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Geographical Indication (GI) and Market Advantage for Indian Sundarban's Wild Honey: A Catalyst for Regional Entrepreneurship and Development

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Abstract

The Sundarbans is a unique mangrove ecosystem shared by both the economies of India and Bangladesh; it supports honey collection as a conventional livelihood essential to the local economy and cultural heritage. While both regions share similar environmental conditions, notable differences exist in honey collection practices, economic dependencies, and market structures.

In West Bengal, India's Geographical Indication (GI) status for Sundarbans honey received in January 2024 has enhanced its market value and demand, giving local honey a formal recognition that protects its identity and links it to regional qualities. But in Bangladesh, Sundarban honey lacks GI status, which impedes its prominence and potential worth in local and global markets. This variation in GI acknowledgment presents a comparative advantage to India enhancing its potential to trade, thereby providing unique opportunities for local honey collectors called "Moules" as well as the governmental organizations, private honey sellers, Co-operative etc.

By analyzing secondary data on honey production volumes, this study compares critical economic and environmental factors influencing honey collection in each country. The findings aim to deepen understanding of how traditional practices and modern market mechanisms like GI certification affect honey-collecting communities' sustainability and economic resilience in both Sundarbans. Apart from this, the paper has adopted a theoretical approach to analyze whether the GI tag of India provides a comparative advantage over Bangladesh.

Keywords: Sundarbans, India, Regional Entrepreneurship, Geographical Indicator.

Introduction

The Sundarbans is recognized as a UNESCO World Heritage Site and is one of the largest interconnected mangrove ecosystems, extending across West Bengal, India, and Bangladesh. The region is famous for its abundant biodiversity and vital ecological roles. The area nurtures a variety of livelihood practices; one of the most prominent among them is the tradition of honey collection that has persisted for centuries.

The honey from wild bee colonies inhabiting the mangrove forests is intricately connected to the cultural legacy and economic well-being of local communities in both nations. The Sundarbans Tiger Reserve in India encompasses a significant portion of the mangrove region and plays a crucial role in facilitating honey collection.

Despite the immense life threat associated with such activity, the tribal population of the area has been engaged in this profession for generations. The annual report from the Sundarbans Tiger Reserve emphasizes the controlled distribution of permits for honey collection, balancing the livelihoods of the community with ecological preservation. Honey gathered is kept and distributed through organized channels such as the West Bengal Forest Development Corporation, which provides more significant economic benefits for local collectors while ensuring alignment with conservation objectives (2022_23_annual_report).

In West Bengal, the Geographical Indication (GI) status granted to Sundarbans honey has improved its market standing and global competitiveness, thereby creating a distinct branding that ties its quality and origin to the mangrove's rich biodiversity. It can pave a way for our country to earn increased foreign exchange. This acknowledgment not only boosts its appeal in domestic and international markets but also enhances the earnings of honey gatherers. By contrast, honey collection in Bangladesh remains informal mainly, with limited market structures and no GI certification, resulting in lower visibility and economic potential for Sundarbans honey from that region. Geographical Indication (GI) certification could provide several significant advantages to the honey produced in the Sundarbans region of West Bengal, distinguishing it from honey produced in other areas, such as the Sundarbans of Bangladesh. Here is a brief explanation of how GI could benefit the region:

1. GI would prevent producers from other regions or countries from selling honey under the same name or branding as Sundarbans honey. This protection ensures that consumers get authentic honey and counterfeit products do not undermine local producers.
2. The GI tag could open doors to specialized markets for organic, eco-friendly, and sustainably produced goods. The export potential would increase as global consumers are increasingly inclined toward buying products with a verified geographical origin, especially in the organic food market.
3. The GI process often encourages sustainable agricultural practices, which could result in better conservation of the Sundarbans mangrove ecosystems. This is important as the region faces pressures from overexploitation and environmental degradation.

Literature Review

Honey collection in the Sundarbans, spanning India and Bangladesh, is a crucial livelihood rooted in cultural traditions. **Bhattacharya, Raha, and Mitra (2018)** highlighted the economic significance of honey and beeswax in India's Sundarbans. There was a steady increase in their collection and the market demand for "Mouban" honey. Similarly, **Naskar and Das (2019-2020)** emphasized the ecological importance of indigenous practices like selective hive cutting among India's Mawali, Bawali, and Chuniri communities. In Bangladesh, **Baksha (2008)** detailed

the role of honey hunting in supporting livelihoods but observed a decline in production due to unsustainable practices, such as bee-killing during harvesting.

Samanta et al. and Sohela (2013) examined the challenges honey collectors face in India and Bangladesh, including financial precarity, wildlife risks, and moneylenders' exploitation. **Singh et al. (2019)** found that non-timber forest products (NTFPs) contribute up to 79% of household income in India, with honey and wax as vital components. **Siddiqui (2017)** documented the ecological impact of improper harvesting practices in Bangladesh, which led to declining pollinator populations.

Environmental pressures, including climate change and coastal erosion, affect both nations, but rising ecotourism in India presents opportunities for income diversification. Recommendations include modern harvesting methods, protective gear, and integrating communities into ecotourism and sustainable honey production to safeguard livelihoods and ecosystems (**Kothari, 2015; Sarker, 2022**). The paper by **Das and Bandyopadhyay (2019)** explores the impacts of tourism in the Sundarbans, India, using GIS and spatial technology. It identifies tourism potential in buffer zones, emphasizing eco-tourism socio-economic benefits while recognizing challenges like inadequate infrastructure. Recommendations include using GIS for planning and mapping tourist sites, improving connectivity through rail, road, and waterways, and addressing the need for infrastructural development by government and private stakeholders to support sustainable tourism.

Research Gap

While the literature highlights the rich traditions and changing economic dynamics of honey collection in the Sundarbans, some aspects still need to be explored. *Therefore, the present paper analyzes the impact of India's GI certification on cross-border trade and competitiveness and its superior position over Bangladesh in the world market.*

The backdrop

The Sundarbans, spanning southern West Bengal, India, and Bangladesh, is a unique ecological region where honey collection is deeply tied to the livelihoods and traditions of local communities. In India, honey collection is an age-old occupation for groups like the "Mouals," who use ropes, ladders, bamboo scaffolds, and handmade tools like the "Jor" to scrape honeycombs. Collectors face significant risks, including encounters with tigers and other wildlife. The activity is often family-based, with honey sold informally to intermediaries, local markets, or cooperatives in raw, unprocessed form. In Bangladesh, honey collection involves similar tools and techniques but is more community-oriented. "Modh" collectors typically harvest in groups, emphasizing teamwork, integrity and sharing the spoils. This communal approach contrasts with the smaller-scale, individual enterprises seen in India. Both regions face challenges but maintain honey collection as a critical cultural and economic activity.

Over the years, some organized sectors and government initiatives have supported the commercialization of honey collection, but the market still needs to grow. Large-scale buyers, including exporters, often source honey from intermediaries who purchase it from the collectors at a lower price.

The Indian honey market has expanded, with increasing local and international demand. Many honey gatherers in the Sundarbans continue to depend on conventional trading methods due to lack of exposure to sustainable modern practice that restrict their market access and bargaining capabilities. In Bangladesh, the honey trade tends to be more centralized, with established cooperatives and community-focused organizations playing a significant role in the collection and marketing of honey. These cooperatives organize trade, creating supply chains, guaranteeing fair prices for collectors, and facilitating the commercialization of honey through formalized channels. It prevents deprivation of the hardworking producers. The honey market in Bangladesh is more organized compared to India, benefiting from government support and the engagement of NGOs promoting sustainable practices and higher quality production. Honey is distributed in

local and larger regional markets, with a developing export market on the rise. NGOs and cooperatives have enhanced supply chains by providing training in sustainable harvesting, conservation, packaging, and certification, assisting Sundarban honey in meeting international standards. The GI tag has improved its global visibility, increasing export potential by guaranteeing authenticity and quality. This enables India to tap into premium markets where consumers appreciate traceable and region-specific products. In West Bengal, Mouals benefit from cooperatives, standardized pricing, and branding initiatives such as the GI tag, which enhance market reach, although their earnings remain variable due to the seasonal nature of honey collection. Conversely, Bangladeshi Mouals experience lower incomes since honey is sold locally or internationally without branding or certification, making them susceptible to exploitation by intermediaries. Climate change exacerbates challenges in both areas, as rising sea levels and salinity intrusion diminish floral resources.

Bangladesh faces more severe impacts due to its geography, further deepening poverty among its Mouals and forcing many to seek alternative livelihoods.

Table 1.1: Yearly production of honey in Sundarban West Bengal

Year	Achievement in kg
2012-13	24,750
2013-14	20,950
2014-15	47,412
2015-16	33,515
2016-17	19,050
2017-18	15,000
2018-19	15,000
2019-20	17,800
2020-21	389
2021-22	3,649.7
2022-23	12,000

Source : Sundarban Tiger Reserve Annual Report 2022-23

Table 1 shows that The data on honey production achievements in the Sundarbans West Bengal for 2012–2023 reveals significant trends shaped by environmental, policy, and economic factors.

The highest production was achieved in 2014-15 (47,412 kg), likely due to favorable ecological conditions and effective management practices. Honey collection during this time may have benefited from a combination of high flowering in mangrove areas and organized efforts by local communities and government agencies. Production steadily declined after 2014-15, dropping to just 389 kg in 2020-21, a significant low point. Cyclones, habitat degradation, and changes in the mangrove ecosystem likely reduced the availability of nectar-producing flowers. The drastic drop in 2020-21 aligns with disruptions caused by the COVID-19 pandemic, which may have limited access to forests and markets for honey collectors. Production recovered in 2021-22 (3,649.7 kg) and improved further in 2022-23 (12,000

kg). This suggests a gradual normalization of forest access and market activities after the pandemic.

The observed trends in honey production in the Sundarbans from 2012–2023 can be explained by several interconnected factors that influence both the natural and socioeconomic dimensions of the region:

- The Sundarbans mangrove forests are the primary source of nectar for bees. Any decline in the health of mangrove flora due to factors like salinity intrusion, deforestation, or reduced flowering directly impacts honey production. The decrease in production from 2015 onward could be partially attributed to changes in mangrove ecosystems.
- The Sundarbans are highly vulnerable to cyclones. Cyclone Aila (2009), Cyclone Amphan (2020), and other storms damaged the ecosystem, disrupted beekeeping activities, and reduced the availability of nectar and bee populations in the region.
- The drastic drop in honey production in 2020-21 aligns with COVID-19-related restrictions, which hindered forest access, disrupted supply chains, and reduced market opportunities for honey collectors.

Table 1.2: Yearly honey and wax production in Bangladesh Sundarban

Financial Year	Honey Quantity	Honey Revenue	Wax Quantity	Wax Revenue
1999-00	5352.00	555250.00	1389.00	208387.00
2000-01	3465.00	346580.00	866.00	129967.00
2001-02	2341.00	621600.00	619.00	91400.00
2002-03	2796.00	581800.00	642.00	192750.00
2003-04	3378.00	675600.00	844.00	253550.00
2004-05	3962.00	820800.00	800.00	241350.00
2005-06	3218.00	643600.00	800.00	211350.00
2006-07	5694.00	1131617.00	1415.00	242690.00
2007-08	4084.24	748040.00	935.05	185450.00
2008-09	3706.95	798468.75	699.64	261982.00
2009-10	1756.48	498467.85	812.86	269182.00
2010-11	3614.99	980863.65	812.86	334242.19
2011-12	1654.49	1243871.00	417.64	417437.00
2012-13	2392.39	1744272.75	589.53	517423.00
2013-14	1987.38	1490518.50	403.62	584255.00
2014-15	3543.65	1877575.50	627.394	632840.00
2015-16	2603.18	1487550.00	487.05	491415.00
2016-17	2207.38	1655534.00	634.02	643018.00

Source: A Review of Bee Foraging Plants and Honey Collection from the Sundarbans by Asm Helal Siddiqui

Table 2 gives us data on honey collection from 1999 to 2017, highlighting key trends and reflecting variations influenced by environmental, economic, and policy-related factors. The highest honey production was recorded in 2006-07 (5,694 maunds), indicating a significant demand surge. But production saw declines in later years, such as 2011-12 (1,654 maunds) and 2016-17 (2,207 maunds). This could be due to stricter conservation efforts, environmental challenges, or reduced access for honey collectors to forest areas. The possible reasons for such setback may be represented as:

- Honey collection in the Bangladeshi Sundarbans often relies on traditional and less efficient methods. These methods might lead to excessive destruction of bee colonies, reducing the bee population over time and affecting long-term production
- The health of bees is closely tied to the state of their environment. Deforestation, reduced flowering plants, and pollution in the Sundarbans have led to a decline in the population of pollinators, including honeybees. With fewer bees to collect nectar, honey production has naturally declined.
- In Bangladesh, honey collection is regulated by a licensing system, but enforcement issues and unregulated harvesting often disrupt sustainable practices. This contrasts with India's relatively organized collection system, which incorporates sustainable beekeeping practices
- Prevalence of tiger attacks and other wildlife risks in the Bangladeshi Sundarbans can deter honey collectors and limit collection activities. This factor

is also present in India but is often managed more effectively through local support systems

The Model

To focus on the trade and export of each country (India and Bangladesh) with the rest of the world and how the GI tag for honey in India influences this, we can construct a model that evaluates the global market share of each country. Here, we will build on the idea of horizontal differentiation and the impact of the GI tag on market share and welfare for each country.

Key Assumptions and Framework:

1. India and Bangladesh both produce honey, but Indian honey benefits from a GI tag, which increases its perceived quality and allows it to command a higher price premium in international markets.
2. Each country exports honey to the rest of the world, with the demand for honey depending on price and quality.
3. Honey produced in India and Bangladesh is a differentiated product based on quality, with the GI tag increasing the perceived quality of Indian honey.
4. Trade is costless, but production costs may differ across countries.

Let us assume that the rest of the world consists of a representative consumer market that demands honey from both India and Bangladesh. The demand function for honey in the international market will depend on price and quality. Let us assume that the quality premium due to the GI tag is represented by α , where α is greater than 0. This parameter reflects the quality improvement for Indian honey relative to

Bangladeshi honey due to the GI tag. The demand curve for Indian honey will then incorporate this quality differentiation parameter.

For Indian honey, the demand function is: $QI = A \cdot Pi^{-\sigma} \cdot qi^{\epsilon}$

Where:

- QI is the quantity demanded of Indian honey,
- PI is the price of Indian honey,
- qI is the perceived quality of Indian honey,
- A is a scaling factor related to market size,
- σ is the price elasticity of demand, and
- ϵ is the quality elasticity of demand.

The demand function for Bangladeshi honey is: $QB = A \cdot Pb^{-\sigma} \cdot qb^{\epsilon}$

The parameters here possess the usual meaning as specified.

To account for the quality premium induced by the GI tag, we can modify the perceived quality qi as: $qi = \alpha \cdot qb$

Where:

- α is the quality premium parameter (i.e., the relative increase in quality for Indian honey due to the GI tag), and
- QB is the baseline quality of Bangladeshi honey.

Now, the demand function for Indian honey becomes:

$$QI = A \cdot Pi^{-\sigma} \cdot (\alpha \cdot qb)^{\epsilon}$$

This simplifies to: $QI = A \cdot Pi^{-\sigma} \cdot \alpha^{\epsilon} \cdot qb^{\epsilon}$

The term α^{ϵ} reflects the impact of the quality premium on demand. Since $\epsilon > 0$ (quality elasticity of demand), a higher α increases the quantity demanded for Indian honey at any given price.

We assume that Indian honey sells at a premium price due to the GI tag. So, the cost of Indian honey Pi is related to the price of Bangladeshi honey PB by a factor γ , where $\gamma > 1$: $Pi = \gamma \cdot Pb$

Substituting into the demand function for Indian honey: $QI = A \cdot (\gamma \cdot Pb)^{-\sigma} \cdot \alpha^{\epsilon} \cdot qb^{\epsilon}$

This simplifies to: $QI = A \cdot \gamma^{-\sigma} \cdot Pb^{-\sigma} \cdot \alpha^{\epsilon} \cdot qb^{\epsilon}$

Market Share Calculation

Now, let us calculate the market share of Indian and Bangladeshi honey in the global market. The market share for each country's honey is determined by the proportion of the total demand for honey that each country's exports capture.

The total demand for honey in the global market is the sum of the demands for Indian and Bangladeshi honey:

$$QT = QI + QB$$

Substituting the expressions for QI and QB:

$$QT = A \cdot \gamma^{-\sigma} \cdot Pb^{-\sigma} \cdot \alpha^{\epsilon} \cdot qb^{\epsilon} + A \cdot Pb^{-\sigma} \cdot qb^{\epsilon}$$

Now, the market share of Indian honey is:

$$QT = A \cdot Pb^{-\sigma} \cdot qb^{\epsilon} \cdot (\gamma^{-\sigma} \alpha^{\epsilon} + 1)$$

Market Share of India $\frac{QI}{QT}$

Substituting the expressions for QI and QT:

$$\frac{A \cdot \gamma^{-\sigma} \cdot Pb^{-\sigma} \cdot \alpha^{\epsilon} \cdot qb^{\epsilon}}{A \cdot Pb^{-\sigma} \cdot qb^{\epsilon} \cdot (\gamma^{-\sigma} \alpha^{\epsilon} + 1)}$$

Market Share of India = $\frac{\gamma^{-\sigma} \cdot \alpha^{\epsilon}}{\gamma^{-\sigma} \cdot \alpha^{\epsilon} + 1}$

Market Share of Bangladesh: $\frac{QB}{QT}$

Similarly, by substitution we get:

$$\frac{A \cdot Pb^{-\sigma} \cdot qb^{\epsilon}}{A \cdot Pb^{-\sigma} \cdot qb^{\epsilon} \cdot (\gamma^{-\sigma} \alpha^{\epsilon} + 1)}$$

By simplification we get = $\frac{1}{\gamma^{-\sigma} \cdot \alpha^{\epsilon} + 1}$

To understand how the change in quality parameter is affecting the market share mathematically, let us compute the derivative of the market share concerning α to see how it changes with α in case of India:

$$\frac{\partial}{\partial \alpha} \left(\frac{\gamma^{-\sigma} \cdot \alpha^{\epsilon}}{\gamma^{-\sigma} \cdot \alpha^{\epsilon} + 1} \right) = \frac{\gamma^{-\sigma} \cdot \epsilon \cdot \alpha^{\epsilon-1}}{(\gamma^{-\sigma} \cdot \alpha^{\epsilon} + 1)^2}$$

Since this is positive for $\alpha > 0$, we conclude that the market share of India increases as α increases.

The market share of Bangladesh honey is the complement of India's market share, as the total market share of both countries must sum to 1

Market Share of Bangladesh = 1 - Market Share of India

Substituting the formula for India's market share: $1 - \frac{\gamma^{-\sigma} \cdot \alpha^{\epsilon}}{\gamma^{-\sigma} \cdot \alpha^{\epsilon} + 1}$

Market Share of Bangladesh = $\frac{1}{\gamma^{-\sigma} \cdot \alpha^{\epsilon} + 1}$

Let us compute the derivative of Bangladesh's market share concerning α to show how it formally changes with an increase in α .

Taking the derivative of this concerning α :

$$\frac{\partial}{\partial \alpha} \left(\frac{1}{\gamma^{-\sigma} \cdot \alpha^{\epsilon} + 1} \right) = - \left(\frac{\gamma^{-\sigma} \cdot \epsilon \cdot \alpha^{\epsilon-1}}{(\gamma^{-\sigma} \cdot \alpha^{\epsilon} + 1)^2} \right)$$

Intuition

- When α increases, the quality of Indian honey improves, making Indian honey more attractive to consumers. This reduces the relative competitiveness of Bangladeshi honey in the global market.
- As a result, Bangladesh's market share diminishes as more consumers opt for the superior quality of Indian honey, causing competition between the two nations to favor India.
- As observed from the mathematical results, the overall market dynamics between India and Bangladesh may change due to the increased demand for higher-quality Indian honey, resulting in India gaining a giant share at the cost of Bangladesh.

Conclusion

This study highlights the predominant role of quality over price determination in determining the pattern of trade. The crucial influence of quality differentiation, represented by the parameter α , on shaping export demand from India and Bangladesh to global markets. The parameter α , which reflects the perceived quality advantage associated with a Geographic Indication (GI) tag, illustrates how improvements in quality can drive demand, irrespective of price-induced changes. It represents the fact that, how a country gains increased market share at the expense of the other. Elevated α values signify a stronger consumer preference for Indian honey, emphasizing the significance of quality differentiation in international trade. For the effect to work effectively, the consumers must also possess a strong inelastic demand for the product. It will ensure increasing demand despite rising prices. While the scaling factor A establishes the general economic factors like income and consumer preferences that affect the trade scenario, α functions as a multiplier

that enhances the effect of quality on export quantities. Our analysis shows that an increase in α notably shifts the demand curve for Indian honey, enabling it to secure a more substantial market share in global trade. The potentiality of Indian Sundarbans wild honey for its organic nature and unique medicinal value had made this an attractive product for regional entrepreneurs both from governmental organizations like West Bengal Forest Development Corporation Limited (W.B.F.D.C.L) under the brand name 'Mouban', Sundarban Co-operative Milk and Livestock Producers' Union Limited under the brand name 'Sundarini Wild Honey' and Joint Forest Management Committee (JFMC) led Sundarban Banaraksha Bahumukhi Samabay Samiti (SBBSS) under brand name 'Bonophool' honey etc.

From a policy perspective, these insights highlight the importance of improving product quality (raising α) and ensuring favorable market conditions (high A) to maximize export performance. The results provide a strong case for investing in quality enhancements like GI certification while expanding market access and consumer awareness. Future research could explore how such GI certification is affecting other livelihood measures of Sundarbans. We can also further analyze how the market situation can alter in response to protective practices taken by the opponent.

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