BOX BEEKEEPING BUSINESS: A CASE STUDY FROM WEST BENGAL, INDIA

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Abstract

Apiculture in West Bengal, India, has transformed from a traditional backyard hobby into a structured, profitable agro-enterprise that leverages the state's unique multi-floral biodiversity. This case study evaluates the operational framework, economic viability, and challenges of commercial box beekeeping by focusing on an experienced practitioner managing 150 Langstroth beehives (*Apis mellifera*). By utilizing a migratory approach synchronized with seasonal floral blooms, the enterprise generates an annual yield of 4,500 to 6,000 kg of raw honey. Financial analysis reveals a net annual profit ranging from Rs71,000 to Rs 4,31,000. This wide variation underscores the unpredictable nature of the business, which is heavily influenced by fluctuating wholesale market rates and high logistical costs. Despite its economic potential and crucial contribution to rural livelihoods and ecosystem services through crop pollination, the sustainability of migratory beekeeping is increasingly threatened by severe environmental factors. Climate change disrupts flowering cycles, leading to bee starvation, while the intensive, unregulated use of synthetic chemical pesticides causes catastrophic honeybee mortality. To safeguard the future resilience of this sector, strategic policy interventions are urgently required. Implementing a state-regulated Minimum Support Price (MSP) is essential to protect smallholder farmers from unfair pricing by corporate buyers. In conclusion, migratory beekeeping remains vital for regional agricultural growth but its long-term viability depends on targeted government support to mitigate climate risks, standardize market values, regulate pesticide exposure, and protect honeybee health.

Keywords: Apiculture, *Apis mellifera*, Migratory beekeeping, Honey profit, Rural livelihoods, Honeybee mortality, Minimum support price (MSP).

Introduction

The state of West Bengal possesses a unique geographical and ecological advantage for apiculture. Extending from the mustard-rich plains of Dakshin Dinajpur, Malda and Murshidabad to the mangrove ecosystems of the Sundarbans and the litchi orchards of Baruipur in the South 24-Parganas district, the region offers a continuous, multi-floral nectar flow throughout most of the year (Das and Mandal, 2021; Deyashi and Nandi, 2025). In contrast to traditional, destructive honey-hunting methods, managed box beekeeping utilizing *Apis mellifera* facilitates controlled production, superior volumetric yields, and standardized quality management (Roy et al., 2020). Consequently, the apiculture sector has emerged as a cornerstone of West Bengal's rural economy, effectively leveraging local traditional ecological knowledge and rich floral biodiversity (Sarkar, 2023).

The operational model of box beekeeping in West Bengal typically relies on Langstroth hives. Structurally, each hive unit comprises a bottom board, a brood chamber, a super chamber, and a secure top cover (FAO, 2022). Aspiring entrepreneurs generally initiate operations with a baseline inventory of 20 to 50 boxes, with each unit housing a structured colony consisting of a single queen, fertile drones, and sterile worker bees. To optimize honey production, apiarists practice migratory beekeeping, transporting their hives across various districts to synchronize with sequential floral blooms. Typically, colonies are migrated to the mustard belts in December and subsequently relocated to litchi groves in March (Chatterjee and Sen, 2019). Post-harvest, honey is extracted via centrifugal machinery to preserve the structural integrity of the honeycombs for consecutive seasonal reuse. Primary processing thereafter entails moisture reduction and micro-filtration to align the final yield with regulatory market standards (Bureau of Indian Standards [BIS], 2020).

Ultimately, apiculture represents a critical agro-based industry in West Bengal, generating essential ecological services, such as enhanced crop pollination, while securing sustainable rural livelihoods. This communication presents an empirical case study of a veteran migratory beekeeper, analyzing the operational framework, economic viability, and systemic challenges currently confronting apiarists within the region.

A case study from West Bengal: operational profile and socio-economic analysis

This case study examines the empirical profile and economic structure of a commercial migratory apiculture enterprise in West Bengal, India. The analysis is based on primary field data gathered from an active, long-term practitioner in the region.

1. Practitioner profile and scale of operation

The subject of this case study is Mr. Saheb Ali (aged 52), a veteran apiarist based in Kachua village, Basirhat, within the North 24-Parganas district of West Bengal. With three decades of professional experience, the practitioner operates at a commercial scale, managing an active inventory of 150 Langstroth bee boxes (*Apis mellifera*) (Fig-1a). The enterprise's human resource structure comprises a core workforce of three individuals, including the lead apiarist and two seasonal labourers who are contracted on a fixed monthly wage for the six-month active production cycle.

2. Migratory dynamics and floral sources

Apiculture within this jurisdiction is strictly migratory, requiring the strategic relocation of hives to exploit sequential floral blooms across West Bengal and the neighbouring state of Jharkhand. The primary geographic hubs for these migratory circuits include Bankura (specifically Taldangra), Murshidabad, Malda, and the estuarine Sundarbans. The botanical sources driving honey production are categorized into three distinct ecological types:

- **Agronomic crops:** Mustard (*Brassica* spp., locally termed *Sarisa*), Sesame (*Sesamum indicum*, or *Til*), and Black Cumin (*Nigella sativa*, or *Kala Jeera*) (Fig-1b and c).
- **Fruit and horticultural species:** Litchi (*Litchi chinensis*) and Eucalyptus (*Eucalyptus* spp.).
- **Mangrove flora (Sundarbans ecosystem):** Khalsi (*Aegiceras corniculatum*), Goran (*Ceriops decandra*), and Keora (*Sonneratia apetala*).

Figure 1: (a) The apiarist, Mr. Saheb Ali is showing the wooden bee boxes and his labours are working in a rural site; (**b)** Mustard (*Sarisa*) field; **(c)** Sesame (*Til*) field.

3. Operational logistics and seasonality

The operational framework of the enterprise is fundamentally governed by macroclimatic conditions and floral phenology.

- **Production seasonality:** The peak honey production window spans approximately seven months, commencing between late October and early November, and concluding between late May and early June (corresponding to the traditional Bengali months of *Agrahayan* through *Baishakh*).
- **Colony maintenance:** Conversely, the period from June to mid-November (*Jyaistha* to *Kartik*) represents a critical lean phase characterized by floral scarcity. During this interval, intensive apiary management is required to ensure colony survival, primarily through artificial carbohydrate supplementation via sucrose syrup feeding.
- **Labor overhead:** Labor deployment is highly seasonal; the two field assistants are compensated at a rate of Rs12,000 per month per individual exclusively during the six active production months.

4. Quantitative economic analysis

An economic assessment was modelled based on the active baseline operation of 150 hive units. Tables 1 and 2 delineate the annualized operational expenditures (OPEX) and revenue projections, respectively.

Table 1: Annualized operational expenditures (estimated in INR)

Expense category	Quantitative description	Estimated cost range (Rs)
Seasonal labour	2 assistants x Rs12,000/month x six active months	1,44,000

Logistics and migration	Flatbed vehicular transport of 150 units across 4–5 districts	60,000 – 80,000
Colony maintenance	Sugar syrup feeding during the 5 to 6 months lean phase	30,000 – 50,000
Overheads and veterinary care	Physical box maintenance, hive repairs, and chemical treatments	15,000
Total operational expenditures (OPEX)		**2,49,000 – 2,89,000**

Table 2: Annualized revenue and profitability projections (estimated in INR)

Parameter	Output range	Valuation (Rs)
Gross volumetric honey yield	150 boxes x mean yield of 30–40 kg/box	4,500 kg – 6,000 kg
Gross wholesale income	Evaluated at a wholesale market rate of Rs80 – Rs120/kg	3,60,000 – 7,20,000
Secondary revenue streams	Crude beeswax processing and localized pollination services	Variable supplemental income
Net annualized profit		**71,000 – 4,31,000**

[**Note:** Net annualized profit is shown here as Rs 71,000 – Rs 4,31,000 (average Rs2,51,000). This excludes the owner's remuneration @ Rs20,000 per month for 12 months (totalling Rs2,40,000 for six active months in the field and six sugar-supported lean phase months in-house). As such, the beekeeping enterprise is apparently sustainable on a "no-profit, no-loss" basis.]

5. Systemic vulnerabilities and environmental risks

Despite demonstrating financial viability, the enterprise is subject to volatile environmental and institutional externalities:

1. **Ecotoxicological hazards:** The intensive application of synthetic chemical pesticides, specifically neonictinoids and organophosphates within adjacent mustard and litchi agro-ecosystems, frequently triggers acute honeybee toxicity and severe colony mortality.
2. **Climatic instability:** Anthropogenic climate shifts, manifested through unseasonal precipitation anomalies and extreme heatwaves, routinely disrupt macro-floral blooming cycles, causing premature resource depletion and subsequent colony starvation.

3. **Market asymmetry and price volatility:** The absence of a regulated Minimum Support Price (MSP) for raw honey leaves smallholder apiarists economically vulnerable. Consequently, primary producers remain price-takers, dependent on large private corporate aggregators who exert asymmetric control over wholesale pricing structures.

Discussion

The commercialization of box beekeeping in West Bengal underscores the transformative capacity of integrating scientific apiary management with regional ecological endowments. Historically conceptualized as a localized, low-yield backyard activity, contemporary apiculture utilizing *Apis mellifera* has transitioned into a highly structured, capital-generating agro-enterprise (Sarkar, 2023). The empirical findings from this case study of a 30-year veteran practitioner demonstrate that a migratory model utilizing an inventory of 150 hives is economically viable. The operation achieves an annual aggregate yield of 4,500 to 6,000 kg of raw honey, generating a net annualized profit margin ranging from Rs71,000 to Rs 4,31,000. This substantial variability in profitability is directly tied to fluctuating wholesale market rates and the efficiency of seasonal resource management.

However, the long-term socio-economic sustainability of this enterprise remains vulnerable to severe environmental and institutional externalities. The operational cycle is strictly bound to macroclimatic stability and predictable floral phenology. As documented across eastern India, anthropogenic climate shifts, such as unseasonal precipitation and extreme heat stress, increasingly disrupt floral synchronized bloom cycles, inducing nutritional stress and subsequent colony starvation (Chatterjee and Sen, 2019). Furthermore, ecotoxicological hazards present an existential threat to regional apiaries; the unregulated, intensive application of synthetic chemical pesticides in surrounding agronomic and horticultural landscapes routinely triggers catastrophic honeybee mortality (Roy et al., 2020).

To navigate these challenges and catalyze the next paradigm of sectoral growth, strategic policy shifts are essential. There is an urgent need to transition toward organic certification protocols and the diversification of apiary outputs into high-value secondary derivatives, such as propolis, royal jelly, and crude beeswax (FAO, 2022). Furthermore, addressing market asymmetries through institutional interventions, specifically the establishment of a state-regulated Minimum Support Price (MSP), is critical to insulate smallholder primary producers from the monopsonistic pricing behaviours dictated by large-scale private corporate aggregators (Das and Mandal, 2021).

Conclusion

This study demonstrates that despite high logistical overheads and intensifying environmental risks, the strategic execution of migratory apiculture routes can yield significant financial returns within the rural economy of eastern India. The operational architecture of the examined enterprise reveals that sustained success in this agro-based industry is precarious, functioning as a high-risk equilibrium between logistical efficiency, intensive micro-management of resources during lean seasons, and uncontrollable macroclimatic variables. Ultimately, while migratory beekeeping serves as an effective mechanism for securing sustainable rural livelihoods and delivering essential ecosystem services via crop pollination, its future resilience is contingent upon targeted policy frameworks. Institutional support aimed at mitigating pesticide exposure, standardizing market values, and providing climate-

risk safety nets will be instrumental in sustaining the apiculture sector as a pillar of regional agricultural development.

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