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ICT Intervention for Marketing of Medicinal Plants by using E-Charak Apps and Price Analysis Method

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ABSTRACT

Medicinal & Aromatic Plants (MAPs) are botanical raw materials, also known as herbal drugs that are primarily used for therapeutic, aromatic and/or culinary purposes as components of cosmetics, medicinal products, health foods and other natural health products. They are also the starting materials for value-added processed natural ingredients such as essential oils, dry and liquid extracts and oleoresins. There is a clear industrial demand for MAPs. The global market for botanical and plant-derived drugs is therefore expected to increase from $19.5 billion in 2008 to $32.9 billion in 2013, an annual growth rate of 11.0%, according to a 2009 study by BCC Research. National Medicinal Plant Board (NMPB) is working to promote cultivation of medicinal plants and supported in a Mission mode under Centrally Sponsored Scheme of "National Mission on Medicinal Plants (NMMP)" since 2008-09 and now continuing under National AYUSH Mission (NAM), a flagship program launched by the Ministry of AYUSH, Government of India during XII Plan period. The program is being implemented in the country through State Government designated agencies. Smartphone mobile apps in agriculture as a ICT tool of intervention in agriculture is becoming increasingly popular. Smartphone penetration enhances the multi-dimensional positive impact on sustainable poverty reduction and identifies accessibility as the main challenge in harnessing the full potential in agricultural space. The reach of smart phone even in rural areas extended the ICT services beyond simple voice or text messages. Several smart phone apps are available for agriculture, horticulture, animal husbandry and farm machinery. Similarly, National Medicinal Plant Board, New Delhi (India) has launched an online virtual platform www.e-charak.in and a mobile application e-charak apps to provide an online market portal for the trade of medicinal plants and their produce.

Keywords: ICT, Medicinal Plants, e-Charak

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Information and communication technology in agriculture (ICT in agriculture), also known as e-agriculture, focuses on the enhancement of agricultural and rural development through improved information and communication processes. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture (Anonymous; 2020). ICT includes devices, networks, mobiles, services and applications; these range from innovative Internet-era technologies and sensors to other pre-existing aids such as fixed telephones, televisions, radios and satellites. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components of e-agriculture.

Many ICT in agriculture or e-agriculture interventions have been developed and tested around the world to help agriculturists improve their livelihoods through increased agricultural productivity and income, or by reducing risks. Some useful resources for learning about e-agriculture in practice are the World Bank's e-sourcebook ICT in agriculture – connecting smallholder farmers to knowledge, networks and institutions (Anonymous; 2011), ICT uses for inclusive value chains (FAO; 2013a), ICT uses for inclusive value chains (FAO; 2013b) and Success stories on information and communication technologies for agriculture and rural development (FAO; 2015) have documented many cases of use of ICT in agriculture.

Similarly, E-charak is an online market platform for the sale of medicinal plants (NMPB; 2015). To provide an online market portal for the trade of medicinal plants and their produce, National Medicinal Plant Board, New Delhi (India) has launched an online virtual platform www.e-charak.in, and a mobile application e-charak. This online gateway could be accessed either through an internet browser or the mobile app which could be downloaded through google play store in any android cell phone. On this online platform, farmers and collectors could show their produce under possession and purchasers like merchants, traders, manufacturers, exporters could able to see products according to their requirements. This application and online platform would make a clear straight forward, serviceable exchange linkage among the producers and buyers. In this way formation of e-charak is a route forward of the Digital India Program.

Why Start a Herbal Medicine Business?

If you are interested in leveraging on the existing love for herbal products, then you should consider starting an herbal medicine production company. The fact that people are interested in taking less chemical or non-chemical medications made from plants makes this type of business a viable and profitable one. Herbal medicine is one commodity that is useful in all parts of the world and of course those that are in the business of producing herbal medicines and related supplements, are known to generate sales repeatedly if the business is properly managed. Again, economic downturn hardly affects the consumption of herbal medicine and teas because it is a healthy substitute for chemical based medications. If you want to start this business, then you should conduct your market research and feasibility studies. You also need to write a good business plan that would help you raise your seed capital, set up the business, sort out tax and market your products. The truth is that it is one thing to have a fantastic idea cum business plan, but another thing for the business plan to translate to profits, which is why it is important to assemble a team of experts to work with if you want to be successful with your herbal medicine business.

Associations that can Provide Further Information Relating to Medicinal Plants and Extracts

- International Council for Medicinal and Aromatic Plants (ICMAP).
- British Herbal Medicine Association (BHMA).
- European Herb Growers Association (EUROPAM).
- American Botanical Council (ABC).
- American Council for Medicinally Active Plants (ACMAP).
- Association for African Medicinal Plants Standards (AAMPS).
- Peruvian Institute of Natural Products (IPPN).

- Global Information Hub on Integrated Medicine (GLOBinMED).
- Society for Medicinal Plants Research.
- Federation of Indian Herbal Industry (FIHI).
- Government of India National Medicinal Plants Board (NMPB).
- Central Institute of Medicinal and Aromatic Plant (CIMAP, Lucknow).
- Directorate of Medicinal and Aromatic Plant Research (DMAPR, Anand).

What is E-Charak

- A virtual market place.
- A platform for buyers & sellers to interact.
- A virtual showcase to display goods & services.
- For knowledge access and sharing.

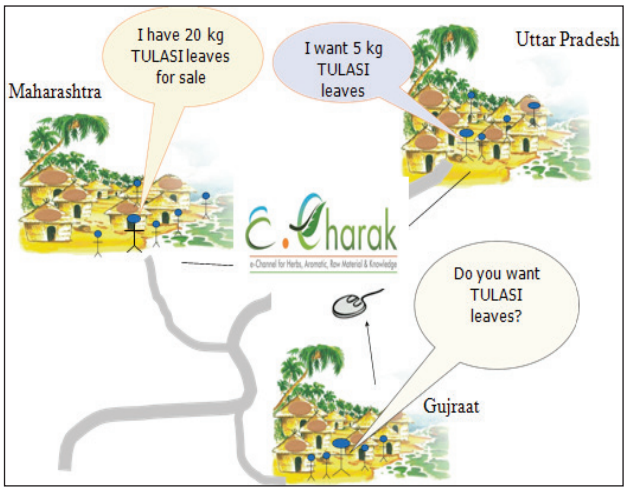


Fig. 1

Who Can Use E-Charak

- Individuals -Farmers, traders, collectors, Manufacturer.
- Community Groups – FPO, SHGs, CBOs.
- Institutions – NGOs, Cooperatives.
- Anybody who has interest in medicinal plants.

What Items Can be Posted

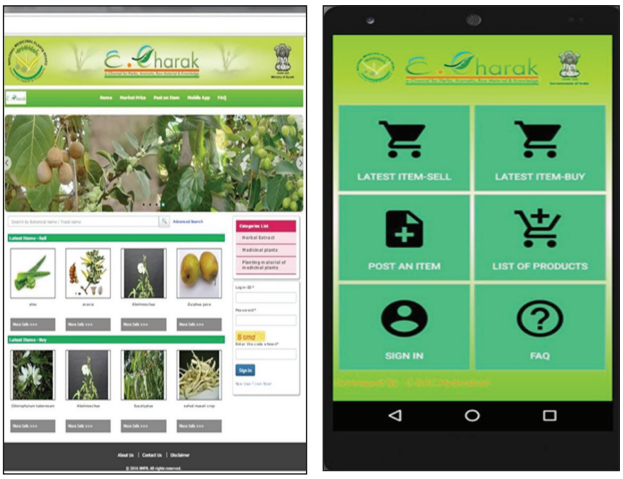
- Planting Materials.
- Medicinal Plants / Herbs.
- Herbal Extract.
- Value Added Products.

Why Use E-Charak

- Get better markets for products/services.
- Save time and energy in identifying right customers.
- Get to know the value of one's goods Get rightful share of benefits.
- Make better decisions - what & how much to produce.

Working of E-Charak Mobile App (How to Use)

www.e-charak.in **Mobile app**



Trading Pattern by Actors of Value Chain in Medicinal & Aromatic Plants

The returns received by the actors of the medicinal plant value chain namely villagers, middlemen and wholesaler, constitute the total trade in medicinal plants. The villagers constitute the first link in the trade in medicinal plants, wherein the cultivators separately or combined collect the medicinal plant produce and take them up to the processors for further refinement. There upon, the middle men intervene in the medicinal plant trade and act as facilitators due to the lack of efficient infrastructure and link of the cultivators to the wholesalers for commissions. The wholesalers are the distributors of the medicinal plant products to the ultimate markets and they carry out the work through a complex network of agents and retailers. The medicinal plant value chain also included the secondary actors which are the industries that use the medicinal plants and their extracts as their input materials and then the value added to them through the processes operated on them through which the end products are obtained. The Pharmaceutical industries and the

Cosmetic industries are the prime example of the value addition made to the medicinal plants. These industries use the medicinal and aromatic plants in fixed percentages and the final products made are the blend of multiple such plants and extracts every stake holder's level for quality assurance.

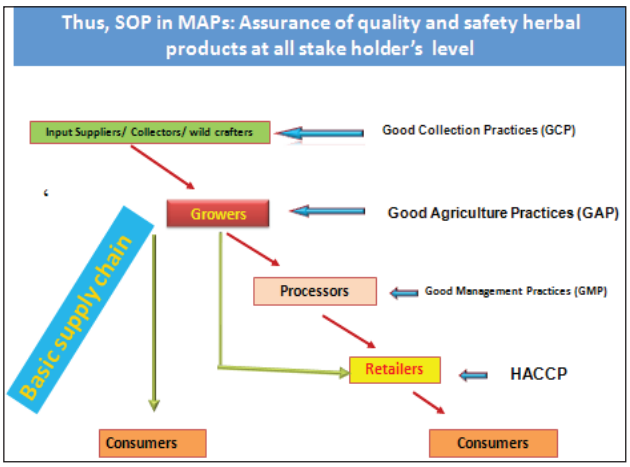


Fig. 3

Price Analysis of Medicinal Plants

The available literature and the preliminary survey of the market revealed variable prices within and across various '*mandis*' in the country (Table 1). A fair idea of the prevailing prices of the botanicals is necessary to work out economic contribution of the raw drug trade to the society. To address this issue, data related to the prevailing prices of the various botanicals was gathered from two sources i.e. (i) the sale prices quoted in the '*mandis*' and (ii) the procurement prices paid by different herbal manufacturing units.

Analysis of the given below table reveals that prices of only *Acorus calamus*, *Aegle marmelos*, *Picrorhiza kurroa* and *Terminalia chebula* have shown some increase over the past 6-8 years. As regards other botanicals analyzed in the table, prices seem to have either stagnated or actually gone down. Such inferred decline in prices of botanicals, in high demand, may be due to the higher price estimates recorded in CERPA report and not due to any market dynamics.

Factors Influencing Prices of Botanicals:

(i) Locational Effects

(ii) Purity/ Quality

(iii) Seasonality of Production

(iv) Bulk Purchases

(v) Scale of Production

(vi) Imports

1. Locational Effects

Das *et al.* (2018a) reported that the problems related to medicinal and aromatic crops are lack of location specific research related to medicinal and aromatics crops suited to the soil and climate of different agro-climatic conditions of the Bihar. Therefore, ample opportunities exist in the state for generation of scientific data on various good agricultural practices (GAPs) aspects for MAPs cultivation. The prices of botanicals were observed to be much lower in the intermediate mandis which are located near the production areas and obtain these materials directly from these areas. Prevailing price of '*kalmegh*' (*Andrographis paniculata*) in the markets in Chhatisgarh, collected locally from the area, was recorded to be in the range of ₹ 6-8/- per kg. However, the sale price of this entity quoted in the Delhi and Amritsar *mandis* ranged from ₹ 18-28/- and ₹ 18-22/- respectively. Similarly, palash flowers (*Butea monsperma*), traded as '*tesu*' in Chhatisgarh markets at ₹ 6/- per kg., had a price tag of ₹ 18/- in the markets of Delhi and Amritsar. An idea about the increase in prices, as the entity enters a market far away from the production areas, can be had from the following table which showing the comparison of prices of some botanicals recorded from intermediate markets in Chhatisgarh (production areas) and Delhi *mandi* (Table 2).

Similar significant variations in prices of many other botanicals, between the intermediate *mandis* (markets) located near the production areas and the *mandis* located away from such production areas, were also noticed. However, the percentage difference in these prices seems to be higher in respect of botanicals that are traded in large volumes. In case of Himalayan species, which are traded in comparatively lesser volumes, such percentage difference is much less. A comparison of prices of a few botanicals recorded in Amritsar *mandi* acting as an intermediate *mandi* for these Himalayan species, viz-a-viz Thrissur *mandi* has been presented in Table 3 to elaborate the issue.

It has been found that *Swertia chirayita* is largely

Table 1: Price analysis of medicinal plants in various '*mandis*' in the country

Sl. No.	Name of Species	Traded Part	Prices (₹ per kg) as per CERPA report			Price range (₹ per kg) as per FRLHT Survey
			1997-98	1998-99	1999-2000	2005-06
1	*Achyranthes aspera*	Fruit	17	18	20	10-15
2	*Acorus calamus*	Rhizome	23	27	30	30-35
3	*Adhatoda vasica*	Leaf	—	—	15	10-15
4	*Aegle marmelos*	Fruit pulp	17	18	20	10-25
5	*Andrographis paniculata*	Whole plant	17	19	20	17-30
6	*Asparagus racemosus*	Tuber	52	56	70	40-70
7	*Cyperus rotundus*	Rhizomes	9	9	15	15-30
8	*Embelia ribes*	Fruit	83	79	100	40-45
9	*Emblica officinalis*	Fruit	14	16	40	30-35
10	*Nardostachys grandiflora*	Rhizome	119	131	150	110-150
11	*Picrorhiza kurroa*	Rhizome	108	125	150	220-230
12	*Pistacia integerrima*	Leaf gall	85	79	110	90-110
13	*Saraca asoca*	Stem bark	23	22	30	20-25
14	*Swertia chirayita*	Whole plant	274	282	300	200-225
15	*Terminalia chebula*	Fruit	8	9	10	10-15
16	*Tribulus terrestris*	Fruit	16	16	20	10-20
17	*Withania somnifera*	Root	39	42	60	60-70
18	*Woodfordia floribunda*	Flower	17	18	20	10-15

Table 2: Price comparison between Delhi and Chhatisgarh *Mandis*

Sl. No.	Trade Name	Botanical Name	Traded Part	Price Range (₹ per Kg)	
				Delhi	Chhatisgarh
1	Bael	*Aegle marmelos*	Fruit pulp	12-15	7-8
2	Kalmegh	*Andrographis paniculata*	Whole Plant	18-28	6-8
3	Satawari	*Asparagus racemosus*	Root	34-240	40
4	Tesu/ Gul Palash	*Butea monosperma*	Flower	18-22	6
5	Amaltas	*Cassia fistula*	Fruit	8-22	10
6	Nagarmotha	*Cyperus scariosus*	Root	12-15	6
7	Vai-Vidang	*Embelia ribes*	Seed	34-48	25-35
8	Amla	*Emblica officinalis*	Fruit	28-36	18-20
9	Gudmar	*Gymnema sylvestre*	Leaf/Stem	22-32	15
10	Kaladana	*Ipomoea hederacea*	Seed	13-16	4-8
11	Konch (White)	*Mucuna pruriens*	Seed	14-16	4-5
12	Bhilawa	*Semecarpus anacardium*	Seed	12-14	4-5
13	Kuchla	*Strychnos nux-vomica*	Seed	28-35	14-15
14	Ashwagandha	*Withania somnifera*	Root	68-80	40
15	Dhai Phool	*Woodfordia fruticosa*	Flower	12-14	5-10

imported from Nepal into Delhi *mandi* and it is from this *mandi* (prevailing price ₹ 175-190/- per kg) that it is supplied to other mandis and manufacturing units. A marginally lower price of this entity recorded in Thrissur market, which is located far away from the region of its production, compared to the Amritsar market, might be on account of a better deal. Das *et al.* (2018b) reported in case of Magahi Pan and stated that the variation in yield from location to location can be accounted for varying climatic condition, prevailing microclimate and variation in agricultural practices followed by the farmers. Hence, location specific recommendations are necessary to bridge the gap.

Table 3: Price comparison between Amritsar & Thrissur *Mandis*

Sl. No.	Trade Name	Botanical Name	Traded Part	Price Range (₹ per Kg)	
				Amritsar	Thrissur
1	Karu	*Picrorhiza kurroa*	Rhizomes	200-250	260-300
2	Jatamansi	*Nardostachys grandiflora*	Rhizomes	170-200	175-200
3	Kiriat/ Chirata	*Swertia chirayita*	Whole Plant	260-270	250
4	Talishpatram	*Abies spectabilis*	Leaves	35-40	50-60
5	Atis	*Aconitum heterophyllum*	Rhizomes	3500-4000	4000-5000

2. Purity/ Quality

Quality and purity of the raw drugs does seem to have an impact on their prices. A number of these botanicals are traded in markets at different levels of grading and their different grades command different prices. To cite an example, rhizomes of *Valeriana jatamansi* are in high demand but short in supply. Thus, use is made of all the underground parts, which are graded and sold under different categories like '*Tagar*' (rhizomes free of any roots), '*Mushakbala*' (thin rhizomes with roots), *Mushakbala ghaia*' (roots with root hairs) and '*Mushakbala choora*' (root hairs and other waste). Prices of ₹ 110/-, 70/-, 50/- and 40/- per kg respectively of these different grades of *Valeriana* roots have been recorded at Amritsar *mandi*.

Similarly, the *mandi* price of *Cinnamomum tamala* leaves being sold as '*tejpatta*' was recorded as ₹ 25/- per kg while that of '*tejpatta* with *dandi*' was recorded as ₹ 15/- per kg. '*Kalmegh*' (*Andrographis paniculata*) when sold in neatly cut and packaged form was observed to command about 20% higher price than the one sold loose. Grading seems to play a definite role in the prices of '*harar*' (*Terminalia chebula*) also as the large variation in price ranging from ₹ 10/- per kg to ₹ 80/- per kg would indicate. It has been observed that '*harar*' conforming to "75 dana per ser" was commanding the highest price in this price range.

Many a times botanicals produced in, or obtained from, some specific region are perceived to be of better quality and, therefore, command better price. For example '*jatamansi*', roots of *Nardostachys grandiflora*, when obtained from the forests of Kullu (Himachal Pradesh) command about 15% higher price in comparison to the material obtained from other areas as recorded in Amritsar *mandi*. Similarly, '*asgandh*' (*Withania somnifera*) obtained from Nagore in Rajasthan (popularly traded as '*nagori*') is preferred due to its quality and commands higher price in comparison to *asgandh* obtained from other areas.

Sometimes the apparently large variation in prices could to be due to trade of more than one species under one trade name. For example '*shatavari*' (*Asparagus racemosus*), gathered from the wild in Chhatisgarh and traded in local *mandis* recorded a price of ₹ 40/- per kg. In Thrissur market the recorded rate for this entity was ₹ 50/- per kg, whereas it was ₹ 60/- per kg in Amritsar *mandi*. However, a large rate variation (₹ 34/- to ₹ 240/- per kg) was reported in Delhi market. This cannot be explained away only on account of quality parameters. Apparently more than one entity is being traded in Delhi market as '*shatavari*'. Our interpretation is that the high priced '*shatavari*' of Delhi *mandi* is obtained from *Asparagus adscendens* (a Himalayan species) and this entity is recorded as '*shatavar*' in Amritsar *mandi* with a price range of ₹ 200–250/- per kg.

Another factor influencing the price seems to be the presence of physical impurities or adulterants in the traded botanicals. For example a large difference in the prices of '*Banslochan*' (obtained from more than one species of Bamboos), being traded as '*Banslochan asli*' at more than ₹ 500/- per kg and '*Banslochan desi*' at less than ₹ 50/- per kg, was recorded from Delhi *mandi*. Similarly, a large variation in the rates of 'Babool gum' (*Acacia nilotica*) was recorded from the Delhi and Chhatisgarh *mandis* where it was recorded as ₹ 200-250/- per kg and ₹ 15-40/- per kg respectively. In both these cases the price variation seems to be due mainly to purity issues. It is not uncommon in the raw drug markets to come across suffixes, like 'No.1' or 'No.2' or '*Asli*' etc., added to the trade names apparently to denote purity levels.

3. Seasonality of Production

There is a definite season for harvesting of appropriately mature plant based raw material from the wild as well as from cultivated sources. This seasonality of production results in arrival of the harvested botanicals in large quantities in the *mandis* bringing their prices down often to the lowest level for the year. Informal discussions with the traders revealed that the low prices at the time of bulk receipt of any particular botanicals in the *mandi* were due to the reason that many a times such material was not properly dried and needed drying and packaging for further trade. Drying of such botanicals by the traders obviously results in reduction in weight necessitating raising of prices at the time of forward trading. However, the study could not bring out the exact impact of seasonality of production on prices as it would require repeated visits to the *mandis* during a year.

4. Bulk Purchases

Analysis of the data obtained during the study reveals that prices of botanicals are also influenced by the size of procurement order. The bulk buyers, procuring the material at appropriate time of the year, are able to get it at substantially low prices than those generally quoted in the market at the time of such procurement. Some of these bulk buyers include the large industrial houses having adequate monetary resources and storage facilities for this purpose. Even though only a few industrial units have come forward to share the information about their procurement prices, yet it is adequate to draw inferences about the price of botanicals vis-à-vis size of purchase order.

'*Atis*' (*Aconitum heterophyllum*) commands a price of ₹ 3,500-4,000/- per kg in Amritsar market. However, Dabur, Baidyanath and Kottakal with purchase orders of 1.3 MT, 1MT and 18 MT respectively, managed to procure '*Atis*' at average prices of ₹ 2,122/-, ₹ 2,400 and ₹ 2,500/- per kg. Similarly, per kg prices for 'Bach' (*Acorus calamus*) as recorded from Delhi, Amritsar, Thrissur and Viruthunagar *mandis* were ₹ 44-45/-, ₹ 42-45/-, ₹ 40-50/- and ₹ 35/- respectively. However, both Dabur and Kottakal with purchases of 27 MT and 15 MT respectively procured the material at ₹ 32/- per kg and ₹ 30-40/- per kg whereas Nagarjuna with a smaller purchase of 4 MT had to procure the material at ₹ 43/- per kg. Similar situation prevails in respect of botanicals like 'Nagarmotha' (*Cyperus rotundus*), 'Vaividang' (*Embelia sp*.), Amla (*Emblica officinalis*), 'Dhatki' (*Woodfordia floribunda*), 'Asgandh' (*Withania somnifera*), 'Gokhru' (*Tribulus sp*.), etc. that are purchased in large quantities by the large herbal pharmaceutical units.

5. Scale of Production

Production of raw drugs, whether obtained from wild or from cultivation, was reported to fluctuate from year to year directly impacting their prices. One of the factors for this fluctuation was cited to be climate, especially precipitation, as bulk of the medicinal plants is obtained from rainfed areas. Another factor for this fluctuation in production seems to be the regulations in place for harvesting from the forests under which different forest areas are opened for harvesting once in a harvesting cycle of 3-4 years. Moreover, harvesting of some botanicals is sometimes temporarily suspended by the state forest departments to recoup wild populations of such botanicals. This affects the production of such entities in the area impacting their price.

6. Imports

Prices of botanicals usually produced within the country show sudden fluctuation in prices if these botanicals or their substitutes are imported to the country at lower prices. For example the import of *Piper chaba* as 'long pepper' at lower prices finds many manufacturers using this species in place of *Piper longum*, the indigenous 'long pepper' that sells at higher prices.

Constraints in Using E- Charak

It is predicted that the availability of broadband Internet, 3G and 4G- connectivity will soon be available in rural areas. The prices of smart phones are decreasing and they are becoming affordable. Technology therefore is not considered a major constraint. The most critical constraint now is appropriate agricultural content. There is a need for more availability and openness in accessing data and information, making it 'interoperable' and development of relevant apps to effectively and easily process and present this information in a useful way.

Drugs Manufactures and Traders of Medicinal Plants in Bihar

Sl. No.	District	Drugs Manufactures/Traders for medicinal plants in Bihar (NMPB; 2019)	
Agro-climatic Zone I			
1	Betia (West-Champaran)	M/s Laxmi Aushadhi Udyog Phulwaria, Betia, Bihar	M/s Base Ayurvedic Pharmacy, Ralley Bazar, Ram Nagar, Betia, Bihar
		M/s Base Ayurvedic Pharmacy, Ralley Bazar, Ram Nagar, Betia	
2	Motihari (East Champaran)	M/s Shivam Pharmaceuticals Works, Yog Sewa Ashram Pataura, Motihari, Bihar	M/s. M.H Ayurved Bhawan, Adapur, East Charmparan (Mothari), Bihar
		M/s Shivam Pharmaceuticals Works, Yog Sewa Ashram Pataura, Motihari	M/s Bajrang Ayurveda, Tumariatola, Raxaul, Motihari
3	Siwan	M/s S.C.L Seo narain & co- Brahamansthan, Siwan, Bihar	Laxmi Drug Company, Laxmipur Siswah Road, Siwan- 841226
4	Saran (Chhapra)	M/s Gupta Ayurveda, Rasoolpur, Chhapra	M/s Rudra veda Pharma, Naya Gao, Saran
		M/s Sri Ram Ayurveda Bhawan, bhatkeshari, Jalalpur, Saran,	M/s Garg Herbal research Laboratory, MasarakhRoad, Chhapra
5	Sitamarhi	Santosh Ayurvedic Pharmacy, Nanpur Dist - Sitamarhi, Bihar -843333 E-mail: info@santoshayurvedic.co.in	M/s Charak Ayurveda Bhavan, Industrial Area, Sitamarhi, Bihar
		M/s Unique Herbal Formulation Visa, Dumara, Sitamarhi	—
6	Sheohar	—	—
7	Muzaffarpur	Shri Gauri Shankar Ayurvedic Bhawan New Area, Sikandarpur, Muzaffarpur - 842001, E-mail: madhukasari@yahoo.com	M/s Hymnody Pharma Ltd. Bela Chapra Muzaffarpur, Bihar E-mail: hymnodypharma@gmail.com
		M/s Hymnody Pharma Ltd. Bela Chapra Muzaffarpur	
8	Vaishali	—	—
9	Madhubani	M/s Dabs Pharmaceuticals, Ranti, Madhubani, Bihar	
10	Darbhanga	M/s Bundel Khand Ayurveda Bhavan Ranipur, Darbhanga- 846009	M/s Bhardwaj Pharmaceutical, Shyambagh, Dharbhanga, Bihar
		M/s Vaidyaraj Herbal, Kilaghat, Bajitpur, Darbhanga, Bihar. Email: manoj06272@gmail.com	Chaudhary Pharma, Katki Bazar, Darbhanga, Bihar-846004.
11	Samastipur,	M/s G.R.B. Biosite Lab Moti Nagar, Samstipur, Bihar	M/s Thaneshwar Ayurveda & Pharmaceutical, Tateu, Samstipur
12	Gopalganj	M/s Sri Prakash Aushadhi Udyog, Thave, Gopalganj, Bihar	---
13	Begusarai	M/s Surya Shakti Chemical Works, Barauni, Begusarai	M/s Maa Laxmi Ayurveda Niarmashala, Lohia Nagar,Begusarai, Bihar
		M/s Jawahar Aushdhalaya Laboratories, Teghra, Begusarai	M/s Krishna Aushadhalaya, Teghra, Begusarai, Bihar
		Laxmi Aushadhalaya Meghra Begusarai	M/s Maa Laxmi Ayurveda Niarmashala, Lohia Nagar, Begusarai
		M/s Raja Herbal International Pharmacy, Lohianagar, Begusarai	—
Agro-climatic Zone II			
14	Purnea	M/s Ichalo Ayurveda Pharma Ichalo, Mohmadia, Dagarua, Purnea, Bihar	
15	Katihar	M/s Ridhi Herbal, Tingachia, Katihar Email: kamakhya.ayurveda@gmail.com	M/s Ashoh Herbal Udyog, Sirsadalani, Katihar, Bihar
16	Saharsa	—	—

17	Supaul	M/s D.N. Ayurvedic Ekdangawa Ekama, Sapaul, Bihar	M/s Rudra veda Pharma, Naya Gao, Saran, Sapaul, Bihar
		M/s Sri Ram Ayurveda Bhawan, bhatkeshari, Jalalpur, Saran, Sapaul E-mail: deepak101984@gmail.com	M/s Shyamsunder Ayurveda Anusandhan Bhavan, Sounpur, Chhapra, Sapaul, Bihar
18	Madhepura	—	—
19	Khagaria	M/s Sanjeevan Karyalaya Khagaria, Bihar	—
20	Araria	—	—
21	Kishanganj	—	—
Agro-climatic Zone III A			
22	Shekhpura	—	—
23	Munger	—	—
24	Bhagalpur	—	—
25	Banka	—	—
26	Jamui	—	—
27	Lakhisari	—	—
Agro-climatic Zone III B			
28	Patna	M/s. Reanimate, Rajendra Nagar, Patna-16	Ayurvedic Physician, Railway Hopital, Danaput PO Khagaul Patna Bihar801105
	Patna	M/s. Banaushadi Vikash Kendram, P.C. Colony Kankarbagh, Patna	Galpha Laboratories Ltd., Jagdish Bhawan, Exhibition Road, Patna, Bihar-800 001
	Patna	Bharat Chemical & Pharmaceutical Works Makhania Kuan Road, Nagarnausa Kothi, Patna, Bihar-800004	M/s. Triloka Pharmaceuticals, S.P. Verma Road, Patna
	Patna	India Pharmaceuticals, Chowshikarpur, Patna-800009, Bihar	M/s. J.J. Ayurvedic Pharmaceuticals Works, Lohia Nagar, Patna-20
	Patna	M/s. Natraj Ayurvedic, bari Nagar, Malsalmi, Patna	M/s. Jha Ayurvedic Company, X.T.T.I. Road, Digha, Patna
	Patna	M/s. Patna Ayurvedia Pharmacy, Jakanpur, Patna	Albert David Limited, Kumhar, Kankarbagh Road, Patna-800020
	Patna	M/s. Shakti Pharmaceuticals, West Lohanipur, Near Budh Murti, Patna-3	M/s. Aescelpious Laboratory, Jamal Road, Near Viky Hotal, Patna-800001
	Patna	Care Pharmaceuticals, Annie Besant Road, Patna, Bihar-800004	M/s. Cura Pharma, D-1, Phase-1, Industrial Area, Fatuha, Patna
	Patna	M/s. Suraj Pharmaceuticals, D-1, Bhagwat Nagar, Patna	Herbals (APS) Pvt. Ltd., B.M. Das Road, Patna, Bihar-800004 E-mail: haps@dte.vsnl.net.in
	Patna	M/s. Esto Pharma, Rajendra Nagar Road No.2, Patna-16. E-mail: office@estopharma.com	M/s. Modgal Pharma, Upsa, Patna, Bihar
	Patna	M/s. M.K. Jain Industries, Chhipi Tola, Haziganj, Jhaganz,Patna, Bihar 800008 Email: m.k.jainindustries@gmail.com	Around Pharmaceuticals, G-27, Mahima Place, Govind Mitra Road, Patna, Bihar -800004
	Patna	M/s. Sri Baidyanath Ayurved Bhawan Ltd., Baidyanath Ayurved Bhawan Road, Lohianagar, Patna – 800020. E-mail: baidyanathsales@rediffmail.com	East India Pharmaceutical Works Ltd., Jaintpur Kothi, Bank Road Patna 800 001 E-mail: eipwl_patna@eastindiapharma.org, sales@eastindiapharma.org
	Patna	Patna Ayurvedic Pharmacy, New Area Jakkanpur, Patna-1, Bihar	M/s. Dhanesh Herbals, Saman Pura, Patna-14
	Patna	M/s. Haseeza Ayurvedic Company, North Mandiri, Patna-1. E-mail: alkahasija209@gmail.com	Auric Pharmaceutical Pvt. Ltd., Boring Road, Patna, Bihar-800001

	Patna	M/s. M.K. Pharmaceuticals, Ghaghaghat Road, Road No. 1, Mahendru, Patna-6	Eastern Drug, Awas Apartments, Canal East Boring Road, Patna, Bihar-800001
	Patna	M/s. Ayush Products, Postal Park, Jakanpura, Patna	M/s. Rose Laboratories, Phase-II, Industrial Area, Fatuha, Patna, Email: rose@roselab.com
	Patna	M/s. Herbal (APS) Pvt. Ltd., Chhoti Phari, Patna, Bihar	Eastern Drug, Awas Apartments, Canal East Boring Road, Patna-800001.
	Patna	M/s. V. Sarabhai Ayurveda & Chemical Research, Om Shanti, Plot No. 177, Anand Vihar Colony, Ambedkar Path, Patna E-mail: omshanticancer@gmail.com	M/s. Care Remedies, New Aitwarpur, Kurhtol, Parasa Bazar, Patna,Bihar
	Patna	Viking Pharmaceuticals Abulas Lane, Patna -4	Bharat Chemical & Pharmaceutical Works Makhania Kuan Road, Nagarnausa Kothi, Patna, Bihar-800004.
	Patna	M/s. Triloka Pharmaceuticals, S.P. Verma Road, Patna	India Pharmaceuticals, Chowshikarpur, Patna-800009, Bihar. E-mail: npha@vsnl.com
	Patna	Sri Aurved Bhawan, Ayurved Physician, Railway Hospital, Dhanapur, Post-Khagaul, Patna, Bihar 801105. E-mail: drarun410@gmail.com	M/s. Fresh India Formulation, Naubatpur, Patna
	Patna	M/s. Prannjivani Health Cate Pvt. Ltd., Kurthol, Parasa Bazar, Patna E-mail: info@prannjivini.com	Alkem Laboratories Ltd., Exhibition Road, Patna, Bihar - 800001
	Patna	M/s. Aglow Pharmaceuticals Pvt. Ltd., Adarsh Colony, Khemani Chak, Patna	M/s. Cura Pharma, D-1, Phase-1, Industrial Area, Fatuha, Patna, Bihar E-mail: curapharmaceuticals@gmail.com
	Patna	Asklepios Remedies Pvt. Ltd., Rukanpura, Bailey Road, Patna, Bihar 800014 E-mail: asklepiosremedies@yahoo.com	Albert David Limited, Kumhar, Kankarbagh Road, Patna-800 020, Bihar E-mail: adlpatna@sancharnet.in
	Patna	M/s. Shakti Pharmaceuticals, West Lohanipur, Near Budh Murti, Patna, Bihar -3	Care Pharmaceuticals, Annie Besant Road, Patna, Bihar-800004.
	Patna	M/s. Yogbadri Pharma, Sultanpur Danapur, Patna, Bihar. E-mail: info@maharshibadri.com	M/s. Glaxy India Pharma, Bahadurpur, Patna
	Patna	M/s. Glaxy India Pharma, Bahadurpur, Patna	M/s. Jha Ayurvedic Company, X.T.T.I. Road, Digha, Patn
	Patna	M/s. Patna Ayurvedia Pharmacy, Jakanpur, Patna	Albert David Limited, Kumhar, Kankarbagh Road, Patna-800020
	Patna	M/s. Shakti Pharmaceuticals, West Lohanipur, Near Budh Murti,Patna -3	M/s. Aescelpious Laboratory, Jamal Road, Near Viky Hotal, Patna- 800001
	Patna	Care Pharmaceuticals, Annie Besant Road, Patna-800004	M/s. Dhanesh Herbals, Saman Pura, Patna-1
	Patna	M/s. Haseeza Ayurvedic Company, North Mandiri, Patna-1	M/s. M.K. Pharmaceuticals, Ghaghaghat Road, Road No. 1, Mahendru, Patna-6
	Patna	Auric Pharmaceutical Pvt. Ltd., Boring Road, Patna -800001.	M/s. Ayush Products, Postal Park, Jakanpura, Patna
29	Nalanda	Nav Vihar Samaj Kalyan Prathishtan Kendra Pawapuri, Nalanda, E-mail: amresh.nbskpk@gmail.com	
30	Bhojpur	M/s. Ayurvet Pharma, Gosaipur, Shahpur, Bhojpur, Bihar	M/s. Jagdish Manjar Works, Kazitola, Arah, Bhojpur, Bihar 802301
		M/s. Jain Industries, Mahajan Toli No. 1, Arah, Bhojpur, Bihar-802301	Ms/. Gyanco Laboratories, Bhalirhi, Arah, Bhojp

31	Buxar	M/s. Maharshi Upmenu Pharmaceuticals, Niyajipur, Buxer, Bihar	M/s. Bhojpur Ayurved, Pratishthan, Dumarao, Buxer, Bihar
		M/s. Hind Ayuirvedic Aushadhalaya, Dumarao, Buxer, Bihar	M/s. Sri Shyam Ayurved Bhawan, Civil Line, Buxer, Bihar
		M/s. Maharshi Upmenu Pharmaceuticals, Niyajipur, Buxer, Bihar	M/s. Bhojpur Ayurved, Pratishthan, Dumarao, Buxer, Bihar
		M/s. Sri Shyam Ayurved Bhawan, Civil Line, Buxer, Bihar	M/s. Krishna Pharmaceuticals, Bishwambhar Nagar, Deokali, Buxer
		M/s. Sri Shyam Ayurved Bhawan, Civil Line, Buxer,	
32	Rohtas	Sri Gaurishankar Asudhalaya, VPO Chenari Rohtas, Bihar	M/s. Ramayan Pharma, Dehri-on-sone, Rohtas, Bihar
		M/s. Rani Herabaceuticals, Tilauthu, Rohtas, Bihar	M/s. Rani Herabaceuticals, Tilauthu, Rohtas, Bihar
		M/s. Decan Pharmaceuticals, New Area, Dehri-on-sone, Rohta	Shiv Ganesh Ayurved, Prathishtan, Bir Nagar Virnagar, Chenari Rohtas
		M/s. Dadan India, Mochi Tola, Rohtas	
33	Bhabhua	—	—
34	Gaya	M/s. Herbomeel Pharma, Dandibagh, Chand Chawa, Gaya, Bihar	M/s. Bharat Ayurveda Laboratory, K.P. Lane Kabirbagh, Gaya, Bihar
		M/s. Ganesh Ayurveda, Luxman Sahai Lane, Gaya	M/s. Agrawal Rasayanik Udyog, Alipur, Gaya
		M/s. Herbomeel Pharma, Dandibagh, Chand Chawa, Gaya, Bihar	M/s. Ganesh Ayurveda, Luxman Sahai Lane, Gaya, Bihar
		M/s. Copra Pharmaceuticals, G.K. Road, Gaya, Bihar	M/s. Green Lab Health Care, Bahelia Bigha, Gaya
35	Jehanabad	M/s. Hardwar Sewashram, Prajapatinagar, Jahanabad, Bihar	
36	Arwal	—	—
37	Nawada	M/s. Subhas Ayurvedic Store, Station Road, Nawada, Bihar	M/s. G.S. Harbal Health Care, Navi Nagar, Nawada, Bihar
		M/s. Zimalaya Drug Pvt Ltd., Gandhi Nagar, Nawada, Bihar	M/s. Dhrvuvkan Ayurvedic Pharma, Rajendra Nagar, Nawada, Bihar
		M/s. I.P.L. Research Centre, Industrial Area, Nawada, Bihar	M/s. Shanti Herbal Health Care, Nondiganj, Nawada, Bihar
		M/s. Zimalaya Drug Pvt Ltd., Gandhi Nagar, Nawada, Bihar	
38	Aurangabad	—	—

ICT initiatives for farmers other than E- Charak

ICT initiatives other than E- Charak (Das and Paswan; 2018)					
Name	**Implementing Agency**	**Sponsoring Agency**	**Target groups/ Area**	**Year of Starting**	**Mode of Information**
Government/ Public Sector initiatives					
ASHA	National Informatics Centre	Dept. of IT, Govt. of India	North East	2001	Internet
Agriculture Technology Information Centre (ATICS)	CAR, SAUs	ICAR	India	2001	Internet, Mobil e/telephone
AGMARKNET	National Informatics Centre, Govt of India	Directorate of Marketing and Inspection (DMI) - Ministry of Agriculture	India	2001	Internet

AGRISNET (Agricultural Informatics and Communications Network)	NICNET	ICAR	Rural areas of India	2002	Internet
e-Sagu	International Institute of Information Technology, Hyderabad	Ministry of Communication and Information Technology, Govt. of India	Farmers India	2004	Internet
e-Arik	College of Horticulture and Forestry, Central Agricultural University (CAU	Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Govt. of India	Tribal farmers of India	2007	Internet, TV, Telephone/mo bile
I Kisan	Nagarjuna fertilizer & chemical Ltd, Hydearabad	NFCL	India	2004	Internet
IFFCO Kisan Sanchar	Airtel & IFFCO Kisan Sanchar	IFFCO Kisan Sanchar Ltd.	India	2008	Mobile
Kisan Call Centres	Department of Agriculture & Cooperation (DAC), Ministry of Agriculture, Govt. of India	DAC	Farmers India	2004	Telephone/mobile
Private Sector initiatives					
ITC eChoupal	ITC's International Business Division (IBD	ITC's IBD	Farmers of MP, Haryana, Uttarakhand, Karnataka, AP, UP, Rajasthan, Maharashtra	2000	Internet
Tata Kisan Kendra	Tata Chemicals Limited (TCL)	Tata Chemicals Limited (TCL)	Farmers of Haryana, Punjab & UP	2003	Internet
NGO-initiatives					
Jamset Ji Tata National Virtual Academy for Rural Prosperity	M S Swaminathan Research Foundation (MSSRF)	Sir Dorabji Tata School Welfare Trust	Pondicherry	2003	Internet
Information Village Centers of MSSRF	M.S. Swaminathan Research Foundation (MSSRF)	International Development Research Centre (IDRC), Canada	12 villages in Pondicherry region	1998	Internet

Technically this information is a 'public good' in the public domain and a public resource. The same applies to information for agricultural development and progress generated by public sector research organizations. This is an area that now needs attention. There is huge potential for agricultural knowledge services providers but the key question at the moment is who and how this emerging vacuum can be filled?

CONCLUSION

Traditionally, Marketing of Medicinal Plant based products mostly occurs through *Mandis* and other wholesale markets. There are various mediators as well. Trades are rather opaque and based on data on costs and appearances because different trends are not easily available to the farmers or producers. Here NMPB has started various initiatives to fill this gap through virtual platform www.e-charak.in and a

mobile application e-charak, with a view to provide an online market portal for trade of medicinal plants. This application and online platform would create a vivid transparent, workable trade linkages among the producers & purchasers. It has been also found that there are large scale variations in prices of botanicals within and across the markets/*mandis* of the country. It is, therefore, not feasible to work out and assign specific price tags to the botanicals across the markets, for any specific year.

The organization like NMPB will need to be able to manage and promote effective use of data and information that new ICTs will generate to bring greater productivity efficiencies to all actors from producers to consumers.

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