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Assessing the Dynamics of the Menthol Economy: Natural and Synthetic Co-Existence

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Pahlé India Foundation (PIF) is a not-for-profit policy think tank, established in June 2013 by Dr. Rajiv Kumar. At PIF, we undertake analytical research and disseminate its findings both to policy makers and in the public domain. The driving vision in all that we do is "Putting India First to make India First." PIF also provides a credible, trustworthy and neutral policy platform for bringing together government, industry, academia and civil society for enriching the public narrative on topical issues. In the past one decade, PIF has been able to carve out a niche for itself and earn a reputation with policymakers as an independent, extremely credible institute that can be relied upon for producing high quality inputs for policy formulation. It is registered as a Section 8 company and is FCRA certifed.

PIF currently has an analytically strong team of dedicated researchers who are self-motivated. Our team specialises in analyzing India's political economy and its engagement across verticals that are relatively underworked areas.

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Our deepest appreciation goes to CSIR-CIMAP for their invaluable insights and support, particularly to Director Dr Prabodh Kumar Trivedi, Dr Manoj Semwal, Dr Chandan Chanotiya, and Dr Devesh Shukla for their guidance throughout this endeavour. We also extend our sincere thanks to industry stakeholders from the pharmaceutical, oral care, food and beverage as well as aromatics sectors for their contributions. A special mention goes to Mr Vaibhav Aggarwal from MMEA and Mr Shukla for their assistance in connecting us with the right experts, which made this report possible. Finally, we are grateful to Ms Garima Jain for her support in assisting our team with research.

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From the Chairman's Desk

India's menthol economy stands at a pivotal crossroad. The fate of small and marginal farmers hangs in balance because of the emergence and robust growth of synthetic menthol. As one of the world's leading producers of natural menthol, India has long been home to nearly more than half a million small and marginal farmers whose livelihoods depend on mentha (the plant from which menthol is extracted) cultivation. Can the two routes for menthol production subsist together or will a choice be inevitable In the coming period?

This report by Pahlé India Foundation (PIF) carefully examines this issue. It identifies the efficiency gains from production of synthetic menthol but also posits the costs in terms of large-scale loss of rural employment and livelihoods among small and marginal farmers.

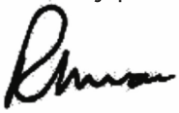
The way forward, recommended after due field research and diligence, is to put in place a policy framework that protects the interests of natural menthol farmers while enabling a viable domestic synthetic menthol industry. Public awareness through advertising, incentivising buyers, and mandating blend disclosure, such as clear labelling of natural vs. synthetic menthol in products, could achieve the desired results of co-existence of both natural and synthetic menthol, especially in the context of a rising demand for menthol products in Indian and global markets.

By adopting such a policy stance, which also encourages transparency, sustainability, and innovation, India can set a global example for the long-term co-existence of natural and synthetic production.

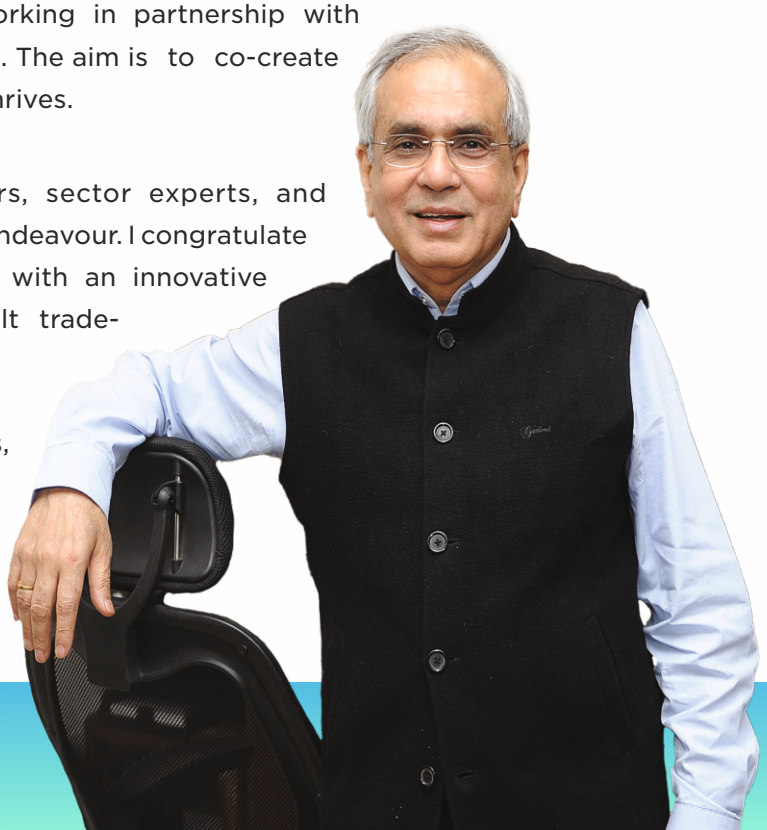
PIF, now in its 12th year, remains deeply committed to shaping India's economic trajectory through research that is timely, grounded in field realities, and oriented toward solutions. We see PIF not just as generator of policy ideas but also as enablers of innovative policy implementation by working in partnership with governments, industries, and communities. The aim is to co-create an ecosystem where private enterprise thrives.

We are grateful to all the stakeholders, sector experts, and government partners who supported this endeavour. I congratulate the PIF's research team for coming up with an innovative approach for resolving a seemingly difficult trade-off.

With my personal regards and best wishes,



Dr Rajiv Kumar
Chairman, Pahlé India Foundation
June, 2025



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Abbreviations

CAGR	Compound Annual Growth Rate
CIMAP	Central Institute of Medicinal and Aromatic Plants
DMO	Dementholised Oil
EMT	Early Mint Technology
FFDC	Flavours and Fragrance Development Centre
FMCG	Fast-Moving Consumer Goods
FSSAI	Food Safety and Standards Authority of India
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GMP	Good Manufacturing Practices
GST	Goods and Services Tax
HACCP	Hazard Analysis and Critical Control Points
ISO	International Organization for Standardization
MCX	Multi Commodity Exchange of India Limited
MEIS	Merchandise Exports from India Scheme
MMEA	Mint Manufacturers and Exporters Association
MT	Metric Tonne
RoDTEP	Remission of Duties & Taxes on Exported Products
VAT	Value Added Tax
WHO	World Health Organisation

Introduction

1. Introduction

Menthol, regarded for its cooling and anti-microbial properties, is a key ingredient in various industries such as oral care, pharmaceuticals, tobacco, aromatics, food and beverages as well as cosmetics.[1] There are primarily two kinds of menthol: natural, extracted from the Mentha arvensis plant (Japanese Mint), and synthetic, chemically produced from petroleum-based or other compounds. India produces 80% of the world's natural menthol, with a production of 35,000 MT of essential oil, menthol crystal and allied products.[2] The estimated value of menthol exports for India in 2023 was at $170 million.[3] As market demands evolve, India remains a major player in natural menthol while also importing synthetic menthol to meet industrial needs. Menthol is processed as oil, crystals, and flakes, each serving specific uses. Mentha oil is used as a raw material for flakes and crystals, which offer unique benefits and are utilized in cosmetics, personal care, and medicinal products. Menthol crystals are used in products such as balms, creams, and oral care items.[4] Industries choose between natural and synthetic menthol based on factors like sensory profiles of products and cost, as there no standardised practices dictating the use of either type. The menthol economy supports rural development, especially in Uttar Pradesh, which accounts for 75% of India's natural production, enhancing exports and economic growth.[5]

1.1 Objectives of the Study

The primary goal of the study is to explore the interplay between natural and synthetic menthol within the Indian market. By assessing their respective value chains, the study seeks to provide a clear understanding of how these two types of menthol coexist and influence the market as well as highlight its implications for industry stakeholders contributing to informed decision-making within the menthol industry.

The specific objectives are as follows:

- To evaluate and analyse the supply and demand side value chain of natural and synthetic menthol in India. This involves factors that influence production, distribution and consumption
- To understand key challenges and feasibility with 'only natural menthol economy' and 'only synthetic menthol economy' for the end user industry and their key buying considerations.
- The study aims to understand the challenges and benefits for end-user industries when relying solely on one type of menthol, considering factors such as cost, sustainability and consumer preferences.

[1] https://www.taylorfrancis.com/books/mono/10.1201/9780849307980/mint-brian-lawrence
[2] https://www.csir.res.in/index.php/csir-success-stories/importing-menthol-mint-becoming-leadingexporter#:~:text=CSIR%2DCIMAP%20has%20played%20an,superior%20agro%20and%20processing%20technologies.
[3] ITC trade map
[4] https://www.researchgate.net/publication/348863765_Natural_Menthol_Mint_Oil_Production_in_India_Role_of_CSIRCIMAP_Opportunities_and_Challenges
[5] https://epubs.icar.org.in/index.php/IndHort/article/download/114656/44704/299088

- To determine the viability of co-existence of natural and synthetic menthol in India.
- To identify the drivers and challenges to the co-existence of natural and synthetic menthol. This includes an analysis of the drivers and bottlenecks that both pathways of menthol face in maintaining their market positions.

1.2 Scope of the Study

The study provides a comprehensive analysis of India's menthol economy in India, focusing on the coexistence of natural and synthetic menthol. It covers key market factors, including pricing, production processes, demand-supply trends along with consumer preferences.

Chapter 2 outlines the methodology used to collect and analyse data, ensuring a robust foundation for the study. Chapter 3 provides an in-depth exploration of the value chains, including a snapshot of the cultivation and harvesting processes. Chapter 4 highlights roles and influence of key stakeholders entrenched in the Menthol economy.

Chapter 5 delves into the market dynamics and trends shaping the industry, while chapter 6 examines the current state of coexistence between natural and synthetic menthol in India. Chapter 7 and 8 focus on quality assurance practices and the environmental impact of production processes.

Chapter 9 reviews the regulatory framework governing menthol production and trade, providing context for industry standards and compliance. The study concludes with chapter 10, offering policy recommendations to improve sustainability and efficiency, and chapter 11 presents a future outlook for the menthol industry in India. The insights gleaned from this study are intended to guide industry stakeholders in making informed decisions and fostering fair competition within the menthol industry.

1.3 Natural and Synthetic Menthol Overview

The global menthol industry has witnessed a shift over the years. Initially dominated by Japan and China, the industry expanded with the cultivation of Mentha arvensis in Brazil during the 1960s.[6] India entered the menthol market in the late 1950s and experienced a substantial growth in the 1980s aided by the development of high-yielding varieties by the Central Institute of Medicinal and Aromatic Plants (CSIR-CIMAP). By 1996, India had produced 6,000 MT of Mentha oil, that grew to 32,000 MT by 2016-17, thereby solidifying India's position as the largest producer and exporter of natural menthol.[7]

India transitioned from being an importer to a major export of menthol products by the mid- 2000s, with natural menthol chiefly cultivated in the northern regions.[8] It is sought after by producers of fast-moving consumer goods (FMCG), pharmaceutical and aromatherapy products due to its functional benefits such as affordability compared to peppermint oil, sensory experience and medicinal properties.[9]

[6] https://www.mcxindia.com/products/agro-commodities/Mentha-oil
[7] Ibid
[8] https://www.cropin.com/blogs/the-shubh-mint-project-for-sustainable-farmer-livelihoods
[9] Ibid

The introduction of mentha oil futures contracts in 2004 further boosted production, ensuring stability. The country's mentha oil is used to produce menthol crystals and flakes, essential in consumer goods like toothpaste, shampoos, and lotions where the cooling sensation makes it appealing. Additionally, menthol's analgesic effects render it a prized ingredient in topical pain relief formulations as well, addressing the growing demand for holistic healthcare solutions and health-conscious consumption.[10]

As the demand for menthol continues to grow, synthetic menthol has emerged as a cost effective alternative due to its lower cost and consistent supply. Over the last two decades, India's menthol industry has evolved to accommodate both natural and synthetic menthol meeting the diverse and growing needs of various sectors. Imports of synthetic menthol have increased, while domestic natural production has seen steady growth, supported by stable acreage under mentha cultivation. The supply side is reliant on climate sensitivity which led a shift in certain industries towards use of synthetic menthol, gaining momentum since 2008 in downstream applications where natural was once utilised.[11]

[10] https://horticulture.bihar.gov.in/HORTMIS/BAIPP/Downloads/Medicinal_Aromaticplants-Menthaoil.pdf
[11] https://www.beroeinc.com/category-intelligence/menthol-market/


Methodology

2. Methodology

This study employs a mixed-method approach by combining both primary and secondary data collection methods to learn about the dynamics of the menthol market. It involves quantitative analysis for assessing economic dimensions, such as import and export data, cost structures, market composition and shares, as well as qualitative methods including secondary desk research, interviews, and case studies to provide insights into industry perceptions and practices. By comparing and synthesising data from both sources, the study allowed for a deeper understanding of how each pathway operates.

Secondary Research

A variety of sources including scholarly articles, industry reports, government publications and market analyses were reviewed to establish a foundation for the menthol ecosystem. It helped in understanding market protocols with respect to regulations and assess the gap between demand and supply of both natural and synthetic menthol to articulate the dynamics of coexistence.

Systematic searches in academic databases; Google Scholar, Elsevier, Science Direct, and Research Gate, helped identify relevant materials such as production processes, geographic distribution and industry players. The credibility of these sources was considered based on the author's expertise, recency of publication and the reputation of the reports.

Primary Research

It consisted of structured interviews with two stakeholders across key segments of the menthol industry, including oral care, food and beverage, tobacco, pharmaceuticals and aromatics. This approach aimed to gather information on industry practices and consumer perceptions. Initial data collection involved a select sample of industry representatives including manufacturers, traders and industry associations to give direction to the interviews. Questionnaires were designed to capture the diversity of the menthol industry focusing on the use, quality and addressing the deficiencies in the current data to deliver a nuanced understanding into both natural and synthetic menthol.

Ethical considerations were carefully observed throughout the research process with informed consent obtained from all participants and measures taken to ensure privacy and made aware of how their information would be used, including the anonymisation of responses.

Value Chain of Natural and Synthetic Menthol in India

3. Value Chain of Natural and Synthetic Menthol in India

3.1 Natural Production Value Chain

Mint is an aromatic herb with over 30 species is cultivated globally. It belongs to the genus Mentha in the Lamiaceae family,[12] which includes other commercially grown essential oil yielding plants such as rosemary, sage, lavender, thyme and basil. Each species varies in its chemical constitution, aroma and end use and they thrive in tropical/ subtropical regions. The four most commonly grown species in India on a large scale are Mentha arvensis (Japanese Mint/ Cornmint), Mentha piperita (Peppermint), Mentha spicata (Spearmint) and Bergamot Mint (Mentha citrata).[13] The United States of America and Canada are the largest producers of spearmint and peppermint, while 80% of the world's supply of Japanese mint (known for its high menthol content) stems from India.

Mentha arvensis includes several key varieties (ref. to the appendix). Shivalik, suitable for second cuts and imported from China, is valued for its fragrance and therapeutic uses. Himalaya boasts a high essential oil yield, commonly used in pharmaceuticals and cosmetics. Hybrid 77 is resistant to rust diseases, while EC-41911 is preferred for food flavouring due to its resilience to rain. CIM Kosi is known for its high menthol content, biomass, and oil yield, and CIM Kranti performs well in winter, making it ideal for oil production. CIM Kosi and CIM Kranti account for crop resilience and sustainable facets.[14]

[12] Lawrence, B. M. (2006). Mint: The genus Mentha. CRC Press.
[13] Ibid
[14] https://www.mcxindia.com/docs/default-source/products/agro-commodities/performance-review/performance-review-2020-21---Mentha-oil.pdf?sfvrsn=2780bf90_2
[15] https://www.researchgate.net/publication/348863765_Natural_Menthol_Mint_Oil_Production_in_India_Role_of_CSIRCIMAP_Opportunities_and_Challenges

Table 1: Acreage and Production in India[16]

	Area (In '000 Hectare)	Production (In '000 MT)	Productivity (In MT/ Hectare)	% Increase in Area	% Increase in Production
2016-17	327.85	34.48	0.11	-	-
2017-18	327.36	32.74	0.10	-0.15%	-5.05%
2018-19	333.90	34.05	0.10	2.00%	4.00%
2019-20	328.04	43.23	0.13	-1.76%	26.96%
2020-21	347.28	45.80	0.13	5.87%	5.94%
2021-22	346.30	35.01	0.10	-0.28%	-23.56%
2022-23	347.46	35.12	0.10	0.33%	0.31%
2023-24	348.68	35.15	0.10	0.35%	0.09

Source: Data collected from Spices Board and
Ministry of Agriculture and Farmers Welfare, Government of India via Indiastat

The table above reflects a period of fluctuating yields and production, despite a relatively stable area under cultivation. This could potentially be due to external factors like climate conditions affecting crop health, variation in agricultural practices. This presents a challenge for downstream stakeholders, such as distillers and exporters, who depend on a consistent supply of high-quality mint.

3.1.1 Production Clusters

Mint is cultivated in the Indo-Gangetic plains, with Uttar Pradesh contributing 75%, Madhya Pradesh and Bihar comprising 15%, Uttarakhand at 5%, and Haryana and Punjab collectively at 5%. Its cultivation occupies roughly 3,40,000 hectares (ha) of farmland across India[17] and the country exports approximately 15,000 metric tonnes (MT)[18] of Mentha oil annually. Based on primary research, specifically an interview with a CSIR-CIMAP scientist revealed that yield variability and availability of natural resources like water and availability of labourers are factors influencing the expansion of natural menthol cultivation beyond Uttar Pradesh.

[16] https://www.indiastat.com/table/agriculture/selected-state-wise-area-production-productivity-m/1418932
[17] https://www.csir.res.in/index.php/csir-success-stories/importing-menthol-mint-becoming-leadingexporter#:~:text=CSIR%2DCIMAP%20has%20played%20an,superior%20agro%20and%20processing%20technologies.
[18] https://www.indiastat.com/table/agriculture/selected-state-wise-area-production-productivity-m/1418932

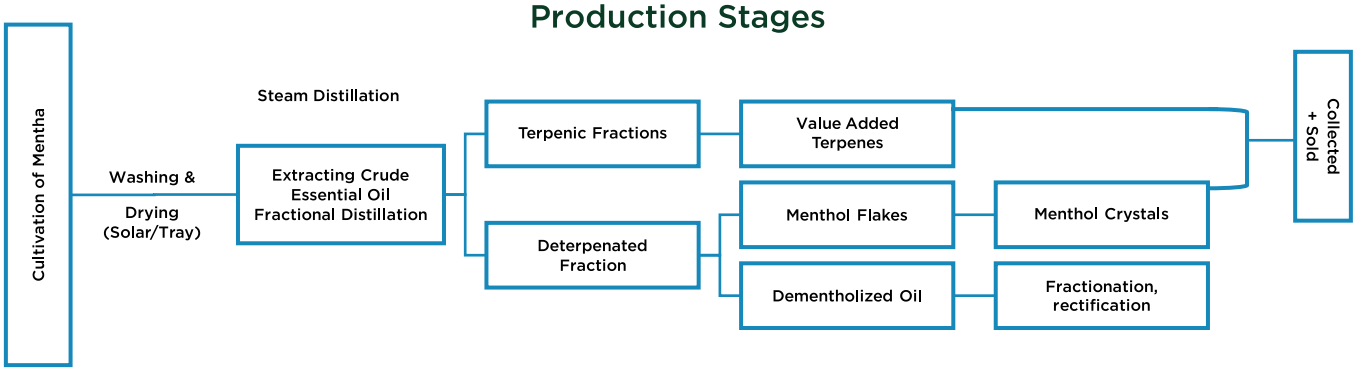
Table 2: Cultivation Clusters in India

Uttar Pradesh	City: Barabanki, Moradabad, Sitapur, Sambhal, Chandausi, Lucknow, Bilari, Basti, Rampur, Jalaun, Konch, Budaun & Bareilly
Punjab	City: Ludhiana, Jalandhar, Moga, Navasaher, Hoshiarpur & Amritsar
Haryana	District: Ambala, Yamuna Nagar
Uttarakhand	District: Nanital, Udham Singh Nagar
Madhya Pradesh	City: Chhatarpur & Hoshangabad
Himachal Pradesh	District: Lahul and Spiti City: Kukumseri, Kishori. Tosh, Kasol, Mudh and Darcha
Bihar	City: Bengusarai, Bhagalpur, Lakhi Sarai, Khagariya, Samastipur, Darbhanga, Muzaffarpur, Aurangabad & Samasti

Source: Data collected from primary and secondary research

3.1.2 Production Process and Applications

Figure 1: Natural Menthol Production Process



Freezing the oil – Centrifugation/ Filtration -- Drying
Source: Taneja - S.C. and Chandra, S. Mint- Handbook of Herbs and Spices Volume 1

Mint crops are propagated using suckers and stolons in furrows, using organic manure and careful irrigation. Typically, the crop requires a total of 10-13 times irrigation cycles for optimal yield and is harvested at the flowering stage, between June and September.[19] After harvesting, leaves are wilted overnight and processed through steam distillation to extract mentha oil. This oil is refined into natural menthol, which is used in medicines, oral care products, cosmetics, and food and tobacco flavouring. Other major producers of Japanese mint are China, Brazil and to a smaller extent Thailand and Vietnam.[20] Japanese mint is highly productive, yielding 100-150 kg of oil per hectare annually, compared to peppermint's 25-40 kg.[21] The oil's quality is preserved through storage in air-tight, moisture-free aluminium or stainless-steel containers under dark conditions.[22]

The commercial value of mentha oil is driven by compounds such as menthol (70-75%), limonene, cineole, and menthone. Approximately 50-55% of frozen mint oil crystallizes into menthol when cooled at -5 to 14°C over 48 hours, with slower cooling yielding larger crystals.[23] The leftover oil, called Dementholized Oil (DMO), is also used in fragrance and flavour industries.[24] Additionally, interviews with stakeholders specify that higher menthol concentration is associated with better commercial value in oral care and FMCG sectors.

Table 3: End-Use Applications of Natural Menthol

Oral Care **Pharmaceuticals**	Used in tooth paste and mouthwash Used in cough syrups, stomach remedies, pain balms and ointments
FMCG & Cosmetics	Used as cooling agents in cosmetics and confectionary
Tobacco	Used in menthol cigarettes and pan masala
Personal Care	Used in shaving cream
Flavour & Fragrance	Used in essential oils, perfumes and menthol crystals are used for flavouring in food items

Source: Reading Manual for Mint and Mint Product Processing Under PMFME Scheme (National Institute of Food Technology Entrepreneurship and Management Ministry of Food Processing Industries)

[19] http://www.jnkvv.org/PDF/07042020143105Sahu.pdf
[20] https://www.nhb.gov.in/Horticulture%20Crops/Mint/Mint1.htm
[21] https://updes.up.nic.in/updes/data/sss/activities_undertaken/2RSAC_mapping_mentha_report.pdf
[22] https://updes.up.nic.in/updes/data/sss/activities_undertaken/2RSAC_mapping_mentha_report.pdf
[23] https://static.vikaspedia.in/media/files_en/agriculture/crop-production/mints.pdf
[24] https://updes.up.nic.in/updes/data/sss/activities_undertaken/2RSAC_mapping_mentha_report.pdf

3.2 Synthetic Menthol Value Chain

Synthetic menthol is a man-made version of menthol, chemically identical to its natural counterpart in terms of its structure and sensory attributes. It is produced through chemical synthesis routes derived from petrochemicals.[25] Synthetic menthol was developed in response to increasing global demand and to address limitations in the natural supply chain. It has gained prominence in market as it offers a consistent supply, stable pricing and uniform quality over 99% purity, as it is not subject to agricultural fluctuations. The large-scale production of the synthetic variant by organized producers[26] has led to its widespread adoption across consumer products such as tooth paste, chewing gum and topical ointments. As the production for the synthetic variant of menthol grows, it plays a significant role in the global menthol market complementing natural menthol. According to an industry stakeholder we interviewed from the Oral Care segment, if current trends remain unchanged, synthetic menthol is projected to account for nearly 75% of the total global demand by 2026.

3.2.1 Production Clusters

Table 4: Production Clusters of Synthetic Menthol Globally

Germany	**City:** Ludwigshafen, Krefeld and Holzminden
Japan	**City:** Kawasaki
China	**City:** Shanghai, Hangzhou[27]
Malaysia	**City:** Kuantan[28]
USA	**City:** New Jersey, Cincinnati

Source: Data taken from multiple secondary sources

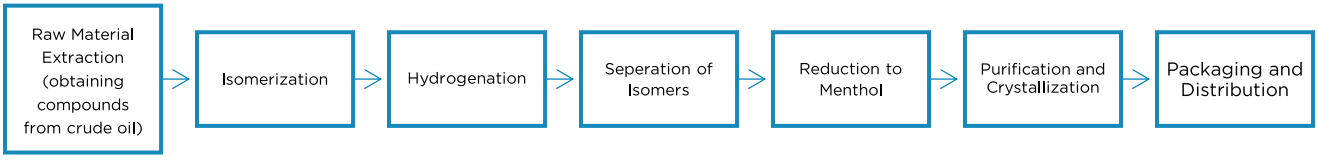
[25] https://www.researchgate.net/publication/245023301_Cooling_Ingredients_and_Their_Mechanism_of_Action
[26] https://www.careratings.com/upload/CompanyFiles/PR/04032022080811_Neeru_Menthol_Private_Limited.pdf
[27] http://www.betterchemtech.com/product/l-menthol
[28] https://www.basf.com/global/en/media/news-releases/2016/09/p-16-290

3.2.2 Production Process and Applications

Synthetic menthol is derived from petrochemicals like m-cresol and natural compounds such as myrcene and pulegone.[29] Its pricing is directly influenced by the cost of essential oils, as these oils serve as key sources of raw materials. The production methods are categorized into semi-synthetic and fully synthetic processes, each with varying raw materials, reagents, and sustainability considerations.

Figure 2: Synthetic Menthol Production Process

Production Stages



Source: Leffingwell, J. C. (2009). Cooling Ingredients and Their Mechanism of Action. In A. O. Barel, M. Paye, & H. I. Maibach (Eds.), Handbook of Cosmetic Science and Technology

Semi-synthetic menthol, demonstrated by Takasago, utilises turpentine-derived myrcene and chiral catalysts to create high-purity (menthol) with reduced waste and its environmental impact, aligning with sustainable practices.

Fully synthetic methods, such as those by Symrise and BASF, rely on petrochemical-based inputs like m-cresol, isobutylene, and formaldehyde. Symrise emphasises efficiency and waste reduction, although its use of fossil fuels raises sustainability concerns. Whereas, BASF employs advanced techniques like asymmetric hydrogenation and continuous production to optimize resource use. However, it carriers an inherent environmental impact due to carbon emissions and fossil fuel extraction.[30]

[29] https://www.researchgate.net/publication/245023301_Cooling_Ingredients_and_Their_Mechanism_of_Action
[30] Formulas and manufacturing process of synthetic pathways included in the annexure

Table 5: Applications of Synthetic Menthol

Final Product Type	End Use
Synthetic Peppermint Oil	Synthetic Spearmint Oil
Food and Beverage	Pharmaceuticals
Blended Synthetic Mentha Oil	Cosmetics, Personal Care, Tobacco

Table 6: Finished Goods Consumption Category

Food and Beverage	Used in the manufacture of sweets, chocolates,
Cool and Refreshing Effect	chewing gum, confectionaries, beverages, carbonated drinks, flavoured water, herbal teas, cocktails etc.
Pharmaceuticals Antibacterial and Breath Freshening	Used in oral care products, cough drops and syrups, throat lozenges, lotions, balms etc.
Personal Care	Used in soaps, shampoos, conditioners, body wash,
Minty Fragrance	perfumes, scented candles etc.

Source for both tables: Leffingwell, J. C. (2009). Cooling Ingredients and Their Mechanism of Action. In A. O. Barel, M. Paye, & H. I. Maibach (Eds.), Handbook of Cosmetic Science and Technology

3.3 Comparative Analysis between Natural and Synthetic production Processes

	Natural Menthol	Synthetic Menthol
Factors Affecting Yield	Influenced by climate change, government policies, and prices	Less vulnerable to external risks, ensuring consistent supply
Processes	Small farmer-run distillation plants use inefficient local units which require more time or heat to extract the oils. Interviewed stakeholders state that this is currently being tackled by innovative measures such as solar panels.	More streamlined and cost-effective production pathways
Water Usage	High water demand (10 irrigations per crop), contributing to groundwater depletion, but less than crops like sugarcane	Water footprint of synthetic menthol production is significantly lower. It is reduced to activities such as cooling, cleaning or for reactions
Market Dynamics	Price-sensitive demand; competition intensifies when synthetic prices are significantly lower	Economic viability depends on maintaining a significant price advantage
Challenges	Farmers struggle to compete due to higher costs and inefficiencies. They choose to go for other commercial crops	Poses competitive pressure on natural menthol producers and small farmers


Stakeholders

4. Stakeholders

The table below outlines the stakeholders across the natural menthol value chain, ranging from farmers and traders to entities and major players that drive industry dynamics. Understanding both levels of stakeholders is essential for comprehending the full scope of the ecosystem, from raw material production to the end-use product.

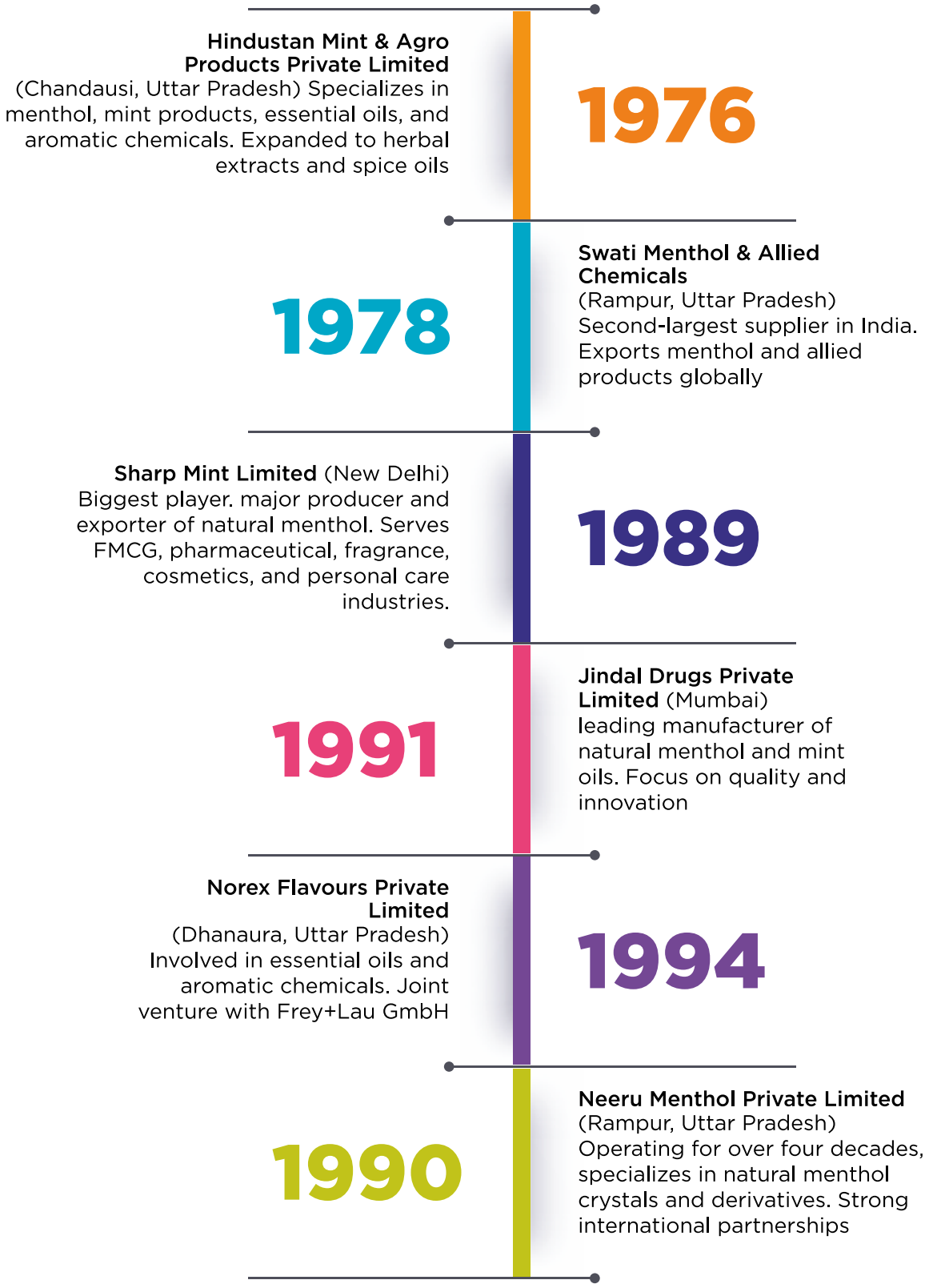
Activity	Agent	Output	Profit Margins	Challenges
Input Supply	Seed suppliers – private input dealers/ CIMAP	Provide quality mentha seeds, fertilisers, pesticides, irrigation equipment	Negligible (profit from volume of sales)	High input costs, limited availability of quality seed suckers
Training and Extension	CIMAP, agricultural universities, government agencies	Training in modern distillation practices, crop management and subsidies	-	Mainly focussed on districts in Uttar Pradesh. Expanding to other states
Crop Production	Famers (Smallholders cultivating 1 to 3 acres)	Grow and harvest mentha crop typically yielding 40-60 kg oil/ acre	Farmers in Central UP, where cultivation costs are low, enjoy high profit margins - sometimes earning 3-4 times their production cost. In other regions, margins are lower due to higher cultivation and distillation costs	Yield inconsistency, climate risk and pest infestations
Distillation and Oil Extraction	Farmers (with distillation units), collectors/ aggregators	Purchase raw mentha crops from farmers and process them into crude mentha oil via distillation (steam/ hydrodistillation)	Small collectors: Rs 5-10/ kg of crude mentha oil	High distillation equipment costs and inconsistent oil quality. They capture a larger share of value due to control of distillation processes

Activity	Agent	Output	Profit Margins	Challenges
Aggregation and Refining	Aggregators/ large collectors and refiners	Aggregate crude mentha oil and refine it into menthol crystals or high-purity mentha oil. Sold to end-users such as pharmaceutical, FMCG, and flavouring industries	Large collectors handle larger volumes, often selling full truck loads to menthol manufacturers. Their profit model involves buying oil continuously over time and averaging out their purchasing prices to sell at current market rates, thus making higher margins	Price volatility and market access challenges
Processing and Packaging	Exporters, processors	Process and package menthol oil/ crystals for end users. They typically handle larger volumes of menthol and supply to both domestic and international markets.	Varies across the supply chain depending on demand and pricing dynamics	Competition with synthetic menthol and export regulations. Small-scale processors used to dominate in areas like Sambhal, Moradabad, and Chandausi, but many have switched to synthetic menthol due to price parity between natural and synthetic menthol in the spot market
Major Players	Sharp Mint Limited[31], Jindal Drugs Private Limited[32,33], Neeru Menthol Private Limited[34], Swati Menthol & Allied Chemicals[35,36], Norex Flavours Private Limited[37,38] and Hindustan Mint & Agro Products Private Limited[39,40]			

[31] http://www.sharpmint.com/about.php | [32] https://www.bloomberg.com/profile/company/JND:IN
[33] https://www.jindaldrugs.com/ | [34] https://www.careratings.com/upload/CompanyFiles/PR/Neeru%20Menthol%20Private%20Limited-02-12-2020.pdf
[35] https://www.bloomberg.com/profile/company/6590548Z:IN | [36] http://swatimenthol.com/
[37] https://www.norex.in/expertise | [38] https://www.indiamart.com/norexflavours/ | [39] https://www.hindustanmint.com/about-us
[40] https://www.bloomberg.com/profile/company/1488830D:IN

4.1 Major Players in Natural Menthol

Figure 3: Evolution of Natural Menthol Players

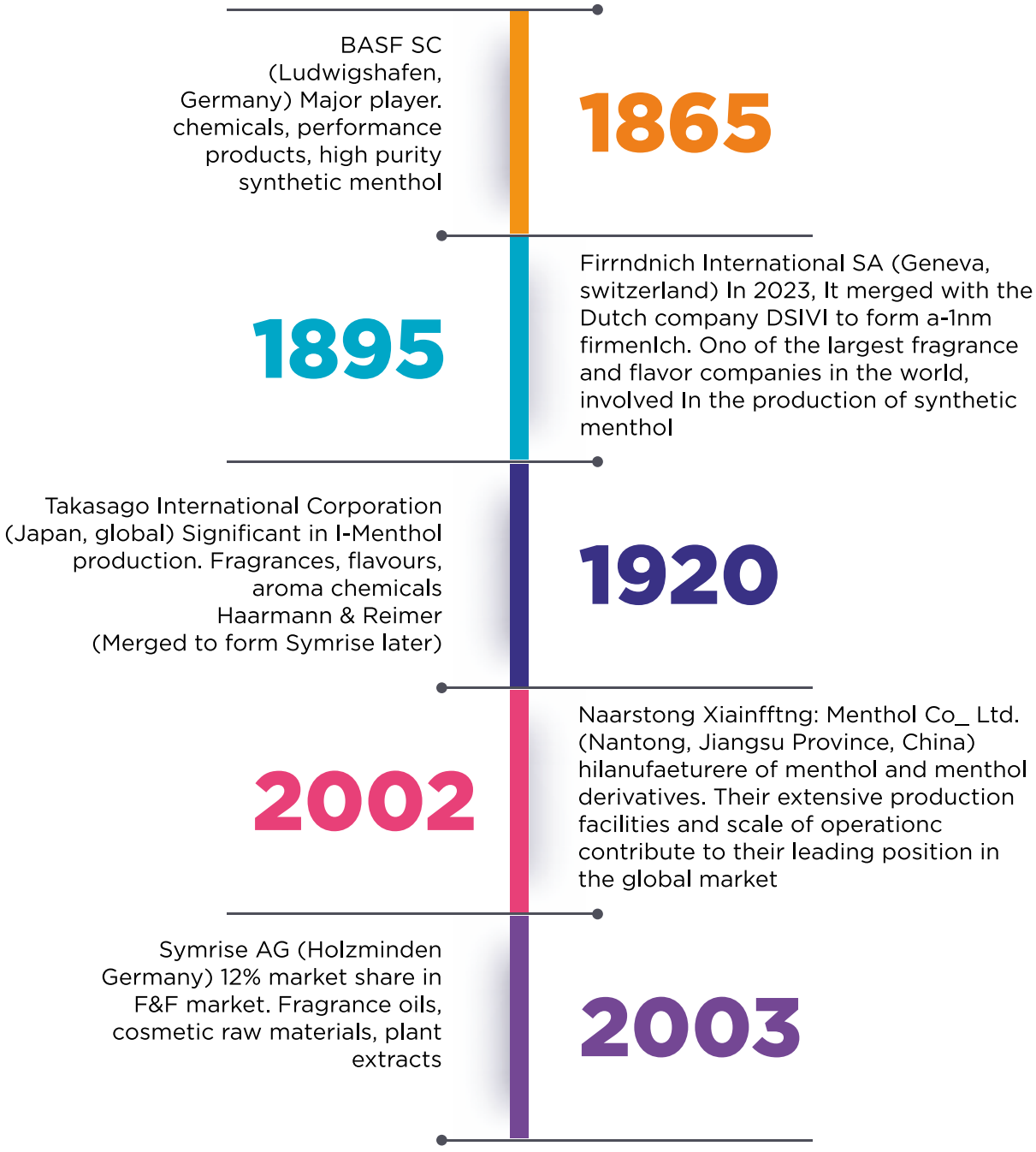


Activity	Agent	Output	Challenges
Input Supply	Chemical suppliers	Organic compounds (Eg: m-cresol)	Price volatility of raw materials, supply security
Production	Manufacturers (Eg: BASF, Symrise, Takasago)	Synthetic menthol crystals/ molten blocks	Compliance with regulatory standards; production costs
Quality Control	Quality assurance teams	Purity testing, consistency checks)	Testing costs
Distribution	Distributors and logistics	Delivery of synthetic menthol to clients	Transportation costs and supply chain disruptions
Marketing and Sales	Marketing teams	Promotion of synthetic menthol products	Competition from natural menthol, consumer perception
End-Use Applications	End-user industries (pharmaceuticals, cosmetic, food and beverages etc)	Final products (Eg: creams, candies etc)	Regulatory compliance, market demand fluctuations
Major Players	BASF SE[41], Symrise AG[42,43], Takasago International Corporation[44,45], Firmenich International SA and Nantong Xianfeng Menthol Co Ltd		

[41] https://www.basf.com/us/en/media/science-around-us/the-cool-freshness-of-menthol
[42] https://www.symrise.com/our-company/
[43] https://www.annualreports.com/Company/symrise-ag
[44] https://www.takasago.com/en/flavors/technology/mintact.html
[45] https://www.ptinews.com/press-release/takasago-international-corporation-expands-presence-in-india-with-inauguration-ofmumbai-fragrance-centre/1402545

4.2 Major Players in Synthetic Menthol

Figure 4: Evolution of Synthetic Menthol Players



4.3 Socio Economic Impact on Stakeholders

Farmers: According to a 2016 report published by the National Academy of Agricultural Sciences, the natural menthol value chain once supported approximately 6 lakh farmers' families and generated over 60 million man-days of employment annually.[46] However, recent figures are yet to be determined due to a shift in the menthol economy. The growth of synthetic menthol production has led to reduced profit margins for farmers, affecting their livelihoods as mint, once a lucrative cash crop, now yields lesser returns.

A stakeholder from the procurement side of the menthol industry revealed that farmer's profitability depends heavily on regional factors like cultivation costs, access to irrigation, and landholding size. In Central Uttar Pradesh (Barabanki region), farmers see significant profit margins due to lower cultivation costs (INR 500-600/kg) and high selling prices (INR 950-960/kg), offering returns of INR 350-460/kg. In contrast, Western Uttar Pradesh and Punjab face higher costs of production (INR 700-900/kg in Western UP) due to larger land holdings, diesel-powered irrigation, and reliance on external labour, leading to reduced profitability or even a sharp decline in production.[47] Smaller land holdings and family-run distillation units in Eastern and Southern Uttar Pradesh help keep production viable despite high costs, but margins are still lower than in Barabanki.

Additionally, scientists from CSIR-CIMAP are working on improving production efficiency through the development of high-yielding plant varieties, the adoption of Early Mint Technology (EMT) for better resource management, drones for timely irrigation, application of fertilizers/pesticides and the introduction of climate resistant strains.[48] Despite these innovations, the competitive edge of synthetic menthol due to its lower production costs and chemically identical properties continues to pose a substantial challenge to natural menthol production.

Over the past seven years, the acreage dedicated to menthol crop cultivation and overall production in India have remained relatively stable, with no significant fluctuations observed on a yearly basis. This indicates that key factors such as crop pricing, weather conditions, and the attractiveness of alternative cash crops such as watermelon, potato, cucurbits, chili etc.[49] have had minimal impact on farmers' decisions to continue growing menthol crops. Farmers have maintained their commitment to menthol cultivation, suggesting a consistent level of confidence in the crop's long-term viability despite external variables.

The National Mission on Medicinal Plants acknowledges that many farmers are new to cultivating medicinal plants, making it essential to provide adequate protection through crop insurance. To facilitate this, the initiative covers 50% of the insurance premium for designated crops. The specific premium rates and terms will be determined in partnership with the Agriculture Insurance Corporation, ensuring that farmers receive the necessary coverage against potential risks.[50]

Traders: They need to stay abreast with the market demands that constantly change. They purchase large quantities of both natural and synthetic menthol. Distribution of the products occurs gradually, fulfilling curated orders from industry stakeholders. These orders are tailored to match the desired sensory qualities of their products. As a result, prices vary depending on the purity grades and customized requests from buyers. They profit by buying over time at lower prices and selling at market rates. Margins tend to be higher for these actors in the value chain, but blending synthetic components is also common.

[46] CIMAP expert review
[47] Primary research, interview with a stakeholder on the ground
[48] Primary research, interview with a senior scientist from CSIR- CIMAP
[49] Ibid
[50] https://www.wbhealth.gov.in/WBSMPB/different_schemes_project_formats/1.pdf

Manufactures: Natural menthol production requires expertise in agriculture, adherence to quality standards, and high capital investment for cultivation and processing (distillation units), while synthetic menthol manufacturing requires a significant capital investment for specialised equipment, skilled personnel, and regulatory compliance. Both sides demand technical knowledge and abiding by industry standards, limiting new entrants and reinforcing market dominance by established players.

The natural menthol value chain is highly fragmented. While there are large manufacturers, producers and a Mint Manufacturing and Exporters Association (MMEA), the natural value chain primarily consists of small farmers and distillers who are not always unified in their demands. The negotiating power, especially in terms of lobbying and the ability to withstand business downturns, would be determined by the size and scale of the organisation/ group of organisations.[51]

[51] Broadly means how much is the sensation, how strong it is, and for how long does it lasts


Market Dynamics

5. Market Dynamics

The menthol market involves two main stakeholders: consumers and the industry. Consumers often favour products with natural ingredients for their authenticity, yet in price-sensitive regions like India, cost is also a significant factor. Some prioritize qualities like taste and cooling effect, making synthetic menthol an accepted alternative due to its ability to meet these preferences. On the industry side, stakeholders focus on input costs while ensuring that menthol retains its essential properties. Research shows that synthetic menthol can match the qualities of natural menthol at a reduced cost, leading to its growing commercial adoption. On the supply side, production time, volume, and input costs play crucial roles in determining the availability and pricing of both natural and synthetic menthol. Companies consider not just pricing but also various factors such as quality standards, certifications, and sustainability when making decisions. As the market expands, the importance of the 'sensory profile'[52] in product composition will increase.

5.1 Export and Import Trends

The export value of natural Mentha oil from India has reached a figure of 237 million USD, representing approximately 75% of the national production, thereby yielding an indicative total production value of 316 million USD (close to the range of what the Annual Survey of Industries predicts).[53] It is important to understand here that while trade data for both exports and imports is available, consumption data is gauged by ASI with reasonable degree of accuracy. Consequently, domestic consumption of natural Mentha oil within India stands at 79 million USD. When factoring in Mentha oil imports totalling 45.3 million USD, the aggregate consumption within India can be estimated at 124.3 million USD. Moreover, an analysis of global menthol trade data reveals noteworthy trends. The top **5** global **exporters of menthol** for the year 2023 are:-

India	Germany	China	Malaysia	USA
237 million USD	143 million USD	116 million USD	73 million USD	35 million USD

On the other hand, the top **5 global importers of menthol are**:-

China	USA	India	Singapore	Indonesia
311 million USD	86 million USD	65 million USD	41 million USD	31 million USD

The figures below give the global trade of menthol (global exports and imports). It can be observed that India assumes a dominant position in global menthol exports topping the chart for the past decade, followed by Germany. Similarly, China assumes a dominant position in global menthol imports topping the chart, followed by USA.

[52] https://oec.world/en/profile/bilateral-product/menthol/reporter/ind?redirect=true#subnational-data. Refer section 5.6 for details.
[53] ITC Trade Map

Figure 5: Menthol Exports (quantity, tonnes)

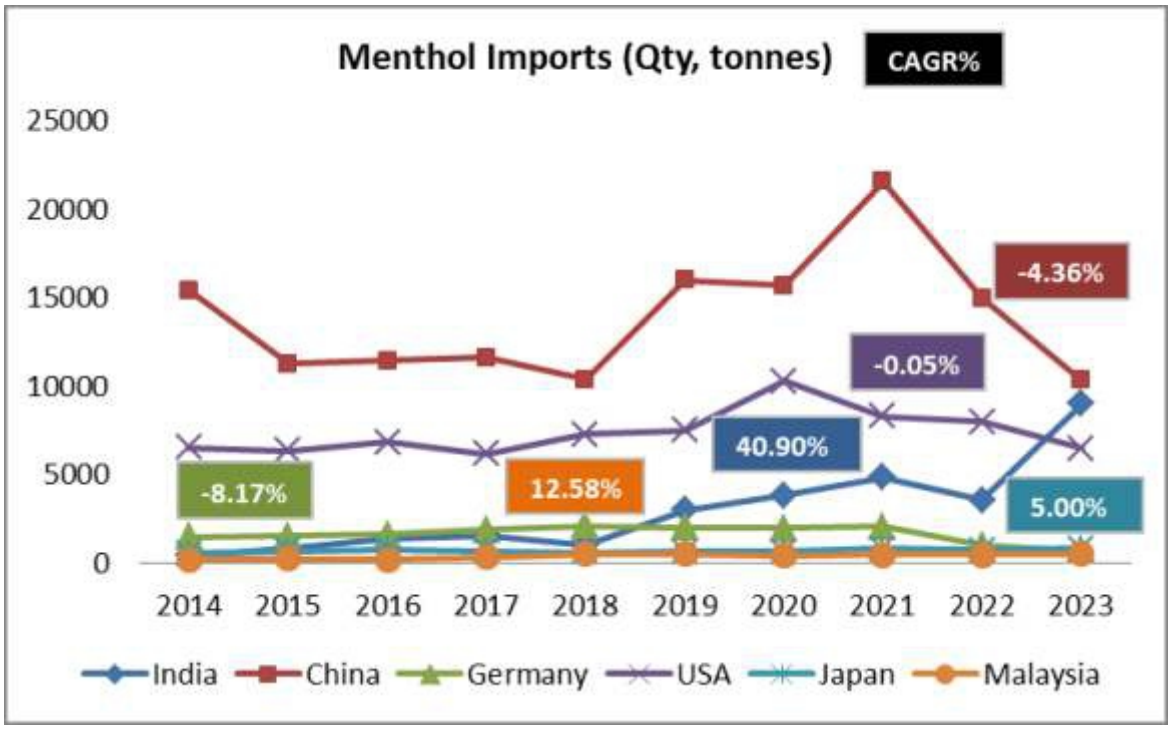
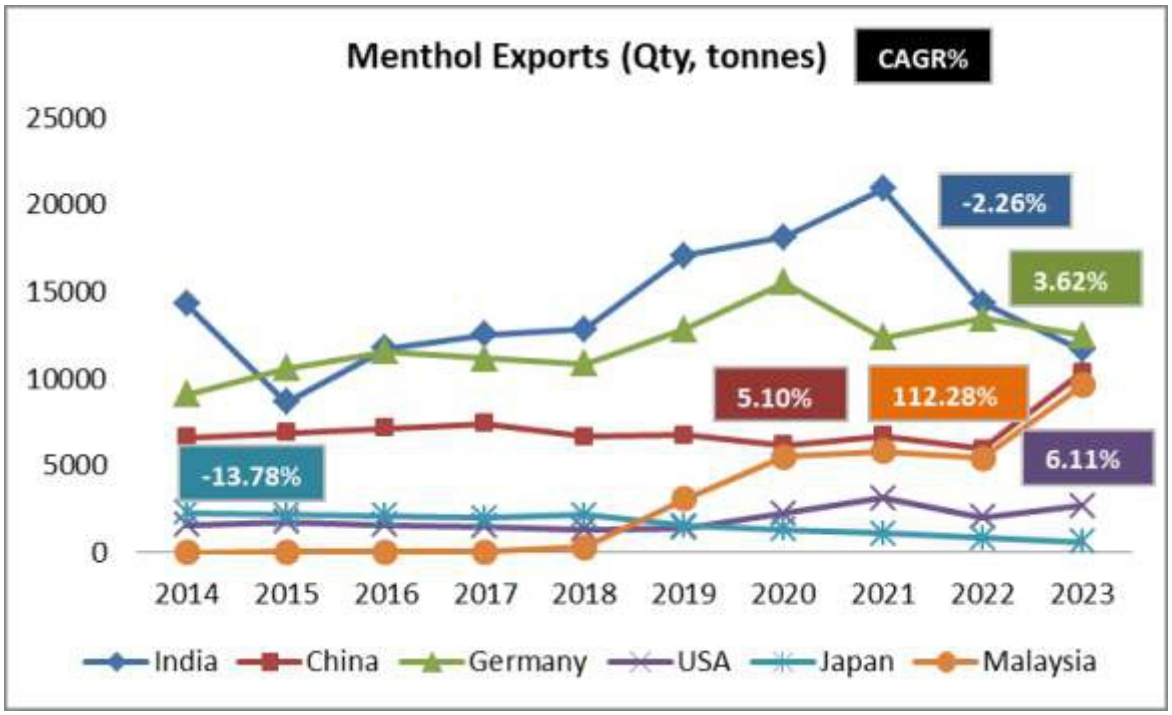


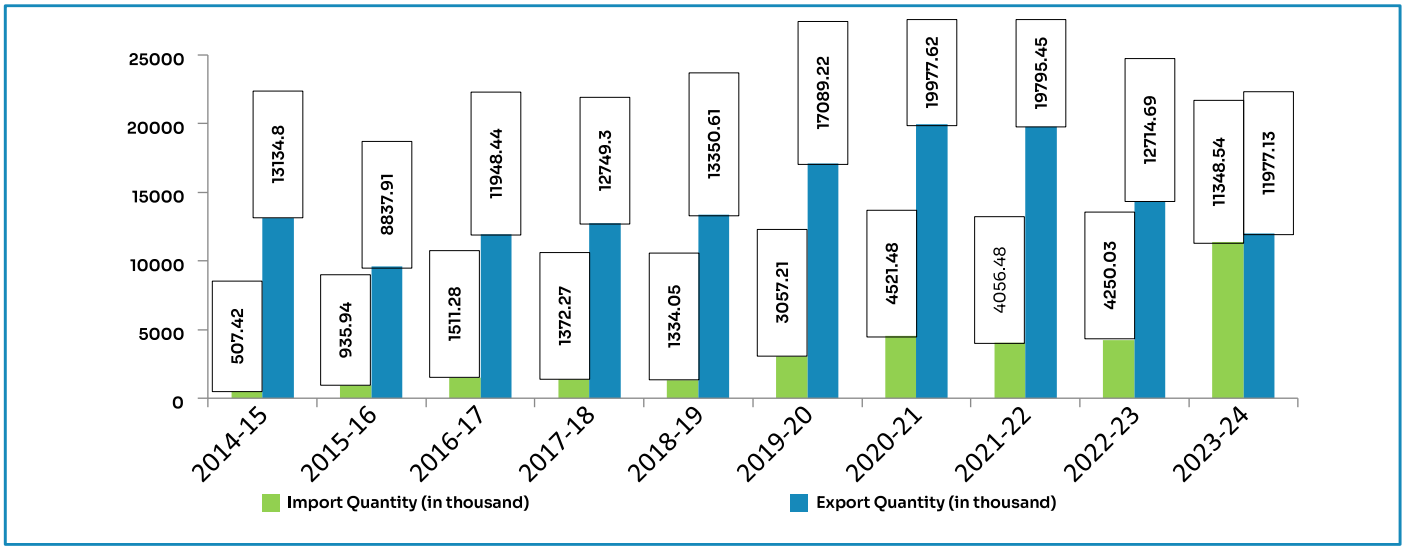
Figure 6: Menthol Imports (quantity, tonnes)



Source: ITC Trade Map

In terms of quantity, while exports did see a rise up until 2021-22, they have been on a decline in the last two financial years. This is contrary to menthol imports which have been on a continuous rise during the last decade.

Figure 7: Import and Export Volume (in 'MT)



Source: Ministry of Commerce and Industry

China emerges as a dominant player in India's menthol export market, accounting for approximately 70% of Indian menthol exports. Interestingly, the majority of Indian menthol exports are directed to just ten countries, underscoring the concentration and dependence of India's menthol exports. Conversely, menthol imports to India are channelled predominantly through seven countries, with Malaysia emerging as a prominent importer, replacing Germany since 2019-20. Other significant contributors to India's menthol imports include Singapore, Belgium, China, Netherlands, and the US. However, the share of Chinese import (from India) has fallen in the last year with a corresponding rise of Chinese exports (to India). This is primarily because of opening of three large facilities (along with other relatively smaller facilities) in China – BASF, NHU, and Haihua inclining more towards synthetic.

Figure 8: India's Top Export Destination (quantity in MT)

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
China	10,470	6,231	8,897	8,538	8,745	12,072	14,614	14,311	7,596	6,387
US	524	394	520	1,182	1,235	1,181	1,186	1,093	1,121	1,179
Singapore	810	761	482	519	958	977	717	749	681	717
Netherlands	196	338	403	771	261	437	483	470	376	491
Japan	96	293	350	398	462	376	471	618	389	646
Philippines	129	138	67	60	180	105	335	92	272	145
France	0	51	510	418	305	464	287	434	260	414
Germany	164	169	120	164	169	291	238	245	269	229
Nigeria	0	89	96	0	112	0	180	230	133	158
Italy	0	0	0	0	0	0	179	31	25	47
Top 10 Total Exports	**12389**	**8464**	**11445**	**12050**	**12427**	**15903**	**18690**	**18273**	**11122**	**10,414**
Total Exports	**13135**	**8838**	**11948**	**12749**	**13351**	**17089**	**19978**	**19795**	**12715**	**11,977**

Source: Ministry of Commerce and Industry

Figure 9: India's Top Import Source Countries (quantity in MT)

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Malaysia	0	1	0	0	274	1,642	2,389	2261	2282	4,234
Singapore	0	4	0	0	256	371	1,086	325	397	981
Germany	371	873	1,413	1,188	727	696	471	599	371	411
Belgium	0	0	0	0	17	40	205	147	220	282
China	1	1	0	148	15	189	110	191	311	4,224
Netherlands	0	1	0	0	10	27	106	49	209	47
US	123	34	61	14	2	57	65	455	436	1,086
Top 10 Total Imports	**495**	**914**	**1474**	**1350**	**1301**	**3022**	**4432**	**4027**	**4226**	**11,264**
Total Imports	**507**	**936**	**1511**	**1372**	**1334**	**3057**	**4521**	**4056**	**4250**	**11,349**

Source: Ministry of Commerce and Industry

The intricate network of menthol value chain creates a substantial barrier for other countries, reinforcing India's role as the top exporter of menthol oil. However, natural menthol faces stiff competition from synthetic alternatives.

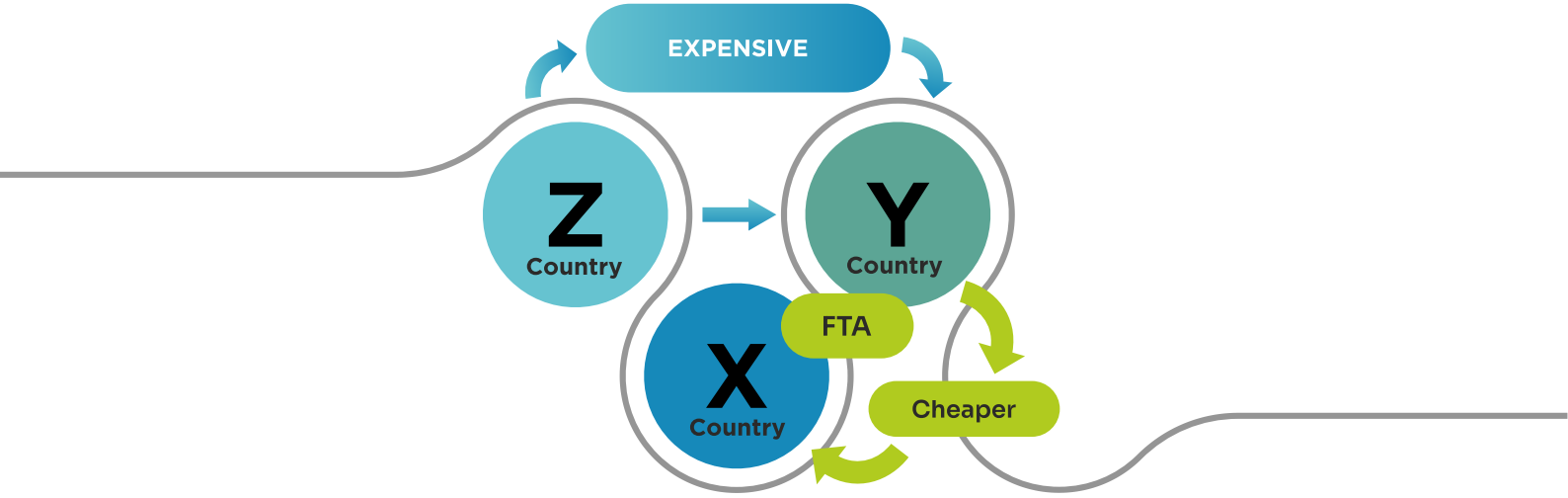
Currently, global menthol production is approximately 34,000 metric tonnes annually, with synthetic menthol making up 60%, underscoring its rising importance.[54] Market estimates suggest that synthetic menthol in India is projected to grow at a CAGR of 6.7% from 2022 to 2028.[55]

[54] Dylong, D., et al. (2022). Synthesis of (−)-Menthol: Industrial Synthesis Routes and Recent Development. Flavour and Fragrance Journal.
[55] https://www.tpci.in/indiabusinesstrade/blogs/menthol-exports-is-indias-dominance-under-threat/

5.2 Market Trends

The global menthol market is expected to reach a market value of US$ 1.2 billion by 2030.[56] However, the global menthol market hinges on the import and export dynamics, reflecting the flow of menthol in and out of countries. This aspect significantly impacts businesses, as international trade mechanisms introduce duties and tariffs, thereby influencing overall costs. Additionally, trade agreements between nations can result in imbalanced costs and benefits for stakeholders. For instance, under a free trade agreement (FTA), a country might be able to sell their products at a lower cost than others, leveraging the FTA advantage. Understanding these international trade dynamics becomes crucial for stakeholders involved. For instance, the FTA between India and Malaysia is one of the factors for the increased imports of menthol (synthetic) from Malaysia. This was also something echoed during the primary stakeholder interaction with the respondents.

Figure 10: Trade Agreements Implications



It is also crucial to understand the market based in global demand and supply of menthol related products. The two models below (export and import) provide some insights.

Export Model – For the first model, which is an export model, we have the following equations:

$$\theta t = \alpha + \beta ij.Xijt + \Omega.Prod + ei,$$ where θt are Indian menthol exports from 2004 to 2023

Xij is the exports of top 8 countries (where India exports its menthol) for menthol-applied products which have been categorized in 7 categories and that are: Oral Care, Menthol Applied Pharmaceuticals, Fragrance and Aromatics, Cosmetic, Menthol related Additives and Flavors, Tobacco and Menthol related Confectionery **(all in 000' USD)**. *Prod* is India's menthol production **(000' KG)** and α, β, Ω are respective co-efficient values indicating

Rationale – As India's production is increasing and other countries' exports of menthol applied products are increasing, India's exports of menthol will increase as it is used as an intermediary product for these menthol-applied industries.

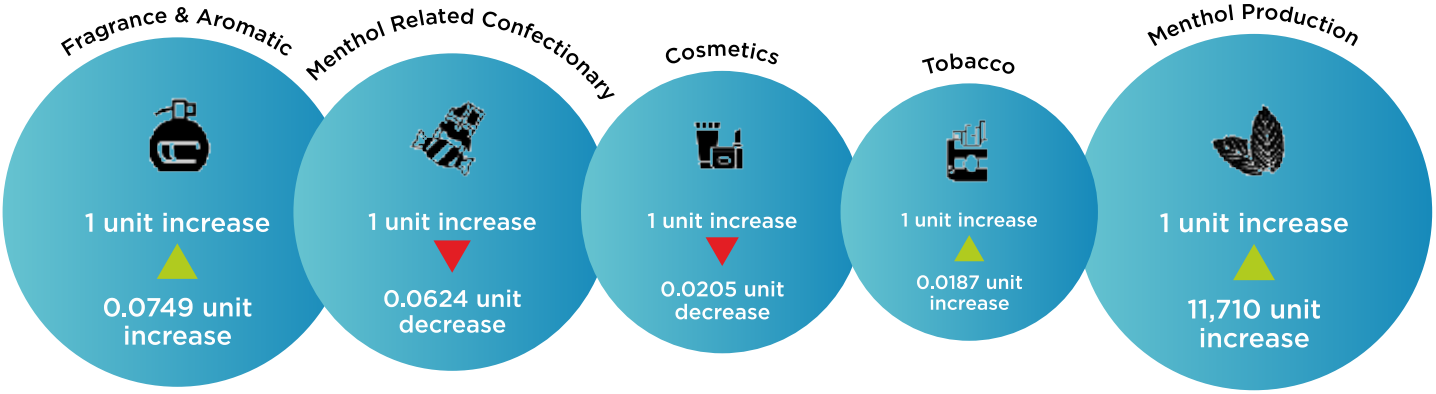
[56] https://www.transparencymarketresearch.com/menthol-market.html

The model analyzes the relationship between India's menthol production and its exports across various industries worldwide. A key assumption is that a significant share of India's menthol imports is synthetic, while domestically produced menthol is predominantly natural and exported.

Exports in the Fragrance & Aromatic and Tobacco sectors positively impact India's menthol exports, indicating strong demand for natural menthol in these industries. Similarly, a substantial increase in India's menthol production significantly boosts exports, underscoring India's dominance as a leading producer of natural menthol.

However, in sectors like Cosmetics and Menthol-Related Confectionery, India's export contributions appear limited. The model suggests that increased exports of menthol-applied products in these sectors slightly reduce India's overall menthol exports, likely due to a preference for synthetic menthol in these industries.

Establishing a large-scale synthetic menthol manufacturing plant, especially in Uttar Pradesh — already the largest producer of menthol in India — could enhance India's capacity to meet global demand across all menthol-applied sectors and solidify its position as a leader in the global menthol market. The source of the data is the result of the model.



Note: The size of the bubble represents the magnitude symbolically and is not to scale.
Source: ITC Trade Map

The menthol-applied sectors positively influencing India's exports are primarily the Fragrance and Aromatics and Tobacco industries. This suggests these industries continue to favour natural menthol, which India predominantly produces. On the other hand, the Cosmetics and Menthol-related Confectionery sectors negatively impact India's menthol exports. This indicates a strong preference for synthetic menthol, likely due to a higher blend of synthetic over natural in their products.

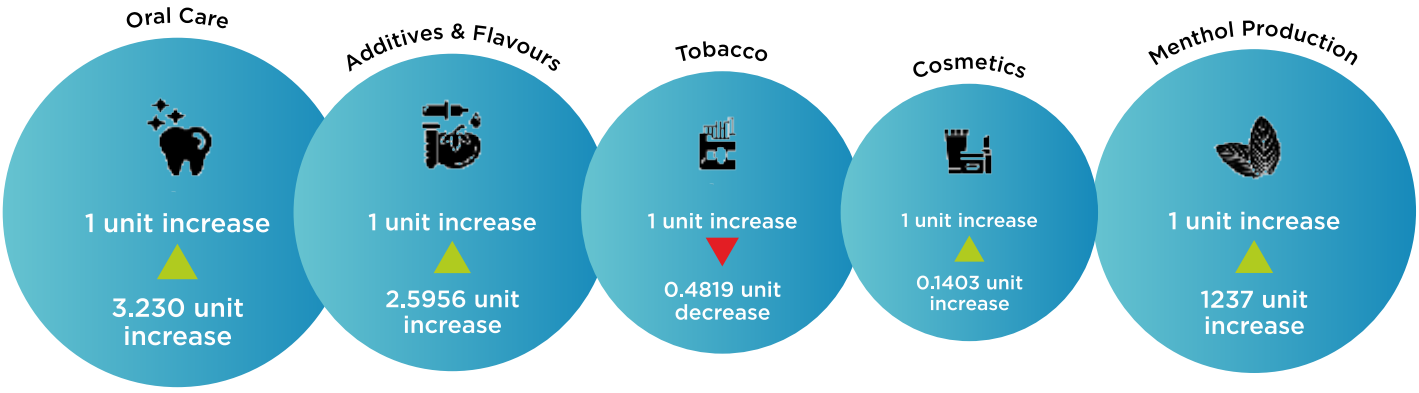
It is crucial for the government to assess the on-going scenario in a deeper manner to understand the rate of shift of the industry towards synthetic. And to make sure the existence of natural menthol continues, policy intervention to support natural menthol and proliferate its demand among industry and consumers becomes crucial.

Import Model – For the second model, which is an import model, we have the following equations:

$$Yit = \alpha + \beta ij.Kijt + \Omega.Prod + ei,$$ where Yit are Indian menthol imports from 2004 to 2023

Kij are the exports of India menthol-applied products to the 8 significant# economies countries from which have been categorized in 7 categories and that are: Oral Care, Menthol Applied Pharmaceuticals, Fragrance and Aromatics, Cosmetic, Menthol related Additives and Flavors, Tobacco and Menthol related Confectionery **(all in 000' USD)**. These exports are to the #major 8 countries importing applied-menthol from India, considered at a 5-year average, to avoid volatility. Prod is India's menthol production in **(000' KG)** and α, β, Ω are respective co-efficient values indicating the magnitude of change.

Rationale – India largely imports synthetic menthol to meet is overall demand as its price is competitive, more reliable and has no scientific evidence indicating any harmful effects and is yet not produced in India at a mass scale. So due to these green signals as of now, and viability of synthetic menthol at a large scale, industry finds it lucrative to use synthetic at least where it is structurally convenient and thus import it.



Note: The size of the bubble indicates the magnitude of magnitude as symbolic (not to the scale).
Source: ITC Trade Map

India's Imports are becoming crucial for India's exports of applied industrial exports; meanwhile India's exports' significance has relatively less importance as the price competitiveness is getting lost out. However, the benefits from production of menthol significantly explain the exports which are expected to satiate given the industry's unpredictable supply and price disadvantage. This is because scale has not been achieved yet in natural with productivity stagnating overtime.

On the other hand, the production coefficient for the import model is relatively lower to the export model. Comparing the two models suggests that India's imports are much more important for the menthol-applied sector. This established the argument of burgeoning usage of synthetic menthol in the industry and truncating influence of natural menthol. Looking at the market forces of menthol, synthetic is going to outweigh the natural over the coming decade, if no policy intervention is applied in the short run (5 years). Imports of menthol by India is increasing which is assumed largely to be synthetic. This is certainly a welcoming signal for the menthol industry as it will also give boost to the natural menthol - Required policy intervention include scaling up the production capacity of both synthetic and natural.

Also, cosmetics industry is positively explaining the imports of India's menthol which was negatively explaining the exports of India. This very well validates the inference. Similarly, menthol related confectionery is positively associated with Indian imports of menthol, but slightly insignificant. Moreover, it seems tobacco and fragrance are more inclined towards natural as of now which might not be the case going forward given structural changes happening in the menthol economy.

5.3 Cost Benefit Analysis

Table 7: Summary of Cost and Benefits of Both Value Chains

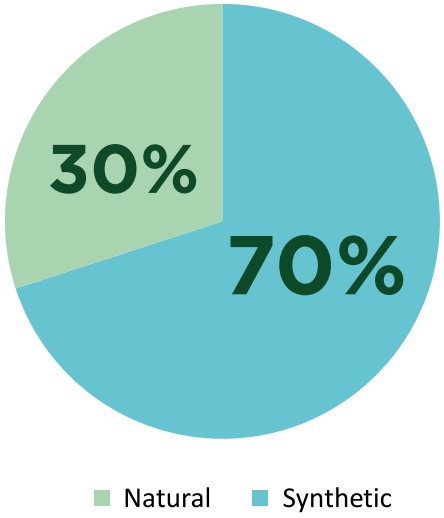
Feature	Natural Menthol	Synthetic Menthol
COSTS		
Production Costs	Requires significant land, labour, and processing resources. The Uttar Pradesh belt gains from the provision of free electricity for pumping groundwater for irrigation	Initial capital investment in research, chemical feedstock, and production facilities. Organised manufacturing processes cut down production costs
Price Stability	Relatively unstable prices due to seasonal variations and market demand. Can range anywhere between Rs. 800-1500 per kg. Dependent on crop yield, distillation, and power costs	Prices are stable and not affected by natural factors due to streamlined processes. Works well in the Indian market that is considered price sensitive. Price ranges between Rs. 800-1200 per kg. Dependent on crude oil prices and production techniques, and power costs
Supply Chain Disruptions	Sensitive to supply chain disruptions as it is dependent on agricultural cycles and geopolitical events	Generally insulated from external factors. However, oil prices are impacted by geopolitical tensions that possible have ripple effects on the value chain
Health Risks	No health implications. Widely considered safe. Consumers prefer natural products due to perceived health benefits	Despite regulatory approvals and certifications like FSSC and FCC, long term studies to gauge the perceived health impacts due to petrochemical origins remains as a gap. CIMAP are trying to undertake the study on the long term impact of synthetic menthol to address the same
Profitability	Farmers and traders, both are stakeholders. Profitability decline would have to be ultimately borne by farmers.	Relatively higher but decreasing due to increasing competition in synthetic space
Regulatory Challenges	Does not gain from duty-free import privileges. Increasing costs. GST rates	Increasing compliance burden due to international regulations and practices
Premium Pricing	Some consumers are willing to pay a premium in niche segments or command slightly higher prices due to use of natural ingredients	Not really susceptible to fluctuations in price making it more standardised for industries
Market Competitiveness	Disadvantages due to higher costs. Fragmented industry	Trade agreements between countries can benefit some nations. Moreover, there are high entry barriers due to huge upfront costs (oligopoly structure as against perfect competition)

BENEFITS		
Purity	It can vary depending on crop yield, with some variations offering up to 98% purity. Different grades are sold in the market to cater to various preferences and industry requirements	Chemical synthesis yields 99% and higher purity of menthol. No difference in attributes relative to natural
Consumer Perception	Perceived higher quality and purity by some consumers	Consumers are largely indifferent or unaware of synthetic use in products. Widely used in industry
Consumer Preference	Increasing demand for natural and organic products	Consumers do not have specific preference for natural or synthetic for certain products. Therefore, shall depend on the consumer preference
Economic Impact	Scalability depends upon farming capacity. Natural alone is insufficient to cater to growing demand	Cost-effective production and stable supply chain. Easier to scale up production to meet growing demand
Sustainability	Promotes sustainable agricultural practices and biodiversity. EMT, use of waste water, seasonal forecasting are leveraged	It can be precisely controlled to minimize waste. Certain processes incorporating biosynthetic pathways. Has converted effluents into an asset, i.e., menthol.
Market Dynamics	Decline in volumes but rising consumer awareness for natural products	General increase in demand for menthol results in increasing consumption of synthetic menthol since natural menthol has its limitation in terms of increasing its production, therefore, the absolute revenue for synthetic producer shall be continuously increasing
Versatility	Widely used in Pharmaceuticals, food, beverages, aromatics, cosmetics, oral care etc.	Extensive use in oral care, Pharmaceuticals, food and aromatics etc. Able to tailor menthol production for different industrial requirements
Employment	Provides additional cash in hand and employment opportunities for farmers and their families involved in the value chain especially in the rural areas and supports local economies	While natural menthol industry would witness spells of unemployment due to synthetic influx, synthetic mentho l market would add employment due to its downstream benefits to industrial workers, especially the FMCG sector

5.4 Consumer Preferences

The average Indian consumer tends to be indifferent between natural and synthetic menthol, provided their properties are comparable, largely due to a lack of clear health implications. However, industries approach this matter differently by evaluating market risks related to price, demand, supply, and storage. They often adopt a 'try and test' strategy, creating multiple product samples for consumer testing prior to launch. For instance, a chewing-gum manufacturer may adjust menthol content across different samples to enhance cooling sensation or flavour longevity based on feedback. Companies tailor products to specific applications rather than adopting a one-size-fits-all approach, particularly in the FMCG sector. This strategy often involves blending natural and synthetic menthol to optimize both cost and product characteristics, capitalizing on the advantages of each. Likewise, almost all respondents[57] from industries (Pharmaceuticals, aromatics, cosmetics, oral care, and tobacco) agreed that blending natural and synthetic is a common practice in their respective industries with an approximate split of 70-30 in favour of synthetic.

Menthol Industry Split*



*Based on primary stakeholder interaction

[57] Barring some menthol manufacturers

With blending being a common practice, it is certain that both natural and synthetic are there to co-exist. This is true, especially in the context of the rising share of the FMCG sector. With the rise of digital platforms and e-commerce[58]; it is expected to gain further momentum. Data suggests that the Indian households spent about US$ 60 billion in the FMCG in 2021.[59] With improved living standards and higher incomes, this spent is expected to rise exponentially in the coming years. For example, market giants like HUL have stated that their premium product portfolio for some categories have gone up to 52% which was close to 30% a decade ago.[60] Factors like narrowing gaps between rural and urban spending[61] would also lead to greater demand for 'premium' products.[62]

Moreover, the PLI scheme of the government (which includes Pharmaceuticals and food & beverages as one of the sectors under the 14 sectors that are being covered under the scheme)[63] is expected to provide further impetus to the supply chain. Therefore, with an expected rise in the share of FMCG sector with changing consumer preferences, the demand for key inputs like menthol would rise simultaneously.[64]

5.5 Nature of Grading and Pricing

The market offers various grades of natural and synthetic menthol. Synthetic menthol is typically produced as 98% pure molten menthol in liquid form. It has grades derived from this base such as crystals and 99.7% menthol.

The prices in the menthol market are known to be volatile and prone to fluctuation. Historically, the Indian menthol industry relied on the natural menthol sector and the involvement of small and medium-sized enterprises (MSMEs). Major menthol manufacturers would conduct transactions with small traders in cash-based markets. The supply chain involved farmers selling the Mentha crop to intermediaries, who then supplied it to larger manufacturers. The market dynamics were characterised by speculation and price control exercised by prominent players, with limited room for negotiation. Large players engaged in speculative activities, influencing prices through transactions in the spot market, leading to daily price fluctuations. In the last 5 years prices have stabilised considerably. However, with the entry of synthetic menthol in the market, price fluctuation has reduced considerably since it has been able to meet demand when supply runs short, ultimately benefiting consumers.

Moreover, as per the Director, CIMAP and Dr. G. N. Singh, Advisor to Hon'ble Chief Minister of Uttar Pradesh, 'there are no standard pharmaceuticals or food grade practice for menthol grades', although companies like BASF do have pharma grade menthol available with them.

[58] E-commerce sector is expected to reach US$ 185 by 2026.
[59] Fast Moving Consumer Goods (December 2023). India Brand Equity Foundation (IBEF).
[60] https://www.livemint.com/industry/retail/affluent-urban-consumers-are-spending-more-on-a-clean-wardrobe11671041787439.html
[61] https://retail.economictimes.indiatimes.com/news/industry/india-sees-shift-in-consumer-wallet-share-towards-discretionarypremium-products/106722317#:-:text=Industry,India%20sees%20shift%20in%20consumer%20wallet%20share%20towards%20discretionary%20%26%20premium,Head%20of%20Research%2C%20Prabhudas%20Lilladher.
[62] https://economictimes.indiatimes.com/news/economy/indicators/rural-urban-household-spending-gapnarrows/articleshow/107974131.cms?from=mdr
[63] https://pib.gov.in/PressReleasePage.aspx?PRID=1945155
[64] https://www.thehindubusinessline.com/economy/durable-goods-spends-see-uptick-in-urban-ruralmarkets/article67894980.ece

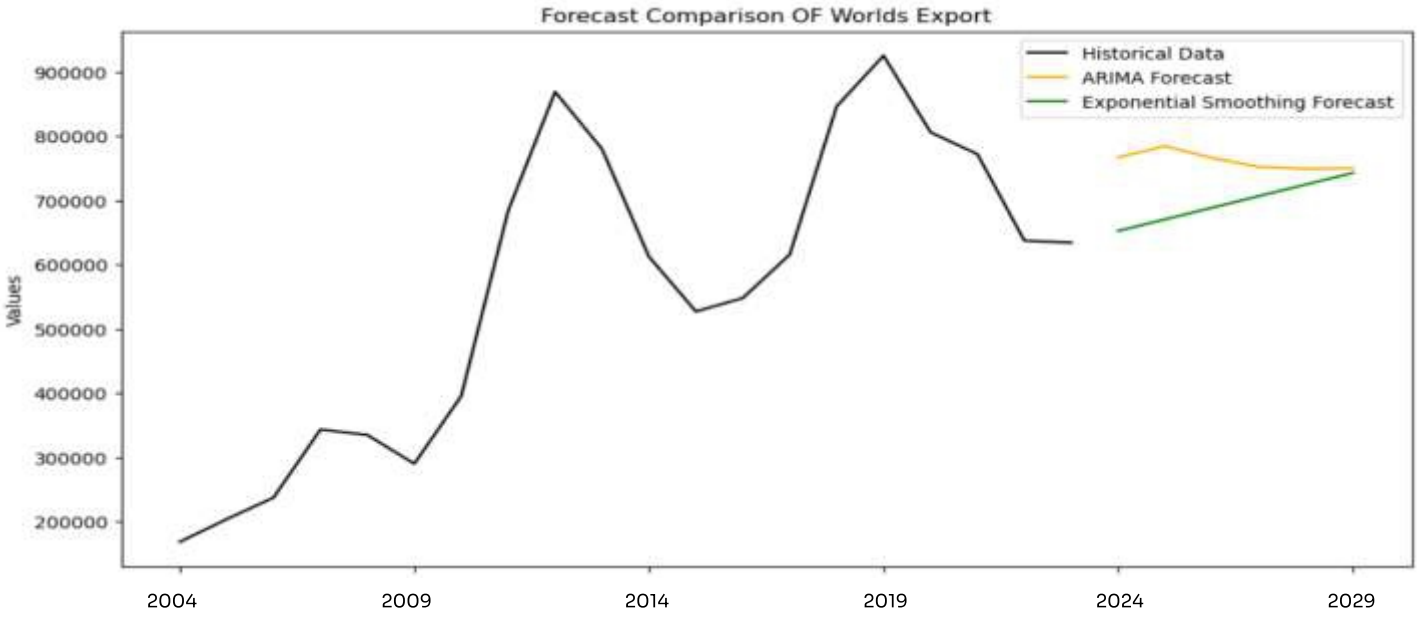
5.6 Demand Forecasting

Menthol is an intermediate product that is not directly consumed by the end consumer. Instead, it serves as a key raw material used in the production of various finished consumer goods. The demand for menthol is therefore a derived demand, driven by the need for menthol as an ingredient in the manufacturing of the final products that are ultimately consumed by the end-user.

This section gives the forecasts of menthol for the Global and the Indian economy based on available data.[65] Two forecast techniques are used to predict the data points from 2024 to 2029 (for the next six years) across the variables. The first technique is ARIMA model (autoregressive integrated moving average) with a given degree of auto regressive, lag difference and moving average. The second is exponential smoothening model which considers the exogenous scenarios like Covid, financial recession etc.

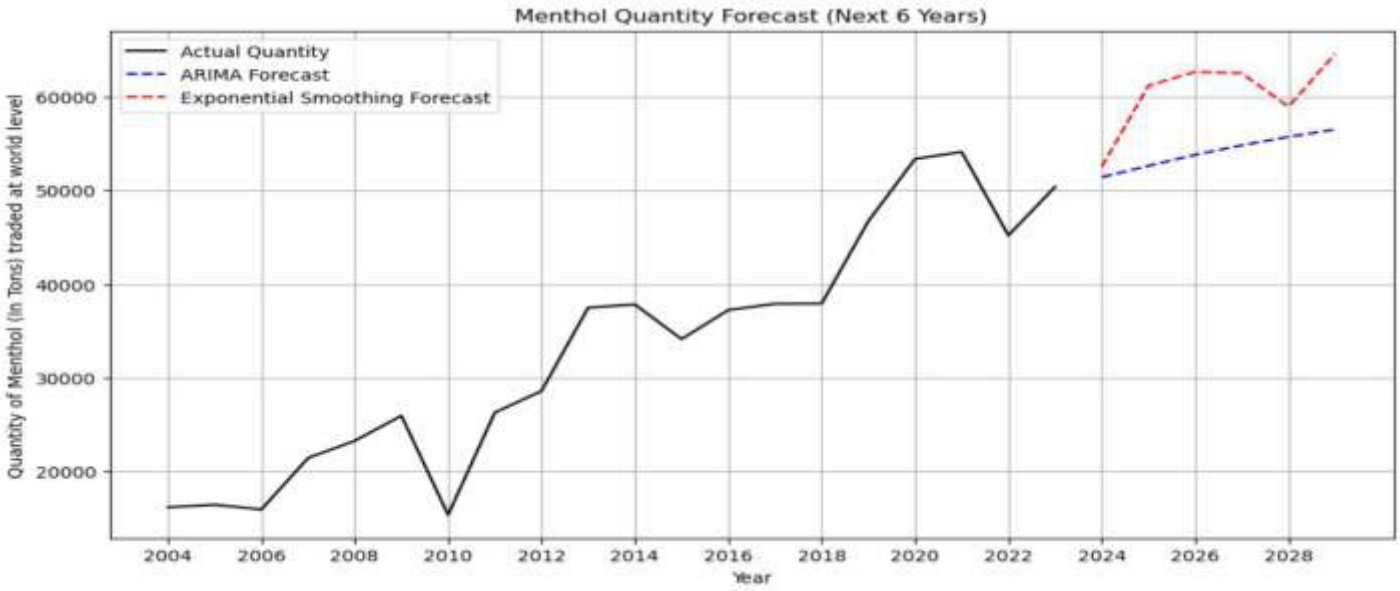
Figure 11: The forecasts of world export trade of menthol

Time Axis	0	1	2	3	4	5	6	7	8	9	10	11	12
Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Time Axis	13	14	15	16	17	18	19	20	21	22	23	24	25
Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029



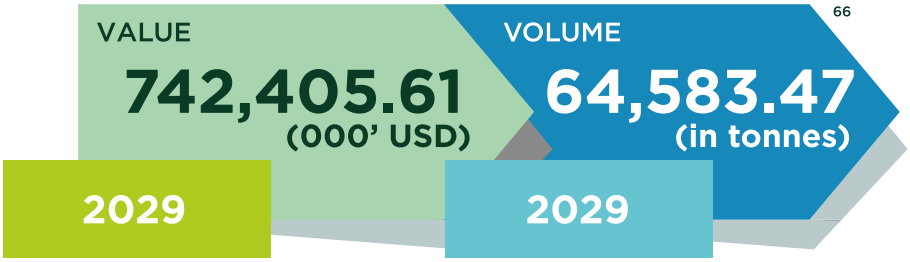
Source: PIF estimates

[65] Global data has been taken from ITC Trade Map. Indian data has been taken from Annual Survey of Industries.



Source: PIF estimates

As per the forecasts, the world menthol export would rise to...

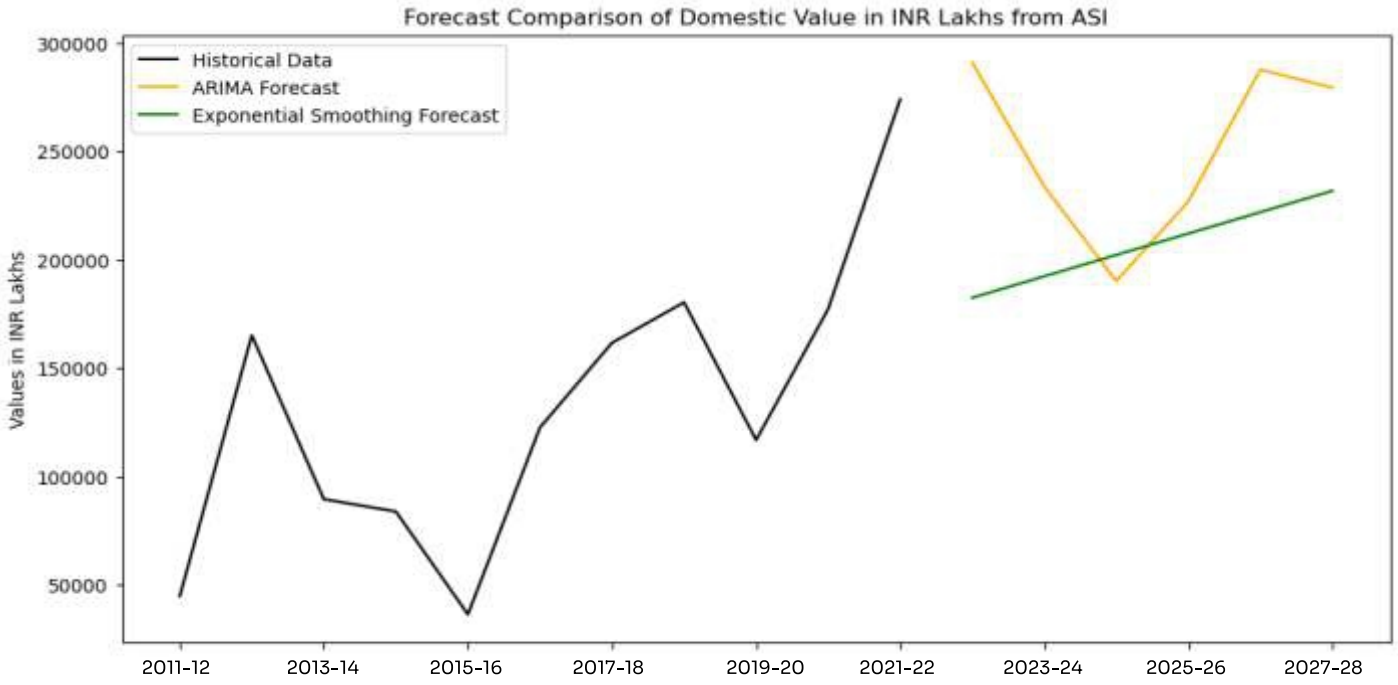


[66]

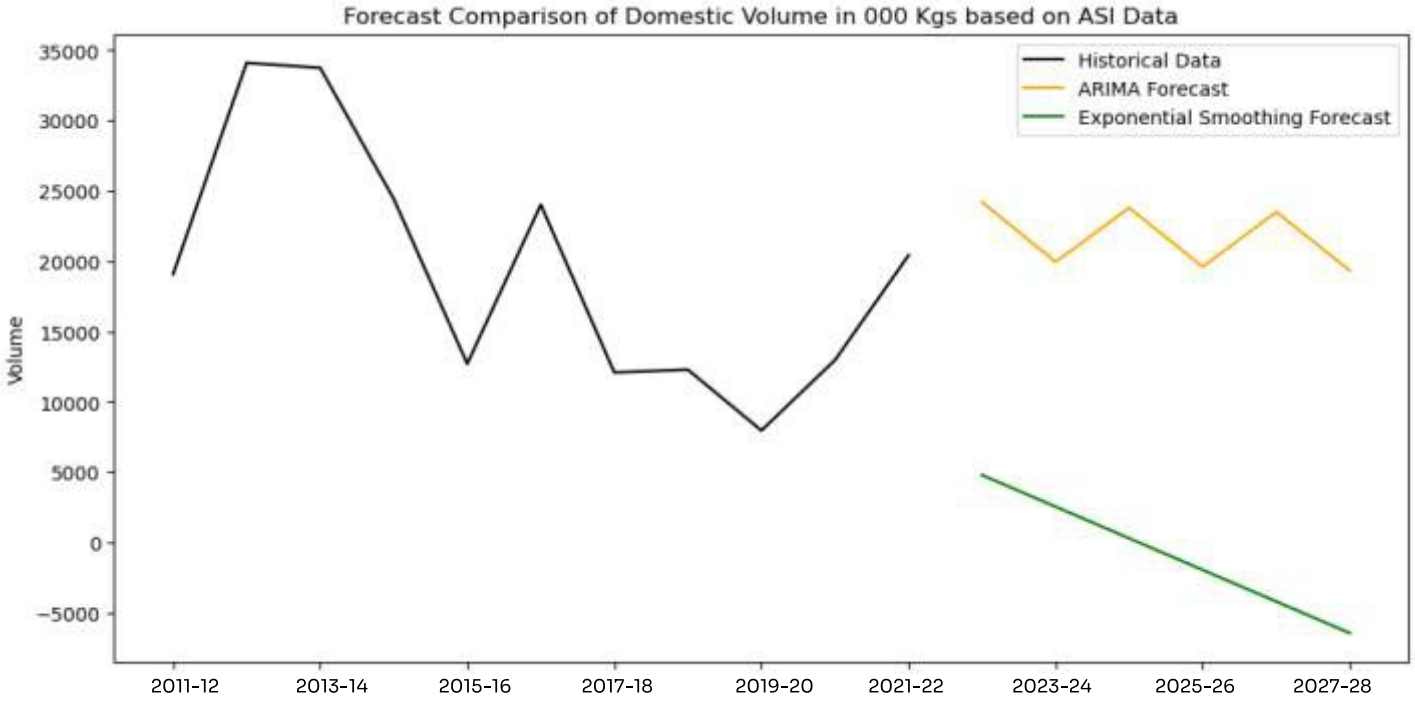
It is clear that forecasted values are expected to satiate over the next five years while volume will clearly rise. This indicates that the menthol prices will decline, probably due to rise in the competition mainly in synthetic menthol. If that so, then, natural menthols' ability to compete with the synthetic will become even thinner. This suggest that policy support needed for natural menthol to keep it floating until we achieve scale for natural menthol, where it can be one of the contributing factors to the synthetic menthol and not competing with it. The projections below showcase forecasts based on two models (Arima Model and Exponential Smoothening) for the next four years. The figure shows scale i.e., how axis should be read.

[66] See appendix for details

Figure 12: The forecasts of Indian Industry Usage of menthol



Source: PIF estimates

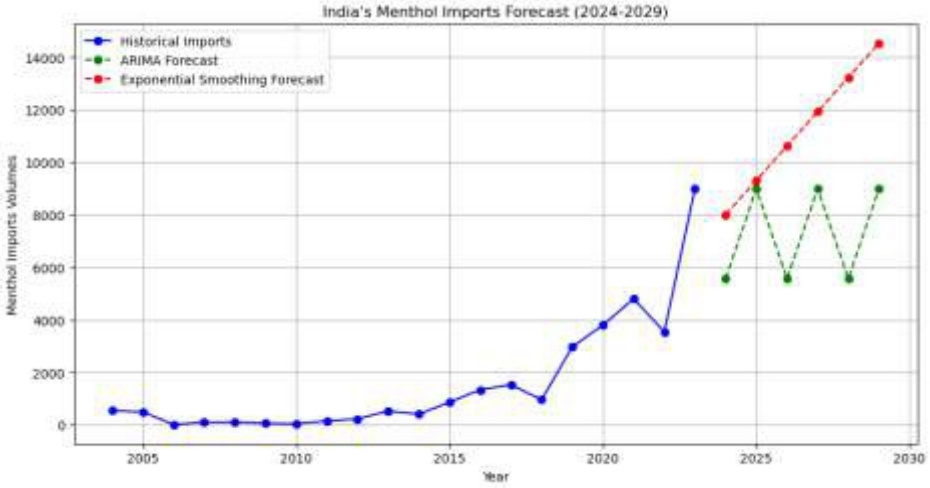


Source: PIF estimates

As per the forecasts, the Indian industry menthol usage is expected to rise to...

[67]

Figure 13: The forecasts of Indian Import of menthol (in MT)



Annual Survey of Industry data on usage of menthol by domestic industries (Fig. 12) suggests that value will remain close to its present figure with some seasonality in between largely due to supply chain issues and price volatility. In terms of quantity, volume is expected to rise a bit and satiate afterwards. This is corroborated by a commensurate rise in synthetic menthol volumes (Fig. 13) that are expected to replace the natural one with more players driving the synthetic menthol price downwards over the next five years. However, the usage will increase.[68]

So synthetic is going to replace natural menthol if no intervention is made and market forces operate in favour of low priced product. Government has to intervene by supporting the natural menthol at least till the time synthetic and natural both achieve the economies of scale so that they can be complementary to each other – may be natural blend will be on a much lower value.

The dynamics across the entire value chain may drive the adoption of synthetic menthol, except in applications that specifically require natural menthol. This shift may benefit the entire ecosystem, given the requisite level of policy support from the government

Export and import models, as referenced above, indicate that oral care, additives & flavors, cosmetics, fragrance, and tobacco play a significant role in driving the demand and supply of menthol (both synthetic and natural). The drivers of expected growth can be categorized into two types: linear (baseline scenario assuming business-as-usual trends) and structural (assuming aggressive policy interventions). For this analysis, we have adopted the linear scenario.

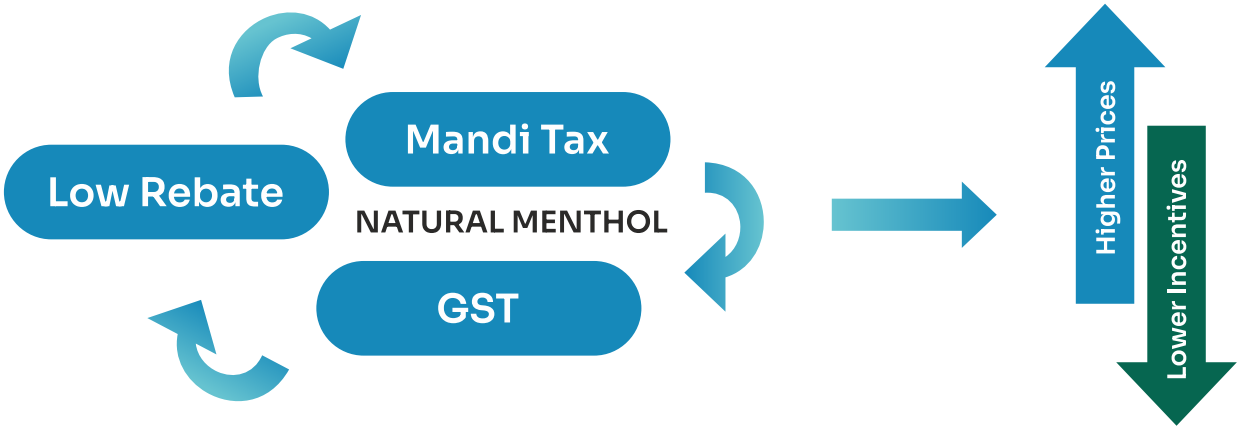
The usage of menthol in industrial applications is inherently accounted for in the existing data, and this has been factored into our forecasts. To project future trends, we have employed two widely recognized models: Exponential Smoothing and ARIMA, providing two distinct projection scenarios.

[67] See appendix for details
[68] https://in.thedollarbusiness.com/magazine/how-about-minting-some-money/46176

5.7 Other Factors

Factors influencing the menthol industry extend beyond regulation and certification; they also include accounting frameworks. Taxation policies, particularly under the Goods and Services Tax (GST), significantly impact menthol products. The introduction of GST has changed the tax landscape, increased production costs and affecting pricing and competitiveness. This tax burden reduces profitability and cash flow for producers, while delays in GST refunds further strain their financial stability.

According to MMEA, natural menthol is subject to a dual taxation framework: a mandi tax of up to 2% since it's classified as an agricultural product, and a 12% GST on menthol crystals. This combination makes the product more expensive for farmers and producers. The higher GST rate has not been well received, especially since it replaced a 5% VAT. Consequently, this creates a price disparity between natural and synthetic menthol, making the former costlier. Additionally, informal cash transactions bypass these tax structures.



As for exports, the Remission of Duties & Taxes on Exported Products (RoDTEP) Scheme has been in place since 1st January 2021. Replacing the erstwhile Merchandise Exports from India Scheme (MEIS), it provides a mechanism for reimbursement of taxes, duties and levies, which are currently not being refunded under any other mechanism, at the central, state and local level, which are incurred by the export entities in the process of manufacture and distribution of exported products. Currently, about 1.5% duty is remitted for menthol[69]; however, this scheme is in place only until 30th September 2024[70], and an overall mechanism to promote/boost menthol exports is echoed across menthol producers.[71]

[69] https://content.dgft.gov.in/Website/dgftprod/86f1afa3-a2a1-43fb-bea4ffa18df56442/Final%20v%20RoDTEP%20Appendix%204R%20to%20be%20notified%20with%20effect%20from%2015%2002 %202023.pdf
[70] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2012779#:~:text=In%20the%20current%20financial%20year,2024.
[71] Synthetic menthol import also attracts a net duty of 8.25% (except for menthol coming from Malaysia due to FTA)


Evaluating the
Coexistence of Natural
and Synthetic Menthol

6. Evaluating the Coexistence of Natural and Synthetic Menthol

Chapter 5 spotlights a noticeable trend of increasing synthetic imports parallel to declining exports of natural menthol in recent years. This decline in natural production has corresponded with a rise in global suppliers of synthetic menthol, with recent entrants such as China.

The attractiveness of synthetic menthol lies in its stable prices, ranging from Rs 950-1200 per kg compared to natural ranging between Rs 800-1500 per kg. This cost advantage appeals to buyers in the FMCG industry, especially in India, where the absence of standard operating procedures (SOP) on natural versus synthetic menthol usage allows for flexibility. Given the comparable attributes of both variants, the industry leans towards the economically advantageous option, aligning with the preferences of price-conscious consumers in markets like India.

Some FMCG companies also encourage the use of natural ingredients. While some choose a blend of both natural and synthetic, others prioritise natural ingredients in products intended for ingestion (food and beverages, etc.) and reserve the use of synthetic menthol in products meant for external applications (sprays, creams, etc.).

On the other side, there is a large part played by the consumers. Given the innate inclination towards natural products, there is some industry resistance to a complete shift towards synthetic menthol. Many stakeholders expressed a desire to maintain versatility in their menthol profile. The growing demand for organic products (driven by a green push) is increasing the preference and impacting the entire value chain. In India, however, this trend is hindered by the lack of labelling regulations. Companies have the freedom to choose and utilise ingredients as they see fit, which may not strongly influence purchase decisions in India. Conversely consumers and businesses are conscious of and adhering to regulations concerning ingredients in regions like Europe and the USA.

A general perception among consumers is that synthetic products are harmful for consumption, and natural alternatives should be chosen whenever possible. There is also a lack of long-term and specific studies highlighting the potential adverse effects of synthetic menthol on human consumption. In the Indian market, a significant segment of consumers remains unaware of the distinction between natural and synthetic menthol, leading to indifference in their purchasing decisions. This demographic, which represents a majority of the Indian consumers, prioritises affordability over composition of ingredients. However, as the standard of living rises and consumers become more informed, a growing urban category emerges and stakes its claim over natural products, ensuring the coexistence of both variants
in the market.

6.1 Industry Usage and Co-existence

The table below shows the industry usage of menthol as an input based on Annual Survey of Industries data[72]. It can be observed that the industry usage has varied over time. For instance, while about 12% of total menthol went in 'pharmaceuticals and botanical products' in 2011 12, its share increased by more than five-folds to about 69% in 2015-16. However, by 2021 22, its share almost decreased by one-third relative to its

[72] It should be kept in mind that there is a difference between ASI and ITC Trade classification. Whereas the former gives 'industry classification' based on NIC codes, the latter gives 'product classification' based on HS codes. Both these codes are not directly comparable.

share in 2015-16. The variation is not just conspicuous within a particular category across years, but also between categories across years.

Given the variation in industry usage over time, it can be said that the menthol value chain long-term view is marked by a dynamic interplay of natural and synthetic pathways, driven by factors such as cost, quality standards, regulations, and consumer preferences. The Indian menthol market is seeing a gradual shift towards synthetic menthol. This is due to lower prices of synthetic menthol, which have led to a decrease in natural menthol processing plant operations, with some operating at only 40% capacity[73] and others closing down.[74] The pricing strategies of multinational corporations (MNCs) have exacerbated the situation, as they consistently set synthetic menthol prices lower than natural prices. This has prompted domestic buyers to opt for importing cheaper synthetic menthol. The rise of synthetic menthol rests on its cost advantages and consistent supply. Originally, only natural menthol oil and its derivatives were available but the development of synthetic alternatives as a viable substitute found a market.

However, not all market segments use synthetic menthol as they prefer natural ingredients. For example, natural menthol is preferred for certain applications, such as in antiretroviral (ARVs) drugs like Lamivudine[75], due to its efficacy and safety. Moreover, it should be noted that certain manufacturers adopt biosynthetic pathways for producing menthol, spotlighting sustainability and cleaner technologies to meet industrial demand involving investment in research and development for alternative sources of menthol and strengthening supplier relationships to mitigate supply chain disruptions. Lastly, sensory profiles requirement of the industry necessitates a blend of natural and synthetic menthol to meet specific product requirements. This is why neither synthetic nor natural for these segments can exist in isolation without end-users changing their consumption criteria ab-initio.

Table 8: Menthol Industry Usage (in %)

Industry Category	2011-12	2015-16	2020-21[76]
Manufacture of tobacco products	3.59	4.06	7.99
Manufacture of basic chemicals	42.81	8.10	7.10
Manufacture of soft drinks and bottled water	0.01	0.11	24.02
Manufacture of soaps, detergents, and other toiletries	0.74	4.89	10.49
Manufacture of other chemical products nor elsewhere classified	17.43	3.10	12.02
Manufacture of pharmaceuticals and botanical products	12.36	69.17	36.63

Estimates based on ASI

[73] https://www.thehindubusinessline.com/economy/agri-business/domestic-Mentha-oil-industry-in-crisis-due-to-jump-insynthetic-Mentha-imports/article67899987.ece
[74] Insight from interview with mint manufacturer
[75] Used to prevent and treat HIV/AIDS and to manage chronic hepatitis B
[76] We have used 2020-21 data since figures for 2021-22 showed results that were not coming out close to market expectations and those discussed with primary stakeholders. For example, figures for 2021-22 showed paints, thinners and related products consumed about 50% of total menthol, the share of whom was only about 1% in previous years.

6.2 SWOT Analysis

Figure 14: SWOT Analysis for Coexistence of Natural and Synthetic Menthol

[77] Although it has been announced in the budget but the different HSN is yet not available to the DGCIS through customs


Quality Assurance
Practices

7. Quality Assurance Practices

Monitoring market trends is important, but regulatory factors also significantly influence the menthol economy. Survey findings highlight the critical role of quality assurance and certifications in procurement decisions across various industries, affecting both natural and synthetic menthol. Companies invest in internal audits and external checks to uphold quality standards from raw material procurement to final product delivery. Certifications such as Halal, ISO, and Kosher, though adding to operational costs, are crucial for accessing specific global markets. As one stakeholder put it, "quality is not a cost, it's a practice," underscoring the importance of maintaining high standards.

Regarding regulations, the current global landscape makes it challenging to impose restrictions on the trade of commodities like menthol unless there are significant implications. While the influx of synthetic menthol can impact the natural menthol economy, respondents noted a lack of biased regulations favouring either variant. This absence of regulatory bias supports the coexistence of natural and synthetic menthol in the market.

Box 1: Impact of Regulation: A Progressive and Regressive Review

From a regulatory standpoint, menthol, like other FMCG products, is subject to various sanity checks. However, when it comes to the Indian regulatory framework and standards, there appears to be a degree of opacity. Gaps in Indian Regulations:

- Lack of a standardized definition of "healthy" food
- No obligation for manufacturers to disclose the use of natural or synthetic menthol as an ingredient

These gaps stand in contrast to international standards such as Halal and Kosher certifications which cater to the specific needs of Islamic and Judaic communities. Although synthetic menthol is FSSC certified, Indian regulatory authorities and autonomous bodies should undertake long-term studies to assess the health implications of synthetic menthol, which would strengthen the food safety standards in India.

Although consumers may currently appear indifferent to the use of natural/ synthetic menthol in products, regulatory bodies should ensure that consumers have access to authentic information and can make informed choices. This shift towards empowering consumers and reinstating the principle of "customer is the king" would make the Indian regulatory framework more progressive and beneficial for the end-users.

7.1 Regulations and Quality Standards

In the menthol industry, compliance is critical and involves adhering to Good Manufacturing Practices (GMP), international food safety standards, and various certifications. GMP is fundamental for maintaining the quality and safety of menthol products, outlining detailed guidelines for their production, packaging, labeling, and storage. This adherence helps mitigate risks to consumer health and ensures product consistency, regulatory compliance, and a strong industry reputation. By following GMP, producers show their commitment to quality and consumer protection, which boosts industry credibility and competitiveness.

International food safety standards are also crucial, especially for export markets. Compliance with standards like ISO 22000, HACCP (Hazard Analysis and Critical Control Points), and FSSAI (Food Safety and Standards Authority of India) ensures that menthol products are safe and highquality for global consumption. Meeting these standards aids in market access and builds consumer trust, enhancing the industry's international reputation.

Additionally, sustainability and ethical practices are increasingly shaping industry regulations. Producers are adopting eco-friendly methods and obtaining certifications like Organic, Fair Trade, and Rainforest Alliance to demonstrate their commitment to environmental and ethical standards. This focus on sustainability improves market access and consumer confidence.

Overall, compliance with these regulations is vital for ensuring product quality, safety, and market access. Non-compliance can lead to legal issues and reputational damage. The importance of these standards is evident, as over 80% of stakeholders in a primary survey indicated they significantly influence procurement decisions. Clear labeling practices are essential for consumer transparency and awareness, highlighting the need for more precise regulatory standards. Director CIMAP informed that quality standards both for natural and synthetic Menthol are being developed by Bureau of Indian Standards (BIS).

7.2 Certification

Certification is crucial for menthol products targeting international markets, particularly halal and kosher certifications, which ensure compliance with Islamic and Judaic dietary laws. While these certifications are not required within India, they are essential for global trade. Agencies like Halal India Pvt. Ltd., Jamiat Ulama-i-Hind Halal Trust, and Kosher Inspection Service India help products meet these international standards.

In addition, adherence to industry-specific regulations is vital for maintaining product quality and safety. For instance, the pharmaceutical industry must comply with the Drugs and Cosmetics Act of 1940. However, for exports, meeting international standards and regulations from importing countries is also necessary.

Despite regulatory approvals and certifications like FSSC and FCC, concerns remain about synthetic menthol's long-term health effects due to limited research. The Central Institute of Medicinal and Aromatic Plants (CIMAP) calls for further research to clarify these effects.[78]

This becomes important, especially in the context of India where more than three-fourth of the food and beverage industry draw their sales from less healthy products.[79] In India, where definitions of 'healthy' foods vary and are often not standardized, clearer long-term studies on synthetic menthol and standardized health definitions could improve industry transparency.

[78] Observed during primary interaction with CIMAP
[79] https://accesstonutrition.org/app/uploads/2023/11/India-Index-2023-Full-Report-Final.pdf


Sustainability

8. Sustainability

Environmental considerations play a significant role in the industry's sourcing strategy. The cultivation of mint for natural menthol is a significant source of income for farmers in regions like Uttar Pradesh's Terai belt. According to a prominent mentha producer, a decline in demand for natural menthol could adversely affect these farmers. In the past, Mentha farming was centred in Japan, then moved to China, and finally to India due to cheaper labour costs. Current market prices for natural menthol are unsustainable which have impacted farmers compelling them to move towards other commercially viable crops.

Concepts such as the circular economy are increasingly becoming vital to the menthol economy, which encompasses both natural and synthetic production, from a long-term perspective. Practices such as efficient water use, precision farming, and pest management are crucial in ensuring that mint cultivation does not lead to water scarcity. The use of regenerative resources in the cultivation process aligns with sustainability principles and promoting biodiversity. For example, the recovery of volatile compounds like menthol (82.3%) from distillation condensates in the natural pathway reduces the loss of valuable resources. Additionally, the use of biorefined byproducts for biofuel production or as industrial feedstock (e.g., levulinic acid) closes the loop, promoting a zero-waste economy. These innovations not only reduce resource depletion but also add economic value to what was once considered waste.

In contrast, synthetic menthol is produced through petrochemical processes, which raises concerns regarding carbon emissions and resource depletion. However, advancements in green chemistry such as utilising bio based feed stocks can significantly reduce the carbon footprint. It also involves the consideration of end-of-life scenarios for menthol products. It suggests that both natural and synthetic menthol production can benefit from innovative practices that prioritize resource efficiency, waste reduction, and social equity. The development of improved and more resilient varieties of Mentha arvensis is currently underway by CIMAP. The goal is to reduce the need for frequent irrigation and shorten the period of maturation of the crop from 90 to 60 days. This would help in productivity and cost efficiency for Mentha farmers. By fostering collaboration among stakeholders, the menthol industry can transition towards more sustainable practices that not only meet market demands. This integrated approach is essential for ensuring the long-term viability of the menthol economy in the face of growing environmental challenges.

Sustainability in the menthol economy, particularly in natural production, benefits from the valorisation of Cornmint (Mentha arvensis) biomass. India generates over 7 million tons of Cornmint annually, with about 6 million tons of distilled biomass typically regarded as waste.[80] By converting this waste into valuable biopolymers—such as cellulose, hemicellulose, and lignin—industries can reduce environmental impacts. For instance, cellulose isolated from the biomass can be enzymatically converted to glucose (610 mg/g), which can then be used to synthesize levulinic acid, a versatile bio-based chemical.[81] In synthetic menthol production, efforts to reduce the environmental footprint have led to the development of greener pathways. The shift from traditional petrochemical methods to biocatalytic processes has enhanced efficiency and reduced harmful byproducts. The synthetic pathway requires less energy and generates fewer emissions than before. BASF, a major player in the synthetic menthol market, emphasizes resource efficiency, targeting circular economy principles through energy-efficient production methods and integration of renewable feedstocks.

[80] https://www.researchgate.net/publication/349053564_Valorization_of_Cornmint_Mentha_arvensis_distilled_waste
[81] Ibid

Table 9: Sustainability Comparison of Natural and Synthetic Menthol

Category	Natural Menthol	Synthetic Menthol
Raw Material	Renewable/ natural input (Mentha arvensis)	Non-renewable
CO2 Footprint	It is carbon positive. Lower in comparison especially with biomass valorization techniques. Distillation and biomass burning releases Co2 This is being further investigated by CIMAP scientists	High, due to fossil fuel extraction and chemical processing. However, BASF method of energy-efficient processes and CO2 emission controls has reduced it
Waste Management	Generates waste biomass which can be valorized into biochemicals	BASF and Symrise have improved traditional processes by utilizing waste heat recovery and minimized chemical waste
Energy Consumption	Lower; primarily agricultural and distillation processes	Higher, energy-intensive chemical synthesis processes Optimized energy efficiency through BASF's proprietary technologies
Resource Efficiency	Biomass converted into cellulose, glucose, levulinic acid. However, less efficient without waste valorisation (Eg: burning waste)	Improved efficiency; though still dependent on petrochemicals
Circular Economy Potential	High; waste-to-biofuel and biochemical conversion possible	Moderate; Some recycle energy and resources but relies on fossil feedstocks
Emissions	Fewer emissions with green refining processes	Lower emissions than traditional synthetic methods
Environmental Impact	Higher with traditional methods	Reduced, but continues reliance on non-renewables


Policy
Recommendations

9. Policy Recommendations

- **Developing Native Capacities and Leading the Market –** India's global competitiveness in the menthol market can be strengthened by a multifaceted approach that focuses on augmenting capacities for natural and developing native capacities for synthetic menthol. Given that India imports about 45.3 million USD of menthol (predominantly synthetic), developing native capacities for synthetic will enable India to diversify its product portfolio by reducing dependence on imports and establish itself as a market leader. One way to support Indian manufacturers can be by leveraging the existing production linked incentives (PLIs) where the government can extend the coverage of three (out of fourteen) sectors including – food products, active pharmaceutical ingredients (APIs), and pharmaceutical drugs. On the other hand, to promote the natural menthol, the government can consider measures including – extending the timeline of the RoDTEP scheme, abolishing the 'mandi' tax, or reducing the GST rate. These measures would in the long run pave the way for India to set the market price for both natural and synthetic menthol in India and also allow the government and industry to collaborate.

- **Creating a space for Co-existence –** The use of synthetic menthol is on the rise, and India is no exception, as indicated by the insights from the export-import model. With the increasing demand for synthetic menthol, it's becoming challenging for natural menthol to sustain the industry due to unpredictable supply and cost disadvantages. Industries tend to blend synthetic and natural products in a 70-30 ratio, positioning them as complementary rather than competing. However, since neither has yet reached optimal scale, it would be prudent for the government to support natural menthol producers, ensuring both can thrive on a level playing field.

- **Adopting Grading Scales for Industry Usage –** There is a pressing need to adopt grading scales for industry usage clearly identifying the different grades to be used for industries like pharmaceuticals, oral care, and other FMCG industries. As mentioned in chapter-5, there are no standard practices for menthol grades going as inputs into the industry. Adopting grading scales for different industry usage would help improve overall standards reiterating coexistence.

- **Adopting Standardised Labelling Practices with Clear Symbols –** The menthol industry could adopt standardised labelling practices to promote transparency. It will be appropriate if industries such as food and flavours, pharmaceuticals, and other industries using menthol clearly indicate use of natural/synthetic in their ingredients. This would enable consumers to make informed choices about the products they use. Educating and empowering consumers about the differences between natural and synthetic menthol is vital, as they are visually similar.

- **Supporting Research for Studying perceived Health Implications –** Since there are no recognized health impacts of synthetic menthol, long-term studies to validate the safety of synthetic menthol would also help alleviate perceived health concerns. This should be complemented with studies estimating the overall carbon footprint for both natural and synthetic (including production, processing, power consumption, logistics, etc.) to chalk out the underlying factors and take measures to reduce carbon emissions. The market must allow for the coexistence of both types of menthol for sustainable growth.

- **Ensuring Sustainability Practices –** The menthol economy can adopt a balanced and sustainable approach to production by incentivising green practices and reducing carbon footprint of value chains. This can be achieved by implementing policies that employ green and cleaner technologies for natural mint cultivation as well as synthetic menthol through concentrated efforts. Additionally, transitioning towards a biosynthetic process for synthetic menthol production could also help minimise the environmental impact.

- **Separate HS Codes –** While the government has introduced separate tariff lines at an 8-digit level, it is yet to be notified by the DGCIS (Directorate General of Commercial Intelligence and Statistics). This information has to be effectively communicated as well among the requisite stakeholders. It would be instrumental in levying appropriate tariffs/custom duties on the imports of synthetic menthol to support the natural menthol industry and farmers. Increasing imports, presumably of synthetic menthol might be a concerning factor. Additionally, a move to rationalise the GST rates will provide further impetus.

- **Carving out a Niche but Significant –** India, as a global leader in natural menthol production has a unique opportunity to establish its market presence by leveraging the use of natural ingredients. To capitalise on this, it is crucial to position natural menthol and develop targeted promotions to appeal to consumers willing to pay a premium for organic products globally. By doing so, India can carve out a niche for products that utilise natural menthol.

- **Organize mentha farmers so that they get maximum benefit of their product -** There is a need to develop Mentha farmer's cooperatives to promote best farming practices, organized marketing and ability to negotiate best price for the farmers. UP being the largest base of Mentha farmers, Government can support creation and development of such cooperatives. These cooperatives can run efficient processing systems to reduce the cost of production. CIMAP can play a very important role in supporting these cooperatives in terms of technical guidance.

10 Future Outlook

10. Future Outlook

The evolving menthol economy reflects a notable transition where natural menthol's dominant leadership is giving way to a space where both natural and synthetic menthol are co-existing. This trend underscores the potential for both natural and synthetic menthol to coexist harmoniously, especially in India, where factors such as export, demand, supply limitations, and price considerations exert influence on their utilisation.

The share of natural menthol is expected to decline as the Indian market expands over time. Natural menthol faces significant supply constraints and pricing pressures in sensitive consumption segments. If synthetic menthol is not manufactured in India, it could be subject to import duties and the impact of a weak INR, significantly increasing its landed cost. With China entering the synthetic menthol production market, competition could pose serious challenges to the viability of potential synthetic manufacturing plants in India.

Will both natural and synthetic menthol have sustainable future? The answer is yes. Consumption segments and labelling laws will ensure the coexistence of both. While natural menthol has dominated the industry for years, its market share is decreasing with the rise of synthetic menthol. Currently, there is a clear case for coexistence of both types in the Indian market, with companies diversifying their menthol portfolios. Despite the relative stable prices of synthetic menthol, consumer preference for natural ensures continued demand.

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Appendix

i. Menthol Concentration Levels in Natural Varieties

Botanical Name	Common Name	Concentration Levels
Mentha arvensis	Japanese Mint	70-80%
Mentha Piperita	Peppermint	35-50%
Mentha Spicata	Spearmint	60-95%
Mentha Cardiaca	Scotch Pear Mint	50-65%

Source: Data taken presentation published by University of Agricultural Sciences (UAS) Raichur Karnataka

ii. Mentha Varieties (Section 3.1)

Varieties like MAS-I (developed by CSIR-CIMAP) and Shivalik introduced from China led to an increase in mint acreage but the main limitations of these varieties were longer crop durations and lower yields, which restricted the adoption of these varieties by many farmers. The research focus of CSIR-CIMAP then turned towards developing a high-yielding variety of relatively short field life span (90 days against 120-130 days of the normal varieties) and possessing resistance against diseases and pests. CSIR-CIMAP then developed a variety which brought a revolution in mint cultivation; this variety, named as Kosi had the potential to yield 30% -50% more essential oil than the other varieties and also superior in the content of menthol (≥75%). This variety, besides being suitable for late planting (first week of February to the third week of April), matured 20 days earlier than the other existing varieties requiring early planting (December-January) but maturing late (June-July). Further, to strengthen mint cultivation, CSIR-CIMAP developed a series of new varieties, such as Saksham, Kushal and Saryu. The variety 'Saksham 'was developed as a soma-clone selected through a tissue culture approach for higher accumulation of menthol in the trichome glands of its leaves. Later, a new agro-technique of mint cultivation as a transplanted crop became popular as a result of the development of a very rapidly regenerating clone Kushal. This variety enabled farmers to have transplanted mint after the rabi crop (like wheat) is harvested. The crop matures for a single cut by June end and can be followed by the Kharif crop (like paddy). Another variety Saryu developed by CSIR-CIMAP with lesser leaf fall at maturity was later released, and could yield more essential oil and menthol.

Later, in 2013-14, another improved variety of Mentha arvensis named CIM-Kranti was developed by CSIR-CIMAP through half-sib selection of the variety Gomti. This variety, apart from being high yielding, was cold tolerant. Until 2020, Kosi remained the most acceptable variety cultivated in > 80% of the total area under menthol mint cultivation. Later in 2020, CSIR-CIMAP came up with another variety, CIM-Unnati, which has higher essential oil content and the potential to yield >200 kg of essential oil in one hectare. Another advantage of this variety was its tolerance to waterlogging that may occur during harvesting due to untimely rains.

iii. Export Model (Section 5.2)

Following are the results of the final model where three variables (exports of applied-menthol products for the countries which are the top importers of menthol from India) were dropped because they were not significant in explaining the variation in India's menthol's exports and also even after dropping them, there was minimal decline in the R-square.

Dependent Variable - India's Menthol Exports		
Estimator: Panel OLS		R-Squared: 0.6959
No. of observations:		160 F Statistic: 67.283 P-value of F-statistic – 0.0000
List of Parameters	Beta Values	P-value for the Parameters
Constant	125,100	0.0000*
Fragrance and Aromatics	0.0749	0.0017*
Cosmetics	-0.0205	0.0007*
Tobacco	0.0187	0.0085*
Menthol related Confectionery	-0.0624	0.0378**
India's Production	11,710	0.0000*

PIF's estimation, * significant at 1% level and ** significant at 5% level

These variables were Oral Care, Menthol Applied Pharmaceuticals and Menthol related Additives and Flavors. Overall, the R-Square is 0.696 or roughly 70% variation is explained and for an OLS panel regression. The model shows that Indian menthol exports are primarily influenced by domestic production, demand from the fragrance and tobacco industries, and domestic use in cosmetics and confectionery. The key driver of exports is India's production capacity. Positive links with the fragrance and tobacco industries indicate global demand, while negative links with cosmetics and confectionery suggest that increased domestic use may reduce exports.

The model is based on ex-post analysis (2024-23). For the coming time period, it is not sure that even tobacco and fragrance & aromatics industry will continue to support the menthol exports of India, with the underline assumption of India being largely exporting the natural one.

Overall, the R-squared is 0.5946 or roughly 59.46% variation is explained and for an OLS panel regression. The model indicates that India's menthol imports are significantly influenced by the oral care, cosmetics, and menthol-related additives industries, as well as domestic production levels. Conversely, the tobacco industry's growth seems to reduce the need for imports.

Menthol Applied Pharmaceuticals, Fragrance and Aromatics, and Menthol-related Confectionery turned out to be insignificant, indicating that their impact on menthol imports is not statistically significant in this model. However, dropping them made the R-square dropped by 9 percentage points so they were retained.

iv. Import Model (Section 5.2)

Following are the results of the import model **Dependent Variable - India's** **Menthol Imports**		
Estimator: Panel OLS		R-Squared: 0.5946
No. of observations:		160 F Statistic: 26.406 P-value of F-statistic: 0.0000
List of Parameters	Beta Values	P-value for the Parameters
Constant	-2655	0000*
Oral Care	3.232	0.0186**
Menthol Applied Pharmaceuticals	0.0008	0.8 – (not significant)
Fragrance and Aromatics	-0.0925	0.5125 – ((not significant)
Cosmetics	0.1403	0.041**
Menthol related Additives and Flavours	2.5956	0.0117**
Tobacco	-0.4819	0.0238 **
Menthol related Confectionery	0.9859	0.1195 - - not significant
India's Production	1236.6	0000*

PIF's estimation, * significant at 1% level and ** significant at 5% level

v. Forecasts (Section 5.6)

World Menthol Exports Value (in 000' USD)

Year	Forecasted ARIMA	Exponential Smoothing Forecast
2024	766,614.14	651,964.78
2025	784,038.93	670,052.94
2026	765,405.12	688,141.11
2027	751,802.78	706,229.28
2028	748,464.19	724,317.44
2029	749,542.71	742,405.61

PIF estimates

World Menthol Exports Volume (in tonnes)

Year	Forecasted ARIMA	Exponential Smoothing Forecast
2024	51413.38	52532.216
2025	52623.165	61181.419
2026	53794.243	62654.392
2027	54816.227	62496.935
2028	55718.463	58942.001
2029	56499.029	64583.475

PIF estimates

vi. Indian Industry Usage of Menthol Forecasts (Section 5.6)

Indian Domestic Industry Value (in Rs. Lakh)

Year	Forecasted ARIMA	Exponential Smoothing Forecast
2022-23	290966.381455	182431.702954
2023-24	233759.808320	192305.954214
2024-25	190088.421734	202180.205474
2025-26	226900.354762	212054.456734
2026-27	287760.001229	221928.707995
2027-28	279368.265489	231802.959255

PIF estimates

Indian Domestic Industry Volume (in tonnes)

Year	Forecasted ARIMA	Exponential Smoothing Forecast
2022-23	24206.025673	4808.113813
2023-24	19953.628711	2561.334016
2024-25	23803.336508	314.554220
2025-26	19606.336642	-1932.225576
2026-27	23501.382920	-4179.005372
2027-28	19346.249177	-6425.785168

PIF estimates

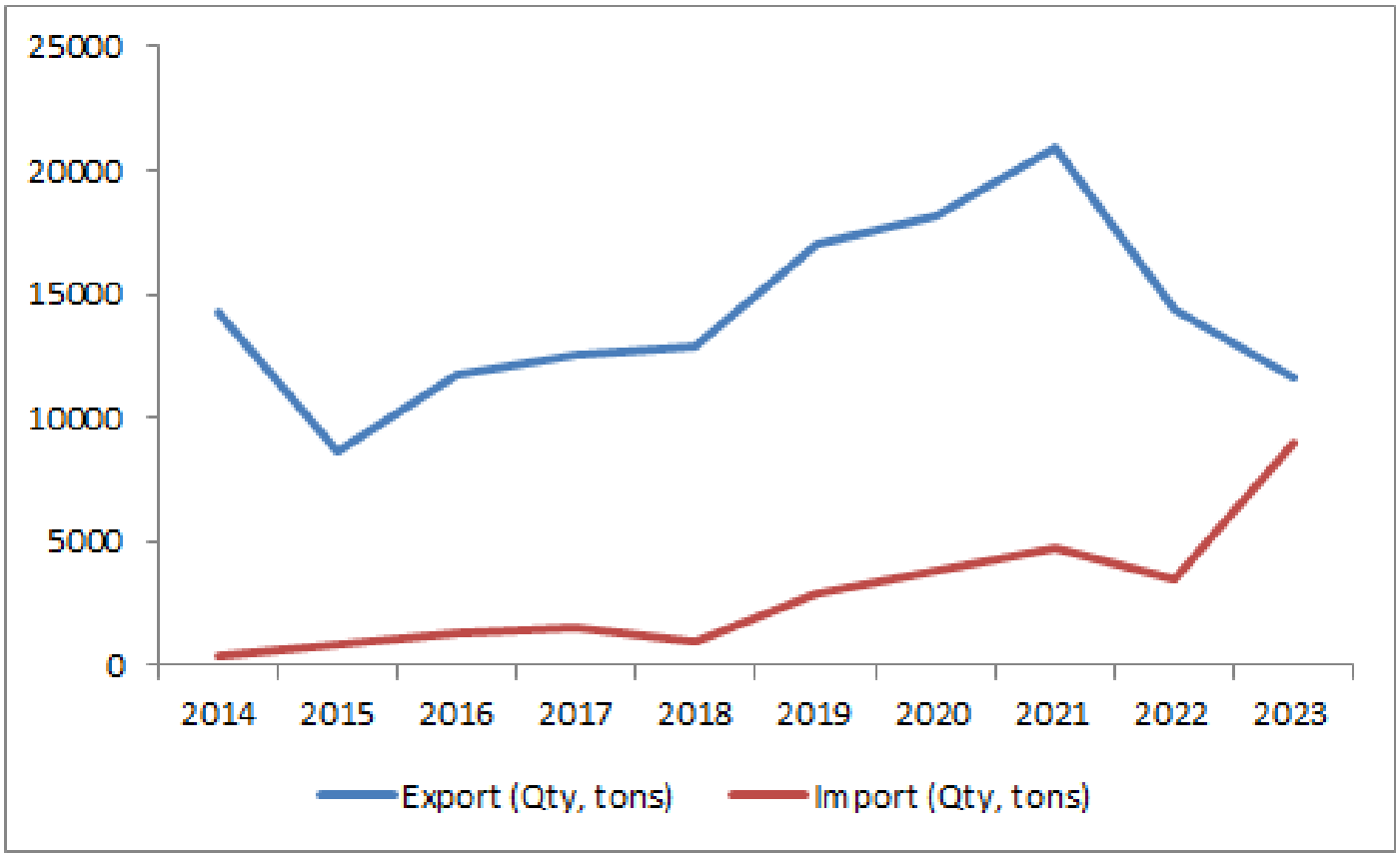
vii. Additional Forecasts

Indian Export-Import

	India's ARIMA Import Forecast, Value	India's ETS Import Forecast, Value	India - ARIMA Export Forecast, Values	India's ETS Export Forecast, Value -
2024	68667.436	100118.391	171847.724	176464.990
2025	108276.97	115608.517	172007.585	182593.264
2026	68667.464	131098.644	172021.800	188721.538
2027	108276.943	146588.770	172023.065	194849.812
2028	68667.492	162078.896	172023.177	200978.087
2028	108276.915	177569.022	172023.187	207106.361

PIF estimates

viii. Market Overview



While the government may exercise vigilance regarding the rising imports of menthol products and additives, increasing imports of menthol products and additives, supporting domestic production would better align with its objectives of enhancing value addition and generating employment.

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