

Commercial significance of medicinal and aromatic plants of India

Importancia comercial de las plantas medicinales y aromáticas de la India

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RESUMEN

Las condiciones agroclimáticas de la India favorecen el crecimiento natural de plantas medicinales y aromáticas. La gran extensión de la India, de sur a norte y de oeste a este, junto con las variaciones topográficas en forma de tierras bajas y tierras altas, ha ofrecido una variedad de estaciones de crecimiento para las plantas. Las variaciones en las características del suelo, su capacidad de retención de humedad y las condiciones climáticas han añadido posibilidades para el crecimiento de plantas con valores medicinales y aromáticos. Con una larga historia de civilización, India ha contribuido significativamente a reconocer el valor de las plantas y sus aplicaciones en medicina y asistencia sanitaria. La respuesta de los precios y el uso popular de cualquier objeto en el entorno socioeconómico favorecen la producción comercial de estos artículos. La demanda de los consumidores depende de los contextos culturales de la sociedad y de su nivel de modernización para usos rutinarios en el intercambio de regalos y como objeto de curación de las heridas y otras dolencias comunes. La respuesta del mercado relacionada con la demanda de contextos de producción masiva y calidad aumenta aún más la producción y la cadena de suministro en los mercados locales, regionales, nacionales y mundiales. Los datos así recogidos se procesan mediante un análisis de entradas y salidas para calcular las inversiones, las pérdidas y el beneficio neto. En este ejercicio se han utilizado tres grupos de variables: medioambientales, tecnológicas e institucionales. La regresión por pasos se ha utilizado para evaluar el impacto de una variable independiente sobre las otras variables dependientes, además de sus impactos conjuntos sobre el desarrollo general y la expansión del cultivo comercial de plantas medicinales y aromáticas. Como política para promover la asistencia sanitaria, el Gobierno de India ha abierto centros de venta de medicamentos a precios subvencionados. Estos centros eran 10.000 antes, pero se ha aumentado a 25.000 centros de este tipo. Del mismo modo, otra política de apoyo es conocida como Drone Didi Yojana, un plan para 15.000 mujeres auto-grupos de 2024 a 2026 para la prestación de servicios de alquiler a los agricultores con fines agrícolas.

Los resultados revelan que la producción de plantas medicinales y aromáticas tiene un uso diverso en la sociedad y su aplicación y cantidad de uso está aumentando a un ritmo rápido, por lo que es una alternativa viable para la población rural, los agricultores y las personas situadas a distancia. La respuesta de los precios y la estacionalidad tienen una alta asociación positiva ($r=0.69$), los eventos climáticos extremos resultan en una alta

mortalidad de las plantas mostrando una asociación negativa ($r = -0.56$). Se descubrió que cuatro de los ocho parámetros del modelo de regresión eran significativos a la hora de afectar a la eficacia comercial de las PAM en la zona de estudio. Se trata de los beneficios, los ingresos generados, los costes de transporte y el alquiler de la tienda.

Palabras clave: Plantas medicinales y aromáticas, Comercio de plantas medicinales y aromáticas, Jan Aushadhi Kendras, Drone Didi Yojana.

ABSTRACT

Agro- climatic conditions of India support natural growth of medicinal and aromatic plants. A large expanse of India from south to north; and from west to east coupled with topographic variations in the form of lowland and highlands has offered a variety of growing seasons for plants. Variations in soil characteristics, their moisture retention capacities and weather conditions have added scopes for the growth of plants that have medicinal and aromatic values. With long history of civilization, India has contributed significantly towards recognizing the value of plants, their applications in medicines and healthcare. Price response and popular use of any object in the socio-economic milieu favors commercial production of these items. Consumer demand depends on the cultural contexts of the society and its level of modernization for routine uses in the exchange of gifts and as an object of healing the wounds and other common ailments. Market response related to demand for mass production and quality contexts further augments production and supply chain in local, regional, national and global markets. The data so collected is processed through input output analysis for working out investments, losses and net profit. In all three group of variables have been used in this exercise which are broadly classed as environmental, technological and institutional. Stepwise regression has been used to assess the impact of one independent variable upon the other dependent variables besides their joint impacts on the overall development and expansion of the commercial farming of medicinal and aromatic plants. As a policy to promote health care Govt. of India has opened, which sell medicines at subsidized rates. These centers were 10,000 earlier but it has been increased to 25000 such centers. Similarly another policy support is known as Drone Didi Yojana, a scheme for 15,000 women self-groups from 2024 to 2026 for providing rental services to farmers for agricultural purposes.

Results reveal that the production of medicinal and aromatic plants has a diverse use in the society and its application and quantity of use is increasing at a fast pace making it a viable alternative to the rural people, farmers and remotely placed people. Price response and seasonality has a high positive association ($r = 0.69$), extreme climatic events result into high mortality of plants showing a negative association ($r = -0.56$). It was found out that four of the eight parameters in the regression model were significant in affecting the marketing efficiency of MAPs in the study area. These include profit, revenue generated, transportation cost and shop rent.

Keywords: Medicinal and aromatic plants, Trade of medicinal and aromatic plants, Jan Aushadhi Kendras, Drone Didi Yojana.

1 INTRODUCCIÓN

Medicinal and aromatic plants (MAPs) have been used since ancient times for human health care and play an important role in the economic, social, cultural, and ecological aspects of local communities around the world. These plants contain aromatic compounds and are used as raw materials for therapeutic purposes, food, and cosmetics. In various industries, chemical compounds from MAPs are also used as a source of dye and plant protection. India, along with China, is a major production center for medicinal plants, possessing more than 40% of the global biodiversity. The international market for MAPs is valued at over US\$ 60 billion per year, and it continues to grow at a rate of 6% annually. India with its rich diversity of medicinal plant species contributes significantly to this global trade. Exporting MAPs from India requires compliance with various legal requirements and procedures. The Foreign Trade Policy (FTP) 2023 governs the export of MAPs from India, providing guidelines and regulations to ensure sustainable harvest, proper processing, and quality control. These valuable plants play a crucial role in supporting local economies, cultural practices, and ecological balance worldwide. From raw materials to processed and packaged products such as medicines, herbal remedies, teas, cosmetics, and more, MAPs continue to be in demand across local, regional, national and international markets.

India is a significant contributor to the global trade of medicinal and aromatic plants (MAPs). These plants, rich in aromatic compounds, serve as raw materials for therapeutic purposes, food, cosmetics, and more. The countries that engage in importing these valuable plants from India are:

Saudi Arabia	Germany	France	Netherlands
United Arab Emirates (UAE)	Denmark	Iran	Kuwait
United States of America (USA)	Belgium	Canada	Czech Republic
United Kingdom (UK)	Bangladesh	Guinea	Thailand
Malaysia	Taiwan	Japan	

These countries participate in the international market for MAPs, which is valued at over US\$ 60 billion per year and continues to grow at a rate of 6% annually. India, with its diverse range of medicinal plant species, plays a significant role in supporting local economies, cultural practices, and ecological balance worldwide. Despite substantial

growth in the medicinal plant and product market, India's share in the global market remains low, at only 2.5%. In India, **medicinal and aromatic plants** play a significant role in both national and international trade.

2 LITERATURE REVIEW

A large number of articles have been published recently that are related to medicinal and aromatic plants found in different parts of India. The Indian System of Medicine is largely based on ancient texts like the **Atharvaveda**, Charak Samhita, and Sushruta Samhita. Ayurvedic treatment is largely practiced by *Vaidyas* across vast expanse of Indian rural community and also partly in urban areas. *Haqims* specializing in *Unani* set of medicines largely depend on medicinal plants and serve rural and semi-urban areas. Since urban areas have relatively better medical infrastructure, people in urban areas largely depend on allopathic medicines for their treatments. Adovasio et.al (1976) analyzed prehistoric psychotropic drug use in Northeastern Mexico and Trans-Pecos Texas in which scholars have explored the scientific connection between plants and herbs as used for healing since prehistoric times. Similarly, Baser et.al (1999) discussed about the essential oil extraction from natural products – nontraditional methods and its application in medical treatment. The paper was presented in training program organized by UNIDO in Trieste Italy. Boer et.al (1996) discussed about crop genetic resources and knowledge of local farming community. Moving a step ahead Bogerset.al (2006), evaluated the role of medicinal and aromatic plants with specific context to agricultural, commercial, ecological, legal, pharmacological and social aspects. Christaki, et.al (2012) explained at depth how aromatic plants serve as a source of bioactive compounds. Craker, et.al (2006) described the application of medicinal plants and growth of pharmacy business in future. Greathead, (2003) worked on plants and plant extracts for improving animal productivity. Prospective strategy for biodiversity conservation and development in medicinal and aromatic plants was developed by Jakhar et.al in 2003. Joy, et.al (2001) published a text on medicinal plants published in tropical horticulture. The Frontiers of medicinal plant research which was published in a book on “Biotechnology and Biodiversity” by Janardhan Reddy and Rajeswara Rao in 2006. Advancing the need for future researches, Kumar et al. (2016) have explained the diversity of medicinal and aromatic plants in India. Through a review article, scholars have also elaborated the future prospects of MAPs in India. In a workshop on “Strategies to Strengthen the Utilization of Medicinal and Aromatic Plants in the National Health-care System” held in Abuza,

Nigeria during July11-13, 2000; Sharma, (2000), presented an article on the Indian experience of utilization of medicinal plants and traditional Ayurvedic system of national health care. According to the scholar, such a traditional system has a great value in healing the ailments and improving the health care among the teeming millions in India. Further, another international conference was convened in Thessaloniki, Greece during1-3 October 2014. In the proceedings of the 8th Pan Hellenic Rangeland Congress; Stefanou, P. et al explained the cultivation and production of aromatic plants in Greece: present situation, possibilities and prospects. Exploring further Wiart (2006) described the status and role of Ethno-pharmacology of medicinal plants in Asia and the Pacific Region. Another significant research was carried out by Zuazo et al. (2008) on the benefits of plant strips for sustainable mountain agriculture. The output of research is published in a journal entitled ‘Agronomy for Sustainable Development’ in its volume 28 (4). NAMO Drone Didi Scheme launched by Prime Minister Narendra Modi in November 2023 plans to train at least 15,000 women across the country on how to use agricultural drones. Goyal (2024) in an article ‘Meet Punjab’s Drone Didis- rural women set for career as drone pilots’ explained that a trained drone pilot Kiranpal from Sekha village in Punjab’s Barnala district describes the feelings as “ a little part of the world I owned and controlled in my hands”. As such how this scheme is ushering a technology driven revolution in agriculture by spraying fields using drones.

The foregoing literature review reveals that MAPs are abundantly available across the world and they vary widely in terms of altitude and latitudinal distributions. There is a need for further research in the field.

3 METHODOLOGY USED

The study is based on the data obtained from international trade statistics namely Statista, reports of WHO and United Nations (UN), WTO and policy documents of India dealing with medicinal and aromatic plants. Data is further supported by the results of intensive field surveys conducted in two sample villages of Meerut Region viz. Sholda (Block Machhara, district Meerut) and Bajot (Block Meerut, District Meerut) where medicinal and aromatic plants are grown on commercial scale and are regularly supplied to the national market at Delhi for onward supply to the domestic and world markets. Functional contexts of field preparations, developing nurseries, planting, weeding, application of fertilizers, pesticides, insecticides watering, plucking, packaging, truck farming, marketing, storage and other processing systems have been studied. Statistical method of

correlation has been used to understand the strength and direction of association among the variables and their direction of relationship. Further regression exercise has been attempted to explain the trend of trade in medicinal and aromatic plants and its impacts on the profitability of selected MAPs products.

3.1 MEDICINAL AND AROMATIC PLANTS ACROSS TOPOGRAPHICAL ZONES OF INDIA

The latitudinal extent of mainland of India from the southern end of Kanya Kumari (Cape Camorin in Tamilnadu) to the northern end of the Union Territory of Laddakh is **8°4'N to 37°6'N**. Since altitude is a major factor to moderate climatic conditions and support plant growth, topographic zones have been considered as a reasonable unit to identify the plant species which are significant in terms of medicinal and aromatic properties. There are about 30 species of medicinal and aromatic plants which are grown across low altitudes to high altitudes and are traded in domestic and global markets (table-1).

Table 1. Selected species of traded MAPs by topographic zones in India (altitude in meters from mean sea level).

Low altitudes (<1000)	Moderate altitudes (From 1000- 3000 Meters)	High altitudes (3000 Meters and above)
Amla	Allo	Bisjara
Chamomile	Chiraita	Sugandhawal
Lemon Grass	Timur	Jatamansi
Mentha	Tejpat	Padamchal
Neem	Ritha	Kutki
Pipla	Dalchini	Yarshagumba
Tetepati	Loth Salla	Panchaule
Giloy	Majitho	Laghupatra
Sarpgandha	Pakhanved	Atis
Bel	Jhyau	Gucchichyau

Source: Compiled by the researcher based on altitudes.

3.2 ROLE OF MEDICINAL AND AROMATIC PLANTS IN INDIAN COMMERCE

In India, medicinal and aromatic plants play a significant role in both national and international trade. A brief account of medicinal, aromatic plants and domestic herbal industry is explained below.

1- Medicinal Plants: India boasts for about **880 species** of medicinal plants that are involved in trade, both domestically and globally. Approximately **48 species** are exported, while around **42 species** are imported. These plants have been used for centuries to treat various human ailments. Currently about, **80%** of the Indian population relies on indigenous medicines derived from these plants for normal ailments. India’s rich biodiversity places it among the top production centers for medicinal plants, alongside China. The international market for medicinal plants is valued at over **US\$ 60 billion per year**, growing at a rate of **6% annually**. Notable exported items include Ginseng roots, Isabgol, Belladonna leaves, Chirata and Asafoetida.

2- Aromatic Plants: India also exports essential oils and other aromatic products derived from various plants. Some important aromatic exports (table-2) include oils from cardamom, mint, geranium, peppermint, vetiver clove and lavender.

Table 2. Major exports of aromatic plant products from India

i. Cardamom oil ii.	iii. Lemongrass oil	iv. Palmarosa oil
v. Pudina (mint) oil	vi. Peppermint oil	vii. Clove oil
viii. Geranium oil	ix. Vetiver oil	Lavendor oil

Source: Developed by researcher based on the volume exported.

4 DOMESTIC HERBAL INDUSTRY

India’s domestic herbal industry comprises some **8,610 licensed herbal units** spread across the country. These industries rely on a continuous supply of medicinal plants. Marketing of medicinal plant produce occurs through wholesale markets and other channels. Efforts are being made to promote exports of value- added herbal products.

4.1 INDIA’S SHARE IN THE WORLD MARKET

Despite substantial growth in the medicinal plants and plant products’ market, India’s share in the global market remains low, at only **2.5%**. Exports are primarily in the form of plants or their parts, rather than value added products. In summary, India’s diverse flora contributes significantly to the global trade of medicinal and aromatic plants, benefiting both to the suppliers of traditional medicines and international markets.

Medicinal and aromatic plants (AMP)

In India, there is a substantial demand for medicinal and aromatic plants (AMP) due to their diverse applications. Some of the highly demanded ones are briefly explained below:

1. **Aloe Vera:** Aloe Vera is India’s favorite succulent plant. It is extremely easy to grow and demands low-maintenance. It is widely used for its medicinal properties.
2. **Tulsi (Holy Basil):** Known as the “Elixir of Life” in Ayurveda. Tulsi is a revered medicinal plant in India. It has various health benefits and is used in traditional medicine.
3. **Coriander:** Coriander is a medicinal plant that is easy to sow. Coriander is used as a spice in cooking food items and has therapeutic properties.
4. **Mint:** Mint leaves are popular for their refreshing flavor and medicinal value. They are used in teas, culinary dishes, and herbal remedies towards healing wounds and boosting general immunity.
5. **Lemongrass:** Lemongrass is rich in essential oils and has a citrusy aroma. It is used for its calming effects and as a flavoring agent.
6. **Carom (Ajwain):** Ajwain seeds are known for their digestive properties. They are used in Indian cuisine and traditional medicine.

These AMPs find applications in various sectors, including pharmaceuticals, cosmetics, and herbal products. Their demand continues to grow as people recognize their health benefits and therapeutic qualities.

4.2 NON-TIMBER FOREST PRODUCTS (NTFPS) IN INDIA

Because of wide variations in agro-climatic and agro-ecological zones in India, there are a large number of non-timber forest products which are used for medicinal and aromatic contexts of Indian traditional healing systems and their usage in food preparations as ingredients. Table-3 displays a list of the common NTFPs found in India.

Table 3. Plant species found in India used for various purposes

Products	Examples of plant species used in these products and found in India
Medicinal and aromatic plants	Kutki, Chiraito, Louth sallo, Yarchagumba, Panchaunle, Pakhanved, Haroo, Baroo, Amla, Neem, Silajeet
Spices and flavors	Cinnamon, timur, Amla, Juniper, Large cordmom
Herbal Teas	Thyme, Gurjo, Gandhaino, Tulsi, Mint, Cinnamon
Dyes and tans	Padmachal, Chutro, Majitho, Louthsallo, Banjh, Thigre, Sallo, Okhar
Gums and resins	Chir Pine, Blue Pine, Sal
Incense	Jatamansi, Juniper, Sunpati , Mahuwa
Essential oils	Jatamansi, Sugandhawal, Titepati, Sunpati, Zuniper, wintergreen, Sugandhakokila, Abies, Deodar, Lauth sallo
Personal care products	Pangar, Chiuri, Rittha, Amla, Sikakai, Naru
Ayurveda and traditional medicines	Kutki, Chiraito, Lauth Sallo, Yarchamgumba, Panchaunle, Pakhanved, Haroo, Baroo, Amla, Neem, Silajit

Source: Developed by the researcher based on descriptions in ancient texts and vegetation types of India.

4.3 TOTAL IMPORT TRADE BY VALUE IN (US\$ BILLION)

It is evident from the table-3 that there are about a dozen items which are traded globally based on their demand. These items serve as intermediate inputs for various outputs. Considering import value in US \$ billion terms for the reference period of 2016;

results reveal that medicaments consisting of mixed or unmixed products accounted for 352.41, and ranks first (table-4). Beauty, make- up and skin care preparations items that account for 42.70 rank second in the list. Mixtures of odoriferous substances rank 3rd in order and account for the import value of 22.10. These intermediate inputs to the industry are important for improving the final products.

Table 4. Other sectors to which MAPs are an intermediate input.

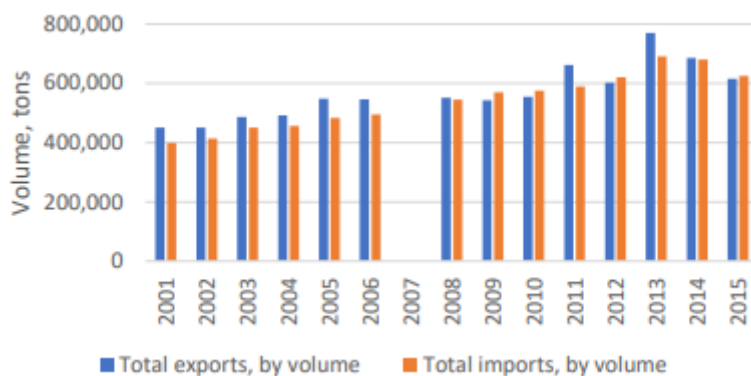
HS Code	Description	Total import trade by value (US\$ billion), 2016*
1302	Vegetable saps and extracts	5.44
2936	Provitamins and vitamins	6.91
3003	Medicaments consisting of two or more constituents mixed together	11.28
3004	Medicaments consisting of mixed or unmixed products	352.41
3301	Essential oils	4.62
3302	Mixtures of odoriferous substances	22.10
3303	Perfumes and toilet waters	16.78
3304	Beauty, make-up, and skincare preparations	42.70
3305	Preparations for use on the hair	12.81
3306	Preparations for oral or dental hygiene	5.60
3307	Other perfumery, toilet or cosmetic preparations, n.e.s.	11.08
3401	Soap	9.68

Sources: Author using ITC calculations based on UN COMTRADE and ITC statistics; total import trade represents the sum of reporting and non-reporting countries (mirror data).

4.4 THE TRENDS OF TOTAL WORLD TRADE (2001- 2015) BY VOLUME

The trends of the total world trade of plants used for perfumery, pharmacy or similar purposes reveal that total exports by volume accounted for more than 400,000 tons during 2001 up to 2010. However, from 2011 up to 2015 export volume was 600,000 and more (figure -1). Similarly, total imports volume was close to 400,000 tons during 2001 and 2002. However, the volume registered an increase in its volume from 400,000tons up to 600,000 tons by 2011. There has been further increase in its volume during 2012 up to 2015; the import volume was more than 600,000 tons. It is important to note that imports were less than the export volumes during 2001 to 2008. Import exceeded the exports during 2009, 2010, and 2012 onwards up to 2015. As evident from the figure-1, there have been fluctuations in the volumes of trade. But it is significant to note that the overall trade is increasing in volume during the period of analysis.

Figure 1. Total imports and exports by volume (in tons) during 2001-2015



Source: ITC Trade Map. Total world imports and exports of ‘Plants used primarily for perfumery, pharmacy or similar purposes (excluding ginseng roots, coca leaf and poppy straw)’ by volume (tons), 2001-16.

4.5 THE TRENDS OF TOTAL WORLD TRADE (2001- 2015) BY VALUE

A trend analysis of total trade in terms of value (US\$ millions) reveal that world trade of MAP was dominated by imports during 2001- 2012. However, export exceeded imports after 2013 (figure-2). Both export as well as import values were neck to neck in 2001 when imports totaled US\$ 900 while exports were around US\$850. Over a period of 16 years the trade value approached above US\$ 2500 million each for import as well as for exports. Ever since 2012 export has an edge over the imports as per ITC Trade Map.

Figure 2. Total imports and exports by value (US\$ Millions)



Source: ITC Trade Map.

A-India’s export performance: India’s export performance of MAPs and essential oils has been erratic, with volatile year-on-year trade flows. Estimates suggest that the number of manufacturers along the MAPs value chain registered as members of the Indian Herbs and Herbal Products Association (IEHHPA) grew from 20 in 2012 to 85 in early 2018. Indian firms have had some success in diversifying export markets in recent years, but India remains by far the most important trade partner and destination in

the MAPs value chain. The trades data indicate that Indian products may enter a new market one year only to disappear the next. Exports are primarily in the form of plants or their parts, rather than value added products. In summary, India's diverse flora contributes significantly to the global trade of medicinal and aromatic plants, benefiting both traditional medicine and international markets.

B-India's Share in the World Market: Despite substantial growth in the medicinal plant and product market, India's share in the global market remains low, at only **2.5%**. **Medicinal and aromatic plants (MAP).** In India, there is a substantial demand for medicinal and aromatic plants (AMP) due to their diverse applications.

4.6 MARKETING PARAMETERS OF MAPS PRODUCTS

Results of marketing parameters are based on the sample field survey conducted during 2022 agricultural calendar. Parameters used are market prices per unit, quantity of MAPs items traded, total input cost, sale amount, profit and market efficiency. It was observed in the study area that the aromatic plants had more demand and profit compared to the medicinal plants. This agrees with the report of Aiyelaja Bello, (2006). Results (table-5) reveal that prices for MAPs products vary significantly from low prices for ginger to high prices for cardamom, rittha, cinnamon and kutki. In terms of market efficiency cinnamon, rittha, mint and cardamom have higher market efficiency compared to others. Further analysis of per unit profitability of MAPs products also reflects higher for cinnamon, rittha, mint and cardamom (table-6). The descriptive statistical results have been shown in table-7. The analysis shows a wide variation in terms of range of profit in MAPs products. The mean profit for MAPs' products is calculated to be INR 70539.00, with a standard deviation of INR 60,502.41. Results further reveal that products' prices vary significantly seasonally as well as regionally, leading to large profit creation and market efficiency for different products. For example profit in case of cinnamon is the highest and lowest for ginger (table-5). Profitability and profit per unit has also being worked out and presented in table-6. Results reveal that cinnamon records the highest profit among MAPs products. However, per unit profit is the highest in case of rittha. The results of descriptive analysis have been presented in table-7. Since products display variations in output; both range and standard deviations are relatively large which demands market orientations towards supports like value chain and minimum support prices for all MAPs products across the country.

Table 5. Marketing Parameters of MAPs Products.

MAPs	Price per unit in INR	Quantity traded in Kg	Total input cost (INR)	Total sale amount in INR	Profit	Market efficiency
Ginger	90	1519.50	156260	176500	20,240	1.13
Garlic	240	2502.00	379650	486,000	106,350	1.28
Amla	350	1946	217010	293,000	75,990	1.35
Cordmom	450	544.00	36680	86,000	49,320	2.34
Rittha	625	360.00	51930	215,000	163,070	4.14
Mint	325	365.00	48660	196,000	147,340	4.03
Cinnamon	475	656.00	56989	326,000	269,011	5.72
Jatamansi	369	249.00	63543	105,000	41,457	1.65
Kutki	456	196.00	46143	96,600	50,457	2.09

Table 6. Profitability of MAPs Products

MAPs Products	Profit (INR)	Profit /Unit (INR)
Ginger	20,240	13.32
Garlic	106,350	42.50
Amla	75,990	39.04
Cordmom	49,320	90.66
Rittha	163,070	452.97
Mint	147,340	403.67
Cinnamon	269,011	410.07
Jatamansi	41,457	169.49
Kutki	50,457	257.43

Source: Field survey 2023.

Table-7 Statistical results

Statistics	Profit (INR)
Mean	70,539
Median	75,990
Minimum	20,240
Maximum	269,011
Range	248,771
SD	60,502.41
Sum	634,855
Count	90

4.7 SOCIO ECONOMIC CONSTRAINTS TO THE MARKETING OF MAPS PRODUCTS

Multi response level field data has been collected to analyze the socio- economic constraints to the marketing of MAPs products. Results reveal that lack of credit, fluctuating market price response and in sufficient facilities for preservation and freezing are most significant of all the constraints. It is closely followed by rising transportation cost and inadequacy of trained workers in this area of agricultural productions. Besides these, low turnover rate and relatively lower profitability and poor connectivity to farms are the other constraints that limit the scope of MAPs marketing (table-8) across regulated domestic markets and in an international trade. The promotion of marketing depends on

operating capital, which is needed all through MAPs marketing systems. The other socio-economic constraints are high cost of transportation (97%), inadequate MAPs gatherer (97%), low turnover rate (88%) and low profitability (88%). This agrees with the observation of Akirga, (2006) when he asserted that there are cases of defective market access condition. Other socio-economic problems affecting MAPs marketing are identified as poor road network (86%) and rate of spoilage (83%) of the MAPs products.

Table 8. Socio- economic constraints to MAPs marketing in the Study Area.

Socio- economic Constraints	Number of observations	Percentage
Lack of credit	90	100
Price of MAPs	90	100
Inadequate facilities for preservation (cold storage and freezers)	90	100
Poor connectivity to farms	78	86
High transportation cost	87	97
Low turnover rate	79	88
Low profitability	79	88
Rate of spoilage and perishability	75	83
Inadequate trained gatherers/ workers in the field	87	97

Source: Field Data (2023), multiple responses were recorded.

4.8 RESULTS OF THE REGRESSION ANALYSIS

Results of the regression analysis have been presented in table-9. Variables such as gender (x_1), profit (X_2), total revenue (X_6) transportation cost (X_7) and shop-rent (X_3) are the major parameters of interest in the study. The R^2 is the coefficient of multiple determinations which measures the extent to which the variation in the dependent variable is explained by the independent variables. Further R^2 adjusted measures the Goodness of Fit to the model. The F statistic measures the joint impact of the independent variables on the dependent variable and, thus, testing the joint significance of the model. The R^2 of 0.91 shows that 91% of the changes in the dependent variable of MAPs marketing was jointly explained by the independent variables captured in the model. The statistical significance of the individual explanatory variables in the model is discussed to explain individual as well as group effects on the dependent variable. The effect of gender on the efficiency of marketing of MAPs is not statistically significant. However there exists a positive relationship. This means that any person male or female could be efficient in MAPs marketing. The profit was statistically significant in affecting the marketing efficiency at 1% level of significance. This implies that the profit is a major determinant factor of the marketing efficiency. Furthermore, a positive relationship existed between the profit and marketing efficiency meaning that higher the profit, higher the marketing

efficiency. The level of education shows that there is a positive relationship between educational attainment and MAPs marketing efficiency. However, it is not statistically significant in affecting the efficiency of marketing of MAPS. There is a negative relationship between the quantity of MAPs traded and the marketing efficiency which signifies that higher the quantity traded the smaller will be the marketing efficiency of MAPs. This is not in conformity with the rational economic principles. Olukosi et al. (2007) had earlier noted that the higher the quantity traded and profit, the higher the marketing efficiency. With regard to total revenue generated results reveal that it was statistically significant in affecting the marketing efficiency of MAPs at 1% level of significant. This variable turned out to be a major determining factor of MAPs marketing efficiency in the study area. The positive signs associated with the variable in the model imply that, as total revenue increases, profit also increases as well as the marketing efficiency. This result is in conformity with the study conducted by Akirga (2006) who noted that increase in revenue would create an increase in profitability. Transportation cost to the nearest MAPs market was selected as a proxy for market access condition and cost associated with MAPs marketing in the study area This variable is a significant determinant for the MAPs marketing in the study area. The negative sign associated with the variable in the model implies that a high transportation cost would reduce the quantity of MAPs a market would like to purchase, hence reducing the profit and the marketing efficiency. But a better market access would reduce the transportation cost to MAPs market. Olapade, (1995) had earlier noted that a better market access would create a wider scope for the medicinal and aromatic plants (MAPs). The shop rent is one of the significant determinants of MAPs marketing efficiency. The coefficient of this variable is negative which implies that as the shop rent reduces, there will always be an increase in profit. This will translate to an increase in marketing efficiency. Thus, low cost of shop rent encourages more market players to go into the business of MAPs marketing in the study area,

Table-9: Results of regression analysis

Variables	Gender (X ₁)	Profit (X ₂)	Level of Education (X ₃)	Quantity of MAPs Traded (X ₄)
Regression coefficients	+0.014383 X ₁	+0.000035X ₂	+0.000840X ₃	- 0.000003X ₄
t- values	(22.5209)	(0.4996)	(0.1461)	(-0.7682)
Variables	Marketing efficiency (X ₅)	Total Revenue (X ₆)	Transportation cost(X ₇)	Shop-Rent (X ₈)
Regression coefficients	+ 0.000000X ₅	0.000003X ₆	-0.000039X ₇	-0.000017 X ₈
t- values	(-0.3702)	(2.0759)	(-2.1071)	(-5.2965)

$$Y = 1.280277(R^2 = 91\% R(\text{adj.}) = 90\%, F = 67.96, DF = 59).$$

Opportunities for sustainable economic growth for MAPs products in India

Medicinal and aromatic plants (MAPs) offer opportunities for sustainable economic growth in India. Medicinal plants (botanicals or herbal drugs) are primarily used to maintain health or treat specific conditions in both traditional and modern medicine systems, while aromatic plants are primarily used in cosmetics (e.g., perfume), the food industry (e.g., spices, flavoring), and medicinal products (e.g., aromatherapy). MAPs are deeply rooted in India’s unique geographical location and cultural identity. Most MAPs products are collected in the wild by non-commercial farmers and landless people to generate supplementary incomes. However, areas with high accessibility and affordability close to major markets have shown a tendency to produce MAPs on a commercial scale to generate greater profits. Estimates suggest that MAPs-related industries account for at least 5 percent of India’s total GDP and a significant portion of government revenues levied through permit fees, royalties, and taxes. The study identified two segments where India is well positioned to compete in the short to medium term:

- (i) Lightly processed products for the discerning and conscientious consumer, specifically personal care products; and
- (ii) Heavily processed, mass-produced products for non-discerning buyers, specifically Ayurvedic and traditional medicine products.

These segments have been identified based on several factors not limited to current capabilities of Indian firms, global demand trends, the evolution of international buyer purchasing criteria, relative knowledge and capital intensities of production, and the potential for attracting FDI in these segments. The segments have been identified based on several factors not limited to current capabilities of Indian firms, global demand

trends, the evolution of international buyer purchasing criteria, relative knowledge and capital intensities of production, and the potential for attracting FDI in these segments.

Indian manufacturers' success in competing with Indian imports of Ayurvedic medicine on the domestic market suggests competitiveness in this segment. India is ideally positioned geographically between Indian Ocean Trade Rout (sea route) and Central Asian Silk Route (land route) to leverage its position as a key supplier in a regional value chains. Despite India's restrictive investment climate, the broader health-care sector is attracting significant foreign direct investment (FDI) from Indian health-care providers. Domestic demand for healthcare products and services is growing and offers a buffer to external shocks. Indian manufacturers use a wide variety of MAPs in production of Ayurveda products, which suggests high potential for backward linkages. States such as Kerala, Gujarat, West Bengal and Uttarakhand have excelled in producing and marketing of MAPS. *Thekadi* and *Moonar* in the state of Kerala are major producing sites of MAPS. Besides above, state of Kerala is also famous for '*Panchkarma*', an Ayurvedic technique, used for healing various ailments using herbal products, and essence mostly from MAPs.

Challenges to growth of MAPs market in India

The public health aspect of these products makes them highly sensitive and more likely to be protected by barriers in destination markets. Firms in India face difficulties proving compliance with buyer requirements. This segment has minimal value addition and a high degree of global competition. As such, it involves little to no primary processing and operates on a commodity business model. Regional wholesalers in India have almost all the bargaining power to dominate. The remoteness of other wild-harvested MAPs, seasonality, variable weather conditions, overharvesting, and high transportation costs make scaling up a major challenge in the near term.

Many of the constraints in the MAPs value chains in India are similar to those across the broader agribusiness sector. These challenges include issues with land rental and aggregating land; lack of investment in physical infrastructure; lack of R & D; distortions in input markets (fertilizer and seeds); poor extension services; inadequate support for building firm capabilities; weak quality infrastructure (for testing and certification) that restricts access to foreign markets; poor logistics; insufficient investment in supply chains; and poor access to finance for smaller players in the sector. Additionally, Government of India can also encourage and incentivize supplier

development programs in the two identified value chains which provide the greatest opportunities for integration into global and regional value chains.

Sustainability of MAPs is a major concern: Over-exploitation, poor harvesting practices, and Climate changes are negatively affecting certain species in specific regions. Strengthening the oversight and in situ management capacity of community forest user groups should be a top priority. Efforts need to be made to promote the cultivation of MAPs endemic to hilly and high elevation districts. India with its rich diversity of medicinal plant species, contributes significantly to the global trade. Exporting MAPs from India requires compliance with various legal requirements and procedures.

The Foreign Trade Policy (FTP) 2023 governs the export of MAPs from India, providing guidelines and regulations to ensure sustainable harvest, proper processing and quality control.

Trade restrictions: There are trade restrictions on the movement of herbal and medicinal plants and that causes problems of assembly and processing at pharmaceutical units. A truck transporting MAPs from Hardwar (State of Uttarakhand) to Kannauj (State of Uttar Pradesh) passes through number of districts and is required to pay legal fees at different district offices and at least at different checkpoints of forest rangers. The reorganization of central and regional governance provides a timely window to address cross district trade issues and foster linkages between domestic MSMEs.

Creating conducive environment for skill development and e commerce

Updating the legal framework for e-commerce, specifically international payment gateways, and establishing the infrastructure for digital signatures will facilitate Indian firms to process transactions with individual final customers via online websites and retail platforms, opening new market access opportunities for these firms. Offering e-commerce and digital literacy training to domestic MSMEs could help strengthen their marketing skills and foster forward linkages. Partnering with the Indian Agribusiness Innovation Center to offer personal and professional development courses targeting entrepreneurs in the boutique personal care product segment can help Indian firms differentiate themselves from competition in this segment.

Implementing intellectual property rights (IPR)

Weak IPR framework limits the abilities of domestic MSMEs to develop unique products and brand identities. Weak IPR protection can also inhibit investment promotion, as international firms are less likely to invest in a country where protection of their IPR is not enforced. It is, therefore, pertinent to implement the policy so as to support private sector growth and attract foreign investors (FDI) in this sector.

The National Intellectual Property Policy of India 2017 provides for legal protections for geographical indications, traditional knowledge, and plant varieties and contains provisions for IPR protection in line with India's international obligations. The policy will need to be supported by enacting an Intellectual Property Rights Law. There is little available public information on which specific MAPs are used in which formulations and final products, and this in an area that requires research support.

Increasing Global demand for MAPs

India has the potential to tap into this demand and compete successfully in this market if the challenges faced by Indian players in the MAPs value chains are addressed. An estimated 3,000 species of MAPs are traded internationally as raw material inputs to an exhaustively long list of products. India's abundance of endemic MAPs, the country's long history of traditional medicine, and its international image as a place of wild landscapes and spiritual healing provide unique comparative advantages in today's global health and wellness industries.

5 CONCLUSION

The marketing of medicinal and aromatic plant (MAPs) is an important dimension in Indian economy as it links to society and its diverse needs towards a healthy life style besides being a source of income generation and employment creation in rural and even in remote areas. Because of latitudinal and altitudinal variations, India has an advantage of growing diverse tropical, subtropical and even temperate plants and use them for medicinal and other pharmaceutical applications. This is because it provides means of livelihood to the people in rural areas as producers and trade services to companies processing various products based in urban areas. The empirical investigations have revealed that it is profitable to all market participants in the study area; although various medicinal and aromatic plants result in wide variations in profit levels. On the whole, if policy measures are taken to protect the interests of MAPs growers, India can excel in

global trade and in domestic pharmaceutical industry. The study has contributed to the agricultural marketing literature; inter regional cooperation and global commerce if backed by the policy and considering risk of diseases, poor and remotely placed people can benefit significantly. New schemes, like Jan Aushadhi Kendras and Drone Didi Yojana, recently launched in India, are likely to open added scopes for boosting MAPS production and marketing.

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