considerably.

There have been very few studies or research on sustainable harvesting methods.

B) Substitution Of Raw Material

The Ayurveda literature prescribes the use of certain alternative species as substitutes in case of non-availability of the species prescribed in the formulations. This practice of using substitutes is increasingly being followed whenever a species becomes scarce or extinct. The drug manufacturers largely depend on Bagbhatt’s directions (Ashtanga Hridayam Samhita) for determining the substitutes. For instance, the eight roots that form ingredients
of the drug Astavarga are jeevaka (Microstylis nucifera), rishbhak (Microstylis wallichii), kankoli (Roscorea procera), kshira-kankoli (Roscorea alpina), meda (Polygonatum verticillatum), Riddhi (Hebenaria acuminata) and vridhi (Hebenaria intermedia), which are now very rare in distribution. In the absence of adequate supply of priority species, alternate species such as bidari-kand (Pueraria tuberosa) is used at present for jeevaka, asgandh (Withania somnifera) for kankoli, kali musli (Curculigo orchioides) for kshirakankoli and taradi (Dioscorea bulbifera) for meda and maha-meda roots in the Astavarga drug. It is apparent that for the survival of the wild populations, either alternative species should be explored to supplement. (TERI web site: www.teriin.org)

C) Import Of Medicinal Plants

Indian markets are heavily supplied by plants from surrounding SAARC countries, especially Nepal and Bhutan. The import of species takes place through both legal and illegal means. The trade in medicinal plants from rural areas of Gorkha district was investigated over a two-year period. The annual trade varies from 180,000 kg to 418,000 kg and consists of 36 species. Approximately 98 per cent of these products are exported to India in unprocessed form (Olesen and Hellens 1997) Many plants of Tibetan origin have entered India following ancient trade routes through the corridors of Nepal and Bhutan. Most endangered species should be imported as alternate source of raw material.

D) Industry’s Response To The Supply Crisis - Cultivation

The soaring export market and increased domestic demand coupled with uncertainty and scarcity of raw materials, adulterated materials obtained through traders, and government restriction on export of some species collected from the wild has encouraged some of the big Ayurvedic manufacturers to opt for cultivation. Although the inaction of many of the pharmaceutical companies indicates their apparent lack of concern about the depleting resources, some major players have initiated steps in the desired direction.

More than 25 companies in the private sector are engaged in nursery development, generation of planting material and seeds, development of agricultural techniques for cultivation of medicinal plants and also initiating and encouraging cultivation of medicinal plants by contracting them to farmers. Cultivation of medicinal plants, in direct partnership with local farmers and tribal women is the key to this. (TAMICSS)
**Cultivation of Medicinal Plants:**
According to Down to Earth, a number of studies have shown that the cultivation of medicinal plants can be very lucrative, but at present the cultivator has to take the risk of the whole enterprise him/herself (Down to Earth 2001). No systematic work has been recorded for non-industrial medicinal species or of growing these in rain fed poly-cultures which would be more suited for the vast majority of small farmers.

**Benefits From Cultivation**
The small and marginal farmers would be unable to benefit in view of the high inputs required to sustain productivity. (The tribal and forest-side people would continue to collect medicinal plants, legally or illegally, because their cash economy and several livelihood requirements are linked to this activity. Many pharmaceutical companies, especially small-scale ones, prefer wild collected species because of their superiority and lower costs (no cultivation costs are involved) and smaller requirements. Thus cultivation of medicinal plants, while it may meet bulk industrial requirements and benefit large farmers (through economies of scale), it might not benefit poorer sections of rural communities and may actually further impoverish the tribal and forest-side people. On one side, hasty strategies to promote cultivation of medicinal plants may lead to the undesired side effects on tribals and rural poor. On the other side conservation of medicinal plants from the clutches of collectors who have no formal training in sustainable harvesting are posing great threat to forests in years to come. Measures of ex situ conservation that bypass the primary stakeholders in the NTFP economy are unlikely to conserve medicinal plants in the forests over the long term. (TAMICSS)

**The Industry Has Identified Various Constraints Regarding Cultivation Of Medicinal Plants:**
1. Urbanization and reduction of fertile soil
2. Land Ceiling Acts
3. Lack of agro technology
4. Inadequate support in wastelands development
5. Infrastructural issues for research and development
6. Economic feasibility
3.9 Overcoming Adulteration
In addition to these attempts to address the demand-supply crisis, there is one long-established response that represents an unofficial, illegal response by sections of the industry. The widespread occurrence of adulterants is one of the most striking aspects of the medicinal plants trade, underlining the absence of an effective mechanism of regulation, quality control or standardization. An ‘adulterant’ is an entirely different species to the original prescribed, which does not necessarily possess similar properties as the original, but which is passed off as the original. The processes employed in producing adulterants are subject to much secrecy. This poses major challenges to any market-based intervention in the trade, as well as to any attempts to integrate traditional medicine into the mainstream health services.

3.10 Strengthening Legalized Market System
Besides government agencies, there are numbers of stakeholders ranging from herb gatherers, local middlemen, urban traders, wholesalers, manufacturers, exporters and herbal healers in the medicinal plants trade sector. The marketing system in medicinal plants sector is largely unregulated and inequitable. The medicinal plant collectors are generally the marginal farmers and labourers. They get cash income to meet their basic requirements for food, health and children education by selling medicinal plants. They are often unaware about the real market prices of many medicinal plant species. Generally, in medicinal plants sector, there is a top down approach and even the many stakeholders at the bottom are not aware of the rising demand of their product and the availability of its market. In some villages of Chamoli district of Uttaranchal, the farmers had cultivated Kut (Saussurea costus) and Dolu (Rheum emodi) but they were unable to sell them due to lack of knowledge on the marketing system. Conversely, many medicinal plant species are traded through illegal channels.

3.11 Problems /Constraints In The Medicinal Plants Sector Are:
1) Slow rate of production of many medicinal plants
2) Long gestation period
3) Shortage of suitable cultivation technology
4) Production of small quantity
5) Unscientific harvesting
6) Lack of research on the high yielding varieties
7) Inefficient processing techniques
8) Fluctuation in demand and supply
9) Poor quality control procedures
10) Scarcity of good manufacturers
11) Poor marketing infrastructure,
12) Poor coordination among different stakeholders

On many occasions, the wild medicinal plants are preferred by manufacturers compared to the cultivated ones, as there is a general feeling that wild plant species contain better chemical contents. The variation in chemical contents also depends upon the harvesting seasons of species and different stages of species growth. The medicinal plant sector is largely less documented and inadequately regulated. The economy generated by this sector is therefore, not precise because of the enormous illegal trade.

3.12 Prospects/Opportunities In Developing The Medicinal Plants Sector

1) For developing the 'herbal industries', the northern India possesses a rich diversity of medicinal plant species across the various forest types. Such a high diversity of medicinal plants would be helpful for further scientific research on exploring their medical efficacy, value addition, and use in curing various old and new diseases. India has already established a reputation as a low-cost manufacturer of high quality generic drugs in the global market. This fact can be used as an important tool for the marketing of herbal products produced in India. It is expected that India's aim to build a golden triangle between traditional medicine, modern medicine, and modern science will be a boon for developing the traditional herbal medicine and the medicinal plants sector and ensure supply of quality planting material.

2) Expansion of selected medicinal plants farming areas,

3) Value addition in harvesting, processing and marketing of medicinal plants, and

4) Developing innovative marketing mechanism.
3.13 Problems & Prospects In Manufacturing Of Ayurvedic Products Due To Issues In Raw Material & Its Impact On Ayurvedic Industry

1) Raw Material Sourcing Cultivated Vs. Wild-Harvested Material

Collection of medicinal plants, is a way of life with tribal and rural communities in an around the forest. As the prices paid to the gatherers tend to be very low, they often "mine" or destructively harvest the natural resources as their main objective is to generate an income. An important factor in the wild harvesting is the availability of cheap labour to undertake the very labour intensive work of gathering. Income from such sources represents the only form of paid employment for rural and tribal people, and hence there is an eagerness to undertake such work.

TRAFFIC estimates that nearly 75% of all botanical species in trade continue to be sourced from the wild (Robbins, pers. comm., 2001). Notably, species coming from developing countries even those with large volumes in the trade - are much more commonly wild harvested than those from developed countries.
In general, in India, the trend is towards a greater proportion of collected raw material. Herbalists and smaller companies will often prefer the quality of wild harvested material. Even majority of companies, including the mass market over-the-counter pharmaceutical and vitamin companies which have moved into this business, as well as the larger herb companies, prefer collected raw material. This is not due to non-sensitivity towards conservation, but rather because collected material offers the following benefits over cultivated source:

**Collected Source**
1. A reliable supply can be guaranteed over time
2. Availability is throughout the year.
3. Raw material can be obtained at a reasonable price.
4. Volume requirements can be met easily.

**Cultivated Source**
1. A reliable supply and volume, at an agreed price, can be guaranteed over time;
2. Quality control can be better ensured (correct species, unadulterated material, known input of pesticides, fertilizers, etc.);
3. The active compound content can be more easily standardized; and
4. Material can be certified organic or biodynamic

Easy & continuous availability of medicinal plants is one of the major factors, which determines the growth of Ayurvedic industry. Though Ayurvedic medicines do contain the food items like jiggery, spices, cardamom, oils, sugar, salt, milk, ghee, animal products, preservatives, honey, fresh & dry fruits, around 80 – 85% of the total raw materials are plant based or in one or the other way related to plant materials. As the nature of the industry is concerned, adequate & timely provision of raw materials & quality of the raw material are most important for the manufacturing units.

Given the demands of the market for a continuous and uniform supply of raw materials, and the increasing depletion of the forest resource base, expanding the number of medicinal plants in cultivation appears to be an important strategy for research and development. However, according to one estimate, of more than 400 plant species used for production of medicines by Indian Industry, less than 20 are currently under the cultivation in the country.
Facts: Collected And Cultivated Source

1. The potential returns to the farmer from cultivation of medicinal plants are reported to be quite high. A 1995 study suggested that the cultivation of certain high altitude Himalayan herbs could yield products priced anywhere between Rs. 7,150 to 55,000 per hectare although it is not clear at which point in the marketing chain these prices are paid.

2. What is clear however is that although estimates of returns vary widely, medicinal plants can be valuable crops. 3. Reported average annual (per hectare) income of Rs. 120,000 through mixed cropping of high altitude medicinal herbs. High altitude medicinal plants tend to command higher prices but those of lower altitudes are still significant.

4. Cultivation is clearly a sustainable alternative to collection of medicinal plants from the wild.

5. Due to pressure of population, the cultivation of food grains and commercial crops has progressively practically eliminated locally growing medicinal plants and because of the vast changes in the social system, the family traditions have also become weak. Given the rapidly increasing demand, there is tremendous pressure on the supply base. This has reached crisis point for some species. It is reported that certain species of medicinal plants have already become extinct through over-harvesting, and other species are endangered.

Drug manufacturers make use of alternative species when the ‘first choice’ is no longer available. However, there are reports that even some of the ‘second best’ alternatives are now facing extinction. Further, there are concerns about maintaining the quality of supplies.

Short-Term Solutions To The Supply Crisis Appear To Be Limited:

1. Cultivation is appropriate for only certain species and will not, in any case, prevent collection from the wild by those who depend on such activities for their livelihoods.

2. The potential for organization at the community/collector level needs to be explored, as also the possibility of ensuring better returns to primary collectors through value addition at the local levels.

3. Organization and control of production may also be encouraged if consumers or retail buyers express preference for supplies that derive from socially and environmentally sustainable production.

4. While it may be some time before the extent of such preferences encourages large-scale changes in production, this paves the way for the introduction of market-based instruments
as a mechanism for meeting consumer demand while ensuring sustainable production of medicinal plants which have almost become extinct.

In order to move towards a system of sustainable management of medicinal plants, there is a need to address a number of issues, including the following:

a) Better information on the current status and potential production of medicinal plants,
b) To provide a baseline from which strategies for sustainable production may be developed;
c) More transparent supply chain information in order to improve the bargaining power of those near the start of the chain, and to help ensure good quality materials for the ultimate consumers;
d) Organization of collectors at the local level that might help to put in place mutually enforced codes of collection and sharing of marketing benefits.
e) The development of criteria and indicators for the sustainable management of the forests or other landscapes in which medicinal plants are found can help to define good practice, and can be applied to measure progress towards sustainable management.

Application of criteria and indicators for sustainable management and supply of medicinal plants to industry may help to address some of the needs identified above; but it has to be driven by voluntary approaches of the collectors (generally the weakest party); by regulations (dependent on enforcement capacity) or by buyers (who will probably want proof of sustainable management through third party certification). The application of criteria and indicators for certification of raw material and products would primarily benefit the collector and the end-user. The market value—or more probably, market access for certified products would be greater if the industry could ensure sustained supply. So, while overall volumes of plants harvested under sustainable management would likely be lower, the price and market access would be enhanced. Certification of medicinal herbs will be feasible in India, only when collection/cultivation areas are subject to control by a recognized ‘manager’. If, in due course, it is applied, it may add to the cost of raw materials and may be reflected ultimately in the price of the products. However, this will ensure ecological, social and economic sustainability. Training and education of both consumers and producers is need of the hour.

**Possible Steps To Ensure Sustainable Supply Of Medicinal Plants:**

i) Increase in the extent of forest and tree cover
ii) Maintenance
iii) Conservation and enhancement of biodiversity;
iv) Maintenance and enhancement of ecosystem function and vitality;
v) Conservation and maintenance of soil and water resources;
vi) Maintenance and enhancement of forest resource productivity;
vii) Maintenance and enhancement of social, cultural and spiritual benefits;
viii) Optimization of forest resources utilization;
ix) Adequacy of policy, legal and institutional framework.

The set of criteria and indicators are potentially a reliable tool for measuring the success of conservation and development measures, as it will simultaneously indicate the social, economic and ecological contribution of medicinal plants. Despite the great contribution medicinal plants are making in local health care and the economic benefit flowing through trade and exports, not much of this contribution is documented. With the use of tools mentioned above, the value of medicinal plants would be highlighted, and so also their contribution to India’s gross national product. This would provide an opportunity to increase sustainable production of medicinal plants.

3.14 Concerns In Manufacturing With Regard To Raw Material And Their Possible Solutions -

1) Medicinal Plant Resource Base

Medicinal plants are living resource, exhaustible if overused and sustainable if used with care and wisdom. At present 95% collection of medicinal plant is from wild. Current practices of harvesting are unsustainable and many studies have highlighted depletion of resource base. Medicinal plants based industries although old and vast are still being managed on traditional ways and practices and lack a proactive and socially responsible image. To some extent manufacturers are responsible for inefficient, imperfect, informal and opportunistic marketing of medicinal plants resulting into shaky situation of raw material supply unsustainably and exploitatively. Trade today in medicinal plants is vast, secretive and largely unregulated, mainly from the wild which continues to grow dramatically in the absence of serious policy attention with environmental planning.

Substandard Medicinal Plant Material (Raw)- Due to increasing demand of Ayurvedic medicines & raw materials, the traders as well as Ayurvedic manufacturers are using substandard medicinal plant material (raw) to manufacture crude/ bulk medicines. During
the survey of the traders, collectors it was found that they are supplying substandard raw material for making Ayurvedic medicines. There are no strict rules, policy, Govt. check etc., in this regard. Ayurvedic industries are manufacturing huge quantity of medicines to meet the increasing market demand without considering the quality. Most of the people involved in the trade are substituting costly Safed musli (Chlorophytum borivillianum), Baibidang (Emblia ribes) Kali haldi (Curcuma caesia), Satawar (Asparagusracemosus) etc. with other similar type of inferior medicinal plants.

2) Lack Of Correct Identification: Due To Lack Of Correct Identification, Similar Looking plants are collected from the field site along with the genuine medicinal plant by mistake. But many times similar looking (inferior) cheap alternatives are intentionally mixed along with some quantity of genuine plant. This may be due non-availability of the genuine medicinal plant in the large quantity. Confusion exists in the identification of plant materials where the origin of a particular drug is assigned to more than one plant, sometimes having vastly different morphological and taxonomical characters.

3) Adulteration: Generally the soil gets adhered with the medicinal plant or its useful part at the time of collection from the field. This renders the medicinal plants adulterated by soil. Due to lack of proper post collection care, the collected medicinal plants lose their pharmaceutical efficacy. After collection from the field, the medicinal plants are sold in local markets/middle man, 'mandi' sooner or later. The collected plants are kept in direct sun/rains, in sub-standard godown, having dust, fungus, termites and rats etc. which adversely affect the medicinal properties.

It was also observed that the adulterators not only mix similar species but also cheap and inferior quality produces such as rotten or substandard products which can be procured at very cheap rates. Like safed musli being adulterated with lesser priced Asparagus, rotten aonla powder in triphala, and so on... and as a result, the Ayurvedic drugs lose their efficacy. When the identity of plant sources is doubtful or still unknown, the adulteration is common in such cases. The true source of the crude drug in such cases can be located only after detailed chemical and pharmacological studies. Detailed chemical investigation on Bacopa monnieri and Centella asiatica, the two plants variously described the name "Brahmi" has revealed entirely different phytochemical composition. The former contains alkaloids brahmine, herpestine, gama amino butyric acid and bacoside A & B which have
been found to have important action on brain function, while Centella asiatica contains asiaticoside, brahmoside, hydrocotyline etc. which have hardly common relationship with the properties ascribed to the drug "Brahmi" in the text.

Adulteration is taking heavy toll on the credibility of Ayurvedic system and medicines.

4) Safety And Quality Of Raw Medicinal Plant Materials: The quality of medicinal plants depends on the geographical origin, time and stage of growth when collection has been done and post harvest handling. The collections in most cases are done by villagers, tribals residing in the vicinity of forest in their spare time. The plant part is collected without paying attention to the stage of maturity, dried haphazardly and stored for long periods under unsuitable conditions. The quality of collected material, as such is often degraded. Thus one of the primary concerns of the industry is the quality of raw material. This presents a major challenge due to the prevailing secrecy in the Ayurvedic industry and the adulteration of raw material. The safety and quality of raw medicinal plant materials and finished products depend on intrinsic (genetic) or external (environment, collection methods, cultivation, harvest, post-harvest care, transport and storage practices) factors. Inadvertent contamination by microbial or chemical agents during any of the production stages can also lead to deterioration in safety and quality. Medicinal plants collected from the wild may be contaminated by other similar looking species or plant parts through misidentification, accidental contamination or intentional adulteration, all of which may have undesirable consequences. Taking into consideration to the above issues, raw medicinal plant quality, adulteration and related problems need to be addressed immediately.

(Source: Executive Summary of a recent research & development project on Quality of raw medicinal plants of central India)

5) Collected Source Of Raw Material: Trade in medicinal plants at all levels in India is marked by secrecy and opacity in working. The industry must develop a long term "social contract" with the collectors or growers & buyers. 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 Government of India has put 29 species in the negative list of export which are believed to be threatened in the wild.
6) **Cultivated Source:** The other main source of medicinal plant is from cultivation. Cultivated material is definitely more appropriate for use in the production of drugs. Standardization is a must, whether for pure products, extracts or crude drugs as quality requirements continue to become more stringent.

With higher cost of cultivated material, cultivation is often done under contract. In the majority of cases, companies cultivate only those plant species which they use in large quantity or in the production of derivatives and isolates, for which standardization is essential and quality is critical. Recently growers have set up cooperatives or collaborative ventures in an attempt to improve their negotiating power and achieve higher price.

3.15 **Constraints Associated With The Processing Of Medicinal Plants Resulting In Reducing Competitiveness In Global Markets And Need Attention Are:-**

A) Poor agricultural practices
B) Poor harvesting (indiscriminate) and post-harvest treatment practices
C) Lack of research on development of high-yielding varieties, domestication etc.
D) Poor propagation methods
E) Inefficient processing techniques leading to low yields and poor quality products
F) Poor quality control procedures
G) High energy losses due to processing
H) Lack of current good manufacturing practices
I) Lack of R&D on product and process development
J) Difficulties in marketing
K) Lack of local market for primary processed products
L) Lack of trained personnel and equipments
M) Lack of facilities to fabricate equipment locally
N) Lack of access to latest technologies and market information

Systematic cultivation of many medicinal plants needs specific cultural practices and agronomical requirements. These are species-specific and are dependent on soil, water and climatic conditions. Hence research and development work has to be done to formulate good agricultural practices which will include appropriate selection and identification, propagation methods, cultivation techniques, harvesting, stepwise quality control of raw material up to processing stage, post-harvest treatment, storage and safety. These aspects have to be incorporated into protocols for the cultivation of medicinal plants.
Organic farming is another practice that is gaining wide acceptance as world demand particularly in developed countries for organically grown crops is rapidly on the increase. Organic farming which is labour-intensive gives the developing countries the comparative advantage to be competitive. Farmers have to be trained in all aspects of organic farming of medicinal plants including obtaining certification from associations that do the monitoring starting from cultivation to final harvesting.

It is time to wake up and act or else, India will lose its age old credibility and traditional heritage of Ayurveda in the years to come!