CEE
Centre for Environment Education

Towards Green and Socially-Sound Recovery
in Rural and Farm Sector

# CASE STUDY OF HONEY BEEKEEPING IN MADARNA VILLAGE IN DIST. VAISHALI, BIHAR

Photo: Subodh Kumar

## ABOUT US

Centre for Environment Education (CEE) was established in 1984 as a Centre of Excellence of the Ministry of Environment and Forests, Government of India. As a national institution, CEE's mandate is to promote environmental awareness nationwide.

CEE develops innovative programmes and educational material and builds capacity in the field of Education for Sustainable Development (ESD). It is committed to ensuring that Environmental Education (EE) leads to action for sustainable development. It undertakes field projects that demonstrate and validate the role education can play in sustainable development.

With partners including State Governments, Foundations and Corporates through CSR funding, CEE has undertaken projects in rural and urban development, waste management, biodiversity conservation, quality improvement in school education, marine conservation and others. Working with the government, CEE has made significant contributions to international negotiations in the area of ESD.

## ACKNOWLEDGMENTS

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## INTRODUCTION

Honey has been used since prehistoric times as a natural sweetener. With rising awareness of the health benefits of honey and health consciousness among people across the world, honey has gained further importance in recent times. Its use is not limited to food for human consumption. Honey products such as beeswax, bee venom, propolis, royal jelly and pollen are in high demand as they are also used in the cosmetics and pharmaceutical industries. Honey also fetches substantial earnings from exports due to the high demand at the global level.

Bihar is among the key honey-producing states in India, producing approximately 4,000 MT of honey each year, which is about 3 per cent of the total honey production in the country (Directorate of Horticulture, 2021). A large section of Bihar's rural population is engaged in the collection of honey from litchi and mango orchards and farmlands. Raw honey has a market price of Rs. 120-135 per kg while processed honey has a market price ranging from Rs. 300-375 per kg in the market. Since there are no modern honey-processing facilities in Bihar, beekeepers in the state miss the opportunity to earn higher prices and additional incomes from the processing of honey. In the absence of these facilities, they outsource honey-processing functions to facilities in other states or sell raw honey at lower prices.

The Bihar Government launched the Bihar Agriculture Investment Promotion Policy 2020 (BA-IPP 2020). The policy identifies honey as one of the core sectors (among six others in agriculture) and aims to create an ecosystem for developing and creating enterprises across honey-processing and value-addition activities. The policy seeks to capitalize on the surplus production of honey and the potential of increasing the level of processing, value-addition, employment generation, creating self-reliance and promoting the growth of the honey sector (Directorate of Horticulture, 2021).

Centre for Environment Education conducted a study in 2021 to assess the impacts of COVID-19 on the honey sector and to understand the value chain. The aim was to assess the possibilities of green and socially-sound recovery strategies.

## STUDY APPROACH

The study was conducted as a rapid assessment of honey beekeepers in the Madarna village of the Vaishali district of Bihar. The impact of climate change on honey bee population, harvesting and collection practices, and the honey value chain was studied using in-depth interviews of various stakeholders and a mapping exercise.

Photo: Subodh Kumar

## STUDY AREA

Madarna village is located in the Vaishali subdivision of Vaishali district, Bihar. It is 6 km from the subdistrict headquarter Vaishali (tehsildar office) and 22 kms from the district headquarter Hajipur. Madarna is the gram panchayat of Madarna village, which is spread over 483 hectares. Madarna has a population of 7,973 of which males are 4,277 and females are 3,696. The literacy rate is 62.16 per cent, of which 69.21 per cent are males and 54 per cent are females. Madarna has 1,425 houses (Registrar General of India, 2011). Lalganj, about 9 km away, is the nearest town for all major economic activities.


## SECTOR OVERVIEW

India has a share of 3.5 per cent in global honey production, which is worth Rs. 15,579 million in 2018 with a compound annual growth rate (CAGR) of 10.9 per cent during the period 2012 to 2018. The honey market is projected to reach a value of Rs. 28,057 million at a CAGR of 10.2 per cent in next five years. Bihar is among the top five states in bee farming. Kerala, Tamil Nadu, West Bengal, Odisha, Himachal Pradesh, Kashmir, Punjab, Meghalaya, Andaman and Nicobar Islands are the other states and union territories in which beekeeping is an important economic activity. There are two techniques of honey extraction:

1. **Wild honey extraction**

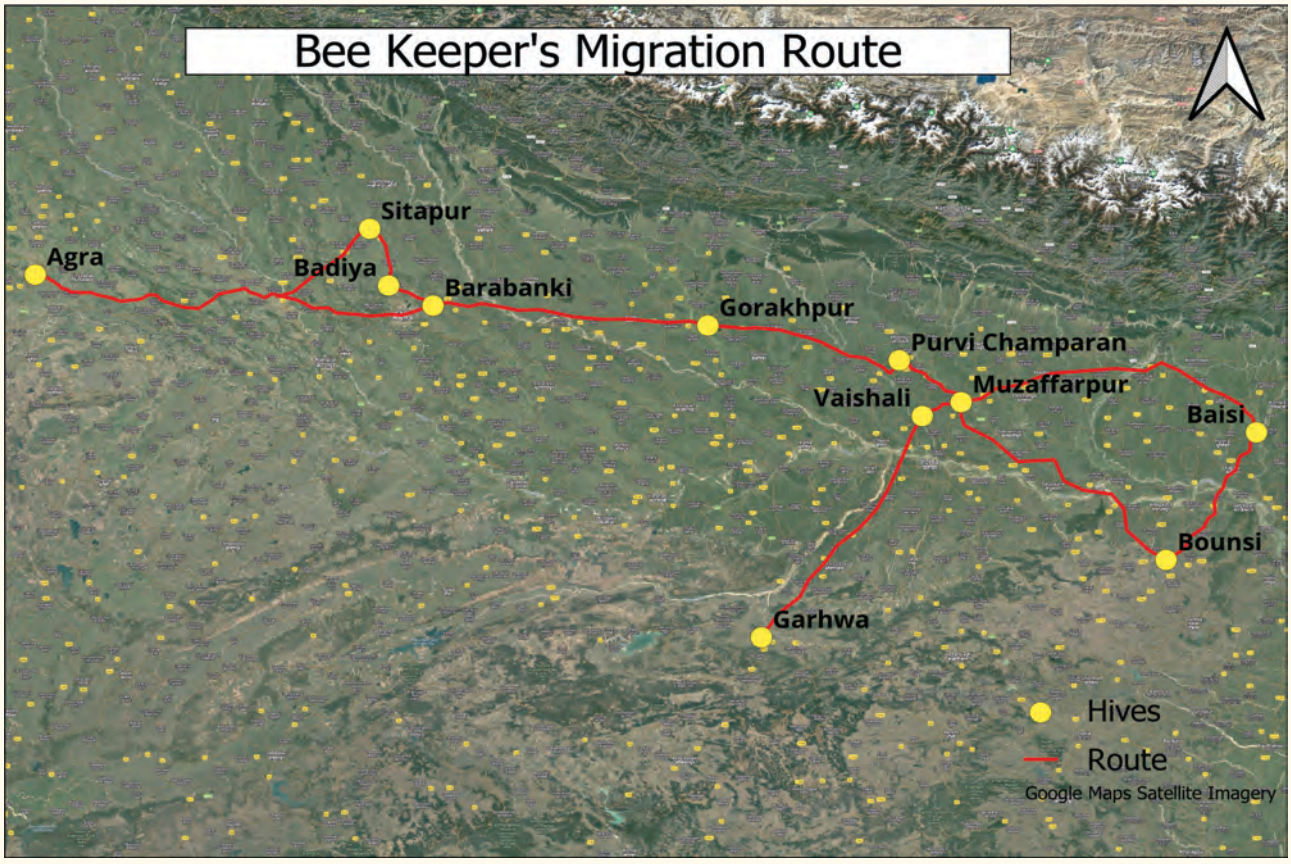
   In this technique, people extract honey from honey combs on jungle trees, clay houses, wooden logs, the hollows of tree stems or the cracks of walls and mountain caves. The chopped *chhattas* are either squeezed or boiled on fire to obtain honey which is then filtered using a clean cloth. By following this method, only muddy and unclean honey is obtained, which is saleable at a lower rate in the local market.

2. **Bee keeping**

   In this technique, bees are maintained in wooden containments. Bee rearing in a wooden box is beneficial because it does not harm the bee eggs and honey can be easily taken out from the boxes.

## HONEY PRODUCTION IN BIHAR

The main regions in which beekeeping is done are the districts of Muzaffarpur, Vaishali, Sitamarhi, Champaran, Madhepura, Katihar and Begusarai. Bihar is the only state producing litchi honey on a commercial scale. Bihar has been endowed with three to four honey flowering seasons that allows bees to produce a variety of honey which are litchi, mango, guava and mustard. Beekeeping with the *Apis Mellifera* species has been popularized in Bihar. The total potential of the state of Bihar is around 20,000 MT per annum and this sector can provide employment to more than 50 thousand people directly or indirectly (Directorate of Horticulture, 2021). Honey producers of Bihar migrate within the state and to other states for honey production, following the route of flowerings of different horticulture and field crops that are sources of nectar for bees. Their route of migration is illustrated in the map ahead:




## Apiculture sites along migration route and month of migration

| Sr. No. | Location | Month of Migration | Description |
|---|---|---|---|
| 1 | Purnia and Banka districts, Bihar<br>Barabanki, Sitapur, Agra, Gorakhpur, Badayun districts in Uttar Pradesh | Nov- Feb | In November, some farmers take bee boxes to Vayasi Block in the Purnia district of Bihar and keep their boxes there until January. After 14th January, most beekeepers take their boxes to mustard fields and eucalyptus plantations in different districts in UP, while some travel to Baunsi Block in the Banka district in the Bihar. |
| 2 | Muzaffarpur, Vaishali and East Champaran in Bihar | Feb-Mar | Bee boxes are taken to litchi plantations during the litchi flowering season. Flavoured Litchi Honey is produced in this period. Honey produced in this season is considered high grade due to the litchi flavour. |
| 3 | Karanj areas of Bihar and Jharkhand | Apr- Jun | From April to June, 20 per cent of the beekeepers take their boxes to the Karanj area of Bihar and Jharkhand. A site is selected where there are less Taad trees of the Arecaceae family. |
| 4 | Garhwa district of Jharkhand | Aug | In August, some beekeepers take their boxes to the Garhwa district of Jharkhand. |
| 5 | Rear at home town/village for colony expansion | Apr-Oct | 80 per cent of Bihar's beekeepers keep their bee boxes near their houses for colony expansion from April to October. Since there is no suitable flowering season from April to October, beekeepers halt the honey production and feed the bees with sugar syrup. |

A bee keepers group at their winter camping site in Bihar Photo: Subodh Kumar

The table below indicates the months of specific types of nectar collected by bees during the year in different locations.

| Flora | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mustard | √ | | | | | | | | | | √ | √ |
| Mango | | √ | √ | √ | | | | | | | | |
| Litchi | | | √ | √ | | | | | | | | |
| Karanj | | | | √ | √ | | | | | | | |
| Guava | | | | √ | √ | | | √ | √ | √ | | |
| Pineapple | | | | √ | √ | √ | | | | | | |

## Beekeeping in Madarna/Gopinathpur

Bee farming for honey production is done by the most deprived section of the community, mostly women and landless farmers. Beekeepers are mainly from the *Kurmi* and *Kushwaha* communities who are designated as Backward Castes by the Government of India and as Economically Backward Classes by the Government of Bihar. They are small and marginal farming communities with less than one acre of irrigated cultivable land. These communities involved in honey collection have small land holdings and their livelihood largely depends on subsistence type of agriculture and daily wages. Due to the uncertainties and risks associated with the beekeeping business, they do not want to involve their next generation in this business.

In 2021, the average bee colony holding was 100

hives per beekeeper. Honey production is limited to a few months of the year, using mainly the pollen from litchi blossoms, and some from *Karanj* flowers. The best honey production time in Bihar is from October to March. The beekeepers usually migrate during different seasons to different areas within state and outside state. Honey production is decreasing due to intensive use of pesticides and monoculture practices in agriculture, seasonal variations and extreme weather conditions, scarce water resources, and decreasing floral species and forest cover. Honey collectors are unaware of scientific harvesting practices and hygienic aspects of harvesting. Due to lack of quality testing laboratory facilities and grading systems, honey beekeepers are usually exploited by the traders.

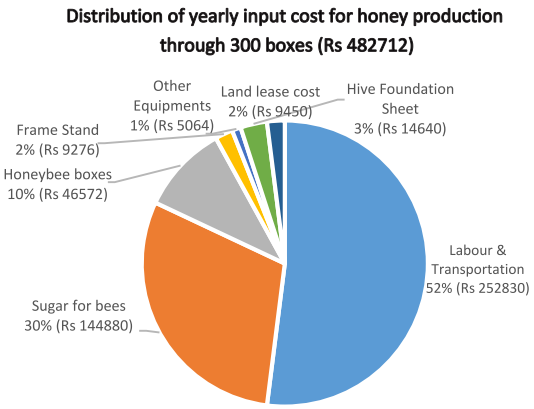
Due to lack of processing units at accessible locations, honey beekeepers sell their produce to aggregators at very low prices. The distance of honey production sites from honey processing units is far which limits the possibility of producers selling their honey directly to processing units. Beekeepers have to store and transport the raw honey if they do not sell it directly to processors. Beekeepers typically do not have the time and capacity to store and transport large quantities of honey along with them to various locations. They would also need to pay the applicable Goods and Service Tax (GST) as per government norms. Therefore, middlemen take the benefit of the situation and buy honey at cheap aggregated prices and sell it to the processing units.

### Honey selling points for beekeepers

| Selling Location | Honey Variety | Selling Months | Quantity (tonnes) |
|---|---|---|---|
| Garhwa, Jharkhand | Honey of Van Tulsi | October | 6 - 10 |
| Sarguja, Chhattisgarh | Sarguja Honey | November-December | 6 - 10 |
| Barabanki and Sitapur, Uttar Pradesh | Mustard and Eucalyptus Honey | December-February | 30 - 50 |
| Muzaffarpur, Bihar | Litchi Honey | February-March | 12 - 15 |

## Economics of honey production

The total annual average cost of a honey beekeeping setup of 300 boxes owned by one honey producer is approximately Rs. 4.8 lakhs. The major proportion of the expenditure i.e. about 52 per cent is for labour for installation, transportation and production of honey. The other major expenditure of about 30 per cent is on sugar required to feed honeybees. The purchase cost of honey bee boxes has a 9.6 per cent share.



Average annual cost incurred on labour and transportation includes the cost of labour for transportation and installation of honey bee boxes at different locations and the labourers' help in the honey production process. The equipment cost includes the cost of the honey extraction machine, weighing machine, unpacking tray, knife and brush and other small equipment.

Beekeepers harvest honey in the months of February, March, November and December. They harvest honey minimum 3 times in each month. The quantity may differ from beekeeper to beekeeper. They harvest anywhere from 1,000 kg to 4,200 kg of high grade honey in four months depending upon the size of their colony.

The gradation is based on the flowering months in which honey is collected. It is believed that the honey produced during the flowering of litchi is high grade honey. Likewise tulsi honey, produced from the pollen of tulsi flowers, is also valued higher.

A substantial amount of honey produced in Bihar is consumed locally and some part of it is sold outside the state. Availability of honey is seasonal in Bihar. Middlemen buy raw honey from beekeepers and sell it to processing units for processing or directly to the honey producer companies. The middlemen buy honey from producers at very low rates of Rs. 120-135 and they sell it to others at higher rates. During the COVID-19 pandemic-induced lockdown, beekeepers incurred loss due to unavailability of transportation and labour. As markets were closed and demand was less, they could not sell honey. The nature of this livelihood is migratory and as the movement of vehicles was halted during the COVID-19 pandemic, the beekeepers could not produce honey.

At the study sites, the honey producers' networks or associations have not been formed yet. There are several government schemes and policies related to agricultural commodities and honey production, but the adoption of these schemes by the honey producers interviewed seems to be quite limited.

Annual net profit of beekeepers from setup of 300 honey bee boxes

| Heads | Rupees |
|---|---|
| Average price received by bee-keepers @120Rs/kg X 20.525kg / box (raw honey) X 300 boxes | 739040 |
| Yearly total expenditure (average fixed cost + annual recurring cost) | 482712 |
| Net profit of farmer (average sale price of honey – total expenditure) | 256328 |

## CONSTRAINTS IN HONEY PRODUCTION

1. **Supportive infrastructure of vocational training and technical advancement**

   The supportive infrastructure of vocational training and technical advancement is lacking due to unawareness of various schemes. There should be beekeeping inspectors or trainers at the village and district levels. Beekeeping by its nature has seasonal crises of disease management. The beekeeping inspectors can track the outbreak of diseases. An upward integrated system of beekeeping experts and trainers in the villages, blocks, districts and in the universities can effectively provide ground level feedback and need based management support.

2. **Poor quality control for production of honey**

   This is a very important aspect of beekeeping and needs to be stressed upon. Some beekeepers extract honey from brood frames by damaging the brood and the honey extracted is of poor quality. All beekeepers do not maintain separate super chambers for the production of honey. Many beekeepers do not use queen excluders. The queen lays her eggs in the honey chamber thereby lowering the honey quality. Honey only develops the flavour which is particular to each flower source if it is allowed to stay in the hive a little longer after the bees seal the frames. However, some beekeepers do not use this technique.

3. **Disease prevention control and Analysis**

   This is the major constraint for the development of beekeeping in India. Regional and central bee disease analysis laboratories are needed to be established to conduct research and support the beekeepers with disease management.

4. **Financial assistance**

   As per the opinion of beekeepers, there is lack of financial assistance from government and lending institutions. Beekeeping requires long term loans at flexible rates of interest. The bee colony produces honey only after a buffer period of one year and only during specific seasons. Beekeepers need loans at lower interest during these periods.

## GHG EMISSION OF HONEY PRODUCTION

This study has revealed that transportation of honey in Bihar is completely based on diesel-operated vehicles. The beekeepers in Bihar travel a total distance of 2,061 km and the emission per vehicle for a medium duty vehicle of 12 tonnes capacity is 1,221.8 kg $CO_2$. Apart from this, a substantial amount of inputs is also required such as sugar and jaggery, which are being given to the bees during their lean period. The processing unit consumes electricity or diesel. The transportation of honey by the middlemen and bottling plants of companies also require electricity which emits GHG gases.

GHG emissions from migration of beekeepers in states of Bihar, Jharkhand and Uttar Pradesh

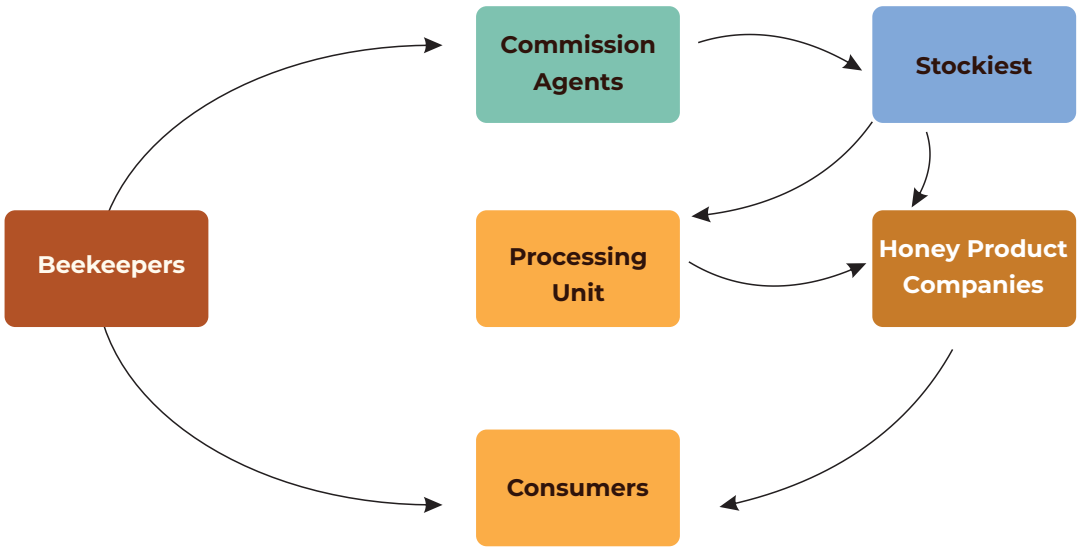
| Origin | Destination | Distance (km) | GHG emission per vehicle @ emission factor of 0.5928 kg $CO_2e$ per km[1] (kg $CO_2e$) |
|---|---|---|---|
| Garhwa | Vaishali | 287 | 170.1 |
| Vaishali | Bounsi | 305 | 180.8 |
| Bounsi | Baisi | 166 | 98.4 |
| Baisi | Muzaffarpur | 307 | 182.0 |
| Muzaffarpur | PurviChamparan | 72 | 42.7 |
| PurviChamparan | Gorakhapur | 187 | 110.9 |
| Gorakhpur | Barabanki | 242 | 143.5 |
| Barabanki | Badiya | 63 | 37.3 |
| Badiya | Sitapur | 74 | 43.9 |
| Sitapur | Agra | 358 | 212.2 |
| | **Total** | **2061** | **1221.8** |

[1]emission factor of 0.5928 kg $CO_2$ per km

# VALUE CHAIN MAPPING AND STAKEHOLDERS INVOLVED IN HONEY VALUE CHAIN

The honey value chain includes input suppliers, beekeepers/ honey producers, commission agents/ middlemen, processors, bottling units, honey goods-producing companies, retailers and consumers. The value chain has been mapped by conducting mapping exercises with the producers. This study has revealed that beekeepers sell their raw honey to middlemen as per the grading of honey. The buyers buy honey directly at locations of beekeeping colonies at the wholesale rate of Rs. 120 per kg. The rate is usually pre-decided by the buyers and varies as per the quality of the honey. Often, buyers directly sell honey to processing units nearby or to the honey manufacturing companies. During this study beekeepers did not disclose their net income. They said they did not attempt to calculate it.

There are two main supply chains of honey which are commission agents/ middlemen, processing units, honey goods-producing companies, consumers and direct from producers to consumer channels. Most of the time, beekeepers sell their produce to traders who come to their locations to buy honey.




**Functionaries in the supply chain**
**beekeepers/ honey producers**

Beekeepers are the main producers and they are from different socio-economic backgrounds. They generally purchase the necessary inputs like bee boxes, honey extraction machine, frame stand, hive foundation sheet etc. from different vendors. The collectivization of beekeepers does not exist in the village. Therefore, all the producers buy inputs individually from the market.

**Commission agents/middlemen**

After the harvest of honey, the commission agents/middlemen buy honey from beekeepers and sell it to processing units or directly to the honey goods-producing companies. Commission agents also sell their produce to distant markets both within Bihar and outside Bihar to other states as per demand of honey quantity and quality by the companies.

**Processing unit**

Honey collected from beekeepers are tested and fed into the honey processing plant. The plant removes excess moisture and wax in Honey to yield thick honey. The processed honey is immediately bottled in clean bottles. Bottles are wiped dry and labelled. Filled, sealed & labelled bottles are then packed in labelled cardboard boxes.

## RECOMMENDATIONS

1. The government afforestation programmes should give preference to key local flowering trees beneficial for honey production with backward integration at the nursery level.
2. Honey production depends significantly on orchards such as litchi-based horticulture plantations. The government should promote beekeeping along with orchard plantation by managing plant protection practices through safer, integrated pest management.
3. There is a need for effective communication to overcome the misconceptions and myths about honey beekeeping being harmful to crops among the farmers in the migration region.
4. Availability of processing units, near production sites and migratory routes can reduce the cost of processed honey production and enhance the incomes of honey beekeepers.
5. There is a need to establish a network of accredited honey testing laboratories in the state, existing Higher Education & Research Institutions can take a leading role towards this.
6. Collectivization of beekeepers is important because currently they are doing business individually due to which their input cost is higher and they do not possess bargaining power in the market. Collectivization can help in breaking the chain of middlemen and also towards value-added product development and direct marketing gradually, with support for capacity building.
7. A special beekeeping-focused insurance scheme can help reduce the losses in case of low production, bee deaths and other damages during the harvest and transportation stages.
8. The greening of transportation required for beekeeping is an important aspect of the greening of the honey value chain. The present diesel-based transportation can be replaced with e-vehicles or CNG-based vehicles by assisting beekeepers to purchase these vehicles.

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Photo: Neeraj Pal

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