

Assessment of Factors Influencing Beekeepers' Activities in Latgale

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Abstract—There are approximately 3,400 beekeeping farms in Latvia with more than 100,000 registered bee colonies. Most of them are family businesses and are not united in cooperatives, organizations or producer groups. This study analyzes the operation of beekeeping farms in Latgale, evaluating the factors that affect their productivity and development. The aim of the study is to determine the relationship between beekeeping practices, farm size, education level, marketing strategies, bee diseases, climate conditions and other factors, and how they affect honey yields and farm openness in Latgale (Latvia). The study used correlation analysis between different factors. The results showed that professional beekeepers, for whom beekeeping is the main source of income, are more open to tourism, have registered with the Food and Veterinary Service (PVD), change queen bees in a controlled manner, sow nectar plants, have developed product identification marks, have a higher number of honey extractions per season, and on average collect more than 50 kg of honey from one colony per season. It was also found that the beekeeper's level of education and the farm's visibility have a positive impact on honey yield and sales price. For example, more educated beekeepers produce 15% more honey per colony on average, and their honey sales price is 10% higher. In addition, it was found that beekeepers who have fewer problems with neighbors using pesticides tend to have higher honey yields. These findings could be useful for developing recommendations for the sustainable development of the beekeeping industry in Latgale.

Keywords—beekeepers, beekeeping industry, Latgale.

I. INTRODUCTION

Latvia is a country with a significant agricultural sector. In 2020, farms managed 1.21 million hectares of owned land, which is 61.7% of the total managed agricultural land. The remaining areas were leased from other farmers. In the same year, there were 69 thousand economically active farms registered in Latvia, which managed 1.97 million hectares of agricultural land, which is 30.5% of the country's territory [1]. Agriculture and food production are important components of the national economy, accounting for 1 to 60% of the GDP of different countries [2]. This depends on the geographical location of the country, traditions, etc. factors. Beekeeping is one of the most important agricultural sectors in Latvia, which provides not only a valuable food product - honey, but also promotes the pollination of agricultural crops and biodiversity. Beekeeping traditions in Latvia are centuries old, and beekeeping is an important source of income for many rural residents. However, the beekeeping industry faces various challenges, such as climate change, bee diseases, pesticide use, competition from other countries and adulteration of beeswax and honey. Therefore, it is important to study the factors that influence beekeepers' activities and honey productivity in order to provide recommendations for the sustainable development of the sector.

In parallel, beekeeping also has other agricultural functions, such as seed production, organic farming. The main competitiveness factors in beekeeping are formed at the regional level, therefore a marketing strategy is needed

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to develop the potential and competitiveness of beekeeping in the local region [3]. Competition is one of the components of the marketing system that affects the company in choosing the market, selecting marketing intermediaries and suppliers, forming the product range and the entire complex of marketing activities. Beekeeping could be a sector that stimulates economic and social development, as in the long term competitiveness will be improved and the number of beekeeping products with high added value will increase [4] - [5]. Latvia does not have traditionally developed beekeeping regions [6]. In 2021, there were almost 3.4 thousand beekeeping farms in Latvia with more than 100 thousand registered bee colonies [7]. Honey farms are mostly family businesses/hobby and small, and they are not united in cooperatives, organizations and producer groups [3], [8]. Honey from various flowers is most widely available in Latvia, however, nectar from a specific plant is becoming increasingly popular [9].

This study analyzes the operation of beekeeping farms in Latgale, evaluating the factors that influence their productivity and development. The aim of the study is to determine the relationship between beekeeping practices, farm size, education level, marketing strategies and other factors, and how they affect honey yields and farm openness in Latgale (Latvia).

II. MATERIALS AND METHODS

Research location: Latvia: Latgale: Rēzekne municipality and Ludza municipality. Time of conducting the study: 2024.

In Latvia, the Agricultural Data Center has registered approximately 3,400 beekeeping farms and more than 3,000 beekeepers, which means that there can be several beekeepers on one farm, and beekeeping is often a family occupation (Table 1).

TABLE 1 NUMBER OF INHABITANTS AND BEEKEEPERS IN LATVIA IN 2024 [10]-[12]

| Ariel | Population | Number of registered beekeepers | Number of beekeepers surveyed |
|----------------------|------------|---------------------------------|-------------------------------|
| Latvia | 1 839 766 | >3000 | - |
| Latgale | 381283 | - | - |
| Rezekne municipality | 30051 | - | 26 |
| Ludza municipality | 23522 | - | |

Table 2 describes the criteria used in the study, their designation, explanation, and the extreme limits of the studied criterion.

The study used correlation analysis, which is a bivariate analysis that measures the strength of the relationship between two variables and the direction of the relationship. The Pearson correlation coefficient is used to measure the strength of the correlation, which shows the linear relationship between two data sets. In terms of the strength

of the linear relationship, the value of the correlation coefficient ranges from +1 to -1, where a value of ± 1 indicates a perfect relationship between the two variables [13].

TABLE 2 TYPE STYLES DESIGNATION AND EXPLANATION OF THE CRITERIA USED IN THE STUDY

| Designation | Explanation of the criterion and its extreme limits |
|-------------|--|
| A | beekeeping as a way of generating income (main activity - other) |
| B | degree of public openness of the farm (tourist attraction - none) |
| C | apiary registration with the Food and Veterinary Service (PVD) (yes - no) |
| D | nectar extraction site (sowing on the farm - I don't know) |
| E | type of design for beekeeping product presentation (designed for each product - not available) |
| F | beekeeping product design author (himself - none) |
| G | number of honey extractions per season (1 - 4 ≤ times) |
| H | honey yield from one colony per season (not counting - 100 ≤ kg) |
| I | number of beehives in the apiary (1 - 31 ≤ hives) |
| Y | beekeeper's educational level in beekeeping (self-study - higher education in beekeeping) |
| J | choice of beekeeping type (mobile - all types) |
| K | self-consumption of cosmetics from beekeeping products (yes - no) |
| L | processing of bee products on the farm (yes - no) |
| M | self-consumption of beekeeping products on the farm (only for bees - no) |
| N | type of wax used on the farm (own wax - only purchased wax) |
| O | pesticide use by surrounding residents (yes - no) |
| P | apiary enclosure (yes - no) |
| Q | number of wild bee swarms received in the apiary (yes - no) |
| R | obtaining organic farming status (yes - no) |
| S | frequency of queen bee replacement in a bee colony (every year - I don't know) |
| T | honey without additives for personal consumption (yes - no) |
| U | honey sales price (≤3.99 EUR. kg-1 - 11 ≤ EUR. kg-1) |
| V | type of bee treatment (organic acids - I did not treat) |
| W | beekeeper's age (20 years - 61 ≤ years) |
| X | production of cosmetics from honey (yes - no) |

III. RESULTS AND DISCUSSION

Beekeeping is a traditional industry in rural Latvia. It is engaged in by many homesteads, private and large farms.

The number of colonies in farms varies: small ones from a few colonies and large ones – from 50-300 colonies (LR ZM, 2006). In Latvia, as in other countries, there are three categories of beekeepers [14]:

- Where are the professional beekeepers for whom beekeeping is the main source of income,
- Where beekeeping provides additional income and the main occupation is agriculture, crafts, pond farming, sawmills, farms where bees are needed for pollination of field crops (primarily clover) and gardens.
- Where beekeeping is a hobby, it gives the house a special atmosphere, the song of the bees, stings to strengthen health, and, of course, honey for yourself and your loved ones.

Looking at the categories of beekeepers, we can conclude that in Latvia, practically anyone who has the interest and opportunities can become a beekeeper. It just depends on what the main goal is – making a profit, expanding their business or as a hobby. This is also confirmed by the fact that 39% of beekeepers have beekeeping at the hobby level, and they distort the local honey market by selling honey below the cost price [15]. The results of the study also show a negative correlation between factors I and A ($r = -0.7$) (Fig. 1). This means that in Rēzekne and Ludza counties, beekeeping with 1-3 bee colonies is more of a hobby than a way of earning income (A). This also means that beekeeping is also an environmentally friendly lifestyle, not just a way of making a living and earning income.

Professional beekeepers (Fig. 1), who have a large number of bee colonies (I), have registered with the PVD (C), sow nectar plants or take bees to “pastures” (D), have developed a design for their products (E), sell honey, not just give it to friends (M), process the products on their farm (L). Packaging, label and its design are part of the marketing complex element – the product (Fig. 1). Nowadays, it is often observed that people choose to purchase a product based on the manufacturer whose product is advertised the most. Another important factor is the type of packaging, labels, overall appearance, and design. To promote awareness and brand development, companies often attract influencers [16], social media and the online market also play a major role, and it is important to use various tools, especially if sales take place via the Internet [16] - [17]. Both the product packaging and the label design, the color combination on it, and the presence of symbols or logos are important for promoting awareness.

Honey contains practically all chemical micro- and macroelements important for human health [18]. Monoculture fields are increasingly appearing in Latvia [19] – [21]. Consequently, taking bees out to pasture (D) is becoming popular, which increases the honey yield from the colony. Although honey contains sugars and water, the

uniqueness of the product is determined by substances that are less than 1%, such as proteins, polyphenols [9].

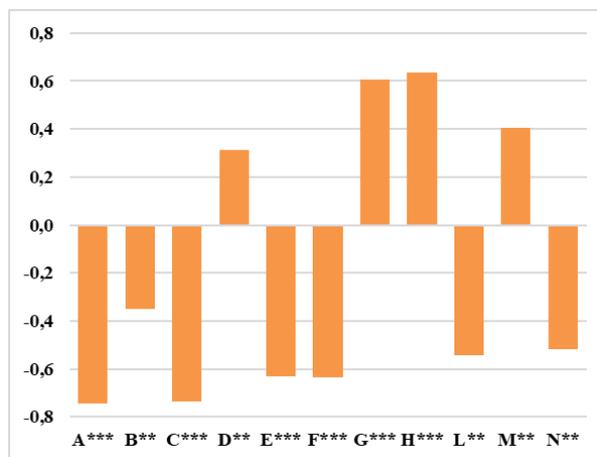


Fig. 1. Correlation coefficient values ($n=26$) for correlations between the number of beehives in an apiary (I) and various factors, where A – beekeeping as a way of generating income, B – degree of public openness of the farm, C – registration of the apiary with the Food and Veterinary Service, D – place of nectar extraction, E – type of design of beekeeping product presentation, F – author of beekeeping product presentation, G – number of times of honey extraction per season, H – honey yield from one colony per season, L – processing of bee products on the farm, M – self-consumption of beekeeping products on the farm, N – type of wax use on the farm.

Note: ** – the influence of the studied factors is reliable at the 95% significance level ($F_{fact} > F_{0.05}$); *** – the influence of the studied factors is reliable at the 99% significance level ($F_{fact} > F_{0.001}$)

The most wild bee swarms are received (Q) by those beekeepers (Fig. 2) for whom beekeeping is more of a hobby (A), whose apiary is not registered with the PVD (C), whose queen bee change in the hive occurs uncontrolled (naturally) (S), whose apiary territory is not fenced (P), who are not engaged in the production of cosmetics from beekeeping products (K). Therefore, there is a tendency that the more bee swarms they receive (Q), the fewer times they extract honey per season (G), and the more natural meadows and forests they use for their bees (D).

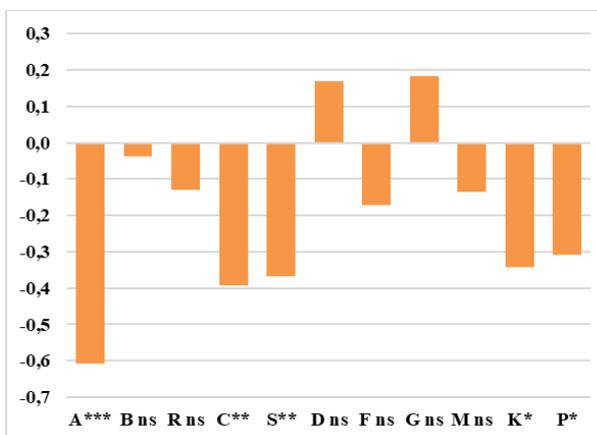


Figure 2. Correlation coefficient values ($n=26$) for correlations between the number of wild bee swarms received in the apiary (Q) and various factors, where A – beekeeping as a form of income generation, B –

degree of public openness of the farm, R – acquisition of organic farming status, C – apiary registration with the Food and Veterinary Service, S – frequency of queen bee replacement in the bee colony, D – place of nectar extraction, F – author of the design of the beekeeping product presentation, G – number of times honey is poured out per season, M – self-consumption of beekeeping products on the farm, K – self-consumption of cosmetics from beekeeping products, P – apiary enclosure.

Note: * – the influence of the studied factors is reliable at the 90% significance level ($F_{fact} > F_{0.01}$); ** – the influence of the studied factors is reliable at the 95% significance level ($F_{fact} > F_{0.05}$); *** – the influence of the studied factors is reliable at the 99% significance level ($F_{fact} > F_{0.001}$); ns – the influence of the studied factors is insignificant at the 95% confidence level ($F_{fact} < F_{0.05}$).

Beekeepers who use stationary and traveling beekeeping (J) (Fig. 3), are open as tourist and sightseeing attractions (B), have created labels and logos for their products (E), carry out bee product processing on their farm (L), sell most of their production (M), use organic acids in bee treatment (V) and have received education in the field of beekeeping (at least 2-year courses in beekeeping) (Y).

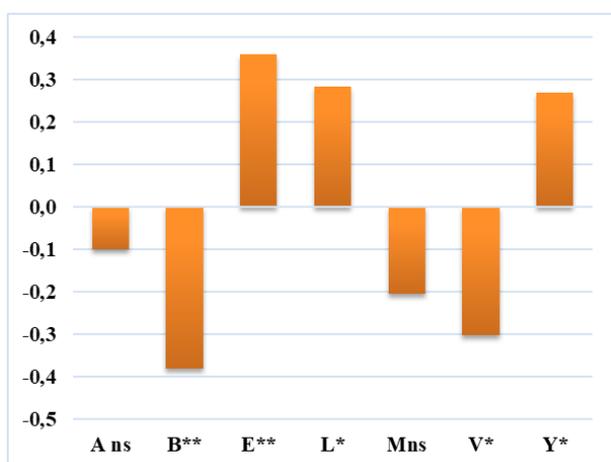


Fig. 3. Correlation coefficient values (n=26) for correlations between the choice of beekeeping type (J) and various factors, where A – beekeeping as a type of income generation, B – degree of public openness of the farm, E – type of beekeeping product presentation design, L – processing of bee products on the farm, M – self-consumption of beekeeping products on the farm, V – type of bee treatment, Y – beekeeper's level of education in beekeeping.

Note: * – the influence of the studied factors is reliable at the 90% significance level ($F_{fact} > F_{0.01}$); ** – the influence of the studied factors is reliable at the 95% significance level ($F_{fact} > F_{0.05}$); ns – the influence of the studied factors is insignificant at the 95% confidence level ($F_{fact} < F_{0.05}$).

Ensuring customer satisfaction is the key to a successful retail business [22]. Every type of business is associated with risk [23] - [24], including the production and sale of honey, therefore market research questions and objectives are important. Agriculture and food processing make up a significant part of the economy. In Latvia, agriculture and food processing make up 4.75% of the country's gross domestic product [2]. Beekeeping farms (Fig. 4) for which beekeeping is the main activity, not a secondary occupation or hobby (A), are open as a tourist attraction (B), have registered with the PVD (C) as home producers, change queen bees in a controlled manner (S), sow nectar plants (D), have developed product identification

signs/logs/labels, social networks, etc. (E, F), and have a higher number of honey extractions per season (G). As a result, these farms have a higher honey yield from one colony per season (H), as well as processing of bee products (L) and wax (N), thought has been given to protecting the apiary from various animals and other uninvited visitors to the apiary, i.e. by fencing the apiary (P), and the age of the beekeepers themselves is mostly up to 40 years (W). The honey season in Latvia traditionally begins in April and lasts until the end of July, but for beekeepers who move their bees to heather, the season can also last until the first half of September. This is observed by beekeepers who use mobile apiaries. By sowing nectar plants and using a mobile apiary, beekeepers diversify the honey offer, i.e. offer more monofloral honey.

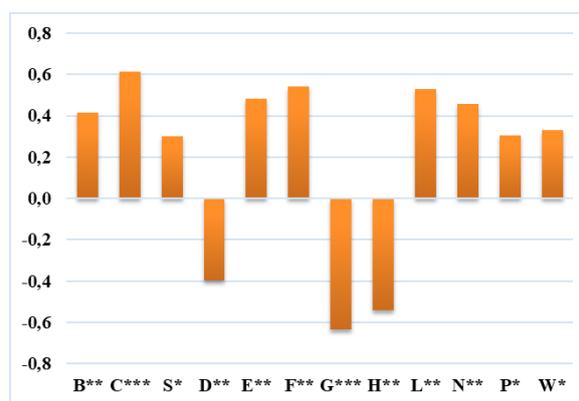


Fig. 4. Correlation coefficient values (n=26) for correlations between beekeeping as a type of income generation (A) and various factors, where B – degree of public openness of the farm, C – registration of the apiary with the Food and Veterinary Service, S – frequency of queen bee change in the bee colony, D – place of nectar extraction, E – type of beekeeping product presentation design, F – author of beekeeping product presentation design, G – number of honey extractions per season, H – honey yield from one colony per season, L – processing of bee products on the farm, N – type of wax use on the farm, P – apiary enclosure, W – age of the beekeeper.

Note: * – the influence of the studied factors is reliable at the 90% significance level ($F_{fact} > F_{0.01}$); ** – the influence of the studied factors is reliable at the 95% significance level ($F_{fact} > F_{0.05}$); *** – the influence of the studied factors is reliable at the 99% significance level ($F_{fact} > F_{0.001}$).

In professional beekeeping, it is assumed that a single bee colony should produce more than 50 kilograms of honey, which most beekeepers, especially those who move their bee colonies to follow flowering plants, will have met and exceeded. This is also observed in their activities by beekeepers of open farms (B) (Fig. 5). The more recognizable the farm is (F), the higher the price at which honey is sold (U), the more often honey is extracted (G), and the greater the honey yield from the colony (H), the more educated the beekeeper is (Y), the fewer problems there have been with neighbors who use pesticides in their economic activities (O). After the privatization of land, which took place in Latvia in 1990-1995, there are many small farms in one parish or region, located next to each other, with different farming practices regarding the use of herbicides and pesticides that are harmful to bees [25].

The food chain system consists of two basic elements: the economy, which is formed by production and consumption, and the cultural elements in the use of a particular product [26]. It is important to create direct marketing activities so that organic products reach consumers as quickly as possible [8]. On the other hand, households can become more efficient both in domestic food use and in planning food purchases, as even those least inclined to change have to use alternative sales methods and marketing of their products [27]. Supermarkets are less involved in honey promotion, more standard operations are performed. In turn, beekeepers and farmers are more involved in various activities, for example, in 2022, 190 educational institutions and 73 beekeepers from all over Latvia participated in the campaign “European Honey Breakfast” [28], as well as every year on the second Saturday of September, the Latvian Beekeeping Association offers all interested parties to visit apiaries, where they can taste and buy honey, learn useful information about honey, from beekeepers who work in the association [29]. Such events are usually attended by beekeepers, for whom beekeeping is their main occupation. Many visitors to farms have indicated that this helps them choose products from a certain manufacturer [4]. Home-grown products attract buyers with their naturalness, as they are usually made without preservatives, artificial colors, etc. food additives, so buyers are willing to pay a higher price than for industrially produced products.

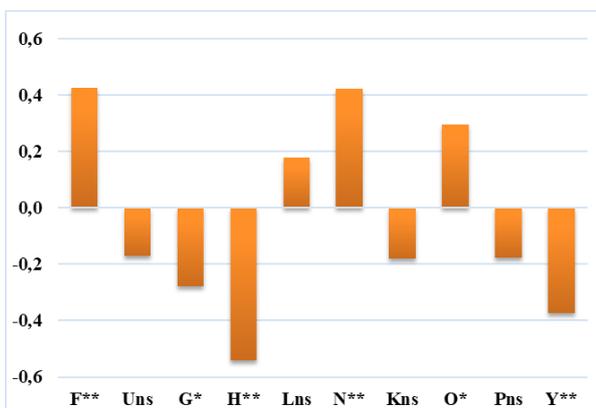


Fig. 5. Correlation coefficient values (n=26) for correlations between the degree of public openness of the farm (B) and various factors, where F – the designer of the presentation of beekeeping products, U – the selling price of honey, G – the number of times honey is extracted per season, H – honey yield from one colony per season, L – processing of bee products on the farm, N – the type of wax used on the farm, K – self-consumption of cosmetics from beekeeping products, O – pesticide use by the surrounding population, P – apiary enclosure, Y – the beekeeper’s level of education in beekeeping.

Note: * – the influence of the studied factors is reliable at the 90% significance level ($F_{fact} > F_{0.01}$); ** – the influence of the studied factors is reliable at the 95% significance level ($F_{fact} > F_{0.05}$); ns – the influence of the studied factors is insignificant at the 95% confidence level ($F_{fact} < F_{0.05}$).

If a beekeeper (Fig. 6) has registered with the PVD (C), has created a design for the products he produces himself or has used free templates (F), he extracts honey more often (G), has a higher yield from 1 colony per season (H),

processes more products on his farm (L), produces more cosmetics from honey (X), and also uses his own products (K), and takes care of the safety of the apiary (P).

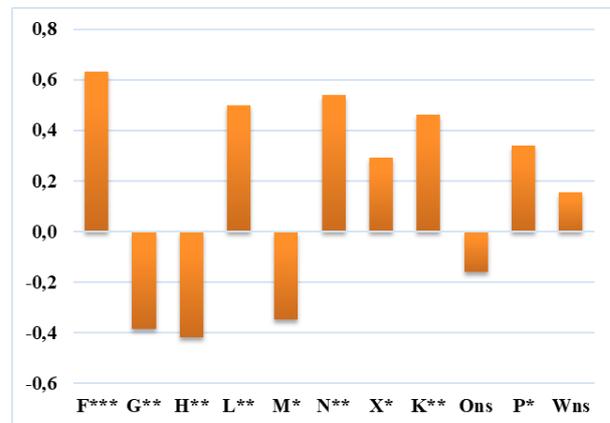


Fig. 6. Correlation coefficient values (n=26) for correlations between apiary registration with the Food and Veterinary Service (C) and various factors, where F – author of the design of the beekeeping product presentation, G – number of honey extractions per season, H – honey yield from one colony per season, L – processing of bee products on the farm, M – self-consumption of beekeeping products on the farm, N – type of wax use on the farm, X – production of cosmetics from honey, K – self-consumption of cosmetics from beekeeping products, O – use of pesticides by the surrounding population, P – apiary enclosure, W – age of the beekeeper.

Note: * – the influence of the studied factors is reliable at the 90% significance level ($F_{fact} > F_{0.01}$); ** – the influence of the studied factors is reliable at the 95% significance level ($F_{fact} > F_{0.05}$); *** – the influence of the studied factors is reliable at the 99% significance level ($F_{fact} > F_{0.001}$); ns – the influence of the studied factors is insignificant at the 95% confidence level ($F_{fact} < F_{0.05}$).

The more a beekeeper (Fig. 7) is interested in the design of beekeeping products (E), the more he thinks up and creates the design of his own products (F). They calculate the cost of their own products more accurately and determine the appropriate selling price of honey (U), and they use their own products more, both by testing different taste nuances, and by trying out new types of products, such as cosmetics, and prepare bees for hibernation themselves (organic farming).

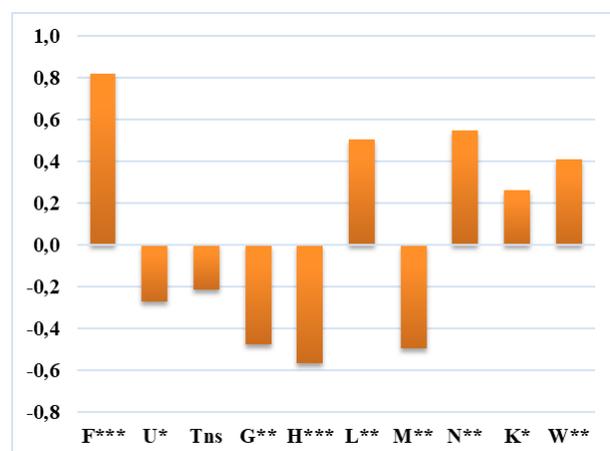


Fig. 7. Correlation coefficient values (n=26) for correlations between the type of beekeeping product presentation design (E) and various

factors, where F – author of the beekeeping product presentation design, U – selling price of honey, T – honey without additives for own consumption, G – number of honey extractions per season, H – honey yield from one colony per season, L – processing of bee products on the farm, M – self-consumption of beekeeping products on the farm, N – type of wax use on the farm, K – self-consumption of cosmetics from beekeeping products, W – beekeeper's age.

Note: * – the influence of the studied factors is reliable at the 90% significance level ($F_{fact} > F_{0.01}$); ** – the influence of the studied factors is reliable at the 95% significance level ($F_{fact} > F_{0.05}$); *** – the influence of the studied factors is reliable at the 99% significance level ($F_{fact} > F_{0.001}$); ns – the influence of the studied factors is insignificant at the 95% confidence level ($F_{fact} < F_{0.05}$).

Beekeeping is mainly carried out by small family businesses in rural Latvia. Often, beekeeping is the only source of income for these people. In order to preserve beekeeping businesses in the country and rural residents, the state urgently needs to find a solution to protect the internal market for honey in Latvia and activate and support a solution to the problem at the EU level.

IV. CONCLUSIONS

Beekeeping in Latvia is diverse, encompassing both professional and hobby-level beekeepers. However, professional beekeepers who focus on beekeeping as their main source of income are more productive and open to development.

Farm size, beekeeper education level and marketing strategies are important factors that affect honey yields and farm openness. Professional beekeepers are more likely to use modern methods, are registered with the PVD, actively participate in market development and achieve better results.

A beekeeper's interest in product presentation design significantly influences his ability to create attractive and recognizable product packaging. This approach contributes to more accurate cost calculation and determination of an appropriate honey sales price, which in turn can improve farm income.

To preserve the beekeeping industry in Latvia, it is important to support beekeepers, promote their education and ensure a favorable environment for business. The state must find a solution to protect the internal market for honey and promote the sustainable development of the industry.

REFERENCES

- [1] "Latvijas statistika", Preses relīze, March 31, 2022. [Online]. Available: <https://stat.gov.lv/lv/statistikas-temas/noz/lauksaimn/preses-relizes/8231-2020-gada-lauksaimniecibas-skaitisanas>. [Accessed: Jan. 23, 2025].
- [2] I.Pilvere, A.Nipers, A. Krievina, I. Upite and D. Kotovs, "LASAM Model: An Important Tool in the Decision Support System for Policymakers and Farmers", *Agriculture*, 12, pp. 704-730, 2022. <https://doi.org/10.3390/agriculture12050705>.
- [3] L. Lyubenov, A. Atanasov and I. Hristakov I. Economic-geographical characteristic of beekeeping in the ruse region. Proceedings of the 2022 International Conference "Economic Science For Rural Development" No 56 Jelgava, LLU ESAF, 11-13 May 2022, pp.213-221, 2022. DOI:10.22616/ESRD.2022.56.021.
- [4] N. A. Dönmez, "Aptourism Through the Perspective of Tourists: An Evaluation of Visitor Comments on Guided Tours," *Journal of Travel and Hospitality Business*, 2, pp. 447 - 468, Aug. 2024. <https://doi.org/10.24010/soid.1372486>
- [5] V.Vevere and I. Shina, The Factors Of Green Marketing Affecting Consumer Purchase Intention In Latvia. *Environment. Technologies. Resources. Proceedings of the International Scientific and Practical Conference*, Rezekne, Latvia, vol. 1, pp. 240–246, 2023. DOI: 10.17770/etr2023vol1.7210.
- [6] ZM "Biškopības nozare", 2022. [Online]. Available: <https://www.zm.gov.lv/lauksaimnieciba/statiskas-lapas/lopkopiba-un-ciltsdarbs/biskopibas-nozare?nid=588fjump>. [Accessed: Apr. 29, 2023].
- [7] K. Kļaveniece, "Zemkopības ministrs K. Gerhards ikgadējā Biškopības pavasara konferencē atzīmē biškopības nozares lomu Latvijas tautsaimniecībā," 2022. [Online]. Available: <https://www.zm.gov.lv/presei/zemkopibas-ministrs-k-gerhards-ikgadeja-biskopibas-pavasara-konference?id=12894>. [Accessed: Dec. 27, 2024].
- [8] L. Aleksejeva, Problems of Local Organic Food Procurement Management at General Education Schools in Latvia. Proceedings of the 2022 International Conference "Economic Science For Rural Development" No 56 Jelgava, LLU ESAF, 11-13 May 2022, pp. 14-24, 2022. DOI:10.22616/ESRD.2022.56.001.
- [9] K.D. Labsvārds, V. Rudoviča and A. Vīksna, "Latvijas medus izcelsmes pētījumi". *Biškopis*. No. 6 pp. 21-22, 2021. [Online]. Available: https://www.lu.lv/fileadmin/user_upload/LLU.LV/Apaksvietnes/Fakultates/www.kf.lu.lv/Biskopis_1_.pdf. [Accessed: Jan. 17, 2025].
- [10] "Iedzīvotāju skaits" [Online]. Available: <https://www.pmlp.gov.lv/lv/search?q=iedz%C4%ABvot%C4%81ju%20skaitis%20latgal%C4%93> [Accessed: Dec. 28, 2024].
- [11] "Iedzīvotāju skaita izmaiņas," [Online]. Available: https://data.stat.gov.lv/pxweb/lv/OSP_PUB/START_POP_IR/IRS/RIG050/table/tableViewLayout1/. [Accessed: Dec. 3, 2024].
- [12] "Population changes," [Online]. Available: https://data.stat.gov.lv/pxweb/lv/OSP_PUB/START_POP_IR/IRS/RIG050/table/tableViewLayout1/. [Accessed: Dec. 3, 2024].
- [13] I. Arhipova and S. Bāliņa. *Statistika ekonomikā un biznesā. Risinājumi ar SPSS un Microsoft Excel*. Macību līdzeklis. 2.izdevums. Rīga: Datorzinību centrs, 2006. p. 352.
- [14] "Biškopība Sēlijā. Biškopība Sēlijā senāk un tagad." *Latvijas Vēstnesis*, Jun. 1999. [Online]. Available: <https://www.vestnesis.lv/ta/id/20411>. [Accessed: Jan 28, 2025].
- [15] G. Jakobsone, "Medus ražošanas izmaksu uzskaitē un pašzmaksas aprēķināšana," *Biškopis*. No5. pp. 51- 57, 2022.
- [16] S.Bormane and M. Urbane, The Use of Influencer Marketing Services for Unfair Commercial Practice in the EU and Latvia. Proceedings of the International Conference "Economic Science for Rural Development" No 56 Jelgava, LLU ESAF, 11-13 May 2022, pp. 416-423, 2022. DOI: 10.22616/ESRD.2022.56.041
- [17] L. Jankova A. Lazdins and A. Auzina, Commercial transactions in the digital environment in Latvia. Proceedings of the 2022 International Conference "Economic Science for Rural Development" No 56 Jelgava, LLU ESAF, 11-13 May 2022, pp.99-105, 2022. DOI: 10.22616/ESRD.2022.56.010
- [18] Z. Vincēviča-Gaile, "Makro- un mikroelementu saturs medū". *LLU Raksti*, 25 (320), pp. 54-66, 2010. [Online]. Available: <https://lluflb.llu.lv/proceedings/n25/6/LLU-raksti-nr25-54-66.pdf>. [Accessed: Jan. 28, 2025].
- [19] A. Suarez and W.Gwozdz. "On the relation between monocultures and ecosystem services in the Global South: A review." *Biological Conservation*, vol. 278, Feb. 2023.
- [20] A.Andersone, S Janceva, N. Zaharova, V. Nikolajeva and V.Jurkijane, Aronia Melanocarpa (Black Chokeberry) Branches Biomass As A Source Of Valuable Biologically Active Compounds With Antioxidant And Antimicrobial Potential. *Environment. Technologies. Resources. Proceedings of the International Scientific and Practical Conference*, Rezekne, Latvia, vol. 1, p. 34–38, 2024. DOI: 10.17770/etr2024vol1.7981.

- [21] I. Augšpole, G. Putniece, G. Bundzēna and R. Sanžarevska, Winfolia Flag Leaf Analysis Of Winter Wheat (*Triticum Aestivum* L.) And Evaluation Of Grain Quality Indicators. *Environment. Technologies. Resources. Proceedings of the International Scientific and Practical Conference, Rezekne, Latvia, vol. 1, pp. 61–65, 2024. DOI: 10.17770/etr2024vol1.7955.*
- [22] I. Linina, R. Zvirgzdina and V. Vevere, Client Relationship Management In Latvian Retail Enterprises Under Covid-19 Circumstances. *Environment. Technologies. Resources. Proceedings of the International Scientific and Practical Conference, Rezekne, Latvia, vol. 1, pp. 155–161, 2021. DOI: 10.17770/etr2021vol1.6573.*
- [23] N. Zaķe, Uzņēmējdarbība. SIA “Biznesa augstskola Turība”, 2016. p. 144.
- [24] D. Petrova, B. Vlahova, A. Lengerov and T. Zlateva-Petkova, Improvement Of Constructive-Technological Approaches Reducing Innovative Obsolescence Of Industrial Technologies In The Context Of Industry 4.0. *Environment. Technologies. Resources. Proceedings of the International Scientific and Practical Conference, Rezekne, Latvia, vol. 1, pp. 180–186, 2023. DOI: 10.17770/etr2023vol1.7238.*
- [25] LR ZM, “Lauksaimniecības nozares un zinātnes attīstības stratēģija”, Rīga, pp.551. 2006. [Online]. Available: https://www.lbtu.lv/sites/default/files/zps_projekti/7591_Strategijas_izstrade.pdf. [Accessed: Dec. 3, 2024].
- [26] L. Proskina, D. Kaufmane, L. Paula, K. Naglis-Liepa and S. Ozolniece, Policy Measures to Support Local Food Systems. *Proceedings of the 2022 International Conference “Economic Science for Rural Development” No 56 Jelgava, LLU ESAF, 11-13 May 2022, pp. 231-239, 2022. DOI: 10.22616/ESRD.2022.56.023*
- [27] S. Jercinovic, Dynamic strategic marketing adjustment of the vegetable producers sector under covid crisis conditions. *Proceedings of the 2022 International Conference “Economic Science For Rural Development” No 56, Jelgava, LLU ESAF, 11-13 May 2022, pp. 106-115. DOI: 10.22616/ESRD.2022.56.011*
- [28] SaimnieksLV, “Akcijai “Eiropas medus brokastis” pieteikušās 190 izglītības iestādes,” 2022. [Online]. Available: <https://www.saimnieks.lv/raksts/akcijai-eiropas-medus-brokastis-pieteikusas-190-izglitiba-iestades>. [Accessed: Dec. 27, 2022].
- [29] LBB, “Ar bīskopību saistītie pasākumi,” 2022. [Online]. Available: <https://www.strops.lv> [Accessed: Dec. 17, 2022].