RESEARCH STUDY ON MEDICINAL PLANTS

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RESEARCH STUDY ANALYSIS OF MEDICINAL PLANTS PRODUCTION FOR IMPORT SUBSTITUTION AND VALUE ADDED PRODUCTS FOR EXPORT-FEASIBILITY AND CONSTRAINS

Outlines

Summary

Islamic Republic of Pakistan is bestowed with **6000** plants as flora of Pakistan. Among flora of Pakistan **600** plants are registered as medicinal plants and among these **135** medicinal plants are being extensively utilized in traditional medicine practices. Pakistan imports **30** high economic valued medicinal plants and their products on expenditure of national exchequer recorded / estimated up to USD **216.392** Millions in year **2020**. Medicinal plants and products are exclusively used as neutracetical products, pharmaceutical agents, industrial products and also in various food products. Among domestic production of medicinal plants did not meet the national demand of medicinal plants because of increasing demand of medicinal plants and its processed products like crude extracts etc. Comparative analysis of exported medicinal plants values subtracted from imported volume of medicinal plants in previous four years from **2017-2020** reveals balance remained negative up to **-42%** volume for exports which is required to balance import volume. Export of medicinal plants to increase up to **42%** is required to balance exports and import volume. Global market for medicinal plants and products in **2020** was USD **217** Billion and expected to reach USD **500** Billion with annual growth of **9%** till **2050**. Medicinal plants are good alternate source of revenue generation for farmers and nations economy. Pakistan lingers behinds in field of medicinal plants cultivation. Wild collection of medicinal plants without expertise to collection and post-harvest techniques to preserve quality of medicinal plants is being practiced by native residents. Pakistan has increasing demand of medicinal plants because of public interest and high number of registered practitioners up to **60,000** registered by National Council for Tibb (NCT). Medicinal plant education is popularizing with name of Eastern Medicine and HEC has recognized and revised the professional education levels up to Ph. D in Eastern Medicine in which ten public and private sector universities are offering education in medicinal plants knowledge and practice. Drug Regulatory Authority of Pakistan **(DRAP)** Directorate of Health & OTC is concerned division for regulation of medicinal plants products development in Pakistan. Negative impact of H&OTC Division on domestic medicinal plant product was observed because of no expert person of Medicinal plants knowledge like Eastern Medicine were given charge of whole division of H&OTC resulted in collapse of small industry of medicinal plant within the country. Medicinal plants could be a source of revenue specifically if given status of minor crops in Pakistan. Selected **50** extensively utilized medicinal plants cultivation at **156,668** acres can substitute USD **216.392** Million import bill. Value addition unit installation could enhance exports of the country. Among

116 extensively used medicinal value added products, Pakistan has natural potential of **39** products production and remaining products can be produced with exclusively promotion strategies. PHDEC is currently focusing on medicinal plants cultivation strategies and intercropping techniques getting expertise from medicinal plant and cultivation expert from the College of Conventional Medicine (UCCM) Islamia University of Bahawalpur (IUB) to launch a medicinal plant cultivation program to facilitate farmers, industrialist and exporters to promote national economy through development of medicinal plants and value added products within the country. PHDEC recommends cultivation and intercropping of Moringa, Withania, veteveria, guar, lavender, jasmin, orchis, salep, star anise, emblica, turmeric, ginger, English ivy, cranberry, blueberry, chemomile, black pepper, caraway, fennel, licorice, ginko, asparagus, bell, cardamom, saffron, tea plant. PHDEC also recommends establishment of facilitation center for farmers, research and development center for development of seeds and germplasm, placement of experts of medicinal plants (Eastern Medicine) in H&OTC division of DRAP, investor friendly policy for attracting foreign investors as well local investors to invest in installation of value addition units like essential oil extraction unit, gum extraction units, powder extraction units, distillation extraction units to boost value addition of medicinal plants.

DOMESTIC PRODUCTION - MEDICINAL PLANTS

Scenario in Pakistan:

In Pakistan, the usage of herbal medicine is ingrained in the culture. Botanical, herbal, and mineral medicine are used by individuals as an alternative and supplementary therapy for a wide range of causes. Patients who are afraid of the adverse effects of allopathic drugs benefited from phytopharmaceuticals, which are a moderate and gentle technique of treatment. The second group consists of people who, as a first step, would like to treat themselves and prescribe herbal medicine based on their medical history and previous treatment and illness experiences. Herbal medicine is preferred by almost everyone in Pakistan, without exception. Some herbal products are ingested because herbs often include important elements such as vitamins and minerals for vitality and to maintain a healthy state of affairs in the body. As a result, herbal medicine is accessible that is more effective and has fewer adverse effects like fever. Surprisingly, several clinically verified herbal treatments are being sold as allopathic medicine, and some herbal elements have even made their way into the formulation of allopathic dosage forms. More than **432** registered companies are actively generating medicinal plant products within the country. These reflect the flourishing market for plant-based health products, the growing diversity of accessible medicinal plant preparations, and a broadening of the consumer base derived by the growing view of plant preparations as safe alternatives to traditional pharmaceuticals.

According to the recently published ***Flora of Pakistan***, Pakistan has **6000** registered plant species, **600** of which are registered medicinal plants that are found throughout the country. Despite having a diverse natural flora with therapeutic characteristics, Pakistan lacks the necessary infrastructure to manage, categorize, and facilitate the production of significant medicinal plants. Pakistan's industrial sector is reliant on imported medicinal plants and products, including extracts of medicinal plants imported from all over the world, which is putting a strain on the country's economy and depleting its foreign reserves. Pakistan imported medicinal herbs, edibles, roots, and tubers worth around $**3** billion dollars. This is causing an imbalance in Pakistan's import-export ratio.

The World Health Organization (WHO) and the United Nations Industrial Development Organization (UNIDO) are actively involved in the industrial development of medicinal plants-based industries in order to scale up production of phytopharmaceuticals and process technologies for phytomedicine growth. UNIDO has expanded its technology transfer facilities for the industrial

organization of medicinal plants to create phytomedicine, traditional medicine, intermediates and isolates, standard extract, aromatic Chemicals and essential oils, and innovative formulations.

To address the demand for natural herbs or herbal extracts, Pakistan has **759** registered importers from DRAP **(As per given data by H&OTC Division).** To fulfill the demand for natural products, the manufacturing of natural products had to rise, which necessitated the use of medicinal plants or extracts of herbs. Imported commodities meet the majority of demand, at the expense of the national foreign reserve. This need can be met domestically to the extent to country's capacity. Cultivation will boost GDP and increase exports of raw herbal goods, which will meet the needs of the country's domestic manufacturers. As a result, imports will be replaced and supplemented and added with increase in exported item to enhance GDP. Medicinal plants produced within the territory of Pakistan can be listed in the following table according to high demand among all medicinal plants. These medicinal plants are extensively used in traditional medicine within the country.

Data extracted from the E-flora Pakistan (http://www.efloras.org/flora_page.aspx?flora_id=5).

Table 1. Important Medicinal plants produced in Pakistan with high market demand along with their uses and place of production:

No.	Scientific Name	Local / English name	Uses	Production area
1.	*Cassia fistula* L.	Amaltas / Golden shower tree	Laxative, fever, cough, itching of skin, constipation skin diseases, jaundice, sore throat, piles, intestinal worms, paralysis, rheumatism	Punjab, Sindh
2.	*Bryophyllum pinnatum* (Lam.)	Zakhm-e-hayat	Wound healing, piles	Punjab, KPK
3.	*Mimosa pudica* L.	Lajwanti/ Touch me not	Piles, wound healing, skin diseases	North Punjab
4.	*Sesamum indicum* L.	Till/ Sesame seeds	Piles, throat problems, chest problems, substitute of ghee, hair dye, flavoring agent, food, diabetes, blood pressure	Punjab, Sindh, Balochistan, KPK
5.	*Eruca sativa* Mill.	Taramira	Lice repellent, bleeding piles, ear pain, constipation	Central Punjab,

6.	*Trigonella foenum-graecum* L.	Methi/ Fenugreek	Reduce cholesterol, reduce risk of heart, control sugar level, digestion, aid in heat burn, lose weight, fever, sore throat, reduce skin problem, reduce hair problem, constipation, blood pressure	Punjab, Sindh, Balochistan, KPK
7.	Cinnamomum tamala (Ham.)	Tez patta/ Indian bay leaf	Paralysis, oil massage, flavor in cooking, muscle pain, constipation	North Punjab, KPK
8.	*Rosa indica* L.	Gulab/ Rose	Constipation, gulqand made of rose flowers, beneficial for liver, throat problems, cough, attar, swelling of eyes	Punjab, Sindh, Balochistan, KPK
9.	*Papaver somniferum* L.	Khashkhash/ Poppy seeds	Constipation, swollen joints, provide strength to brain, diarrhea,	Balochistan, KPK
10.	*Foeniculum vulgare* Mill.	Saunf/ Fennel	Digestion, pain, cough, weight loss, constipation, heat stroke	South Punjab, Sindh
11.	*Limonia acidissima* L.	Katha/ Wood apple	Fever, constipation, swelling, itching of skin, purify blood	Sindh
12.	*Ribes nigrum* L.	Munakka/ Black currant	Anemia, provide strength to body, constipation, sore throat, jams, ice creams, jellies, flavoring agent	Balochistan, Punjab
13.	*Prunus domestica* L.	Alu Bukhara/ Plum	Relief of inflammation, improve thirst, digestive system problems, flu, constipation	KPK, Gilgit Baltistan
14.	*Viola odorata* L.	Banafsha/ Sweet violet	Fever, cold, cough, constipation, throat problems, digestion, gulkand	AJK, GB, KPK
15.	*Lallemantia royleana* (Benth.)	Tukhum Balangu/ salvia	Improve thirst, provide strength to heart, constipation, flavoring agent	South Punjab, Sindh
16.	*Moringa oleifera* Lam.	Sohanjna/ Malungai	Enhance appetite, pain, paralysis, break kidney stones, throat swelling, cold	South Punjab, Sindh
17.	*Ferula assa-foetida* L.	Hing/ Asafetida	pain (headache), help in digestion, liver and stomach problems, improve appetite,	Sindh, Balochistan

			tooth ache, breathing problems, epilepsy, cough, Reduce acidity,	
18.	Boswellia carterii	Loban/ Gold-frankincense	Cough, joint pain, provide strength to brain, preservative,	KPK, AJK
19.	*Mentha arvensis* L.	Podina/ Mint	Oral infection, stomach pain, diarrhea, cold, cough, digestion	Punjab, Sindh, Balochistan, KPK
20.	*Ziziphus jujuba* Mill.	Unaab/ Jujube	Achy throat muscles, fever, flu, cough, skin care products	South Punjab, Sindh
21.	*Trichodesma africanum* (L.)	Gaozuban/ Bee plant/ borage	Flu, cough, strengthen memory power	North Punjab, KPK, AJK
22.	*Cordia latifolia* Roxb.	Lasura	Cough, sore throat, food, pickle, diabetes	South Punjab, Sindh
23.	*Solanum nigrum* L.	Mako/ Black night shade	Liver disorders, Ulcer and skin diseases, liver ailments, asthma, cough, small pox	Panjab, Sindh, KPK
24.	*Trapa natans* L	Singhara/ Water chestnut	Pain, swelling, weight gain, measles, dehydration, cough, cracked heels	Central Punjab, North Punjab. Sindh, KPK
25.	Glycyrrhiza glabra	Mulathi/ Licorice	Cough, digestion, heart diseases, sore throat, depression	North Punjab, KPK
26.	*Echinops echinatus* Roxb.	Barham Dandi/ Camel thistle	fever, blood purifier, wound healing, cough	South Punjab, Central Punjab
27.	Swertia Chirayita	Chirata/ Bitter stick	Skin diseases, washing wounds, liver disorders, fever, cough, flu	Central Punjab, North Sindh
28.	*Fagonia cretica* L.	Dhamasa	Fever, gums disorders, blood purifier, heart	Punjab, Sindh, KPK
29.	*Curcuma zedoaria* Rosc.	Kachur/ White turmeric	Improve appetite, throat pain, cold, cough, fever, pimples, blood pressure	Central Punjab, Sindh, KPK
30.	*Calotropis procera* R	Akk/ Milkweed	Asthma, cough, typhoid fever, kidney and gall bladder stones, joint pain, mosquitoes repellent	Punjab, Sindh, Balochistan, KPK
31.	*Achyranthes aspera* (L.)	Puthkanda/ Prickly caff-flower	Cough, Asthma, Removing kidney stones, diuretic, laxative, stomachache	South Punjab, Sindh,

32.	*Cochlospermum religiosum* (L.)	Gond katira/ Tragacanth	Thickening agent, heat stroke, laxative, provide energy	Punjab, Sindh, Balochistan, KPK
33.	*Jasminum officinale* L	Chambeli/ Jasmine	Relief from pain, skin problems, blood pressure, ubtan, relief from toothache, hair oil, Perfumery	Punjab, Sindh, Balochistan, KPK
34.	*Azadirachta indica* A.	Neem/ Paradise tree	Mosquito repellent, skin problems, blood purifier, toothpaste, diabetes, Pimples, insect repellent	Punjab, Sindh, Balochistan, KPK
35.	*Nelumbo nucifera* Gaertn	Kanwal/ Lotus flower	Pimples, asthma, diarrhea, fever, complexion, inflammation of skin	KPK, GB, North Punjab
36.	*Carica papaya* L.	Papaya/ Pawpaw	Typhoid, stomach upset, malaria, diarrhea, body pain, jaundice, blood purification, asthma, acne	Punjab, Sindh
37.	*Syzygium cumini* (L.)	Jaman/ Black plum	Diabetes, acne, for oily skin, motion, ulcers, fever	South Punjab, Sindh
38.	*Crocus sativus* L.	Zafran/ Saffron	Provide strength, for skin beauty, diabetes, as a diuretic, asthma, cold	AJK, GB
39.	*Curcuma longa* L.	Haldi/ Turmeric	Dark circles and wrinkles, cold, throat problems, liver disorders, heal wounds, joint pain, condiment	Central Punjab
40.	*Citrullus colocynthis* (L.)	Tumah, Toorh/ Bitter apple	Constipation, eye sight, diabetes, weakness	South Punjab, Sindh
41.	*Cuminum cyminum* L.	Zeera/ Cumin	Spice, diabetes, as a flavor, lowering high, blood pressure, digestion, diarrhea	South Punjab, Sindh
42.	*Pueraria tuberosa* (Roxb. ex Willd.)	Bidarikand/ Indian kudzu	Weakness, Improve Appetite, headache, diabetes, Fever, diarrhea	North Punjab, KPK
43.	*Coriandrum sativum* L.	Dhania/ Coriander	Oral infection, stomach pain, diarrhea, cold and cough, digestion	Punjab, Sindh, Balochistan, KPK
44.	*Morus nigra* L.	Toot siyah/ Black mulberry	Throat pain, regulate blood sugar, cleanses blood, improve thirst, Jam, Jellies, Heart health	North Punjab, KPK, AJK

45.	*Eucalyptus globulus* Labill	Safeda/ Eucalyptus	Arthritis, relieves pain, construction, dental problems, fever, low blood sugar	Punjab, Sindh, Balochistan, KPK
46.	*Illicium verum* Hook	Badian/ Star anise	Rheumatism, Digestion, breathing problem, flavoring in tea, flu, pain in intestines	KPK, AJK, GB
47.	*Nigella sativa* L.	Kalongi/ Black cumin	Stomach problems, Dandruff, digestion, migraine, asthma	Punjab, Sindh
48.	*Salvia plebeian*	Kamar kas/ Sage	Diarrhea, Dysentery, fever, provides energy	North Sindh, Punjab
49.	*Sapindus mukorossi* Gaertn	Reetha/ Soap nut	Malarial fever, washing clothes, hair loss and dandruff, skin care, jewelry polish	Punjab, KPK
50.	Mallotus philippensis	Kamala/ Monkey-face tree	Healing wounds, earache, dry hair, dandruff, abdominal diseases	KPK
51.	*Datura stramonium* L.	Datura/ Jimson weed	Relieves pain, wound healing, Dandruff, stimulate hair growth, asthma	Punjab, Sindh, Balochistan, KPK
52.	*Prosopis juliflora* (Swartz) DC.	Kiker/ Babul tree	Diarrhea, substitute for soap, Used in making paste	Punjab, Sindh, Balochistan, KPK
53.	*Tamarindus indica* L.	Imli/ Tamarind	Improve thirst, motion, Piles, urethral infection, wound healing, Mouth ulcer	Punjab, Sindh, Balochistan, KPK
54.	*Linum usitatissimum* L.	Alsi/ Common flax or linseed	Burns, asthma, Respiratory diseases, wound healing, cold and flu	Punjab, Sindh
55.	*Vitex negundo* L.	Sambhalu/ Five leaved chaste	Headache, throat pain, wound healing, liver disorders, swelling of joints and muscle	KPK, AJK
56.	*Lawsonia inermis* L.	Mehndi/ Henna	Swelling, pain, hair dye, Attar, dye for nails	South Punjab, Sindh
57.	Achillea millefolium	Birangesif	cough, Liver problems	Punjab, KPK
58.	*Zingiber officinale* Roscoe	Adrak/ Ginger	Digestive, Relief pain, flavoring agent, burns, Nausea, nose congestion	Punjab, Sindh

59.	*Sorghum vulgare* L.	Joo/ Barley	Improve thirst, reduce fats, used in food	Punjab, Sindh, KPK
60.	*Cocus nucifera* L.	Copra/ Coconut	Improve eyesight, hair growth, paper pulp and brooms, improve thirst	Sindh
61.	*Ricinus communis* L.	Arind/ Castor oil plant	Inflammation of skin, soften skin, irritation of eyes, nails	Punjab, Sindh, Balochistan, KPK
62.	*Hedera helix*	Ivy leaves, English ivy	Cough, sore throat, fever, common cold.	Rawlakot, AJK
63.	*Orchis macula*	Salab Misry / garden orchis	Diarrhea, infertility, impotence, strengthen muscles, nerve tonic	KPK
64.	*Asparagus racemosus*	Satawari / Asparagus	Nutritive, diarrhea, abdominal pain, fever, impotence,	KPK
65.	*Withania somnifera*	Ashwagandha / winter cherry	Anti-rheumatic, fever, Tonic, supplement for male, Paralysis	Punjab
66.	*Berberis aristata*	Darhald, Zarishk, / turmeric tree	Diuretic, anti-inflammatory, fever, lack of epitite, kidney stones.	North Punjab, KPK.
67.	*Chichorium intybus*	Kasni / thistle flower, milk thistle	Hepatoprotactive, anti-inflammatory, diuretic, abdominal discomfort, indigestion	Punjab, Sindh
68.	*Ocimum basilicum*	Rehan , niaz boo/ sweet basil	Digestive, anti-flatulence, fever, antibilous, skin disorders	Sind, Punjab, KP, Balochistan,
69.	*Solanum xanthocarpum*	Kandyari	Liver protective, jaundice, cough, cold, blood purifier,	Punjab, Sindh, KPK
70.	*Tribullus teristeris*	Khar khask / tribulus	Diuretic, anti-bilious, aphrodisiac, kidney stones	Sindh, Punjab
71.	*Chlorophytum borivilianum*	Musli safed/	Tonic, nutritive, hormones booster	KPK, GB
72.	*Chrochorus deperesus*	Bhophali	Coolant, diuretic, anti-bilious, muscles strengther	Sindh, South Punjab
73.	*Euphorbia prostrata*	Hazardani	Anti-inflammatory, anti-aging, anti-diabetic,	Punjab, Sindh
74.	*Commiphora stocksiana*	Guggle / myrrh	High cholesterol, obesity, diabetes, fragrant, resin gum	South Punjab, Sindh, Balochistan
75.	*Cyamopsis tetragonoloba*	Guwar phalli / Guar beens	Nutritive, industrial product guar gum	South Punjab, Sindh

76.	*Cleome scaposa*	Kastoori boti	Fragrant, demulcent, condiment, abdominal discomfort, indigestion,	South Punjab, Sindh
77.	*Piper nigrum*	Kali mirch / black peper	Carminative, flavor, spice, digestive, flue, allergy,	Punjab
78.	*Cinamomum camphora*	Kaphor / camphor	Fragrant, coolant, refreshing, anti-pyretic,	KPK
79.	*Juniperus communis*	Abhal / juniper series	Fragrant, demulcent, condiment, abdominal discomfort, indigestion,	KPK, AJK
80.	*Artemesia absenthium Linn*	Afansteen / worm wood	Liver tonic, fever, malaria, blood purifier	Punjab, Sindh
81.	*Cuscuta epithymum Linn*	Aftimoon / dodder	Liver tonic, fever, malaria, blood purifier, Fragrant	KPK, AJK
82.	*Trachyspermum ammi Linn*	Ajwain desi / bishop weed	Carminative, flavor, spice, digestive, flue, allergy,	Punjab, Sindh
83.	*Polygonum bestrota Linn*	Anjbar / distort	Flavor, coolant , appetizer, diuretic, refresher	Punjab, PKP
84.	*Pimpenella anisum Linn*	Anisoon / anice	Carminative, flavor, spice, digestive,	
85.	*Adhatoda vasaca Nees.*	Bansa / vasaka	Asthma, allergy, cold, cough	KPK, Punjab
86.	*Glycyrrhiza glabra*	Mulethi / licorice	Stomachic, asthma , allergy, cold, cough, steroidal	KPK, Punjab
87.	*Psoralea corylifolia*	Babchi / psoralia	Stomachic, allergy, skin diseases	Punjab, KPK
88.	*Marticaria chemomile*	Babona / chamomile	Stomachic, abdominal discomfort	AJK, Punjab, Sindh
89.	*Terminalia blerica*	Bahira / beleric	Stomachic, tonic, abdominal discomfort, allergy	Punjab, KPK, AJK
90.	*Visia faba*	Baqla / broad been	Nutritive	Punjab, KPK
91.	*Hyoscyamus niger*	Ajwain kharasani / henbane	Pain reducer, allergy, blood purifier	Punjab, KPK
92.	*Aconitum napelus*	Bachnak / aconite	Allergies, cardiac issues,	KPK, North Punjab
93.	*Aegle marmelos*	Behe, safer e jal / quince	Nutritive, supplement	Punjab, PKP, GB
94.	*Swertia chirata*	Charaita / indian gentian	Constipation, gulqand made of rose flowers, beneficial for liver, throat problems, cough	Punjab
95.	*Smilax aspera*	Chob cheni / china root	Laxative, liver tonic,	KPK

96.	*Cedrus deodar*	Deudar	Flavor, coolant , appetizer, diuretic, refresher	KPK, GB
97.	*Valeriana officinalis*	Balchar / valerian	Hypotensive, flavor, fragrance	KPK, GB
98.	*Areca catechu*	Chalia, fofal / areca nut	Astringent, bleeding disorders	Sindh
99.	*Aloe barbadensis*	Kawar gandal / aloevera	Skin disorders, laxative, protective, healer, edible	Punjab, Sindh, KPK, Balochistan, AJK, GB
100.	*Tinospora cordifolia*	Galo / moon creeper	Fever, pain killer,	Punjab, Sindh, KPK, Balochistan, AJK, GB
101.	*Hibiscus rosasinensis*	Garahal / china rose	coolant , appetizer, diuretic, refresher	Punjab, Sindh, KPK, Balochistan, AJK, GB
102.	*Cardiospermum helecabum*	Habul qulul / balloon vine	Tonic, aphrodisiac	KPK, GB
103.	*Lepidium sativum*	Halon / garden cress	Cold, cough, asthma, aphordiasac	KPK, GB, Balochistan
104.	*Croton tiglium*	Jamalgota / croton	Cathartic	Punjab, KPK
105.	*Lawsonia inermis*	Hinna / henna	Dyeing, hair dye, astringent	Punjab, Sindh
106.	*Wrightia tinctoria*	Jao shirin / roseberry	Nutritive, diarrhea, stomachic, diabetes	Punjab, KPK, GB
107.	*Cymbopogon*	Azkhar / lemon grass	Flavor, coolant , appetizer, ornamental	Punjab, Sindh, KPK, Balochistan, AJK, GB
108.	*Delphinium denudatum*	Jadwar / delphinium	Detoxicant, tonic, paralysis, fever, toxicity	Punjab, KPK, GB
109.	*Ipomoea purga*	Jalapa / jalap	Paralysis, fever	KPK, GB
110.	*Capparis spinosa*	Kibar / caper	Liver tonic, cough, cold, fever, blood purifier	Punjab, Sindh
111.	*Bauhinia racemosa*	Kachnal / mountain ebony	Nutritive, edible, detoxicant, fever,	Sindh, Punjab, KPK
112.	*Lactuca sativa*	Kaho / Lettuce	Edible, fever, cough, cold	Punjab, KPK
113.	*Nerium indicum*	Kaneer / rose bay	Cardiac stimulant, ornamental	Punjab, Sindh
114.	*Abutilon indium*	Kanghi boti / country mallow	Laxative, bleeding diseases, hemorrhoids	Punjab, Sindh

115.	*Apium graviolens*	Karfas / celery	Diuretic, cold. Cough, demulcent	Punjab, Sindh, KPK
116.	*Caesalpinia bonduc*	Karanjwa / Nicker nut	Anti-inflammatory, fever, allergy	Punjab, KPK
117.	*Pandanus tictorius*	Kewra / screw pine	Coolant, fragrant, condiment, flavor, refresher	KPK, GB
118.	*Vetiveria zizanoides*	Khas / vetiver	Coolant, fragrant, condiment, flavor, refresher	Sindh, Punjab
119.	*Althea officinalis*	Khatmi / marsh mallow	Asthma, cold, cough, fever, anti-inflammatory	KPK, Punjab, GB
120.	*Portulaca oleracea*	Kharfa / purslane	Diuretic, fever, demulcent	Punjab, Sindh
121.	*Mucuna nigrans*	Koonch / cow hage	Nutritive, epilepsy, hormones booster, vitality	KPK, AJK, GB
122.	*Dolichos biflorus*	Kalthi / Horse gran	Diuretic, cold. Cough, demulcent	KPK, AJK
123.	*Celastrus peniculatus*	Malkangni	Nervine, brain tonic	Punjab, KPK, AJK
124.	*Curculigo orchiodes*	Musli siyah / black musale	Nutritive, tonic, nervine, hormone booster	North Punjab, KPK, AJK, GB
125.	*Narcissus tazetta*	Nurgas / narcissus	Coolant, fever, refresher	KPK, AJK, GB
126.	*Cocos nucifera*	Naryal / coconut	Nutritive, edible oil, stimulant, soother, relaxant, hair growth, nervine, condiment	Sindh
127.	*Paeonia officinalis*	Ood saleb / paeony	Carminative, digestive, abdominal discomfort. Nervine	KPK, AJK
128.	*Cannabis sativa*	Bhang / hemp	Analgesic, carminative, epiterzer, tranquilizer	North Punjab, KPK, AJK, GB
129.	*Convolvulus scammonia*	Saqmonia / scammony	Diarrhea, fragrant, abdominal discomfort	KPK, AJK
130.	*Colchicum leuteum*	Surinjan shirin / colchicum	Anti-inflammatory, analgesic,	KPK, AJK, GB
131.	*Bambusa aurandinacae*	Tabashir / bamboo mana	Antacid, fever, cough, stomachic	Punjab, KPK
132.	*Cheiranthus chieri*	Todari surkh / wall flower	Nutritive, tonic, spermatic, aphordiasac	Punjab, KPK, AJK
133.	*Operculina turpethum*	Turbad / turpeth	Laxative, heamorrhoides	KPK, AJK, GB
134.	*Carum carvi*	Zeera siyah / black caraway	Spice, flavor, condiments, carminative, nausea, vomiting	Punjab, Sindh

135.	*Hyssopus officinalis*	Zufa / hyssop	Fever, cough, cold	KPK, AJK

The cultivation of medicinal plants in the country from agronomic point of view, there prevails sufficient opportunities to cultivate medicinal plants in various agro-ecological zones in all the provinces of Pakistan. However, it is important to mention that agronomic suitability is only meaningful if the chemical and pharmaceutical properties are acceptable as per requirements of the end users and market. In the current study some important medicinal plants commodities have been identified to promote their performance keeping in view the value chain from production to trade. Accordingly, the medicinal plants sector as whole and identification of important commodities. In Pakistan about **6000** plant species exist and out of which only **600** species (**10 %**) are identified having medicinal value. Almost **90 %** of country's Medicinal Plants (MPs) requirement is met through imports. Over **50 %** of the population in Pakistan is being cured using traditional medicines mainly sourced from medicinal plants by almost **60,000** traditional herbal practitioners. There are more than **432** registered manufacturers of herbal medicine which consume most of the MP's material and develop products from plant raw materials **(Aslam, 2018).** In this traditional medicine system most of the medicinal plants consumed are collected from wild and very few are also cultivated in some ecologies of the country by small number of farmers. **Sher and Khatoon (2018)** reported field studies on medicinal plants of Haramosh and Bugrote valleys in Gilgit and found **98** medicinal herbs species on the basis of folk information of medicinal uses. Local people were using these to prevent and cure various diseases such as asthma, diabetes, blood pressure, stomach problems, abdominal problems etc. Out of these **98** medicinal plants **21** MPs were also cultivated by the local community and **77** MPs were wild crafted. Regarding the cultivation of medicinal plant, in fact, no institution has provided tangible list of MPs for their cultivation suitability based on research backstopping. Numerous individual studies and efforts have been made at the institutional level. Few of the research trial have been reported on various MPs by PARC, PFI and other provincial departments and also had made efforts to promote it through research and development. Conservationists are also concerned about this issue.

Promotion of medicinal plants cultivation will result in improved supplies of raw materials, provide an alternative to collecting plants from the wild, and will also lead to standardization. The raw material of medicinal plants is mainly harvested from forests & rangelands, only few medicinal plants are cultivated in the country. According to a survey of different herbal stores,

indicated that total business of crude drug in the country is worth about Rs.**120** million **(Mariam, 2015)**. Few medicinal plants are also exported to different countries in small quantities. The prices of medicinal plants at village level are very low and villagers are generally not well informed about market prices. The market value of medicinal plants increases **3 to 5** times from village to local shops and the prices at national market may be doubled to triple of the same item. A sizeable number of medicinal plants are collected and marketed locally involving a significant portion of the population, particularly those marginalized groups, including women and children. The research work on medicinal plants by Williams and Zahoor, **(1999)** have also pointed out that a rich resource base of MPs is spread over a wide range of ecological zones, with estimates of numbers of plant species with medicinal properties varying from **3,200** species at the upper end of the spectrum to **1,000** at the lower end. Of these species, approximately **500** are known for their active constituents from research conducted in Pakistan and elsewhere, and around **250 to 300** species are known to have entered the herbal markets. Globally, there is a rising trend to shift resources from allopathic to traditional healthcare systems. The global market estimates to surge US$ **5** trillion by **2050**. Twelve percent of Pakistani flora is used in medicines and more than **300** medicinal plants are traded **Shahzad et.al. (2019)**. Ten leading Dawakhanas, (Herbal manufacturers) of Pakistan annually consume more than **2** million kg of **200** medicinal plants in **1990s** while its consumption increased multifold in the last three decades. According to Shinwari et al., to an estimate, **22** species of medicinal plants worth Rs.**14.733** million were traded in **1990** while in **2020**, this value rose to more than Rs.**122** million, an eight-and-a-half times increase. In **1990**, about **95** species were consumed worth Rs. **36** million while in **2020**, medicinal plants worth Rs. **218** million were consumed: a six-fold increase. Shinwari et al published a "pictorial guide of medicinal plants of Pakistan" enlisting more than **500** species of flowering plants, being used as medicine.

In **2008,** the Government of Pakistan through Ministry of Food Agriculture and Livestock (MINFAL) now (MNFSR) has started a project entitled as "Production of Medicinal Herbs in Collaboration with Private Sectors" (PMHPS) to promote the cultivation of medicinal herbs and spices plants as crop. The project has focused the production of medicinal herbs on commercial scale through research-based technology package oriented to World Health Organization (WHO) guideline of good agriculture, collection and processing practices. These included appropriate selection and identification, propagation methods, cultivation techniques, harvesting and

collection, quality control of raw material up to processing stage, post-harvest treatment, storage and safety. However, due to devolution of Minfa as a result of **18th** amendment process no sustainable outcome have been achieved (**Aslam, 2008**) from this project, but it created awareness and published a huge literature for the guidance of various stakeholder involved in MPs sector. No doubt, that Pakistan has a rich and diverse flora of almost **6000** plant species of which around **600** are reported to be medicinally important (**Ullah, 2017**). However, the current trade in medicinal plants of Pakistan is far low than the other countries like India and China.

During the consultation, stakeholders informed that the trade in herbal material is monopolized by wholesale drug dealers, with the small shopkeepers, pansar stores, hakims relying on wholesalers for their supply and more than **250** plant species of medicinal plants are being traded. Normally cultivators and collectors of medicinal plants bring their produce to the nearest market, where it is sold to wholesalers directly or through the middlemen normally known as commission agents. Mostly dry materials are used in trade and these materials are transported to the bigger city markets to the wholesalers and from there the materials are either stored for export or sold out to retailers or supplied to the manufacturers. Sometimes, the demand comes from wholesale dealers who inform their agents for organizing the collection of the required materials. The agents contact small traders to send these items to wholesale dealers for purchase through commission agents. There are approximately **319** large wholesalers operating in the markets located in main cities such as Peshawar, Lahore, Karachi and Quetta (**Aslam, 2016**). Additionally, the produce markets are also located in some smaller towns, as they are close to medicinal crop cultivation areas. Most of the trade remain unorganized and informal and record keeping is poor.

According to Pakistan Forest Institute survey the species of medicinal plants sold in Peshawar herbal markets are generally obtained from District Swat, Lahore, and Afghanistan. Peshawar market also supplies some imported medicinal and aromatic plants to District Swat and Afghanistan for local uses. The market receives large quantities of herbal materials from District Swat which is then supplied to Lahore. Majority of the dealers in Lahore herbal market are trading crude herbs imported from India. Over **50%** of materials traded in Lahore are of Indian origin, and this is mainly due to cross border trade via train or trucks. The Lahore herbal market acts as a hub of national trade of medicinal plants. It is not only catering to the needs of smaller markets in various cities and towns of the province of Punjab but also supplies considerable quantities of

materials to the Karachi market. The market survey by PFI, (**2018**) also indicated that MPs/herbs in quantity of almost **5760** tons' worth of PKR **271** million have been traded in Peshawar, Lahore, Rawalpindi and Swat markets during **2017-18**. The middlemen of the medicinal plants trade usually bring the materials from District Swat to Lahore. Most of the crude MPs items traded in Karachi markets are obtained from the Lahore market. However, a few agents also bring the material directly from up-country, including District Swat. Prices of various items in Karachi market are generally **10-20%** higher than Lahore, reflecting higher transportation, higher labor costs, and profits of additional middlemen. Rawalpindi is another market for medicinal and aromatic plants from District Swat. Both the Lahore and Karachi herbals markets are the major source of materials to the large national herbal pharmaceutical companies. These companies generally purchase materials through middlemen or so-called suppliers from these main markets. The MPs products trade is very multifarious throughout the world, with each region or each country having its own prerequisites for bringing those products in the market. The classification of the products may also vary widely among the different countries. In one country the herbal substance may be classified as medicine, in another as food.

In a meeting on methodologies for quality control of finished herbal products, held in Ottawa, Canada in July **2001**, the entire process of production of herbal medicines, from raw materials to finished products, was reviewed (**WHO 2002**). It was recommended that WHO should give high priority to the development of globally applicable guidelines to promote the safety and quality of medicinal plant materials through the formulation of codes for good agricultural practices and good collection practices for medicinal plants. It was envisaged that such guidelines would help to ensure safety and quality at the first and most important stage of the production of herbal medicines. Within the overall context of quality assurance, the WHO guidelines on Good Agricultural and Collection Practices (GACP) for medicinal plants are primarily intended to provide general technical guidance on obtaining medicinal plant materials of good quality for the sustainable production of herbal products classified as medicines. They apply to the cultivation and collection of medicinal plants, including certain post-harvest operations. Raw medicinal plant materials should meet all applicable national and/or regional quality standards. The guidelines therefore may need to be adjusted according to each country's situation. Food and medicine often require different quality approaches, as the quality assurance systems used for food is HACCP (Hazard Analysis Critical Control Point). In case of medicinal plants, the systems to be followed

is that recommended by WHO, (**2003**) which is mainly concentrated upon Good Agriculture, Collection and Processing Practices (GACP). To comply these quality standards are the basic requirements for entering international trade particularly with developed countries markets. China, the Republic of Korea, Chile, India, Brazil and Thailand are the developing countries with a long tradition of use of medicinal plants and are also major exporting countries. Exports are predominantly in raw material form and only to a lesser extent finished product. With their large populations and ancient heritage of traditional herbal-based medicines.

Humans have used natural products derived from natural sources such as plants as food and medicine for thousands of years, particularly plant parts and complete plants to cure and prevent disease. The usage of plant products and their widespread acceptability have made this a potential industry. According to the World Health Organization, herbal medicine is used by over 80% of the population in most Asian and African countries for primary health care. The aging population, more consumer knowledge, less or no negative effects, providing advancements, and the FDA's release of Current Good Manufacturing Practices (CGMP) for nutritional supplements are all driving factors in the worldwide herbal medicine industry. Other concerns include rising pricing, health budget considerations, and a shift in consumers toward herbal treatment systems that are cost-effective, economical, and safe. Taking all of these variables into account, the market for traditional medicine is estimated to reach $ **115** billion by the end of **2023,** with a CAGR of **7.2** percent from **2017 to 2023.** The global market for herbal products and medicinal plants was worth US$ **60** billion in **2010**, with a healthy response rate. The usage of plant products and their widespread acceptability have made this a potential industry (BCC conducts research). The global market for botanical and plant-derived pharmaceuticals is expected to expand at a compound annual growth rate (CAGR) of **6.1** percent from $**29.4** billion in **2017** to roughly $**39.6** billion by **2022**. From **2016 to 2021**, the global nutraceutical industry is expected to increase at a compound annual growth rate (CAGR) of **7.5** percent, from $**198.7** billion in **2016**. The herbal medicine business alone is expected to reach US $ **3** trillion by **2030**, according to a Euro Monitor research **2016**. According to a report published by the World Bank in **1998**, global trade in medical plants and allied products is predicted to exceed $**5** trillion by **2050.**

Demand Versus Supply Scenario

Consumers of MPs in Pakistan can be categorized into the following:

1. Pansar store (seller of MPs)
2. Registered practitioners of traditional Medicine (>60,000 as per National Council for Tibb (NCT) data)
3. Registered manufacturers / companies by Drug Regulatory Authority of Pakistan (DRAP)
4. Registered importers / companies by Drug Regulatory Authority of Pakistan (DRAP)

Table 2: Registered importers / manufacturers of MPs in Pakistan:

No.	Category	Relevant Number	Reference
1	Registered manufacturer of Natural Medicine / Traditional / Neutraceutical	**432**	*https://dra.gov.pk/Home/HOTC#gsc.tab=0*
2	Registered Importers	**759**	

Price Analysis of Medicinal Plants in Pakistan:

Among medicinal plants in national market of Pakistan found in pansar stores (traditional medicinal plants sellers) the extensively used medicinal plants and their prices are listed according to the local trade markets of all provinces of Pakistan.

Table 3. Price analysis of Medicinal Plants:

No.	Scientific Name	Local / English name	Price Rs / Kg	No.	Scientific Name	Local / English name	Price Rs / Kg
1.	*Cassia fistula* L.	Amaltas / Golden shower tree	**200**	**2.**	*Chrochorus deperesus*	Bhophali	**340**
3.	*Bryophyllum pinnatum* (Lam.)	Zakhm-e-hayat	**240**	**4.**	*Euphorbia prostrata*	Hazardani	**280**
5.	*Mimosa pudica* L.	Lajwanti/ Touch me not	**220**	**6.**	*Commiphora stocksiana*	Guggle / myrrh	**2300**
7.	*Sesamum indicum* L.	Till/ Sesame seeds	**300**	**8.**	*Cyamopsis tetragonoloba*	Guwar phalli / Guar beens	**140**
9.	*Eruca sativa* Mill.	Taramira	**210**	**10.**	*Cleome scaposa*	Kastoori boti	**290**
11.	*Trigonella foenum-graecum* L.	Methi/ Fenugreek	**340**	**12.**	*Piper nigrum*	Kali mirch / black peper	**1900**
13.	Cinnamomum tamala (Ham.)	Tez patta/ Indian bay leaf	**450**	**14.**	*Cinamomum camphora*	Kaphor / camphor	**2100**
15.	*Rosa indica* L.	Gulab/ Rose	**350**	**16.**	*Juniperus communis*	Abhal / juniper series	**340**

17.	*Papaver somniferum* L.	Khashkhash/ Poppy seeds	**180**	**18.**	*Artemesia absenthium Linn*	Afansteen / worm wood	**410**
19.	*Foeniculum vulgare* Mill.	Saunf/ Fennel	**340**	**20.**	*Cuscuta epithymum Linn*	Aftimoon / dodder	**530**
21.	*Limonia acidissima* L.	Katha/ Wood apple	**400**	**22.**	*Trachyspermum ammi Linn*	Ajwain desi / bishop weed	**370**
23.	*Ribes nigrum* L.	Munakka/ Black currant	**600**	**24.**	*Polygonum bestrota Linn*	Anjbar / distort	**610**
25.	*Prunus domestica* L.	Alu Bukhara/ Plum	**450**	**26.**	*Pimpenella anisum Linn*	Anisoon / anice	**370**
27.	*Viola odorata* L.	Banafsha/ Sweet violet	**680**	**28.**	*Adhatoda vasaca Nees.*	Bansa / vasaka	**430**
29.	*Lallemantia royleana* (Benth.)	Tukhum Balangu/ salvia	**540**	**30.**	*Glycyrrhiza glabra*	Mulethi / licorice	**300**
31.	*Moringa oleifera* Lam.	Sohanjna/ Malungai	**300**	**32.**	*Psoralea corylifolia*	Babchi / psoralia	**320**
33.	*Ferula assa-foetida* L.	Hing/ Asafetida	**3400**	**34.**	*Marticaria chemomile*	Babona / chamomile	**200**
35.	Boswellia carterii	Loban/ Gold-frankincense	**400**	**36.**	*Terminalia blerica*	Bahira / beleric	**320**
37.	*Mentha arvensis* L.	Podina/ Mint	**280**	**38.**	*Visia faba*	Baqla / broad been	**200**
39.	*Ziziphus jujuba* Mill.	Unaab/ Jujube	**270**	**40.**	*Hyoscyamus niger*	Ajwain kharasani / henbane	**600**
41.	*Trichodesma africanum* (L.)	Gaozuban/ Bee plant/ borage	**670**	**42.**	*Aconitum napelus*	Bachnak / aconite	**480**
43.	*Cordia latifolia* Roxb.	Lasura	**240**	**44.**	*Aegle marmelos*	Behe, safer e jal / quince	**230**
45.	*Solanum nigrum* L.	Mako/ Black night shade	**260**	**46.**	*Swertia chirata*	Charaita / indian gentian	**300**
47.	*Trapa natans* L	Singhara/ Water chestnut	**420**	**48.**	*Smilax aspera*	Chob cheni / china root	**450**
49.	Glycyrrhiza glabra	Mulathi/ Licorice	**300**	**50.**	*Cedrus deodar*	Deudar	**600**
51.	*Echinops echinatus* Roxb.	Barham Dandi/ Camel thistle	**320**	**52.**	*Valeriana stracheyi*	Balchar / valerian	**1700**
53.	Swertia Chirayita	Chirata/ Bitter stick	**210**	**54.**	*Areca catechu*	Chalia, fofal / areca nut	**430**
55.	*Fagonia cretica* L.	Dhamasa	**230**	**56.**	*Aloe barbadensis*	Kawar gandal / aloevera	**320**
57.	*Curcuma zedoaria* Rosc.	Kachur/ White turmeric	**300**	**58.**	*Tinospora cordifolia*	Galo / moon creeper	**210**
59.	*Calotropis procera* R	Akk/ Milkweed	**260**	**60.**	*Hibiscus rosasinensis*	Garahal / china rose	**480**
61.	*Achyranthes aspera* (L.)	Puthkanda/ Prickly caff-flower	**240**	**62.**	*Cardiospermum helecabum*	Habul qulul / balloon vine	**680**
63.	*Cochlospermum religiosum* (L.)	Gond katira/ Tragacanth	**800**	**64.**	*Lepidium sativum*	Halon / garden cress	**340**

65.	*Jasminum officinale* L	Chambeli/ Jasmine	**230**	**66.**	*Croton tiglium*	Jamalgota / croton	**200**
67.	*Azadirachta indica* A.	Neem/ Paradise tree	**200**	**68.**	*Lawsonia inermis*	Hinna / henna	**230**
69.	*Nelumbo nucifera* Gaertn	Kanwal/ Lotus flower	**670**	**70.**	*Wrightia tinctoria*	Jao shirin / roseberry	**270**
71.	*Carica papaya* L.	Papaya/ Pawpaw	**340**	**72.**	*Cymbopogon*	Azkhar / lemon grass	**600**
73.	*Syzygium cumini* (L.)	Jaman/ Black plum	**180**	**74.**	*Delphinium denudatum*	Jadwar / delphinium	**13000**
75.	*Crocus sativus* L.	Zafran/ Saffron	**150,000**	**76.**	*Ipomoea purga*	Jalapa / jalap	**340**
77.	*Curcuma longa* L.	Haldi/ Turmeric	**450**	**78.**	*Capparis spinosa*	Kibar / caper	**230**
79.	*Citrullus colocynthis* (L.)	Tumah, Toorh/ Bitter apple	**200**	**80.**	*Bauhinia racemosa*	Kachnal / mountain ebony	**200**
81.	*Cuminum cyminum* L.	Zeera/ Cumin	**600**	**82.**	*Lactuca sativa*	Kaho / Lettuce	**300**
83.	*Pueraria tuberosa* (Roxb. ex Willd.)	Bidarikand/ Indian kudzu	**270**	**84.**	*Nerium indicum*	Kaneer / rose bay	**160**
85.	*Coriandrum sativum* L.	Dhania/ Coriander	**200**	**86.**	*Abutilon indium*	Kanghi boti / country mallow	**230**
87.	*Morus nigra* L.	Toot siyah/ Black mulberry	**180**	**88.**	*Apium graviolens*	Karfas / celery	**220**
89.	*Eucalyptus globulus* Labill	Safeda/ Eucalyptus	**200**	**90.**	*Caesalpinia bonduc*	Karanjwa / Nicker nut	**460**
91.	*Illicium verum* Hook	Badian/ Star anise	**440**	**92.**	*Pandanus tictorius*	Kewra / screw pine	**700**
93.	*Nigella sativa* L.	Kalongi/ Blach cumin	**210**	**94.**	*Vetiveria zizanoides*	Khas / vetiver	**800**
95.	*Salvia plebeian*	Kamar kas/ Sage	**480**	**96.**	*Althea officinalis*	Khatmi / marsh mallow	**430**
97.	*Sapindus mukorossi* Gaertn	Reetha/ Soap nut	**340**	**98.**	*Portulaca oleracea*	Kharfa / purslane	**380**
99.	Mallotus philippensis	Kamala/ Monkey-face tree	**220**	**100.**	*Mucuna nigrans*	Koonch / cow hage	**600**
101.	*Datura stramonium* L.	Datura/ Jimson weed	**160**	**102.**	*Dolichos biflorus*	Kalthi / Horse gran	**400**
103.	*Prosopis juliflora* (Swartz) DC.	Kiker/ Babul tree	**425**	**104.**	*Celastrus peniculatus*	Malkangni	**320**
105.	*Tamarindus indica* L.	Imli/ Tamarind	**320**	**106.**	*Curculigo orchiodes*	Musli siyah / black musale	**700**
107.	*Linum usitatissimum* L.	Alsi/ Common flax or linseed	**200**	**108.**	*Narcissus tazetta*	Nurgas / narcissus	**280**
109.	*Vitex negundo* L.	Sambhalu/ Five leaved chaste	**180**	**110.**	*Cocos nucifera*	Naryal / coconut	**240**
111.	*Lawsonia inermis* L.	Mehndi/ Henna	**260**	**112.**	*Paeonia officinalis*	Ood saleb / paeony	**560**
113.	Achillea millefolium	Birangesif	**200**	**114.**	*Cannabis sativa*	Bhang / hemp	**570**

115.	*Zingiber officinale* Roscoe	Adrak/ Ginger	**540**	**116.**	*Convolvulus scammonia*	Saqmonia / scammony	**18,000**
117.	*Sorghum vulgare* L.	Joo/ Barley	**170**	**118.**	*Colchicum leuteum*	Surinjan shirin / colchicum	**1200**
119.	*Cocus nucifera* L.	Copra/ Coconut	**160**	**120.**	*Bambusa aurandinaca e*	Tabashir / bamboo mana	**3000**
121.	*Ricinus communis* L.	Arind/ Castor oil plant	**160**	**122.**	*Cheiranthus chieri*	Todari surkh / wall flower	**800**
123.	*Hedera helix*	Ivy leaves, English ivy	**4000**	**124.**	*Operculina turpethum*	Turbad / turpeth	**1200**
125.	*Orchis macula*	Salab Misry / garden orchis	**22000**	**126.**	*Carum carvi*	Zeera siyah / black caraway	**1400**
127.	*Asparagus racemosus*	Satawari / Asparagus	**20000**	**128.**	*Hyssopus officinalis*	Zufa / hyssop	**230**
129.	*Withania somnifera*	Ashwagandha / winter cherry	**1200**	**130.**	*Myristica fragrans*	Jaiphal / nutmeg	**3000**
131.	*Berberis aristata*	Darhald, Zarishk, / turmeric tree	**460**	**132.**	*Myristica fragrans*	Jawatri / Nutmeg peel	**3000**
133.	*Chichorium intybus*	Kasni / thistle flower, milk thistle	**400**	**134.**	*Panax ginsing*	Ginsing	**22,000**
135.	*Ocimum basilicum*	niaz boo/ sweet basil	**260**	**136.**	*Gracinia compogia*	Vilayati imli / gracinia	**2200**
137.	*Solanum xanthocarpum*	Kandyari	**340**	**138.**	*Saw palmetto*	Saw palmetto	**5000**
139.	*Tribullus teristeris*	Khar khask / tribulus	**150**	**140.**	*Cyamopsis tetragonolob a*	Guwar phalli / Guar beens	**2100**
141.	*Chlorophytum borivilianum*	Musli safed/	**11800**				

Neutraceutical manufacturing sectors demanded high volume of extracts and raw herbs for gross production of medicinal products for domestic business. Demand is met by imported products by the registered importers. Among these imported products, following is list of medicinal plants having worth of high economic values imported for domestic need.

Table 4: List of Imported Medicinal plants of higher economic values:

No.	Scientific Name	Vernacular Name / English name	Uses	Category
1	Elleteria cardamomum	Elaichi Khurd / green cardamo	Spice, flavor, condiments, carminative, nausea, vomiting	**Import**
2	Syzygium aromaticum	Long / Clove	Spice, Flavor, condiments, analgesic, carminative, anti-inflammatory, pain relieving	**Import**
3	Cinnamomum zyelanecum	Darcheni / cinnamon	Spice, Flavor, condiments, analgesic, carminative, anti-inflammatory, pain relieving	**Import**
4	*Holarrhena antidysenterica*	Andar jao Talkh	Anti-diabetic, anti-diarrheal, immunity regulator, nutritive,	**Import**
5	*Piper longum*	Piplamol / long pepper	Carminative, flavor, spice, digestive, flue, asthma	**Import**
6	*Hedera helix*	English ivy	Cough, cold,	**Import**
7	*Vaccinium subg*	Cranberry	Anti-inflammatory, urinary infections, kidney diseases, anti-aging	**Import**
8	*Ammomun sabulatum*	Elaichi kalan / black cardamom	Carminative, flavor, spice, digestive, flue, asthma	**Import**
9	*Ginko biloba*	Ginko	Nervine, brain tonic,	**Import**
10	*Piper nigrum*	Kali mirch / black pepper	Carminative, flavor, spice, digestive, flue, asthma	**Import**
11	*Anacylcus pyrethrum*	Aqar qarha / pelithroy	Nervine, paralysis, aphordiasac	**Import**
12	*Centaurea behen*	Behmen safaid / white behen	Nutritive, tonic, muscular strengthen	**Import**
13	*Salvia daematodesm*	Behemen surkh / red behen	Nutritive, tonic, muscular strengthen	
14	*Holarrhena antidysenterica*	Andar jo talkh /	Diabetes, diarrhea, intestinal worms	**Import**
15	*Gymnema sylverter*	Gur mar / Indian ipecac	Diabetes, blood purifier	**Import**
16	*Pistacia lentiscus*	Mastagi / mastic	Diarrhea, astringent, laxative, excipient	**Import**
17	*Commiphora cpobal*	Ood hindi / eagle wood	Fragrant, coolant, fever, detoxicant	**Import**
18	*Saussurea lappa*	Qust shirin	Fever, anti-inflammatory, tonsillitis, rheumatic diseases	**Import**
19	*Onosma echioides*	Rattan jot		**Import**

20	*Santalum album*	Sandal safaid / sandal wood	Coolant, fragrant, condiment, flavor, refresher	**Import**
21	*Pterocarpus santalenicus*	Sandal surkh / red sandal wood	Coolant, fragrant, condiment, flavor, refresher	**Import**
22	*Ruta graveolens*	Sadab / garden rue	Fever, anti phalagmatic, perfumery, carminative, nervine	**Import**
23	*Levendula stoiches*	Ustakhudos / lavender	Fever, anti phalagmatic, perfumery, carminative, nervine	**Import**
24	*Withania somnifera*	Asgand / winter cherry	Anti-rheumatic, fever, Tonic, supplement for male, Paralysis	**Import**
25	*Myristica fragrans*	Jaiphal / nutmeg	Carminative, flavor, spice, digestive, flue, asthma	**Import**
26	*Myristica fragrans*	Jawatri / Nutmeg peel	Carminative, flavor, spice, digestive, flue, asthma	**Import**
27	*Panax ginsing*	Ginsing	Stimulant, anti-aging, vitality, Nutritive, weakness, aphrodisiac,	**Import**
28	*Gracinia compogia*	Vilayati imli / gracinia	Appetite suppressor, weight loss, obesity, dyslipidemia	**Import**
29	*Saw palmetto*	Saw palmetto	Prostatic hypertrophy, tonic for bladder,	**Import**
30	*Cyamopsis tetragonoloba*	Guwar phalli / Guar beens	Nutritive, industrial product guar gum	**Import**

(Data Collected from local market survey at Akbari Mandi / Papar Mandi Lahore)

Another published analysis provides an alarming state of high imports for domestic purposes by Pakistan since **2008.** Pakistan imported **11045** tonnes off MPs of worth of USD **4.73** million in **2008 (A. Lubbe, R. Verpoorte 2011).** Whereas Pakistan exported **8000** tonnes of MPs in **2000** and imported processed MPs products and spent national exchequer (WHO World TCAM Atlas **2004)**. There is significant gap exist between the demand and supply of MPs for domestic utilization.

GAPS IN LOCAL/DOMESTIC PRODUCTION AND CONSUMPTION IN PAKISTAN OF MEDICINAL PLANT

Plants that contribute only a little amount to a country's agricultural output are referred to as "High Value Minor Crops." Herbs and spices, as well as medicinal and aromatic plants, are the two main categories (MPs). Despite being little contributions to output, the importance of these plants in aggregate may be seen in the fact that their global commerce reached US$ **60** billion in **2006** (**Adhikari B 2001, Hamilton A 2006**). Europe alone imports roughly $**1** billion worth of MPs from Africa and Asia each year (**Ghimire SK2004, Sher H 2009**). Because of the growing popularity of herbal medications (**Khan 2011**), this commerce is predicted to grow significantly by **2050** (**Lange D 1997**). Although MPs make a tiny contribution to national agriculture output, their value per pound is among the greatest among traded plants. For distant populations that practice subsistence agriculture and have limited access to regional economies, medicinal cash crops offer enormous potential (**Chauhan RS 2010, Dubey NK 2004**). For generations, MPs have been collected, cultivated, and marketed in many parts of south and western Asia (**Mati E 2011, Lev E 2002, Lev E 2000, Ali-Shtayeh MS 2000**). The current supply of MPs in Swat District, Khyber Pakhtunkhwa Province, Pakistan, is nearly exclusively derived from wild-harvested material rather than cultivation. MPs are collected by a considerable number of rural households in Swat District, at least as informal gatherers for local usage (**Sher H 2009)**. Many of the rural households that sell MPs collect them from forests and fields, and many of them are nomadic tribesmen who are also small and marginal farmers. MAP cultivation is usually only a minor component of a household's overall farming enterprise. According to previous studies, MAP collecting and trade becomes the main source of household income for **5,000** or more traditional nomadic tribesmen who harvest these plants in the wild in Swat District during the spring and summer (**Shinwari ZK 2010**). The vast majority of nomadic gatherers and small-farm collectors have no formal training. As a result of the random gathering, non-grading, and inappropriate drying and storing, wild herbals have come into contempt. Adulteration with fictitious plants is sometimes done for the purpose of making a quick buck. However, because many nomadic tribesmen and farmers in the Swat District's highlands live on a shoestring budget, MAP collecting and growing could become more important as a source of supplemental income. The majority of Swat District households, including those receiving MPs, are still poor. Similarly, many collected plant species have a high commercial value, but collectors typically do not know how to sell those (**Shinwari**

ZK 2010). Collectors need a deeper awareness of the needs of individual markets to increase their MAP earnings. This is especially crucial when it comes to quality criteria and how they affect pre- and post-harvest management as well as proper product handling. As a result, the Swat District research was launched to identify restrictions such as a fragmented information base, training and educational shortcomings, an uncoordinated approach to MPs species collection and marketing, and the need to clearly identify traders and markets. The overall goal of this research was to see how individuals in Swat District may get more value and benefit from MPs collection, cultivation, processing, and commercialization. Sustainable harvesting procedures, small-scale cash crop growing and local processing of raw materials to add value before marketing were the specific goals. We examine the many steps in the supply chain, from collector/farmer to final domestic market or exporter, to see how the market value of both raw and processed MPs can be improved. Economic examination of the MAP marketing chain, from collection to consumption, has been restricted in Pakistan.

Table **5** shows the estimated pricing along the marketing chain for the **24** high-value MPs sold in the biggest quantities by the surveyed collectors in Swat District. Table **5** shows the prices that were gathered through questionnaires and focus groups with stakeholders. Price fluctuation is particularly significant in the MPs sector, and prices per species vary not just from year to year, but also on a regular basis due to variations in demand and supply. As a result, exporter and pharmaceutical company brochures/price lists were used as a cross reference. The prices in Table **1** represent our best estimate of averages for **2012**. The cost of high-value MAPs rises with each step of the supply chain. Table **1** display this rise is due to two key factors: **1**) Increased transportation and labour costs; **2**) Profit for the benefit of the individuals involved. Another element contributing to the price increase is the loss of plant material at each level as a result of processing activities such as cleaning, processing, grading, and packing, among others. The amount of weight lost varies depending on the species and the manner in which it is processed for sale.

The collectors' lack of knowledge about appropriate procedures for preparing plant material in such a way that it maintains the maximum possible value, as well as their general ignorance of prevailing prices and demand, are four factors affecting the increase in price from the collector to the final point of sale in Pakistan. *M. esculenta* (**10,000 Rs/kg**) was the MPs species that provided

collectors the highest average price in **2012**. *V. pilosa* (flowers only, **500 Rs/kg**) and *Bunium persicum* (Boiss.) *B. Fedtsch*. (**400 Rs/kg**) followed at lower levels. *Aconitum heterophyllum* Wall. Royle had the biggest increase in both national and international price from collectors to consumers, as indicated in Table **1**. (**10** times higher in the national market and **15** times higher in the international market compared to the purchase price of collectors in Swat District*). Adiantum capillusveneris* L. and *Asparagus adscendens* Roxb (**Sher H 2009, Ghorbani A 2005**) are two other plants with significant price differences (**Lev E 2002**). The value of the plant material is determined by what is in the sample, not just the species involved, as indicated by the two rows for *V. pilosa*. At the collector level, *V. pilosa* flowers sell for **500** rupees per kilogram, while a blend of leaves and flowers sells for **200** rupees per kilogram. The international pricing for these items is **3–4** times the price paid by collectors. Table **1** shows the price differences for additional species in a similar way.

Our interviews with collectors and dealers yielded estimates of the quantity of the **24** high-value MPs sold by dealers and merchants in Swat District, as well as prices at various marketing levels. (**H. Sher 2014**).

Table 5: **High value MPs of District Swat origin with their incremental values at different stages of the trade chain, 2012**

Scientific name	**Family**	**Quantity (Kg)**	**Collector revenue (Rs)**
Aconitum heterophyllum Wall. ex Royle (Zaharmora)	Ranunculaceae	1,000	20,000
Acorus calamus L. (Skhawaja)	Acoraceae	3,000	90,000
Adiantum capillus-veneris L. (Persosha)	Adiantaceae	4,000	80,000
Asparagus adscendens Roxb. (Muslisufaid)	Liliaceae	2.000	100,000
Berberis vulgaris L. (Kwaray)	Berberidaceae	4,000	800,000
Bergenia ciliata (Haw.) Sternb. (Makanpath)	Saxifragaceae	3,000	300,000
Persicaria amplexicaulis (D. Don) Ronse Decr	Polygonaceae	12,000	720,000
Bunium persicum (Boiss.) B.(Tora Zera)	Apiaceae	1,000	400,000
Colchicum luteum Baker (Suranjan)	Colchicaceae	3,000	300,000

Commiphora mukul (Hook. ex Stocks) Engl. (Guggal)	Burseraceae	5,000	500,000
Dioscorea deltoidea Wall. ex Griseb. (Kanis)	Dioscoreaceae	3,000	300,000
Diospyros lotus L. (Tour amlok)	Ebenaceae	90,000	4,500,000
Geranium wallichianum D.Don ex Sweet (Srazela)	Geraniaceae	2,000	380,000
Jurinea himalaica R.R. Stewart (Sharrsham)	Asteraceae	2,000	140,000
Morchella esculenta Fr. (Guji)	Morchellaceae	5,000	50,000,000
Paeonia emodi Royle (Mamekh)	Paeoniaceae	5,000	250,000
Pistacia chinensis subsp. integerrima (J.L.Stewart ex Brandis) Rech.f. (Kakar singay)	Anacardiaceae	1,000	250,000
Sinopodophyllum hexandrum (Royle) T.S.Ying (syn. *Podophyllum hexandrum* Royle (Bankarri)	Podophyllaceae	2,000	140,000
Polygonatum multiflorum (L.) All. (Noory alam)	Asparagaceae	5,000	250,000
Trachyspermum ammi (L.) Sprague (Ajwoin)	Apiaceae	1,500	450,000
Trillium govanianum Wall. ex D. Don (Matarjarrai)	Melianthaceae	8,000	2,800,000
Valeriana jatamansi Jones (syn. *Valeriana wallichii* DC.) (Muskay bala)	Valerianaceae	2,500	225,000
Viola pilosa Blume (syn. Viola serpens Wall.) (Banafsha)	Violaceae	4,000	2,000,000
Total or Average		**176,000**	**66,395,000**

Tables **6-7** list two large herbal facilities in Pakistan (Hamdard and Qarshi). In the last decade, two of Pakistan's most important industries (Qarshi and Hamdard) have used medicinal plants in an unusual pattern (**Table 6 and 7**). (**Shinwari, ZK. 2010**). Latest data about import of MPs is being sought be PHDEC for future planning.

Table 6. Species, prices, quantities, and values of medicinal plants (Hamdard laboratories (Waqf) Pakistan

Scientific name	**Common name**	**Avg. price (2002)(Rs. /kg)**	**Avg. price (July' 2008toJun' 2009)(Rs. /kg)**	**Qty. used (July' 2008toJun' 2009)(kg)**	**Qty. used (2002)(kg)**
Lavandula officinalis	Ustukhuddus	320	408	3, 625	3, 000
Achillea millefolium	Baranjasif	285	180	13, 200	6, 000
Viola odorata	Gul-e- Banafsa	550	635	5, 750	2, 000
Carum carvi	Zeerasiya	495	330	3, 100	2, 500
Onosma bracteatum	Gul-e- Gaozaban	290	2, 140	2, 100	1, 500
Berberis aristata	Zarishk	238	350	2, 500	2, 000
Polypodium vulgare	Bisfaij	250	210	5, 000	4,000

Table 7. Data shows the consumption and selling price of Qarshi Industries (PVT) Limited, Pakistan in 2002 and 2009

Scientific name	**Common name**	**Avg. price (2002)(Rs. /kg)**	**Avg. price (July' 2008toJun' 2009)(Rs. /kg)**	**Qty. used (July' 2008toJun' 2009)(kg)**	**Qty. used (2002)(kg)**
Plantago ovata	Ispaghol(HUSK)	225	455	2, 300	1555
Achillea millefolium	Baranjasif	30, 000	3, 10000	20	35
Viola odorata	Gul- e- Banafsha	550	1, 000	2, 000	2760
Carum carvi	Zeera siya	400	185(white)	2, 500	16400
Lavandula officinalis	Ustukhuddus	320	329	3, 000	419
Onosma bracteatum	Gul-e- Gaozaban	290	1, 435	1, 500	250
Berberis aristata	Zarishk	238	250	2, 000	550
Polypodium vulgare	Bisfaij	250	210	4, 000	436

Latest data about import of MPs is being sought be PHDEC for future planning.

Value added Products from Medicinal Plants (MPs)

Despite extensive industrialization over the last many decades, agriculture continues to hold a major position of importance. Agriculture has supplied us with food security, but it has not provided us with nutritional security thus far. Value addition is the process of achieving a high price for the same volume of a primary commodity through processing, packing, quality improvement, or other means. One of the most significant aspects of nutritional security is value addition. Due to excess production, farmers may receive a lower price for a particular farm commodity. Crop diversification can help solve this problem by allowing farmers to earn more money from the many crops they grow. Crop diversification and value addition are two methods for maximizing profits and ensuring nutritional security. The most pressing issue nowadays is ensuring that farmers receive a fair price for their farm products. This problem can be overcome by adding value to various crops, which can then be sold both inside and outside the country. This may also result in greater employment opportunities for rural residents. Through a specific production technique, value added agriculture serves to raise the value of primary agricultural commodities. Small-scale processing facilities, organic food processing, traditional crop farming, agritourism, and biofuels development are just a few examples of value-added enterprises that have helped to create new jobs in rural areas. Value addition in agriculture is necessary for farmers' profitability, for farmers' empowerment, for providing safe, quality, and branded food to consumers, for reducing post-harvest losses, for reducing imports and increasing exports, for encouraging the growth of subsidiary industries, for reducing marketing risk, for promoting crop diversification, and for increasing farmers' financial stability. Attentiveness to the needs of the customer demands in quality, variety and packaging are important. New products should be tried in order to be original and novel. The product we make should be one-of-a-kind, with crops and variations native to our country being utilized. The product should be unique and innovative, such as a black or blue rose, so that no one else in the market can compete with it. Biotechnology can be used to enhance value to horticulture crops, for example. The thing we create should be in high demand in the marketplace. For ease of selling and distribution, the commodity should have a high value for a low volume, and extracts such as spices and herbal plants can meet these criteria. The product's quality and quantity should be maintained in the market. In the end, any product's success is determined by its market. In today's world, the entire globe has become a single global market, with far too much rivalry. In the agriculture industry, value addition and crop diversity have

become buzzwords. Diversification of products is required to realize the full potential of the current development scenario. Value addition aids in the prevention of post-harvest losses, industrialization, job creation, export, increased food availability, foreign exchange earnings, product diversification, and easier marketing, among other things. Agro-processing industries have a big role to play in accomplishing the goal of "doubling farm revenue." Because processed foods have a high income elasticity, their consumption rises in lockstep with rising incomes. Our country has now been classified as a 'lower middle-income' country by the World Bank, and as a result, the proportion of processed food in our population's food basket is expected to rise. Food processing sector growth is fueled by urbanization, diet diversification, globalization, increased female labor force participation, nuclear families, changing policy attitudes, including digitization, and export prospects. Agricultural technologies have a big impact on farm performance and can be helpful for both the producers and consumers. The word "value-added" refers to the extra cost a firm adds to its products or services before selling them to customers. Value-added explains why businesses can sell their products or services for more than they cost to make. Adding value to products and services is critical since it encourages people to buy, hence improving a country's income and bottom line.

Value-added might thus refer to situations in which a company takes a product that might be considered homogeneous—with few, if any, distinctions from that of a competitor—and adds a feature or add-on that gives it a higher perceived value. Putting a brand name on a generic product might be just as useful as creating something new or in a unique way. Additional features or economic value that a firm adds to its products and services before delivering them to customers are referred to as value-added. Adding value to a product or service allows businesses to attract more customers, resulting in increased revenue and profits. Value-added is the difference between the retail price of a product and the cost of manufacturing it. Value can be added in a variety of ways, for as by putting a brand name on a generic product or putting a product together in an unusual way.

China and India are two of the world’s largest markets for medicinal plants, though not necessarily the largest traders. The main importing countries are China, Hong Kong, US, Japan and Germany. The Germany is the leading importer within Europe because its pharmaceutical companies are major players in the world market. During last few years, the medicinal plants were predominantly

exported to Germany, Switzerland, USA, and other European countries. The Pakistan has huge potential of medicinal plants, but regrettably there are no set standards for the trade as well as the cultivation of the medicinal plants according to GACP and international standards that qualify for competitive advantages in the international market.

The major supply of MPs materials was from District Swat, but its market share had declined due to its unreliability and inferior quality of the material supplied, length of the supply chain, and poor marketing strategies. According to various stakeholders, Pakistan is involved in the exports and imports of substantial amounts of MPs material with more than **70** countries. **Lahore (Akbari Mandi) and Karachi (Jodia Bazar)** provide main source for MPs export. The destination of exports includes Germany, USA, Middle East, Switzerland and many other countries. Export of crude herbal items to different countries is largely through individual and local exporters of Lahore and Karachi. The herbal market of Lahore acts as a main hub and receives very large quantities of imported herbs from India and more recently China. Other sources of imports include Thailand, Indonesia, Tanzania, Iran, and Afghanistan. An increasing market trend of imports has occurred, particularly from India, China, Iran and Afghanistan because of short supplies from local sources.

It was highlighted that the foreign trade through unconventional routes, including cross border exchanges, is often unmonitored and is part of the undocumented economy of the country. The export of medicinal herbs is not compiled separately by the Federal Bureau of Statistics. Therefore, it is difficult to record export levels or trends of export. Hamdard Laboratories is one of the leading stakeholders.

The huge market demand for raw and semi-processed MPs both within and outside the country imposes considerable ecological pressure on natural habitats. The populations of many medicinal plant species are rapidly declining with increasing degradation of the natural habitat. However, due to the issues of erratic demand and irregular supply of MPs, the trade has not been able to be properly and effectively established. To ensure the potential value of medicinal plants as a livelihoods option for communities require radical shift in focus and resetting of priorities at the policy and management levels.

Global Exports of Medicinal Plants

Table 8. Global exports of medicinal Plants-List of Countries and year wise quantities in tons.

S.No	Exporters	2016	2017	2018	2019	2020
	World	No Quantity	653,826	684,124	749,327	No Quantity
1	**China**	153,386	150,668	122,904	127,695	136,152
2	**India**	80,997	76,673	89,252	86,131	110,508
3	**Myanmar**	7,692	9,140	8,636	25,451	30,175
4	**Nigeria**	No Quantity	No Quantity	4,612	42,334	29,822
5	**Germany**	22,367	23,476	24,683	24,953	26,973
6	**Morocco**	20,101	22,760	27,390	27,667	22,923
7	**Poland**	16,349	17,886	19,587	18,573	18,551
8	**USA**	16,353	16,634	18,861	16,418	17,393
9	**Afghanistan**	-	186	1,403	7,528	17,289
10	**Albania**	9,608	7,277	7,624	6,371	11,188
11	**Thailand**	10,164	7,531	11,830	10,357	11,103
12	**Indonesia**	9,167	9,164	12,356	12,036	11,005
13	**Pakistan**	12,828	7,897	9,071	8,958	10,672
14	**Mexico**	29,479	34,447	37,561	32,280	10,283
15	**Austria**	2,565	2,349	3,656	4,775	9,618
16	**Congo**	7,272	6,425	6,422	7,399	8,809
17	**Peru**	6,669	6,388	7,924	8,644	8,546
18	**Chile**	8,988	9,748	9,933	9,256	8,187
19	**Colombia**	6,832	8,288	8,602	9,949	8,071
20	**Turkey**	4,673	5,900	6,275	8,373	7,985

Source: ITC calculations based on UN comtrade Statistics.

Table 9.
Global exports of medicinal Plants-List of Countries and year wise Value in Million USD)

S.No	Exporters	2016	2017	2018	2019	2020
	World	3180.057	3171.275	3189.833	3223.928	3526.295
1	**China**	1053.143	964.461	822.422	899.041	932.277
2	**India**	259.342	291.761	307.883	285.797	347.387
3	**Germany**	151.815	175.135	190.892	187.121	213.873
4	**USA**	155.193	171.225	184.103	172.87	177.025
5	**Canada**	192.908	185.565	131.854	120.713	141.646
6	**Egypt**	120.787	115.331	111.34	116.942	138.225
7	**Spain**	81.701	86.644	87.364	100.969	103.811
8	**Poland**	56.835	61.828	84.05	87.68	96.909
9	**Korea**	54.43	71.269	84.913	87.237	75.817
10	**Mexico**	61.29	72.879	80.174	67.155	67.361
11	**Hong Kong, China**	130.166	141.078	125.638	99.166	61.91
12	**France**	48.567	51.962	56.139	52.224	61.435
13	**Austria**	15.057	17.833	23.674	27.94	55.456
14	**Morocco**	44.587	49.817	62.407	63.933	54.651
15	**Singapore**	57.198	63.466	54.484	58.878	53.418
16	**Viet Nam**	17.854	19.478	23.712	20.193	46.862
17	**Netherlands**	27.724	32.479	40.349	35.27	43.641
18	**Indonesia**	20.881	27.249	40.434	37.485	41.59
19	**Myanmar**	8.682	8.163	11.868	29.536	41.019
20	**Albania**	29.595	16.729	21.837	21.117	39.462

Source: ITC calculations based on UN comtrade Statistics.

Conclusion:

The largest global markets for medicinal plants exist in China, India, Germany, France, Japan, Italy, UK and USA. Vasisht et.al. **(2016)** calculated from the global export data. The cost of MPs in **2014** is anticipated to be US$ **33 billion**. For the fourteen-year period, the average global export of medicinal plants under **HS 1211** was US$ **1.92** billion for **601,357** tons each year, with **702,813** tons valued at US$ **3.60** billion in **2014**. **Conclusion:** An annual average growth rate (AAGR) of **2.4** percent in volumes and **9.2** percent in export values was recorded over the study period. The top two countries in terms of import and export account for over **30%** of global trade. China and India are key supply sources in Asia; Egypt and Morocco are important supply sources in Africa; Poland, Bulgaria, and Albania are important supply sources in Europe; and Chile and Peru are important supply sources in South America. The key players are the United States, Japan, and Europe (https://agrihunt.com). Total global trade in MAPs has expanded more than two and a half times in the last **18** years in terms of value. China, India, Hong Kong, the United States, Germany, the Republic of Korea, Canada, and Poland are the top export countries, while the top destinations are the United States, Hong Kong, Japan, Germany, and France, the Republic of Korea, China, and Singapore, according to Himanshu et al (**2017**). The study identifies five key trade centers for MPs around the world: 1The United States, Hong Kong, Germany, the Republic of Korea, and China. Ginseng roots are one of the most traded MPs-based commodities; Canada is the major exporter, and Hong Kong is the primary destination.

Global Imports of Medicinal Plants

Table 10. -List of Countries and year wise quantities in tons.

S.No	Importers	2016	2017	2018	2019	2020
	World		767,290	741,049		
1	**India**	29,464	30,431	36,625	47,061	92,147
2	**USA**	66,692	71,721	85,417	85,043	91,472
3	**China**	43,968	33,238	40,545	62,971	74,185
4	**Germany**	65,530	67,833	72,597	73,186	70,863
5	**Taipei, Chinese**	33,440	31,428	32,085	30,556	31,556
6	**Japan**	30,017	31,048	30,154	30,169	30,044
7	**Korea**	27,599	24,702	25,272	28,445	26,942
8	**Spain**	20,469	21,662	23,036	24,889	25,416
9	**France**	19,630	19,897	20,132	19,230	19,678
10	**Bangladesh**	5,724	3,773	7,517	9,555	15,465
11	**Pakistan**	9,417	11,661	12,932	11,468	15,241
12	**UK**	11,300	18,037	24,123	16,661	14,853
13	**Singapore**	14,181	13,616	13,618	13,755	14,588
14	**Brazil**	6,837	8,417	8,612	9,021	13,442
15	**Canada**	-	13,315	13,606	14,640	13,207
16	**Netherlands**	8,983	10,844	13,243	10,548	13,064
17	**Poland**	10,898	9,623	10,439	11,004	11,608
18	**Russia**	9,309	10,192	9,032	9,423	10,647
19	**Viet Nam**	4,272	5,916	5,797	8,926	9,885
20	**Malaysia**	12,394	11,182	10,652	10,068	9,494

Source: ITC calculations based on UN comtrade Statistics.

Table 11.
Global imports of medicinal Plants-List of Countries and year wise Value in Million USD)

S. No	Importers	2016	2017	2018	2019	2020
	World	3085.885	3.120.135	3356.485	3283.104	3392.592
1	**USA**	413.369	409.819	453.012	403.124	433.599
2	**Germany**	263.350	290.126	341.077	334.159	359.554
3	**Japan**	313.334	272.931	273.463	261.573	257.859
4	**Hong Kong, China**	373.955	307.608	311.652	263.085	236.458
5	**China**	104.741	103.099	125.390	149.148	149.602
6	**Taipei, Chinese**	135.928	135.958	157.199	137.063	138.202
7	**France**	91.071	99.081	97.571	102.377	113.005
8	**Korea**	96.777	95.896	102.416	113.973	107.304
9	**India**	69.742	60.813	79.267	81.324	102.184
10	**Spain**	76.026	90.407	94.082	96.620	99.280
11	**Canada**	91.941	93.515	94.620	99.509	86.647
12	**Italy**	92.410	83.603	84.561	83.573	86.438
13	**Singapore**	110.952	102.525	105.862	103.769	82.027
14	**UK**	56.819	77.624	103.643	80.662	77.118
15	**Netherlands**	47.600	58.937	68.137	50.239	71.090
16	**Saudi Arabia**	25.325	19.700	36.250	52.701	69.731
17	**Switzerland**	42.242	45.920	47.880	44.225	66.095
18	**Viet Nam**	21.807	29.563	33.240	46.183	57.810
19	**Malaysia**	78.573	75.226	71.260	63.327	51.976
20	**Poland**	30.923	31.439	36.334	40.936	45.428

Source: ITC calculations based on UN comtrade statistics.

Review of imports versus export trend in Pakistan

Table. 12: Medicinal Plants exported by Pakistan (Year wise quantities in Metric Tons)

Sr. No	Importers	2016	2017	2018	2019	2020
	World	12,828	7,897	9,071	8,958	10,672
1	**China**	403	229	255	334	1,313
2	**Viet Nam**	158	200	286	438	1,229
3	**UAE**	479	224	243	362	1,063
4	**Nepal**				396	975
5	**Korea**	271	393	565	778	823
6	**Singapore**	1240	324	213	349	812
7	**Sri Lanka**	826	772	698	1383	631
8	**Montenegro**				40	588
9	**Taipei, Chinese**	438				428
10	**Bangladesh**	486	363	404	361	370
11	**Indonesia**	349	261	369	437	309
12	**Saudi Arabia**	706	625	346	642	309
13	**Japan**	160	193	148	170	230
14	**Egypt**	1319	550	439	712	193
15	**Algeria**	20	61	53	146	138
16	**Kuwait**	7	11		15	132
17	**France**	149	142	104	131	126
18	**Germany**	56	71	187	238	99
19	**Malaysia**	284	140	78	87	89
20	**Kazakhstan**	24	180	21	8	82

Source: **ITC calculations based on UN comtrade Statistics.**

Table. 13: Medicinal Plants exported by Pakistan (Year wise values in Million USD)

Sr.No	Importers	2016	2017	2018	2019	2020
	World	12.517	9.373	12.608	11.862	12.026
1	**China**	0.358	0.295	0.384	0.333	1.208
2	**Viet Nam**	0.124	0.211	0.398	0.665	1.171
3	**Korea**	0.423	0.541	0.916	1.172	1.152
4	**UAE**	0.363	0.249	0.359	0.49	0.981
5	**Nepal**	0	0	0	0.624	0.975
6	**Sri Lanka**	1.139	0.993	1.237	1.714	0.948
7	**Singapore**	1.169	0.375	0.237	0.48	0.617
8	**Taipei, Chinese**	0.632	0	0	0	0.58
9	**Montenegro**	0	0	0	0.064	0.507
10	**Saudi Arabia**	0.858	0.764	0.622	0.754	0.435
11	**Indonesia**	0.491	0.28	0.518	0.548	0.374
12	**Japan**	0.239	0.273	0.204	0.283	0.372
13	**Bangladesh**	0.411	0.394	0.553	0.508	0.343
14	**Germany**	0.145	0.105	0.374	0.395	0.237
15	**USA**	0.061	0.048	0.155	0.063	0.195
16	**France**	0.261	0.186	0.201	0.21	0.187
17	**Algeria**	0.008	0.106	0.123	0.202	0.186
18	**Egypt**	1.275	0.664	0.6	0.864	0.171
19	**Finland**	0	0	0	0	0.163
20	**Malaysia**	0.227	0.257	0.127	0.096	0.13

Source: **ITC calculations based on UN comtrade Statistics.**

Table. 14: Medicinal Plants imported by Pakistan (Year wise quantities in Metric Tons)

S.No	Exporters	2016	2017	2018	2019	2020
	World	9,417	11,661	12,932	11,468	15,241
1	**Afghanistan**	1,036	608	695	1,382	8,039
2	**Turkey**	59		0	1,069	1,743
3	**China**	319	162	287	364	1,558
4	**Nepal**	50	64			1,211
5	**Viet Nam**	261	526	699	880	807
6	**Iran**	180	386	159	440	392
7	**Montenegro**	51				363
8	**India**	6,075	8,897	10,114	6,211	235
9	**Nigeria**	7	5			144
10	**Morocco**	108	88	26	135	112
11	**USA**	28	28	31	91	111
12	**Belgium**	21	37	30	35	106
13	**UAE**	48	43	21	1	96
14	**Sri Lanka**	26	19	2		68
15	**Syria**	383	216	430	255	53
16	**Mexico**	4	24	11	29	37
17	**UK**	39	45	38	141	35
18	**Singapore**	15	12	15	20	32
19	**Indonesia**	226	180	76	56	25
20	**Germany**	31	26	6	5	21

Source: ITC calculations based on UN comtrade Statistics.

Table. 15: Medicinal Plants imported by Pakistan (Year wise values in Million USD)

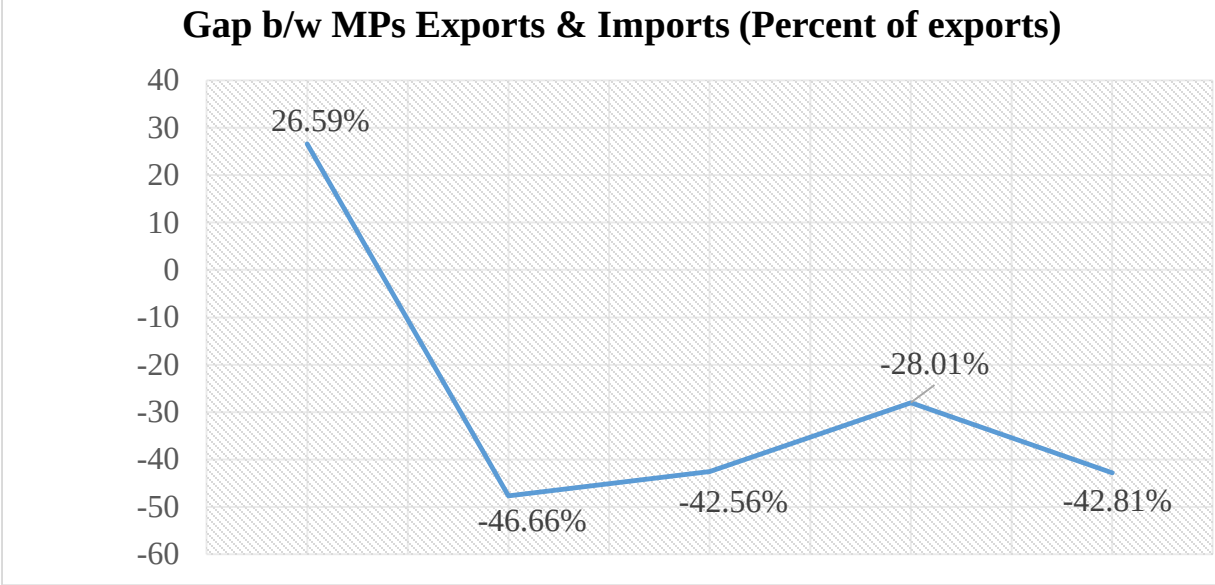
S.No	Exporters	2016	2017	2018	2019	2020
	World	8.747	10.684	10.012	7.741	6.892
1	**Afghanistan**	0.69	0.416	0.478	0.61	2.588
2	**Turkey**	0.057	0	0	0.913	1.505
3	**China**	0.199	0.204	0.188	0.209	0.598
4	**Nepal**	0.027	0.05	0	0	0.55
5	**Viet Nam**	0.212	0.421	0.497	0.477	0.459
6	**Montenegro**	0.027	0	0	0	0.25
7	**India**	5.641	8.397	7.883	4.382	0.186
8	**Iran**	0.151	0.249	0.107	0.221	0.157
9	**USA**	0.038	0.052	0.022	0.064	0.094
10	**UAE**	0.13	0.084	0.071	0.012	0.066
11	**Morocco**	0.094	0.103	0.016	0.096	0.063
12	**Nigeria**	0.006	0.004	0	0	0.062
13	**Belgium**	0.02	0.026	0.023	0.051	0.057
14	**UK**	0.03	0.045	0.027	0.131	0.053
15	**Syria**	0.548	0.162	0.332	0.221	0.043
16	**Greece**	0	0	0	0	0.032
17	**Sri Lanka**	0.023	0.017	0.001	0	0.027
18	**Indonesia**	0.247	0.195	0.054	0.034	0.022
19	**Germany**	0.024	0.023	0.004	0.014	0.018
20	**Mexico**	0.003	0.016	0.007	0.023	0.018

Source: ITC calculations based on UN comtrade Statistics.

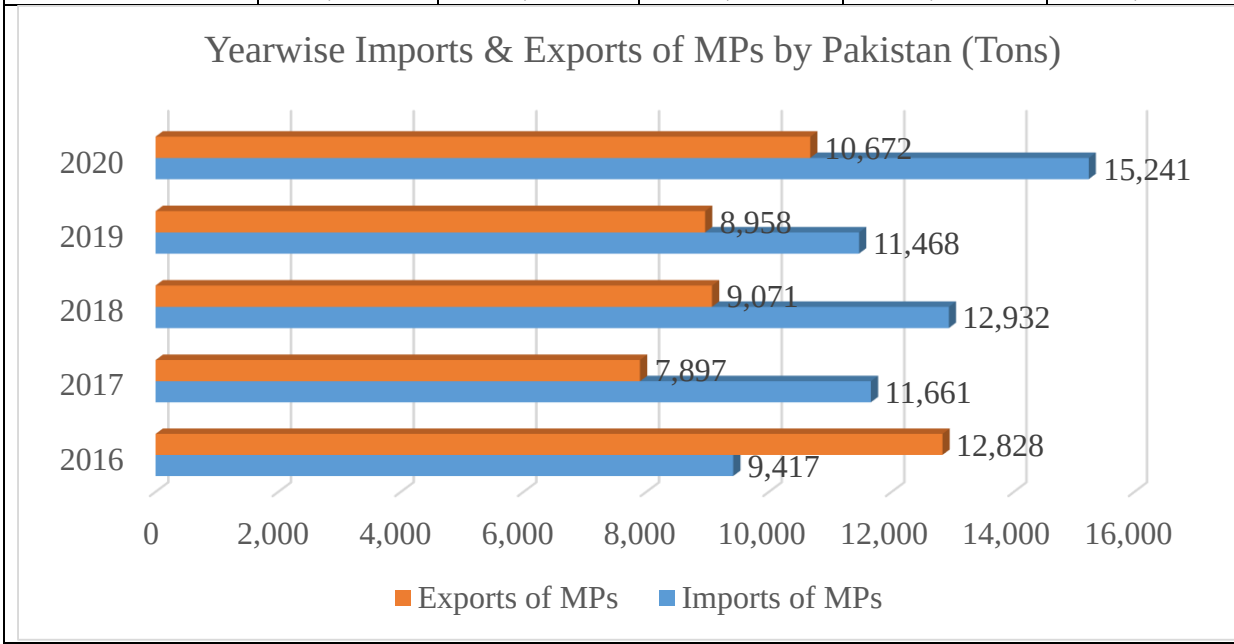
Gap Between Import & Export of Medicinal Plants

Table 16:

Gap between import and export of medicinal plants in Pakistan (year wise quantities in tons)



Tons of MPs	2016	2017	2018	2019	2020
Imports of MPs	9,417	11,661	12,932	11,468	15,241
Exports of MPs	12,828	7.897	9.071	8,958	10,672
Net effect	3,411	-3,764	-3,861	-2,510	-4,569



Medicinal plants exports increased to **26.66%** in **2016** and thereafter exports of medicinal plants was significantly less to imports of MPs. Exports were less up to **46%** in **2017**, **42%** in **2018**, **28%** in **2019** and **42%** in **2020.** Net gap in negative figure showed higher import of MPs and low export quantities. Reason attributed to less export or MPs production was lack of cultivation practices on commercial basis to meet demand of MPs of the country. Domestic consumption of MPs increased every year compared to MPs production within the country leading to net negative effects on exports. High domestic demand of MPs was met with increased imports on expenditure of national exchequer. Pakistan need to increase exports of MPs up to **50%** to balance net effect of imports and exports. This demands increase production of MPs on commercial basis as minor crops of the country.

Prospects of Import Substitution (Cost of Imported Verses Local Production)

Import of medicinal plants under specified category is not provided in completed form. Rather, medicinal plants consisted on grains, seeds, tubers, roots, and value added products like extracts, dyes, tannins are imported under the category of grains, seeds, oils, roots and tubers, tea and spices, pharmaceutical products, dyes and tannins. This makes difficult of accurately estimate the cumulative burden of import of medicinal plants. Specifically designed category and coded medicinal plants products are measured up to USD **6.892** million and other specified categories containing medicinal plants products import bill remained USD **4.19** Billion for year **2020.** The figures showed a huge burden of imported medicinal products in Pakistan. Following table showed year wise imported medicinal plant values.

Table 17. Pakistan Import value of medicinal plants – year wise analysis in Million USD.

Year	**2016**	**2017**	**2018**	**2019**	**2020**
MPs Import Values (Million USD)	8.747	10.684	10.012	7.741	6.892
MPs and MPs products imported in other categories (year 2020)					
Import bill of medicinal plants under various categories of import in year 2020 Grain, seeds, fruits, oils: USD 1.28 Billion Roots and Tubers USD 895.15Million Tea and Spices USD 782.36Million Neutra. Products USD 781.48Million Tannins, Extracts etc. USD 453.07Million **Total: USD 4.19 Billion**				*Reference: https://tradingeconomics.com/pakistan/imports-by-category*	

An estimate projected to be **05% share** of medicinal plants imported in previous year (2020) in other categories will ranged up to **USD 209.5 Million**. A cumulative estimate to imported medicinal plants and products in year 2020 will reach up to **USD 216.392 Million**. This estimate showed high economic importance of MPs and its products to be substituted with domestic products of MPs through domestic cultivation / production and MPs and promotion of domestic industry for value addition to MPs to substitute import.

As estimate is project to overlook of domestic production of MPs feasibility and projected required cultivation to meet the need of MPs and its product to substitute import burden. In the following table selected medicinal plants production per acre and income generation per acre is estimated

Table 18. Estimated income generation / feasibility for future production of MPs per acre analysis.

No.	Scientific name	Local name	Production (Kg/Acre)	Amount (Season)
1	Moringa olifera	Moringa	400	120000
2	*Asparagus recmosus*	Stawari	400	640000
3	*Mimosa pudica*	Lajwanti	340	204000
4	*Brasica junicae*	Rai	520	182000
5	*Eruca sativa*	Taramira	300	108000
6	*Olea ferruginea* *Lecuta cerriola*	Kahu	660	264000
7	*Ziziphus jojuba*	Unaab	540	162000
8	*Trichodesma africanum*	Gaozuban	480	432000
9	*Withania somnifera*	Ashwagandha	400	340000
10	*Oligochaeta ramosa*	Barham dandi	300	240000
11	*Glycyrrhiza glabra*	Mulathi	700	280000
12	*Emblica officinalis*	Amla	750	390000
13	*Terminalia chebula*	Harar	750	382500
14	*Foeniculuam vulgaris*	Saonf	320	118400

15	*Cuminun cynimun*	Zeera	340	306000
16	*Viterveria zizaniodes*	Khas	600	498000
17	*Chlorophytum borivilianum*	Musli	800	352000
18	*Curcuma zadeora*	Kachur	600	360000
19	*Wrighta tingtoria*	Andr joa	640	160000
20	*Achyranthus aspera*	Chirchita	200	300000
21	*Viola odorata*	Banafsha	230	78200
22	*Convulvulus prostrates*	Hiran boti	480	177600
23	*Fegonia cretica*	Dhamasa	400	140000
24	*Neurada prodcumbens*	Chapri boti	350	140000
25	*Fumeria indica*	Shahtra	320	256000
26	*Chrochorus depresus*	Bhophali	300	60000
27	*Euphorbia prostrata*	Hazardani	280	448000
28	*Macula orchis*	Salep	400	120000
29	*Hedera helix*	Ivy	650	520000
30	*Vaccinium subg*	Cranberry	800	640000
31	*Elleteria cardmomum*	Elaichi	450	315000
32	*Ginko biloba*	Ginko	430	258000
33	*Piper nigrum*	Kali mirch	540	189000
34	*Alpinia galanga*	Khulinjan	400	120000
35	*Swertia chiryata*	Chirayta	100	210000
36	*Ferrola asafoetida*	Hing	800	160000
37	*Trapa natans*	Singhara	100	110000
38	*Cinnamomum camphora*	Kaphor	230	69000
39	*Macrotyloma uniflorum*	Kulthi	320	96000
40	*Pueraria tuberosa*	Badarikand	480	240000
41	*Myristica Fragrans*	Jaiphal/jawatri	400	200000
42	*Chochlospermum religiosum*	Gond katira	350	157500
43	*Centella asiatica*	Berhami	410	369000
44	*Syzygium aromaticum*	Long	370	166500

45	*Holarrhena antidysenterica*	Andar jao Talkh	900	162000
46	*Casia fistula*	Amaltas	200	168000
47	*Commiphora stocksiana*	Guggle	1900	190000
48	*Cyamopsis tetragonoloba*	Guar beens	170	47600
49	*Cleome scaposa*	Kastoori boti	190	57000
50	*Crotalaria burhia*	Chag	400	180000
Total production per season			**22.99 M Tons**	**11.7633 Million PKR**

Table 19. Estimated Cultivation land required for total import substitution of MPs

50 acre production of MPs income generation in Millions PKR	11.7633
50 acre production of MPs income generation in USD Millions taking Dollar exchange rate constant at 170 PKR/ USD	0.0691
Land cultivation require to reach one million USD for MPs production taking 50 acres / 0.0691 as unit constant. (14.472 units X 50 acres)	**724 acres**
Land cultivation required to reach up to USD 216.392 million to substitute import of MPs (724 acre X 216.392)	**156,668 Acres**

Table 19 projected land cultivation for import substitution of medicinal plants is subjected to **156,668-**acre cultivation of medicinal plants. Pakistan being an agricultural country with four season and range of soil texture make it feasible for cultivation of medicinal plants in their natural habitat. This cultivation of MPs will pave way to import substitution of MPs to save national exchequer. Development in this sector will requires extensive supervision and consideration at favourably intent of Government Authorities and policy make leading to facilitation to farmers and technical support through experts and provision of latest agricultural technology for successful production of MPs in Pakistan.

LIST OF VALUE ADDED PRODUCTS IN HIGH DEMAND INTERNATIONALLY

Table 20. List of value added products in high demand internationally

No.	Scientific Name	English name
1.	*Moringa oleifera*	Moringa leaves, seeds and oils
2.	*Agathosma betulina*	Buchu leaf
3.	*Vanilla planifolia*	Vanilla fruit
4.	*Commiphora spp.*	Myrrh powder
5.	*Prunus Africana*	Pygeum bark
6.	*Centella asicatica*	Gotu kola herb
7.	*Menthe spicata*	Spearmint leaves
8.	*Syzygium aromaticum*	Clove flower bud
9.	*Foeniculum vulgare*	Fennel fruit
10.	*Rosa canina*	Rose hip
11.	*Aspalanthus linearis*	Rooibos herb
12.	*Rosmarinus officinalis*	Rosemary herb
13.	*Panax ginseng*	Asian ginseng roots
14.	*Schisandara chinensis*	Schisandar fruit
15.	*Ginko biloba*	Ginko extract dry powder
16.	*Lyceum bardarum*	Lyceum fruit
17.	*Carthamus tincturius*	Safflower
18.	*Eleutherococcus senticosus*	Eleuthrero root
19.	*Zingiber officinale*	Ginger dried roots
20.	*Allium sativum*	Garlic bulb
21.	*Crocus sativus*	Saffron
22.	*Asparagus racemosus*	Satawari roots
23.	*Andrographis paniculata*	Andrographis herb
24.	*Saussurea costus*	Costus roots
25.	*Delphinium denudatum*	Nirvisa root
26.	*Eletteria cardamomum*	Cardamomum seeds
27.	*Cinnamomum aromaticum*	Cassia bark
28.	*Rauvolfia serpentine*	Rauvolfia roots

29.	*Swertia chirayita*	Chirata herb
30.	*Myristica fragrans*	Nutmeg kernel
31.	*Plantago ovate*	Psyllium husk
32.	*Withania somnifera*	Ashwagandha roots
33.	*Curcuma longa*	Turmeric rhizomes
34.	*Cassia aungustifolia*	Seena pods
35.	*Cordinandrum sativum*	Coriander fruit
36.	*Bacopa moneri*	Bacopa herb.
37.	*Phyllanthus emblica*	Amla fruit
38.	*Trigonella foenum-graecum*	Fengu greek fruit
39.	*Hydrastis Canadensis*	Golden seal rhizomes
40.	*Actaea racemosa*	Black kosh rhizomes
41.	*Vaccinium macrocarpons*	Crannbery fruit powder
42.	*Serenoa repens*	Saw plalmatto
43.	*Dioscorea villosa*	Wild yarm root powdered
44.	*Lepidium meyenii*	Mecahypocotyle
45.	*Uncaria tobentosa*	Cat's claw
46.	*Stevia rebaudiana*	Stevia leaves
47.	*Vaccinium myrtillus*	Bilbery fruit
48.	*Teraxacum officinalis*	Dandelion root
49.	*Sabucus nigra*	Elder flower
50.	*Artemisia vulgaris*	Mugwort herb
51.	*Chinacea prupurea*	Purple coneflower
52.	*Urtica dioica*	Stinging nettle herb
53.	*Carum carvi*	Caraway fruit.
54.	*Withania somnifera*	Indian ginseng roots
Oils, Extracts, Tannins (Dyes) And Pharmaceutical Ingredients As Product Of Medicinal Plants		
	Name of product	**Scientific name**
55.	Rose oil	*Rosa damascana*
56.	Sandal wood oil	*Santalum album*

57.	Chamomile oil	*Matricaria recutita*
58.	Cardamom oil	*Elleteria cardamomum*
59.	Cinnamon oil	*Cinnamomum verum*
60.	Ginger oil	*Zingiber officinale*
61.	Geranium oil	*Pelargonium graveolens*
62.	Vetiver oil	*Chrysopogaon zizaniodies*
63.	Basil oil	*Ocimum basilicum*
64.	Cumin oil	*Cuminun cyminum*
65.	Lavender oil	*Lavandula officinalis*
66.	Tea tree oil	*Melaleuca alternifolia*
67.	Nutmeg oil	*Myristica fragrans*
68.	Orange oil (bitter)	*Citrus aurantium*
69.	Bergamot oil	*Citrus aurantium subsp. Bergamia*
70.	Lemon oil	*Citrus lemon*
71.	Lime oil	*Citrus aurantifolia*
72.	Palmarosa oil	*Cymbopogon martini*
73.	Peppermint oil	*Mentha piperita*
74.	Spearmint oil	*Menthe spicata*
75.	Patchouli oil	*Pogostimon cablin*
76.	Eucalyptus oil	*Eucalyptus spp.*
77.	Citronellal oil	*Eucalyptus spp.*
78.	Citronella oil	*Cymbopogon citratus*
79.	Aniseed oil	*Pimpinella anisum*
80.	Star anise oil	*Illicium verum*
81.	Orange oil (sweet)	*Citrus sinensis*
82.	Clove leaf oil	*Syzygium aromaticum*
83.	Castor oil	*Ricinus communis*
84.	Jojoba oil	*Simmondsia chinensis*
85.	Almond oil	*Prunus dulcis*
86.	Sesame oil	*Sesamum indicum*
87.	Avocado ail	*Persea Americana*

88.	Apricot kernel oil	*Prunus armineiana*
89.	Rapeseed oil	*Brassica napus*
90.	Cocoa butter	*Theroroma cacao*
91.	Carnauba wax	*Copernicia prunifera*
92.	Candelilla wax	*Euphorbia spp.*
93.	Gum Arabic	*Acacia spp.*
94.	Gum tragacanth	*Astralagus spp.*
95.	Locust bean gum	*Ceratonia siliqua*
96.	Guar gum	*Cyamopsis spp.*
97.	Jasmin oil	*Jasminum officinale*
98.	Aloe gel	*Aloe vera*
99.	Acai fruit extract	*Euterpe oleracea*
100.	Baobab fruit extract	*Adansonia spp.*
101.	Guarana extract	*Paullinia cupana*
102.	Indigo extract	*Indigofera spp.*
103.	Curcuma extract	*Curcuma spp.*
104.	Henna extract	*Lawsonia inermis*
105.	Marigold extract	*Tagetes spp.*
106.	Alkylamide compound	*Achinacea purpurea*
107.	Gensinosides	*Panax gensing*
108.	Saw palmetto extract	*Serenoa repens*
109.	Ginkgolides	*Ginko biloba*
110.	Hyperforins	*Hypericum perforatum*
111.	Valerianic and isovalerianic acids	*Valeriana officinalis*
112.	Allicin	*Allium sativum*
113.	Sesquiterpene lantones	*Tanacetum parhentum*
114.	Alkaloids	*Ephedra sinica*
115.	Triterpene glycosides	*Cimicifuga racemosa*
116.	Kavalactones	*Piper methysticum*

Table **20** contained **116** powder herbs, extracts, dyes, oils, essential oils, tannins, excipients and neutraceutical agents among high demand in worldwide trade are prescribed. Among these **116** international value added products Pakistan has native potential for **39** MPs found in flora of Pakistan and their value added products which could be a source of revenue to national economy. Others can be opted through active participation in medicinal plant cultivation and installation of value added processing units in the country.

Constrains / Barriers in development of Medicinal Plants and its Products:

Pakistan has its unique history of traditional medicine embodied in cultural heritage. Use of medicinal plants as treatment recipe is being practiced here since time of ariyans and knows as Ayurveda. In 2nd century AD Greek philosophical treatment reached Indian subcontinent and migrated Muslim Arabs in 6th and 7th century AD paved prosperous way to traditional medicine previously known as Unani medicine system and current popularized as Eastern Medicine System. Pakistan Parliament passed and entacted Unani Ayurvedic & Homeopathic Practitioners Act II of **1965** to promote traditional medical practices within the country. National Council for Tibb (NCT) and National Council for Homeopathy (NCH) were established under UAH Act **1965** and were assigned with research and development in traditional medicines within the country. These councils are also empowered to register practitioners of traditional medicine having recognized qualification in approved by the Federal Government. Councils affiliates teaching institutions. Currently knowledge and education in Eastern Medicine (Medicinal Plants) whose practitioners are given proposed nomenclature of "Doctor of Natural Medicine" for qualified graduates of "Bachelor of Eastern Medicine & Surgery" (BEMS). Higher Education Commission (HEC) had approved and revised the curriculum of Eastern medicine up to level of Ph. D in various disciplines of Eastern Medicine. Higher qualification, research and development in medicinal plants is being carried out since **1995** in **10** universities of Pakistan. The Islamia University of Bahawalpur (IUB) is the pioneer public sector university teaching Eastern Medicine education up to level of PhD since **2000**. More than **3000** graduates has been passed out across the country in Easter Medicine. These graduates were expected to be provided with professional education and expertise in medicinal plants, research and development. But irrespective of potential advancement available with graduates of Eastern Medicine; potential is being wasted through policy lacking. Government

policy priorities inculcation of Eastern Medicine is necessary for medicinal plants economic development in collaboration with agronomist and regulatory authorities.

Drug Regulatory Authority of Pakistan (DRAP) contained a directorate of "Health & OTC products" for regulation and registration of medicinal plants products within the country. Concerned directorate of Health & OTC is the appropriate place for policy implementation for promotion of medicinal plant products within the country. Policy regulation gap is present at Health & OTC products division of DRAP because all the officials of Heath & OTC are not registered from National Council for Tibb (NCT) which sole registering public organization. Health & OTC product division is captured by Pharmacists who are registered with Pharmacy Council. Pharmacist has no basic knowledge, professional skill and education in medicinal plants and its products. This constitutes conflict of interest being irrelevant to the profession and subjugating medicinal plants development in comparison to modern allopathic medicine. Devastating effect of such subjugation can be understand from the outcome of H&OTC division that small industry of medicinal plants and its product manufacturer estimated to be more than **40,000** in number all over Pakistan has been lapsed in name of standardization. Domestic industry closure leaded to decrease in GDP and reliance on imported items for domestic utilization. Furthermore, Pharmacists are not fit for the responsibilities embedded in H&OTC division because the difference of acceptance is paved in initial creation of a Pharmacist with separate educational and professional system like "Doctor of Pharmacy" registered with separate council namely "Pakistan Pharmacy Council". Medicinal Plant education is provided in Eastern Medicine education like BEMS and registration with NCT. Both are opposing ends of opposite professions. Policy regulation can only be productive if concerned education and professional experts are involved in such policy making and implementation at authoritative level.

Other constrains involved in low medicinal plants production is lack of provision of technical support to the farmers or producers.

Establish a critical mass of cultivable land and farmer groups (cooperatives) in order to guarantee larger consistent supply.

Small farms producing small marketable surpluses of variant quality make quality control and consistent supplies very difficult. Farmer groups (cooperatives) have been organized in many

developing countries and have proved success. Commodity specific farmer cooperatives and/or association like turmeric grower's association, garlic grower's associations etc. should be organized and promoted in order to encourage "grow for export" approach. Promote farmer cooperation at village or regional level to guarantee a critical mass of cultivable land. Collectors should be organized into associations and clusters so that changes can be introduced in an effective and efficient manner.

Reduce the number of intermediaries. It involved in the distribution and marketing chain, and increase the negotiating power of the producers and collectors. This would enhance the profit of primary farmers and collectors,

Establishment of Infrastructure in the form of roads network, processing facilities, storages, etc., is imperative for sustainable exports. The poor infrastructure facilities result in enormous losses and cost escalations thereby adversely impacting our competitiveness in the international markets. The private sector is also shy to invest.

Research and development on the chemical composition and the effect of poor practices on the active ingredients of the selected species. These efforts would be facilitated by improved cooperation and coordination between many of the groups with an interest in this subject – namely those involved in education, research, production, distribution and marketing. Greater cooperation between researchers and farmers needs to be encouraged. Associated with these efforts, there is a need for improved product development.

Country authorities to develop effective strategies to support improved cultivation, quality controls systems, provision of high quality planting materials, and the encouragement of investments in new technologies.

Undertake a more in-depth global overview of the demand and supply of medicinal plants, herbal products and herbal drugs in order to clarify market issues, and consider more effective solutions. Many of the issues require more country and market-specific analysis because of the different market conditions, approaches used, materials and products being focused on. Case studies of successful marketing approaches being used may assist other organizations or

countries.

Identify products which would be most amenable to sustainable commercial development and industrial processing in the supplying countries.

National grades & quality standards are essential to offer quality products into the domestic markets and also prevent export of substandard produce. So far such standards are non-existent in Pakistan. There is need to design and introduce national grades and quality standards. Organizations like Pakistan Standard and Quality Control Authority (PSQCA), Pakistan Horticulture Development and Export Company (PHDEC) and Ministry of National Food Security and Research (MNFSR) should play their role. This will ensure export of good quality produce on consistent basis and will fetch premium price. It will be assured that the benefits reach down and shared through at each link of the value chain up-to the farmer end. This will encourage growers to grow better varieties and to work efficiently for better value of their products and also ensure compliance on GAP.

Value-addition through processing, and improved marketing of the medicinal plants. It is also important that the benefits of the expanded interest in medicinal plants be more equitable shared.

Enterprise development and promotion of the complete market chain. A strong market orientation is essential for the development of the sector. A holistic approach needs to be adopted for the promotion of trade. Specific interventions which only target the collectors are insufficient. The organic nature of the produce should be explored and capitalized on for export marketing.

Export Development Strategy

In order to boost exports, it is necessary to adopt a holistic approach involving supply chain management. There are three main players in the supply chain i.e. growers, infrastructure/services providers and exporters. Nothing can be achieved unless they work in harmony and complement each other's. So far they have been working in isolation with the results that export of medicinal plants and herbs has not shown an impressive growth in spite of surplus production.

A number of actions are considered important at a country level for improving the medicinal plant industry and enhancing the development of a more effective trade in medicinal plants and their products in developing countries.

Establishment of a Brand name. The establishment of "brand name" is sin qua none for sustainable export of medicinal plants and should be developed in conjunction with national grades and quality standards, international compliances (GAP, HACCP, etc.), and farmer groups. It may be started with a few selected commodities and expanded gradually. Ideally there should be an umbrella brand (national brand) that will be easy to promote internationally. The branding system i.e. adoption of GAP and national grades and quality standards leading to branding should be promoted through incentives in the form of cost subsidization, freight subsidies, etc. The custodian organization of the national brand should run extensive promotional activities in the targeted international markets through advertisements, promotional schemes, international seminars etc.

Human Resource Development. The fast changing business environment especially under the wake of globalization and WTO regime has impacted the whole value chain, especially with regards to human resource requirements both at the managerial and skill/technical levels. Hence, training and education of the workforce is a critical issue for the future development and economic growth. Technological changes and increased globalization in the world economy are placing great demands on business to stay ahead of technology growth curve or risk loosing competitiveness and market share.

Market Intelligence. Lack of access to relevant information on emerging market opportunities and how to avail them is a constraint faced by the participants of the export marketing system. The problem has been further compounded by the protective attitude particularly of the traders. Information dissemination is one of the Key goals of PHDEC. It should also cover medicinal plants and information should be comprehensive to cover market intelligence, import/export regulations, produce quality, packaging & labeling, food safety, etc.

Networking. Successful marketing including exports are result of collective efforts of a number of players contributing at different stages along the whole chain right from the farm to the end user. Greater the harmony and coordination better is the performance. The working in isolation at present poses serious constraints in boosting exports. PHDEC should facilitate such networking through regular liaison and interface with entrepreneurs, donors, support institutions and policy makers within the country and overseas partners in order to achieve the desired goals.

Major issues pertaining to medicinal plants cultivation, conservation and income-generation in Pakistan

Trade the medicinal plants:

In medicinal plants it is difficult to estimate accurately because much of the local trade is either unrecorded or poorly classified and because medicinal plants are also used in non-medicinal end-uses and not reported separately. Rising global interest in medicinal plants has also created a sustained and largely "underground'' trade in medicinal plants, many of which are being collected in least development countries in an unregulated manner, resulting in indiscriminate harvest of wild varieties and serious damage to biodiversity. It is therefore not possible to assess global trade in all medicinal plants. In addition, official trade statistics either do not identify the plants individually or do not separate their medicinal use from other uses.

Following are the major issues that the medicinal plants face in Pakistan, besides the prospects of cultivation, conservation and income generation:

a. Potentials of medicinal plants in Pakistan.
b. Increasing global demands of herbal medicines and current status in Pakistan.
c. Extent and causes of threats to existence of medicinal plants in Pakistan.
d. Policy issues in relation to promoting large scale cultivation and conservation.

The various review reports have concluded that research and development in medicinal plants is an overlooked sector in Pakistan. There are a number of opportunities to expand and effectively utilize this sector through research, development, conducive government policies and regulations, public awareness and adopting good agricultural and collection practices according to guidelines provided by WHO and FAO. It will help in mass production of MPs with sustainably establish a medicinal plant industry sector to support the economy. There are a number of other studies on the cultivation of MPs, however, in the country overall cultivations, processing and trade of medicinal plants is facing a number of constraints, which mainly results in reducing their competitiveness in global markets. These constraints have to be alleviated for the prosperity of the MP sector as whole and clusters under study explicitly.

- Poor agricultural, cultivation, harvest, post-harvest and collection practices.
- Lack of research on development of certified and registered high-yielding varieties.
- Lack of quality control procedures
- Neglecting professional and technical experts in Medicinal plants for considering at their due place of work, policy making participation, regulation implementation.
- Snags in marketing system and lack of local market for primary processed products
- Lack of access to latest technologies

Challenges faced by the medicinal plants industry in Pakistan-Constraints at production level:

The unavailability of good quality registered seeds, disease free, true to type planting material are limiting factors in improving productivity of medicinal plants. There is lack of backstopping of research-based package of technology tailored according to the needs of various soil types and changing climatic conditions of the clusters. The farmers are not aware of modern cultivation techniques and there is needed for practical training and extension education for the cultivation of important medicinal plants following WHO guidelines.

Constraints at processing level:

In the current state of affairs, the capacity of producers to meet the quality specifications demanded by processors and exporters could not be possible due to lack of facilities. There is need to furbish the capacity of the producers by providing facilities and technology of post-harvest management, cleaning, grading and proper storage of the produce.

Constraints at market level:

Currently in the cluster stakeholders within the cluster are not compliant with the International standards and guidelines designated by World Health Organizations (WHO) generally called as Good Agriculture and Processing Practices (GACP) as well as phyto-sanitary, quality and safety regulations. It is important to mention that in future the identification of new export markets and the expansion of existing markets will depend on adoption of these standards and regulation. In case of marketing of the medicinal plants, the market information utilized currently are primarily price orientated which has flaws which does not consider the product quality, grade, volumes traded, consignment size, origin and

the prices are disseminated without analysis.

Plan, Policies and Strategies

The following are the salient goals and targets for the development of medicinal plants in Pakistan.

i. The production of medicinal plants will be promoted on commercial scale through research-based technology package oriented on WHO guidelines on good agriculture and processing practices. The emphasis will be to increase productivity of medicinal plants. This goal may be achieved by;

a. Increase yield by 50% over 5 years through R&D backstopping

b. Harvest and Post-harvest losses to be reduced from 40% to 10%

c. Convert 50% of total MPs cluster commodity produce to clean product by providing mechanized cleaning/processing

d. Import substitution to reduce imports by 25% in 5 years

ii. Development, multiplication and registration of improved high yielding varieties of export potential medicinal plants.

iii. Promote new production technologies based on good agriculture practices.

a. The National Agriculture Research Council (NARC) in the country at Federal and Provincial level in collaboration with Eastern Medicine teaching institution and National Council for Tibb (NCT) will be given this task of R&D to evaluate the available germplasm and production technologies in the cluster areas and within the next 1-2 years' suitable varieties and technologies of export potential medicinal plants may be made available for the cultivation of the cluster farmers at large scale.

iv. Promote post-harvest technologies such as cleaning, storage and packaging and training of all stakeholders in the chain from production to trade.

v. Promote contract growing for better marketing of the produce.

vi. Promote and encourage set-up of new processing units in private sector.

vii. Develop and promote marketing information and guiding system for farmers and traders.

Policy Reforms

As a policy reform, a common intervention is recommended for both the Spices and Medicinal Plant clusters under feasibility studies. To deal with the problems of all stakeholders of the sector and successful execution of the Cluster Development Based Agriculture Transformation Plan for spices and medicinal plants. It will provide an umbrella infrastructure as a strategy of execution and policy interventions implementation. The cost of establishing this board is divided over all the clusters (both spices and medicinal plants) under study on basis of the area under each commodity. After sorting and finalizing the mechanics of the PSMPDB in order, under this parasol the strategies and activities/plans will be initiated to strengthen the current clusters of medicinal plants.

Strategies

Production level strategies:

The yield levels of medicinal plants clusters will be increased by 50% from the current base, over five years, following strategies are suggested:

a) Strengthen and persuade National Research System (NARS) to enhance its focused research and development activities.

b) The NARS will be also entrusted upon to establish in each cluster for adaptive research, such as evaluate and introduce new hybrids, varieties, machines, management models, etc.

c) The NARS and provincial extension departments will identify the export potential medicinal plants of R&D issues and seek grants from government or fund research from its own resources.

d) Promote Good Agricultural Practices (GAP) at the farm level.

e) Promote certified and registered seeds through vibrant system at public and private sector.

Harvest and post-harvest level strategies:

To reduce post-harvest losses following strategies are suggested at farm level.

a) Introduce and promote mechanical harvesting of important medicinal plants and train the farmers to harvest respective crop at appropriate maturity stage.

b) Promote cleaning of important medicinal plants using appropriate equipment at farm level.

c) Introduce proper methods and technology for the storage of the respective produce.

Processing and value addition strategies:

To promote the processing of medicinal plants following strategies are suggested.

a) Promote state-of-the-art and efficient technology of medicinal plants. For this purpose, machines/equipment and technology could be imported from China and later could be fabricated locally.

b) Promote cleaning of the different medicinal plants using mechanical cleaners at farm level to enhance quality and price of the produce.

c) There is need to enhance the productivity of international market demand of medicinal plants cluster as it will help to save significant foreign exchange in the form of import substitute.

Marketing and trading level strategies:

Following strategies are suggested at market and trading level

a) To minimize marketing costs and increase in producer profit.

b) Efficiency in the distribution and delivery of the produce.

c) Promote contract farming between processors/exporters and farmers with obligations to supply specific quality and quantity of medicinal plants at intended period with agreed price in the contract.

d) Provision of technical advice to the cluster farmers in the field from production to harvest of the crop – an opportunity for exposure to new technology and best practices

Recent Developments in Promotion of Medicinal Plants Production by PHDEC:

Pakistan Horticulture Development and Export Company (PHDEC) Ministry of Commerce had arranged and conduct a meeting of stake holders of medicinal plant products all over the country. In the meeting industrial stake holder were invited, academia and research institutes participated and experts were invited. Consultation was done among all participants to make up a road map for medicinal plant production. The forum revealed and agreed that the experts in medicinal plants and cultivation of medicinal plants are a few and their expertise in selection of medicinal plants, maintaining quality of medicinal plant in collaboration with agronomist is an integral part to achieve the goal of successful medicinal plant production.

Thereafter, PHDEC had conducted consultative meetings with expert of Medicinal Plant Cultivation Dr. Hafiz Abdul Sattar Hashmi expert in Phytomedicine (Medicinal Plants) having vast experience of more than 10 years in medicinal plant cultivation, remained Managing Director of medicinal plant products manufacturer and working as Faculty Member at University College of Conventional Medicine (UCCM) the Islamia University of Bahawalpur (IUB). His work on medicinal plants has inspired the stake holders being a sole expert with highest experience in medicinal plant cultivation.

PHDEC is also evaluating a proposal of Dr. Hafiz Abdul Sattar Hashmi for medicinal plant cultivation and formation of a model medicinal farm along with establishment of a model unit for medicinal plant value added products to substitute imports of medicinal plants and enhance export of medicinal plants and value added product. Proposal also aimed at enhancing the income of a farmer by practicing medicinal plant cultivation through provision of quality seeds, germplasm, access to technical support and expertise, linkage to value addition units associated with domestic manufacturers of medicinal products and exporters to boost national economy through medicinal plant potential utilization in true spirit.

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