

Orchard to Market: Applying Porter's Value Chain Framework to Mango Production in Himachal Pradesh.

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ABSTRACT

Mango (*Mangifera indica* L.) is a globally significant tropical fruit, and Himachal Pradesh (HP) has seen substantial expansion of mango cultivation over the past two decades. This study applies Porter's Value Chain Framework to systematically map and analyse HP's mango production from orchard to market, examining primary activities—input supply, cultivation and processing, post-harvest handling, marketing and services—and support activities including procurement, technology development, human resource management and firm infrastructure. Using secondary data from state horticulture records, literature review and value-chain analysis, we document an increase in area from 30,933 ha in 2000 to 42,415 ha in 2024 and production growth from 9,414 MT to 36,569 MT, highlighting the sector's growing economic importance. The analysis identifies core strengths such as a late-season harvest niche (late July–mid August) and late-maturing varieties like Mallika and Pusa Arunima that confer market advantages and higher price realization. Key weaknesses include climate sensitivity, frost risk, shortages of disease-free planting material and inadequate post-harvest practices (for instance, poor de-sapping and limited cold-chain facilities). Opportunities exist in value addition, branding, improved post-harvest management, market integration and capacity building; threats arise from environmental variability and potential loss of competitiveness if infrastructural and institutional gaps persist. We propose targeted interventions—enhanced quality planting material, adoption of improved orchard and post-harvest technologies, development of pack-houses and grading facilities, farmer training, and market-based branding strategies—to strengthen linkages across the value chain. Strengthening institutional support and promoting private–public partnerships are recommended to leverage HP's comparative late-season advantage. Overall, applying Porter's framework reveals specific nodes where value is created or lost and provides actionable recommendations to improve productivity, profitability and sustainability of mango production in Himachal Pradesh. Successful implementation of these measures can transform HP's mango sector into a resilient, higher-value agribusiness meeting domestic and export market demands within a decade and boost rural growth.

Keywords: *Mango value chain, Porter's value chain framework, SWOT analysis, Mango production, Value chain mapping and Horticulture.*

Introduction

Mango (*Mangifera indica* L.) is globally recognised as the most significant tropical and subtropical fruit, with the global production of commodity cluster (mangoes, guavas and mangosteen) reaches approximately 60 million metric tonnes in 2022 (Kouadio et al. 2025). Asia dominates this market, accounting about 75 per cent of global production, roughly 42 MT in 2021. India consistently holds the position of the world's largest producer of mangoes, contributing

substantially to the overall agricultural economy. India alone accounting for an estimated 45 percent and 52 per cent of total world mango fruit production. The mango sector contributes substantially to overall agricultural economy, international trade and foreign exchange earning for many tropical and subtropical countries. As India's national fruit, mangoes are the part of the horticulture sector which is key engine of Indian economy, contributing 33 per cent of agriculture gross value added (GAV) and helping to

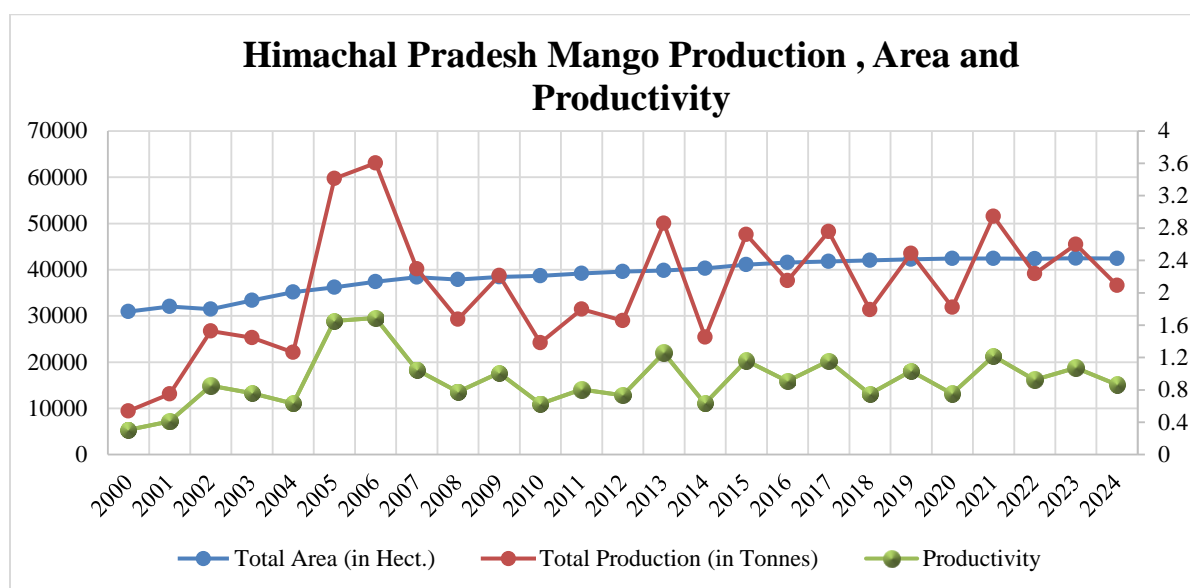
ensuring nutritional security for the population (Gautam et al. 2025).

Horticulture plays a vital and unique role in the hill economy of Himachal Pradesh (HP) by improving income, enhancing livelihood security and supporting economic development (Sharma and Chauhan, 2024). Among the wild range of fruits cultivated, mango (*Mangifera Indica L.*) affectionately known as the “king of fruits” and the national fruit of India, is considered the next important crops of the state, second only to apple.

Mango cultivation is primarily focused in the low hills and valleys of the subtropical region of Himachal Pradesh, specifically districts like Kangra, Una, Bilaspur, Hamirpur,

Mandi, Solan and Sirmour (Vaidya and Singh, 2005).

The area dedicated to mango cultivation in Himachal Pradesh has significantly expanded over the past two decades. In the year of 2000, total area under mango was 30,933 hectares, with a corresponding production of 9414 metric tonnes (MT) by the end of year 2024, total area under mango cultivation reached 42415 hectares, generating a production volume of 36,569MT. these upward trends in area over time suggests overall expansion in the sector. Here **figure 1** represent the total production, total area and productivity from 2000 to 2024 (Department of Horticulture Himachal Pradesh, 2024).

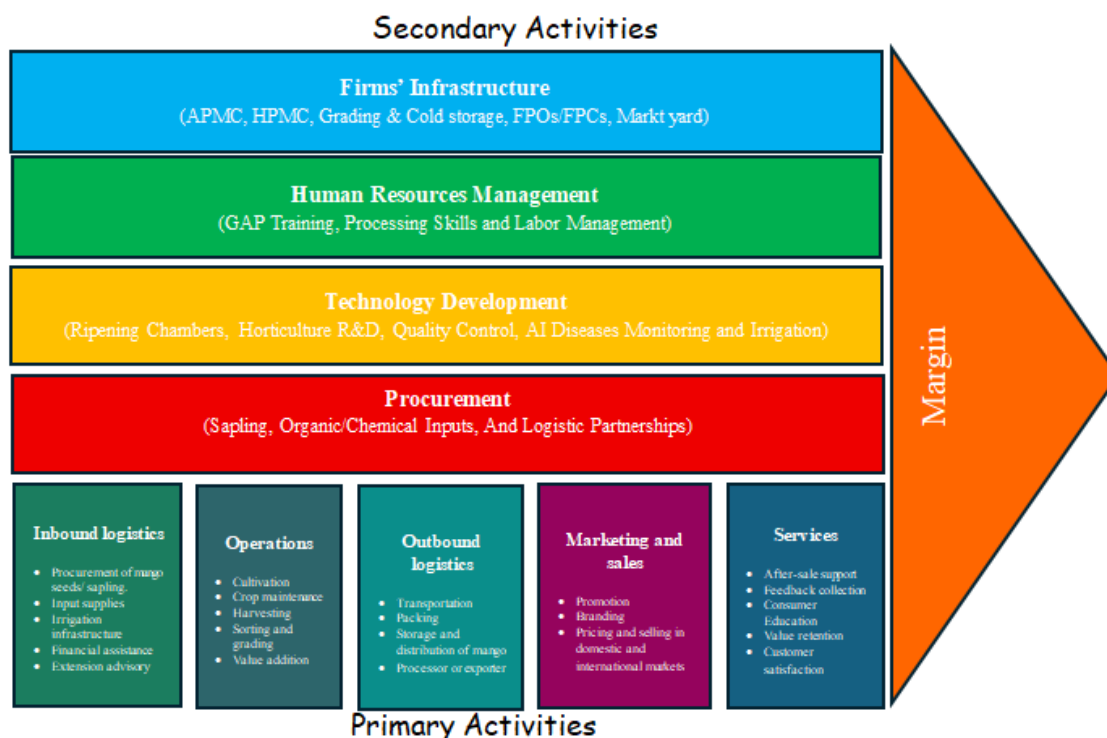


(Department of Horticulture Himachal Pradesh, 2024)

Fig 1: Mango Production, Area and Productivity Per Unit Area.

Mango cultivation holds profound and multifaceted importance for Himachal Pradesh, where mango playing vital role in the socio-economic transformation of rural masses (Rattan et al., 2022). Economically, mango is highly lucrative as the return from its cultivation are reported to be far higher than those from traditional field crop (Vaidya and Singh, 2005). More over Himachal Pradesh enjoy a crucial competitive market advantage due to its geographical location, which ensure late harvesting (from the last week of July to mid -august) (hp value chain cited) when fruit

supplies from adjoining plains have generally ceased, often leading to better price realization. This marketing edge is supported by the unique climatic variations in subtropical zone, which favourable for developing excellent colour and achieving the requisite sugar-acid ratio and exquisite flavour (Asian Development Bank, 2023). The primary purpose to apply the value chain frame work (Poter value chain model), systematically map all activities from production to marketing and evaluating SWOT analysis of mango in Himachal Pradesh.



(Abbasi, 2017; Porter, 2008)

Fig.2 Illustrates Porter's Value Chain Framework

Explaining Porter Value Chain Activities

Porter's original concept focused on the intra-firm standpoint, the framework has been widely extended beyond the boundaries of the firm to analyse entire industries, clusters and complex value system that include supplier, distributors, partners and collaborators. The expansion addresses the weaknesses of traditional analysis, which tends to be static. The value chain perspective, especially the Global Value Chain (GVC) segment, acknowledges activities increasingly spread over several countries and defines economic upgrading as shifting to higher-value-added products and production stage through efficient domestic and international linkages. Some frameworks suggest that analysis must evolve into value configuration analysis, introducing alternative value creation logics such as value shops (focused on solving customer concerns) and the value network (focused on linking customer) in addition to the traditional value chain (focused on input transformation). when applied to agriculture (agribusiness), value chain

analysis assesses all functions contributing to efficiency and profitability of agricultural operations (Zamora, 2016; Dubey, et al. 2020). The Porter value chain model provides a structured framework for analysing the series of activities a firm undertakes to create and sustain value and competitive advantages (Lee, 2018). This model classifies activities into primary activities (directly related to producing and distributing the product) and support activities (providing the necessary infrastructure for the primary activities). The value chain model, developed by the Michael Porter in 1985, refers to the linkage of activities, functions and processes that directly or indirectly relate to creating added value. It organises business functions into Five Primary Activities and Four Supporting Activities (Tuoi and Son, 2023).

- **Primary Activities:** are the tasks performed on-site, such as production, distribution and marketing directly create added value.
- **Secondary Activities:** play an intermediary role by supporting the primary functions.

Table1: Primary activities

Poter's value chain model	HP Mango value chain application	Description
Inbound Logistics	Input supply and management	This involves procuring and storing necessary resources for cultivation. Key requirements including securing high-density plantation (HDP) sapling, accruing diseases free quality planting material, fertilizer, tools, and irrigation resources. Farmer depends on state horticulture nurseries, local agri-dealers and governed advisor for technical information and also accesses financial assistance through schemes and subsidies.
Operations	Cultivation, production and processing	These are the activities that transform input into final fruit products. For mango in HP, this includes Land preparation (deep ploughing, harrowing, pit digging). Production (e.g. planting grafts, irrigation management, Training, pruning and protection against pests /diseases like mealy bugs or powdery mildew). Value addition through micro-interventions like fruit bagging (to prevent pests/fruit flies, latex burns and fungal spots on fruits) processing (conversion of raw mangoes into pulp, juices, jam or canned fruits) especially utilizing lower-quality produce.
Outbound	Post-harvest handling, storage and transportation	These activities manage the collection, storage and movement of finished fruit. For mango, this involves: harvesting (manual using harvesters through traditional methods can lead to bruising). Handling process like de-sapping (critical step, often not practice leading to unpleasant marks on fruit) and sorting/grading by size and weight. Storage in cold room. Packaging using rigid containers /boxes. Transportation (often by trucks, need of temperature-controlled vehicles-reefer trucks-for long distance).
Marketing and sale	Market Access, negotiation and promotion	These are the activities to convince customers to buy the products. The Hp mango is sold through channel including direct sales to consume, sales via trades/aggregators, sale via pre-harvester contractor, sale by HPMC (by MIS scheme). Branding activities (e.g. an umbrella Branding highlighting the superior quality and late arrival advantage of HP mangoes) are proposed to target high-end domestic and export markets.
Services	Post-sale support and quality assurance	Post sale services in Himachal Pradesh are limited, but activities like grading, sorting and packaging help maintain product quality and buyer satisfaction. Ongoing quality monitoring and the availability of processes product such as mango pulp or juices also support value retention after sale.

(Asian Development Bank, 2023; Ruan, 2020; Ajayi and Laseinde, 2021)

Table 2: Secondary activities

Poter's value chain model	HP Mango value chain application	Description
Procurement	Sourcing key supplies	This is the purchasing of inputs used across the entire value chain. For mango, this involves sourcing of packaging material (e.g. mango box /crates) which are often bought from neighbouring places like Delhi and Punjab due to inadequate local downstream industries. It also includes procuring material FYM, Insecticide and pesticides.

Technology development	R&D and modernization	Activities related to improving process and products. This includes; Horticulture R&D (supported by UHF and government agencies) for selecting dwarf varieties and improved cultivar like Milika and Pusa Arunima. Developing and implementing technology package of practices (PoPs) for production and post-harvest management. utilizing advance managements models like traceability system (e.g. blockchain technology) for quality control and visibility across the value chain.
Human resources managements (HRM)	Training and labour management	Involves the recruitment, training and development of personnel. Key concerns in mango cultivation are high cost and shortage of skilled/ unskilled labour for picking and packing. Intervention requires capacity building and training for farmers and micro-entrepreneurs on scientific cultivation, integrated nutrient/pest managements, harvesting, post harvest handling and marketing skills.
Firm infrastructure	Institutional, financial and physical infrastructure	Include general managements, planning, finance and quality managements. This includes institutional backing from the APMC& their regulation, Department of horticulture, HPMC, e-NAM facilities and mandi infrastructure (market yards). Infrastructure needs such as pack houses, grading units and improved road connectivity enhance market access, while financial support from various schemes.

(Presutti and Mawhinney, 2009;Asian Development Bank, 2023; Ruan, 2020; Ajayi and Laseinde, 2021)

Swot Analysis of Mango Value Chain:

Strengths (s)

The core strengths of Himachal Pardes mangoes centre on their unique harvest timing which provides a key market advantage:

Late season harvest: the harvesting of mangoes occurs late in the season, typically from the last week of July to mid-august.

Favourable price realization: this late timing is favourable for better price realization because there is no supply from major growing region during period.

Targeted Late Varieties: The major selected varieties for the state as Malika (harvested July 3rd week -August 2nd week) and Pusa Arunima (harvest August 3rd week till September 2nd week), are specifically late -ripening cultivars. Pusa Arunima, for instance, ripens late in the season and has a very long shelf-life (10-12) at room temperature after ripening.

Weakness (w)

Internal limitations and environmental sensitivities poses challenges to cultivation expansion and quality

Climate sensitivity: mango is very sensitive to both harsh summer temperature and winter frost.

Planting material shortage: there is lack of disease-free quality material in adequate quantity of expanding the area under cultivation in the region.

Mould blackening risk: high humidity and rains during the critical fruit development phase may lead to loss due to mould blackening.

Post- harvest practices: specific issue include the lack of de-sapping, which lead to unpleasant mark on the fruits.

Opportunities (O)

The late -season niche create significant economic and market development potential

Market advantage: the proven cultivation of late varieties like Malika and Pusa Arunima gives the region a distinct market advantage.

Better Prices: the combination of extended harvesting and less competition in the market may result in the realization of better prices.

Economic development: there is ample opportunities for skill full employment in various part of the value chain, including growing, post-harvest handling, value addition and marketing of mango, there by contributing to the economic development of the region.

Threats (T)

External factors, particularly environmental extremes and market risks, threaten the stability and potential growth of the industry.

Frost Damage: mango is highly sensitive to frost occurrence at the time of flowering.

Complete crop loss risk: frost may kill vegetable growth and flowering leading to complete loss of the crop.

Loss of competitive edge: if the competitive market advantage of mango is not harnessed it will negatively affect the development of the region.

The strategic timing of Himachal Pradesh mango harvest which aim to fill the supply gap evident in markets like Azadpur mandi, Delhi, after peak season ends is like a specialized runner waiting until the main pack has tried out however this runner must always be wary of the unpredictable environmental hurdles-severe climate sensitivity and frost risk that threaten to stop the race entirely.

Conclusion:

Mangoes are an important aspect of hill agriculture in the State of Himachal Pradesh. Being the second most key fruit crop of the State after apples, mango cultivation ensures considerably higher returns than that obtained by traditional field crops. During the last two decades, the sector has been showing rapid growth. The area under mango cultivation increased from 30,933 hectares in 2000 to 42,415 hectares in 2024. Similarly, production increased from 9,414 metric tons to 36,569 metric tons. This increase substantiates the increasing role of the crop in improving incomes and ensuring livelihood security, thus stabilizing the rural economy. Himachal Pradesh has a unique advantage because of its geography and climate, whereby late-season harvesting, usually from late July to mid-August, is allowed. This is a time when supplies from major mango-producing areas have started to dwindle, hence the better prices and sustained market demand. Subtropical low hills are conducive to producing quality fruits with excellent flavour, colour, and sugar-acid balance, thus adding to the demand for Himachal mango varieties. The Porter Value Chain Framework provides a clear way to understand how value is created and lost at different stages of mango production and marketing. Organizing activities in five main areas-input procurement, cultivation and production, post-harvest handling, marketing, and services-and four secondary areas-procurement support, technology development, human resource management, and institutional infrastructure-allow

us to identify the efficiency of processes, the roles of stakeholders, and systemic issues. The value-chain assessment, in conjunction with the SWOT analysis, illustrates that the main strengths of the state include its late-season niche, desirable mango varieties such as Mallika and Pusa Arunima, and favourable climate conditions. However, weaknesses exist such as climate vulnerability, frost sensitivity during flowering, limited access to disease-free planting material, labour shortages, and poor post-harvest practices including inadequate de-sapping and cold-chain facilities. Opportunities such as value addition through processing, branding and geographical identity development, pack-house facility expansion, farmer training improvement, and integration into higher-value domestic and export supply chains exist in the sector. Similarly, unpredictable weather, frost events that may wipe out an entire crop, market instability, labour shortages, and loss of competitive advantage are threats that demand immediate strategic action. A multi-faceted approach is called for in the strengthening of the mango value chain in Himachal Pradesh. This encompasses the realms of improved access to good planting material, scientific orchard management, improved post-harvest and storage technologies, efficient logistics and transportation, and generally better coordination amongst farmers, government, research organizations, and the private sector. Current challenges must be met, and inherent strengths leveraged, so that the mango sector in Himachal Pradesh develops into a resilient, high-value, and responsive system capable of meeting growing domestic demand and reaching out into potential export markets. This would spur rural development, farmer income, and cement the state's position as a leading producer of late-season, premium-quality mangoes.

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