Environment. Technology. Resources. Rezekne, Latvia
Proceedings of the 15th International Scientific and Practical Conference. Volume I, 182-188

Characteristics of the Beekeeping industry in the Latvia

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Abstract. **The activities offered by beekeeping (bee products, api-therapy, beehive air, bee museums, production activities, historical beekeeping activities, pictures, and others) are aimed at attracting beekeepers and people who want to earn and increase national income. The purpose of the study: to investigate the possibilities of using the beekeeping industry in the national economy of Latvia. Research object: Latvian agricultural sector - Beekeeping. Within the framework of the research, the literature of different countries related to beekeeping, data collection, processing, survey and observation, processing and description of the obtained data were studied. The beekeeping industry could play an important role in promoting the development of the national economy, because the export of honey in Latvia is already much higher than the import, which can be evaluated positively from an economic point of view, honey and beekeeping by-products are in demand. However, in order to achieve the set goal, it is important to involve the government and local governments, promoting the development of beekeeping in the regions, helping with realization opportunities. Utilizing the available potential requires high-level professionals, modernization of equipment and greater protection of the environment from pollution, all of which can be realized if the government increases informational and financial support for the beekeeping industry, because in the long term it would contribute to the economic growth of the country.**

Keywords: Agritourism, Api-tourism, Beekeeping, Enviroment, Honey.

I. INTRODUCTION

One of the objectives of European environmental policy is to encourage all types of companies to reduce their harmful effects on the environment [1]. Agricultural economics are linked to markets, agri-food industries, consumption and agricultural policy [2]. In today's world, when the demand for natural living conditions and natural products is growing, the interest in beekeeping, including api-tourism, is also growing. Thus, you can evaluate the development of beekeeping in the past by developing tourism, while simultaneously presenting the natural beauty, traditions, and cultural accumulations of your country, preserving them in a healthy way [3]. The interconnection of agriculture and tourism gives impulse to both sectors of the economy [4]. The beautiful natural landscapes, which can be seen more directly in the counties than in the cities, speak in favor of supporting the regions, especially this can be attributed to Latgale [5]. Bees are in the closest contact with their surroundings. Depletion of the soil by switching to a monoculture, treatment with herbicides, leveling of slopes, clearing bushes, plowing of meadows and floodplains, expansion of cities has a strong impact on the life of bees, changing the conditions of its existence [6]. Despite the fact that the world is talking about the need for environmental protection measures, people themselves are also destroying it. Beekeeping is an industry that can and should be developed, however, environmental pollution and destruction of the natural environment can hinder it.

Print ISSN 1691-5402
Online ISSN 2256-070X
https://doi.org/10.17770/etr2024vol1.7990
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Interest in the development of bee products and their medicinal, health, nutritional and beauty benefits has increased, but little attention has been paid to the crucial role of beekeeping in maintaining ecological balance [7]. Humans and honey bees have a long history of association [8], as shown by the history of beekeeping.

Beekeeping is one of the oldest animal husbandry industries in the world. As early as 50,000 BCE (Before Common Era), hominids were able to collect honey with a stick in order to steal the honey by tearing open the nests of wild bees [8], but in the Neolithic, primitive people also ate honey from wild beehives. This is confirmed by the rock painting preserved in Valencia, Spain, which depicts people extracting honey [9]. Stealing honey from wild bees is the oldest documented interaction with bees. Rock paintings in Spain depict honey hunters suspended from rope ladders as they harvest the honeycomb. These paintings are believed to date back 7,000 to 8,000 years, but are not the earliest evidence of the bee product usage [8]. Bees were mentioned in the Pyramid texts and the ancient Egyptian Mythology [10], Drawings related to beekeeping have been found in cave paintings dating from about 10,000 BCE [3]. The domestication of bees is shown in Egyptian art about 4,500 years ago [11]. The first depictions of beekeeping can be found in Egypt the Solar Temple of king Nyuserra of the fifth dynasty at Abu Ghorab, north of Abusir [8], [10]. The ancient Egyptians, Romans and Greeks believed that the life of bees has a slave-holding system, but as early as 1950 it was suggested that the bee colony is similar to a single organism [6]. The fact that beekeeping was cultivated already in prehistoric times and still plays a significant role in the development of the national economy, shows its importance and the need not only to preserve it, but also to promote its development.

The nobles were honored with a honey drink by order of Princess Olga (Princess of Kiev from 945 to 964) [3]. Charlemagne (Charles the Great 747–814) ordered all manors to keep bees and give two-thirds of the honey produced to the crown [8]. Bee products were also respected among the nobles and were considered an exclusive product.

The European honey bee, *Apis mellifera* L., is considered more productive, so pilgrims took the first bees to North America in the 1600s [9]. In England, the honey bee (*Apis mellifora*) was described in the 17th century, and in the United States of America - in the 18th-19th centuries [12]. 16th century historical accounts indicated that the northern limit of beekeeping was Denmark, where natural conditions might be too harsh for bees to thrive [11]. The honey bee was introduced to Alaska in 1809 [12]. In addition to honey, honey wine and honey vinegar have also been found in the human food chain of the relevant historical period. [3]. History also confirms that Europe has a suitable environment for beekeeping.

Beekeeping flourished during the European Middle Ages as the demand for honey and beeswax for trade increased [8]. In the Middle Ages, beeswax was used as currency, used in writing, painting, sculpture and lighting, as well as protecting works of art [9], already in the Middle Ages, people were aware of the various possibilities of using honey and wax.

In the Middle Ages, forest beekeeping flourished in the forests of Eastern Europe, especially in the territory of present-day Poland, Ukraine, Russia, Latvia, Estonia, Lithuania and Germany [8]. where Forest beekeeping evolved as honey hunting, searching for wild nests in natural tree hollows. Honey hunters began enlarging tree hollows to encourage the growth of colonies of wild bees they found, and this eventually led to artificial hollows being cut in trees in hopes of attracting a colony, a practice that formed the basis of true beekeeping in Eastern Europe. When the hollow was completed, the opening was closed with a board fitted with a small entrance hole and marked to show ownership. To protect them from looting by bears and humans, the hives were placed 5-25m high, and if the tree was large enough, the beekeeper could cut two or even three hives in one tree, essentially creating a tree apiary. Several species of wood were used for these wooden hives, but many beekeepers preferred oaks and pines [8]. Interest in beekeeping has increased in Latvia in recent years. In addition, beekeeping opens up wide range of opportunities to work, which contributes to employment, entrepreneurship and the development of the national economy in general.

There are three categories of beekeepers in Latvia, as elsewhere in the world [13] (Fig.2):

- The first are professional beekeepers, for whom beekeeping is the main source of income.
- The second, beekeeping provides additional income. The main occupation in that case is agriculture, crafts, pond farming, sawmills, etc. This also includes farms where bees are needed to pollinate field crops (primarily clover) and gardens.
- For the third, beekeeping is a hobby, it gives the house a special atmosphere, the song of bees, stings to strengthen health and, of course, also honey for themselves and their loved ones.

Looking at the categories of beekeepers, it can be concluded that practically any interested person who has the desire and the means can become a beekeeper, it just depends on what the main goal is - making a profit, expanding economic activity or for a hobby.

The purpose of the study: to investigate the possibilities of using the beekeeping industry in the national economy of Latvia.

II. Materials and Methods

Research object: Latvian agricultural sector - Beekeeping.

Research methodology:

- General scientific research methods (scientific induction method, graphic method, monographic or descriptive method).
- Sociological research methods (survey, observation).
- Statistical research methods (statistical grouping or descriptive statistics, sampling method).

Within the framework of the research, the literature of different countries related to beekeeping, data collection, processing, survey and observation, processing and description of the obtained data were studied.

III. Results and Discussion

The activities offered by beekeeping (bee products, apitherapy, beehive air, bee museums, production activities, historical beekeeping activities, pictures, and others) are aimed at attracting beekeepers and people who want to earn and increase national income [3]. During the last half-century beekeeping, as one of the agricultural industries in the world, increased globally by nearly 45% [14]-[15]. The importance of honey and beekeeping by-products is increasing day by day [3]. The study revealed that the beekeeping industry has far-reaching opportunities for further development, as there is a demand for honey and its by-products.

There are different kinds of honey. There can be monofloral (with specific sensory, physical and chemical characteristics) and multifloral; also honeydew honey, called forest honey [9]. The honey obtained in Latvia is polyflor, which contains a wide spectrum of biologically active substances [16]. Bees can also collect the so-called honeydew honey, which is a sweet liquid of plant origin that is exuded through the leaves, branches, or stems of plants [6]. Beekeepers in Latvia offer consumers a wide range of honey types (Fig. 1).

Bee colonies of various subspecies of Western honey bees (Apis mellifera L.) are used in beekeeping in Latvia [17]. The local honey bee in Latvia (*Apis mellifera mellifera* L.) or European (Western European) dark bee appeared 8000 years ago [18]. In the northern regions, also in Latvia, during the short flowering period of nectar plants, the nectar is more concentrated and richer in biologically active substances than in the southern regions [17]. Honey contains antioxidants, which are higher in bee honey than in bumblebee honey [19]. To increase antioxidant activity honey is added to food and beverages [3]. The most available honey in Latvia is from various flowers, however the nectar of a particular plant is becoming more and more popular [20]. The wishes and needs of consumers are growing, as a result beekeepers must regularly expand the range of offered products.

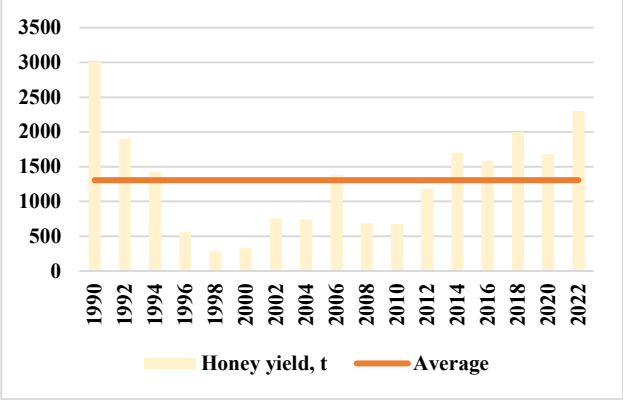

Fig.1. Honey production in Latvia 1990 - 2022, in tons [21].

In Latvia, the export of honey exceeds the import (Fig. 4). This means that Latvian honey is in demand worldwide, because it is of high quality and cheap. This indicates that in Latvia honey is sold below the cost price level. 39% of beekeepers do beekeeping at the hobby level (Fig. 2), and they distort the local honey market by selling honey below cost price [33]. However, this trend needs to be changed and the focus should be on increasing the beekeeping production of the country in the domestic market, defending the development of beekeeping [22]. Researchers [23] have pointed out that cross-border transport corridors are important for the development of beekeeping, to provide easy access to foreign markets, to showcase an area with a rich history and centuries-old traditions, crafts, festivals, culture, etc., including beekeeping. Latvia does not have traditionally developed beekeeping regions [24], the creation of which would significantly improve the honey sales possibilities.

Latvian statistics portal [25] shows the grouping of farms by the number of bee colonies (Fig. 2), where it can be seen that beekeeping in Latvia is more of a hobby, as less than 3,000 farms have 2-3 bee colonies. In 2021, there were almost 3.4 thousand beekeeping farms in Latvia with more than 100 thousand registered bee colonies [26]. In 2022, 3,496 beekeepers with 105,491 bee colonies were registered. Compared to 2021, no significant changes have taken place [27]. Despite the fact that for a large number of beekeepers, beekeeping is more of a hobby than a source of profit, income, there are still many beekeepers who are actively working in this industry to be able to provide demand for local consumers and for export. From an economic point of view, the large number of beekeepers for whom beekeeping is a hobby is a kind of market distortion, because they offer their products cheaper, which can be explained by the fact that making a profit is not their primary concern, as a result, it affects other beekeepers as well.

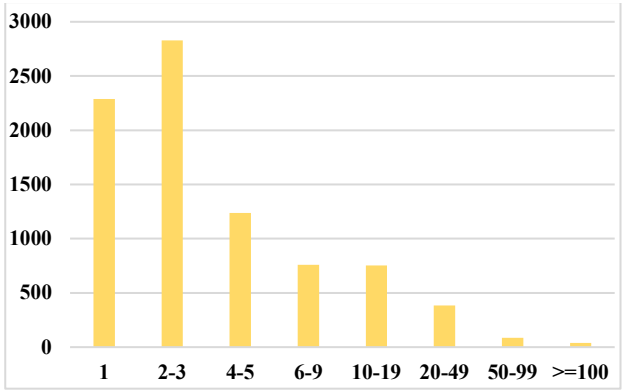

Fig. 2. Grouping of farms according to the number of bee colonies in 2001, number [25].

In Latvia (2018-2021), the average price of honey decreased (Fig. 3). Most of the honey produced is sold in direct sales and wholesale [16], part of the production is also exported (Fig.4).

The products produced in beekeeping are honey, pollen, bee bread, propolis, beeswax and royal jelly, as well as bee queens and bee colonies, which are sold to meet the industry's internal needs. In Latvia, beekeepers collect honey of various flowers, linden flower honey, buckwheat honey, rapeseed honey, heather and other types of honey from bee colonies [6], [27]. Various types of produced honey (Table 1) are commercially available, such as spread

honey, cellular honey, creamed honey, pressed honey and other types [27]. In Latvia, consumers are offered a wide range of types of honey, including various honey by-products.

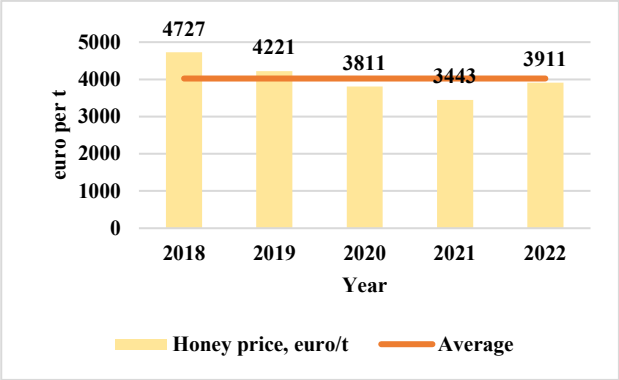

Fig. 3. Honey price in Latvia 2018 - 2021, euro per 1 ton [16] - [17], [27].

The average price of honey export in 2022 compared to 2020 has increased by 22%, and the average price of import – by 42%. [27]. The price of honey is influenced by both the geographical position of the country or region where the honey is collected, as well as the botanical origin of the honey, that is, the purity of the pollen collection. These parameters increase the value of the product and give it a specific aroma and taste, as well as have special medicinal properties [9]. It can be seen that the price of honey in Latvia is decreasing every year (Fig.3), which can be explained by the large number of beekeepers for whom beekeeping is more of a hobby, however, it is positive that the export price of honey is increasing, which indicates stability and growth in the wider market.

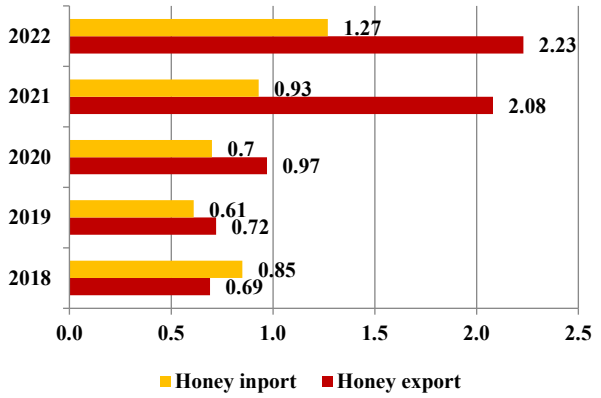

Fig.4. Export and import of honey in Latvia (2018-2021), million euros [16]-[17], [27].

One of the biggest problems in beekeeping is the identification of honey adulteration (Table 1). Because of this, beekeepers suffer both economic losses and consumer confidence [9]. This is a problem that is being fought at a global level.

TABLE 1 QUALITY INDICATORS OF DIFFERENT HONEYS FOR DETERMINING THE NATURAL ORIGIN AND QUALITY OF HONEY [9], [28]-[29]

Quality indicator	**The type of honey origin**	
	Flower honey	***Exudation-honeydew honey, exudation-honeydew and flower honey mixture***
Sugar content*	No less than 60 g/100 g	No less than 45 g/100 g
Water content	No more than 20 %**	No more than 20 %**
Electrical conductivity***	No less than 0,8 mS/cm	No less than 0,8 mS/cm
Free acid ****	No more than 50 milliequivalents of acid per 1000 grams	No more than 50 milliequivalents of acid per 1000 grams
Diastasis number *****	No less than 8	No less than 8
HMF ****** (Hydroxymethylfurfural content)	No more than 40 mg/kg	No more than 40 mg/kg

* Fructose and glucose content (total)

** The amount of water in excess of what is indicated contributes to the fermentation of honey

*** It is determined by the concentration of minerals in the honey. High electrical conductivity indicates that the honey should be considered as honeydew honey

****They play an important role in creating the aroma and taste of honey

***** According to the Schade scale. Diastase is one of the honey enzymes that bees add to the nectar during the honey-making process. The diastasis number is low if the bees have been fed sugar syrup, the honey has been overheated or stored for a long time

****** HMF is a thermal breakdown product of sugars. The amount of HMF is an indicator of the freshness and naturalness of the honey. A high HMF content indicates honey that has been heated at high temperatures or stored for a long time

Beekeeping faces several problems that affect the quality and quantity of honey produced [9]:

- One of the reasons in developing countries is the lack of qualified beekeepers, sufficient training in modern beekeeping techniques
- Availability of suitable equipment which is too expensive.
- In developed countries, damage to bees is caused by intensive agriculture, such as excessive use of pesticides.

In summary, it can be concluded that the beekeeping industry has high development potential, but to be able to use all available potential, high-level professionals, modern equipment and greater environmental protection from pollution are needed, all of which can be realized if the government increases support for the beekeeping industry, as well as informative, and financial, because in the long term it would contribute to the economic growth of the country.

The geographical position of Latvia is favorable for obtaining high-quality honey. Temperate mixed-tree

forests, interspersed with wide swales, natural and floodplain meadows, scrub, bogs and heaths, are excellent habitats for nectar plants [27]. The diversity of nectar plants and its quality is the main prerequisite for the quality of collected honey. In addition, in the northern regions, including in Latvia, during the short flowering period of nectar plants, the nectar is more concentrated and richer in biologically active substances than in the southern regions [27]. The honey bee becomes a central node in pollination networks, visiting both generalist and specialist plant species [14]. The growing world population and the growing need for food have increased the focus on urban agriculture around the world. Most crops grown in urban environments require bees for pollination [30]. Due to the decline of natural pollinators, honey bees are used in crop production, however, *A. mellifora* has been shown to supplement rather than replace pollination services by wild insects. [14]. Plants related to beekeeping play an important role in the conservation of local bees and the development of beekeeping [7]. It has been proven that bees pollinating plants significantly improves their productivity [14]. Honey bees fly up to 5 km from the apiary, most bees are 1 km away, while bumblebees are found 5 km and more from the apiary and during most of the day [15]. The geographic location of Latvia is naturally suitable for the development of the field of beekeeping, it can be positively assessed that bees, when pollinating, also improve the agricultural environment, which contributes to the development of the agricultural field.

In developed countries, rural tourism is seen as an important opportunity to ease the burden of tourism on cities. Rural tourism is an instrument of regional development. In recent years, the quality of tourist demand has changed, so rural tourism is becoming more popular [3]. People want to be closer to nature, so the development of rural tourism is encouraged (Table 2).

Agritourism activities and services are very broad, which include, apart from accommodation or meals, additional services such as education, active involvement in farm activities, volunteer participation in agricultural activities, handicrafts, production of traditional arts, food offered from rural or local [4]. Rural tourism is moving towards agricultural tourism or agritourism, which also includes beekeeping tourism [3]. By popularizing beekeeping tourism, other types of rural tourism would also be popularized.

Api-tourism includes sustainable beekeeping, historical heritage, niche and health tourism as an intersection between alternative medicine, tradition, and the sustainable income generating activity of beekeepers [3]. Today, beehive therapy is also authorized in Austria, Slovenia and Hungary due to its possible contribution to the treatment of asthma, bronchitis, pulmonary fibrosis and respiratory tract infections, however scientific evidence is scarce and further biological and chemical analyzes are needed to substantiate this therapy [3]. It has long been believed that bees can also be used for medicinal purposes, but nowadays it is practiced more and more often.

A nature trail is an attractive, valuable sequence of natural objects in a natural area, where a path suitable for visitors has been created and whose purpose is to attract people to nature, to give them the opportunity to enjoy and explore it in an environmentally friendly way [31]. By creating a nature trail, tourists and its visitors could not only enjoy the closeness and beauty of nature, but also gain new knowledge by learning about nature, plants, etc.

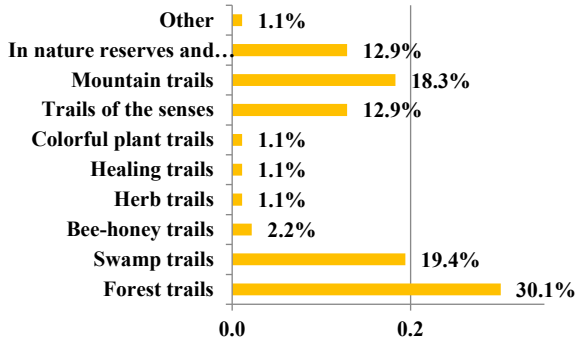

Fig. 5. Respondents' answers to the question: "What tourist trails in Latvia have you visited?" (N=1500).

In the study conducted (Fig. 5), it was revealed that Latvian residents have mostly visited forest, swamp and mountain trails, but they are also the most frequent tourist trails in Latvia. Theoretically, people are interested in getting closer to nature, visiting various tourist trails, so this industry can be developed by expanding the range with new trails, such as Bee-honey trails. In order to attract tourists and visitors, it is recommended to combine the visit of the tourist trail with the educational and practical part. 3 km was indicated as the ideal length of the tourist trail (Fig. 6).

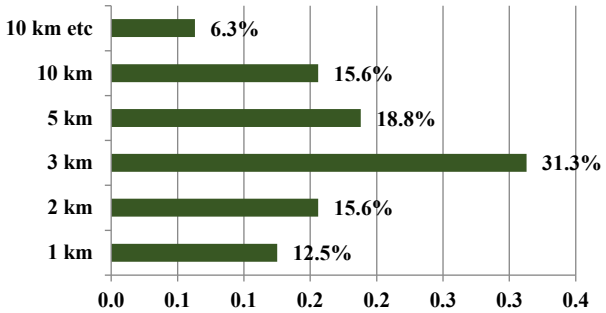

Fig. 6. Respondents' answers to the question: "How long do you want a nature trail?" (N=1500).

TABLE 2 SUMMARY OF THE RESULTS OF THE SURVEY ON THE USE OF BEEKEEPING IN 2023 (N=1500)

Indicator	Totally agree	Agree	Hard to say	Agree	Totally agree	Indicator
I use honey	800	300	213	52	135	I do not use honey
I use other beekeeping products	432	738	41	132	157	I do not use other beekeeping products
I visit agritourism trails	270	780	38	62	350	I do not visit agritourism trails

Indicator	Totally agree	Agree	Hard to say	Agree	Totally agree	Indicator
I visit nature trails once a year	280	780	38	342	60	I visit nature trails 5 times a year
I know Latvian plants well	287	506	501	168	38	I know bee plants well
I visit various beekeeping events	42	180	700	380	198	I do not attend various beekeeping events
Information about the type and name of the honey is available	400	389	120	307	284	Information about the type and name of the honey is not available
Composition is available	399	324	186	308	283	Composition is not available
The manufacturer is specified	422	392	118	288	280	The manufacturer is not specified
The manufacturer 's contacts are indicated	413	379	123	301	284	The manufacturer's contacts are not indicated
The place of honey extraction and the country are indicated on the honey product	165	123	102	350	760	The place of honey extraction and the country are not indicated on the honey product
I use api-therapy	89	42	30	350	989	I do not use api-therapy

With the help of digitization the agricultural environment development leads to technological innovations and above all creativity, animal welfare, significantly reduces the negative impact on the environment [2]. The involvement of the state and local governments also plays an important role in the development of tourism, because by supporting the regions, both the level of employment and the income level of the population, as well as the level of economic development in general, would be positively affected [32]. It is increasingly said that the government should be more involved in the development of regions, however, support from the state and local governments is still not sufficient to make maximum use of the available resources.

Tourism in the rural environment can provide additional income for those farmers who have small properties, who want to diversify their farming, who like to cooperate with people who want to promote their products. In Latvia, farm open days are organized, when all interested parties are introduced and entertained by farm owners. It is often free, but is also part of various large-scale events.

IV. Conclusions

Latvia is suitable for the development of beekeeping both as a livestock breeding and tourism and health promotion industry. The quality of honey and the biologically active compounds contribute to the production of innovative products.

The demand for beekeeping products and related services (api-therapy, tourism, etc.) is growing. Therefore, as much as possible, environmental risks and honey adulteration, which may occur due to societal habits, should be minimized or eliminated.

Beekeeping can also be supported at the state and municipal level, creating favourable conditions for business, education and the introduction of modern technologies. This will create public interest and awareness with the perspective of increasing the competitiveness of the industry and the development of the national economy in general.

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