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ECONOMIC EFFICIENCY OF PRODUCING FUNCTIONAL FOOD PRODUCTS BASED ON BEEKEEPING PRODUCTS

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ЕКОНОМІЧНА ЕФЕКТИВНІСТЬ ВИРОБНИЦТВА ФУНКЦІОНАЛЬНИХ ХАРЧОВИХ ПРОДУКТІВ НА ОСНОВІ ПРОДУКТІВ БДЖІЛЬНИЦТВА

The article examines the market and economic feasibility of producing functional food products derived from beekeeping outputs — specifically pollen, bee bread, propolis, and apiphytocompositions. It highlights current market trends, profitability indicators, and consumer demand driven by health-oriented lifestyle tendencies in Ukraine and Europe, while also outlining the barriers and opportunities for producers operating under challenging wartime economic conditions.

The problem lies in determining whether the production of functional food products from beekeeping resources can be both profitable and sustainable under current market realities. Although functional foods are gaining global popularity, the Ukrainian market for such products remains relatively underdeveloped: functional food products (FFPs) account for only about 6—8% of total food output, dominated mainly by dairy, cereal, and bakery categories. This imbalance limits the visibility, competitiveness, and overall perception of apicultural functional products, despite their proven nutritional, adaptogenic, and therapeutic potential.

The study identifies key obstacles, such as instability of raw material supply, seasonal variability of bee products, lack of unified quality standards, low consumer awareness, and insufficient technological modernization of processing facilities. Preliminary economic modeling shows that the production of bee bread, propolis tinctures, and other value-added apiproductions could ensure significantly higher marginal income compared to traditional honey production, thus enhancing the profitability and resilience of apiaries.

The paper concludes that the strategic development of the functional apicultural product segment could substantially increase producers' revenues and contribute to national food security. The implementation of innovation, quality assurance systems, and effective marketing communications aimed at health-conscious consumers will be crucial. Future research should focus on optimizing production technologies, creating standardized formulations, and developing export-oriented branding strategies to fully realize the economic and health potential of functional bee-derived products.

У статті досліджено ринкову та економічну доцільність виробництва функціональних харчових продуктів, отриманих із продуктів бджільництва — пилку, перги, прополісу та апіфітокомпозицій. Проаналізовано сучасні тенденції ринку, показники рентабельності та споживчий попит, сформований під впливом орієнтації суспільства на здоровий спосіб життя в Україні та Європі. Особливу увагу приділено бар'єрам і можливостям для виробників, що функціонують в умовах воєнного часу та економічної нестабільності.

Проблематика дослідження полягає у визначенні, чи може виробництво функціональних харчових продуктів на основі ресурсів бджільництва бути одночасно прибутковим і сталим за сучасних ринкових умов. Незважаючи на зростання популярності функціональних продуктів у світі, український ринок цієї категорії залишається недостатньо розвиненим: на їхню частку припадає лише близько 6-8% від загального обсягу харчової продукції, причому переважають молочні, зернові та хлібобулочні вироби. Такий дисбаланс обмежує видимість і конкурентоспроможність апіпродуктів функціонального призначення, попри їх доведену поживну, адаптогенну та лікувально-профілактичну цінність.

У роботі виявлено основні перешкоди розвитку цього сегмента: нестабільність постачання сировини, сезонні коливання виробництва, відсутність єдиних стандартів якості, низьку обізнаність споживачів та недостатню технологічну модернізацію виробничих потужностей. Попередні економічні розрахунки свідчать, що виробництво перги, прополісних настоянок та інших продуктів із доданою вартістю може забезпечити значно вищий рівень маржинального доходу порівняно з медом, підвищуючи прибутковість і стійкість пасік.

Зроблено висновок, що стратегічний розвиток сегмента функціональних продуктів бджільництва може суттєво збільшити доходи виробників і сприяти продовольчій безпеці країни. Впровадження інновацій, систем контролю якості та ефективних маркетингових комунікацій, орієнтованих на споживачів, що дбають про здоров'я, є ключовими умовами успіху. Подальші дослідження доцільно спрямувати на вдосконалення технологій виробництва, стандартизацію рецептур і формування експортно орієнтованих брендів, що дозволить повною мірою реалізувати економічний і оздоровчий потенціал функціональних продуктів бджололиного походження.

Key words: functional food, bee products, economic efficiency, market, profitability, Ukraine.

Ключові слова: функціональні продукти, продукція бджільництва, економічна ефективність, ринок, прибутковість, Україна.

GENERAL STATEMENT OF THE PROBLEM AND ITS CONNECTION WITH IMPORTANT SCIENTIFIC OR PRACTICAL TASKS

Beekeeping has long been an important sector in Ukraine's economy and food culture. There are approximately 400 000 beekeepers in Ukraine, making the country one of the world's leaders in apiculture; Ukraine is the largest honey producer in Europe [14]. However, beyond honey, the beekeeping industry produces a range of functional products — bee pollen, bee bread (perga), propolis, royal jelly, and various apifitocompositions (combined bee and herbal supplements) — that have significant nutritional and therapeutic value. In recent years, food consumers have increasingly sought out functional foods that provide health benefits beyond basic nutrition. These trends create new opportunities for beekeepers and food producers to develop value-added products from apiculture. At the same time, producers must evaluate the economic efficiency of diversifying into these functional bee-based foods. This is a pressing issue given Ukraine's efforts to modernize its food industry and align with global health and wellness trends [8].

The problem lies in determining whether the production of functional food products from beekeeping outputs can be profitable and

sustainable. While functional foods are gaining popularity worldwide, the Ukrainian market for such products remains underdeveloped — functional food products (FFPs) constitute only an estimated 6—8% of Ukraine's total food output, mainly in dairy and grain products. The potential to expand this share with bee-derived functional foods is significant but requires careful market analysis. This article addresses an important practical task: examining the market for functional bee products and assessing the profitability, demand conditions, and challenges for their production. By doing so, it contributes to the broader objective of improving the competitiveness and innovative development of Ukraine's food industry [8].

ANALYSIS OF THE LATEST RESEARCH AND PUBLICATIONS

Recent scientific studies emphasize the significant potential of bee products in the food industry. In particular, R. Kaur, S. Sharma, and S. Kaura analyze the antioxidant and immunomodulatory properties of honey and bee pollen [9]. M. Fidan and co-authors assess the antioxidant and anticancer properties of propolis [6], while H. L. Maiselo-Kintana et al. investigate the potential of bee-derived products for application

in functional foods [10]. M. Martinello and F. Mutinelli highlight the importance of honey, bee pollen, propolis, and royal jelly for the food industry and their contribution to the development of value-added food products [11].

Ukrainian researchers, in particular L. I. Mykhailova and V. L. Hrytsenko, explore the theoretical and applied aspects of the formation of the beekeeping products market under conditions of globalization [12]. M. Ya. Vysochanska analyzes the current state and development prospects of the sector, emphasizing the role of beekeeping in increasing agricultural productivity and generating a multiplier effect for related sectors of the economy [1]. Ukrainian scholars (Davydova H. I. et al.) study apiphytocompositions — dietary supplements that combine bee products with medicinal plants — and propose the development of commercial apiphytoproducts with various compositional formulations to meet the needs of different consumer groups [2]. Shkarupa O. and Treus A. investigate the economic aspects of doing business in the beekeeping sector in Ukraine. The authors provide recommendations for improving business practices in the field of apiculture based on survey results and examples drawn from the experience of other countries [3]. However, there is a clear gap in economic analyses (profitability, value chains, regulatory costs — especially under EU-aligned rules per Law № 4122-IX). This article addresses that gap by synthesizing market data and health trends to evaluate the economic efficiency of producing bee-derived functional foods.

FORMULATION OF THE OBJECTIVES OF THE ARTICLE (TASK STATEMENT)

The goal of this study is to assess the economic efficiency of producing functional food products derived from beekeeping products. In order to achieve this goal, the following objectives are addressed: (1) to examine the current market landscape for key functional bee products — bee pollen, bee bread, propolis, and apifitocompositions — including global and domestic trends; (2) to evaluate the profitability of producing these products, by analyzing price levels, cost considerations, and comparative returns relative to traditional bee products (like honey); (3) to analyze consumer health trends and demand for functional foods in Ukraine and Europe that influence the market potential of bee-based functional products; (4) to discuss the barriers (e.g. production, regulatory, market awareness) and opportunities for producers venturing into this segment; and (5) to formulate conclusions and

suggest directions for further research and development in this domain. By fulfilling these tasks, the study will provide insights into whether and how Ukrainian beekeeping enterprises and food producers can successfully diversify into value-added functional foods, and what strategic factors need to be managed in the process.

SUMMARY

OF THE MAIN RESEARCH MATERIAL

The market for functional bee products is expanding under the broader wellness and nutraceutical trends. As noted, bee pollen and bee bread have gained traction as nutrient-dense additions to modern diets. Bee pollen is increasingly incorporated into smoothies, energy bars, cereals and other health foods as an all-natural supplement. Manufacturers of functional foods target bee pollen for its high protein content and status as a plant-based "superfood" ingredient, responding to demand from millennials and Generation Z consumers. The growing popularity of natural and organic foods has put bee pollen "in the spotlight" among health-conscious segments. On the global stage, the bee pollen market shows steady growth; market analyses project an expansion from roughly \$1.0 billion in mid-2020s to about \$1.3—1.4 billion within the next decade, driven by interest in natural supplements and functional foods that boost immunity and energy [4; 13].

Bee bread, a fermented pollen product, is a more niche but promising functional food. Its global market was estimated at only about \$227 million in 2023 but with an annual growth rate exceeding 6% as consumer awareness rises. The appeal of bee bread lies in its rich composition (proteins, B vitamins, minerals, amino acids, and beneficial microbes) and its traditional use as a vitality booster. As people worldwide become more educated about nutrition and disease prevention, they increasingly seek foods that offer "more than basic sustenance but also health-enhancing properties" — a role bee bread fits well. Producers have begun marketing bee bread as a probiotic superfood capable of improving gut health and immunity, sometimes blending it into new products like wellness smoothies, nutrition bars, or dietary supplement capsules. This diversification of formats improves consumer accessibility and convenience, further driving demand [8].

Propolis, while not a food per se due to its bitter resinous nature, plays a significant role in functional nutrition and natural medicine markets.

It is commonly processed into tinctures, extracts, lozenges, or added as an ingredient in fortifying other foods (for example, propolis-enriched honey or drinks). Global demand for propolis has been strong, particularly after studies suggested antiviral and immune-supportive benefits (propolis saw increased attention as a potential adjunct remedy during the COVID-19 pandemic). Various market research sources estimate the global propolis market at roughly \$600—800 million in the early 2020s with a moderate growth trajectory of about 5% annually, reflecting stable interest in this natural product. Europe and North America account for a large share of propolis consumption, where it is sold in pharmacies and health stores as a dietary supplement for colds, sore throats, and general immunity [4].

In Ukraine, the domestic market for these functional bee products is still developing. Honey remains by far the predominant bee product in terms of production and consumption. Nevertheless, Ukraine's position as a top-tier honey producer provides a strong foundation for branching out. Some progressive enterprises and cooperatives have started to focus on collecting bee pollen and processing bee bread for sale, often targeting export markets or e-commerce channels. According to recent accounts, domestic prices for bee pollen and bee bread differ markedly, indicating the value addition of the latter: the average wholesale price of pollen in Ukraine is around 200 UAH/kg, while bee bread fetches up to 1,000 UAH/kg, meaning bee bread can earn five times more revenue per unit than pollen. This price premium for bee bread — achieved with nearly comparable production costs — underscores its market potential and profitability for beekeepers willing to adopt new processing technologies [8].

At present, functional bee products in Ukraine occupy a small niche, often sold through beekeeper cooperatives, farmers' markets, or specialized health shops. A few Ukrainian manufacturers have gained international recognition for innovation in this field. For example, a cooperative from Cherkasy Oblast won an award at ApiExpo-2023 for developing an industrial bee bread production technology, highlighting global interest in scaling up such products. Still, relative to Europe, Ukraine's functional food sector (including all types, not just bee products) is under-supplied — as mentioned, only roughly 6—8% of Ukraine's food product output is attributed to functional foods. This suggests ample room for growth if consumer demand can be cultivated [5].

Meanwhile, in the European market, there is already strong demand for natural functional

foods, which bodes well for bee products. Europe's functional food market was valued at about \$95—100 billion in 2023 and is projected to grow significantly by the end of the decade (estimates suggest it could reach \$170+ billion by 2030, roughly 7—8% CAGR) as health-conscious eating becomes mainstream. Consumers in the EU exhibit clean-label preferences and favor organic superfoods, creating a favorable environment for bee-based products. Key markets like Germany, the UK, and France lead in functional food consumption, supported by regulations that are friendly to natural health products and supplements. Bee pollen and propolis are already relatively well known in European health circles — pollen is sold as an energy supplement and used in muesli and bakery products, while propolis is included in many natural cold remedies. Moreover, European buyers often require high standards of quality and traceability, which means Ukrainian producers aiming to export must adhere to stringent quality control for these products. Nonetheless, Europe's interest in bee products (including honey, royal jelly, etc.) is tied to a broader appreciation of apitherapy and natural remedies, a trend from which Ukrainian producers can benefit if they position their products correctly [8].

From an economic standpoint, producing functional bee products can substantially enhance the profitability of beekeeping operations — provided that producers can access the right technology and market outlets. The profit margins on value-added bee products are considerably higher than on bulk honey or even raw wax. As illustrated earlier, bee bread commands a price several times higher than unprocessed pollen. This dramatic price differential translates to greater income for essentially the same core activity of maintaining bee colonies. In practical terms, if a beekeeper can invest in the processing know-how to convert pollen into bee bread (a fermentation process that bees usually carry out in the hive), they can multiply their revenue with only a modest incremental cost. The case of PAVIK cooperative in Ukraine shows that adopting modern bee bread production techniques can be a game-changer: their new technology allows bee bread to be produced at minimal cost on an industrial scale, which in turn could enable even small apiaries to tap into this high-margin product [5].

Bee pollen itself, even before conversion to bee bread, is a relatively profitable product. It requires beekeepers to install pollen traps on hives and properly dry and clean the collected pollen. While this reduces honey yield slightly (as bees bring in less pollen to turn into honey), the pollen can be

sold as a premium health supplement. Globally, wholesale bee pollen prices vary widely depending on origin and quality, but generally fetch higher per-kilo prices than bulk honey. For context, Ukrainian wholesale honey prices in recent years have been on the order of \$1.5–2.0 per kg for common types, whereas good-quality bee pollen can sell internationally for many times that (e.g., \$8–12 per kg or more). Thus, even a small-scale operation that collects a few dozen kilograms of pollen stands to gain additional profit that would otherwise be missed. The market driver here is that consumers are willing to pay a premium for bee pollen's reputed health benefits (protein content, vitamins) that they would not pay for an equivalent amount of honey, which is seen more as a commodity sweetener [4].

For propolis, profitability comes from its potent bioactive value. Beekeepers can harvest propolis by scraping hive parts or using special propolis traps, yielding a raw resin that can be further processed. Propolis in raw form sells at high prices per kilogram, but often it is more profitable to tincture it in alcohol to create extract drops or to mix it into creams/lozenges, thereby creating retail products that command even higher unit prices. The costs associated with propolis collection are low (it's a by-product of hive maintenance), so most of the value added accrues as profit. In Ukraine, enterprises that produce propolis tinctures or propolis-enriched candies have reported good profit margins, although the scale remains artisan. On the European market, propolis extract is commonly sold in small bottles, and consumers pay a considerable price per milliliter for a product that originates from just a few grams of raw propolis. This indicates strong value creation. The main caveat is that propolis processing for consumables requires compliance with food supplement regulations and careful quality control (e.g., removing contaminants like wood splinters, wax, etc.), which can introduce additional costs [10].

One cannot ignore the cost side of producing these functional products. While raw bee products like pollen or propolis incur minimal extra cost beyond normal beekeeping, further processing (like drying pollen to food-grade standards, or formulating apifitocomposition capsules) may require equipment and knowledge. There is a need for investment in processing technology and skills, which can be a barrier for individual beekeepers. For example, freeze-drying or vacuum-drying equipment improves the quality of bee bread and pollen but can be expensive. Similarly, developing apifitocompositions — say, a mix of propolis ex-

tract with herbal extracts in a capsule form — might require collaboration with food technologists or pharmacists. These upfront investments must be weighed against the potential higher earnings. Generally, cooperatives or specialized processing firms can achieve economies of scale that individual beekeepers cannot. This suggests a model where beekeepers supply raw material to processors or form cooperatives to share equipment, thereby improving overall economic efficiency [1, 3, 8].

In summary, the profitability of functional bee products appears favorable, especially when selling to end consumers or exporting. Market trends, such as those described in global reports, reinforce this: the willingness-to-pay for natural health products means producers capture more value. By moving up the value chain — from producing commodity honey to producing specialized nutrition supplements — Ukrainian apiculture can increase its returns. However, to realize these profits, producers must overcome certain market and production challenges, discussed next.

Consumer behavior in both Ukraine and Europe is increasingly shaped by health and wellness considerations, which directly boosts demand for functional foods. Several trends stand out:

Rising Health Consciousness: In Europe, as noted, consumers are highly aware of the link between diet and health outcomes. Surveys indicate that a growing proportion of the population actively seeks foods with added health benefits, a trend that accelerated after the COVID-19 pandemic. People of various age groups, especially well-educated and middle-class consumers, are choosing foods believed to improve immunity, digestion, or overall vitality. This broad trend benefits bee products since they carry a natural "health halo." For example, immune-boosting properties are a major selling point for products like propolis and bee pollen [6, 9, 11]. In Ukraine, health consciousness is also rising, though somewhat lagging Western Europe. Urban consumers in Kyiv, Lviv, and other major cities are gradually adopting trends such as superfoods, organic products, and functional beverages. Bee products are often viewed favorably as part of Ukrainian folk medicine traditions (e.g., using honey and propolis for colds), which can translate into openness to newer forms like pollen granules or apitherapy mixtures [2].

Demand for Functional Foods in Europe: The European functional food market's robust growth signifies not only general health awareness but also

specific product acceptance. Functional dairy (like probiotic yogurts), fortified cereals, and nutraceutical beverages are commonplace. Bee products are often categorized under nutraceuticals and functional ingredients. For example, some European cereal brands include bee pollen in their granola for marketing as a protein-rich breakfast. In Mediterranean countries, there is a tradition of consuming honey with herbs which has expanded to new products like propolis sprays or pollen-enriched honey spreads for wellness. Additionally, Europe's aging population is looking for products to support longevity and active lifestyles. Bee products — known for antioxidant and anti-aging compounds — align well with the needs of older consumers seeking to improve joint health, immunity, or energy levels. The willingness of Europe's consumers to try novel functional products (so long as they are natural and safe) presents a ripe opportunity for introducing Ukrainian bee-based products, which could be marketed as exotic, high-quality and organic [13].

Ukrainian Consumer Trends: Within Ukraine, functional food consumption is still emerging. Traditional diets have not typically included packaged functional products, but the situation is changing due to higher incidence of lifestyle diseases and influence from global trends. Studies in Ukraine have pointed out that poor diet contributes to a significant portion of non-communicable diseases. This has led to greater attention on improving nutrition. The government and health experts have started encouraging functional ingredients (like iodized salt, fortified flour, etc.), and the public is slowly recognizing the importance of diet for health. Notably, honey has always been a staple, considered a healthy natural sweetener. Building on that positive image, other bee products can be introduced. We see small but growing demand for products like "perga" (bee bread) among health enthusiasts, especially those who follow fitness or folk medicine forums. The COVID-19 pandemic in 2020—2021 also sparked a surge in demand for immune boosters; Ukrainian pharmacies saw increased sales of propolis-based throat sprays and supplements, and many people took to consuming honey with added pollen or propolis for prevention. This event arguably accelerated the acceptance of bee functional products as mainstream supplements for health [1].

Another trend among younger Ukrainian consumers is the influence of social media and wellness influencers. As in the West, Ukrainian Instagram and YouTube influencers in the fitness and wellness space have started featuring natural products — occasionally including bee pollen as a

smoothie ingredient or propolis as a skincare additive [15]. This modern form of word-of-mouth is educating a new generation on the uses of bee products beyond honey. Over time, this could significantly broaden domestic demand.

In conclusion, consumer trends in both Ukraine and Europe are favorable to functional food products based on bee products. The drive for preventive health, desire for clean-label foods, and interest in traditional-natural remedies all intersect in this niche. The key for producers will be to effectively communicate the benefits and proper usage of these products to consumers who may not be familiar with them (especially in Ukraine). Education and marketing are crucial: for example, explaining how to eat bee pollen (e.g., stirred into yogurt or juice) or why bee bread is beneficial will help convert curiosity into regular demand. If done successfully, the rising tide of health-conscious consumption will carry these products into a more prominent market position.

Despite the attractive prospects, there are notable barriers that producers of functional bee products must overcome. Recognizing these challenges is important for crafting strategies to capitalize on the opportunities in this sector.

The production and commercialization of functional bee products, such as pollen, propolis, and bee bread, face a range of structural and regulatory challenges. Supply and production constraints represent a significant barrier, as yields are highly sensitive to environmental factors including weather conditions, floral availability, and colony health. Droughts or insufficient flowering can substantially reduce output, while small-scale apiaries often struggle to collect consistent volumes. Post-harvest handling errors, such as inadequate drying or improper storage, further exacerbate losses and compromise product stability. Addressing these issues requires the adoption of improved techniques, shared processing equipment, and cooperative aggregation of raw materials to ensure consistent supply and quality.

Quality and standardization gaps also pose critical limitations. Food-grade standards for bee pollen and bee bread are still evolving, resulting in variability in purity and potency, as well as occasional adulteration. These inconsistencies undermine consumer trust and restrict export opportunities. Voluntary certification schemes and traceability systems, including HACCP, ISO, and organic labeling, can support compliance with both domestic and international expectations, particularly among health-conscious consumers.

Regulatory and classification hurdles further complicate market entry. Bee-derived ingredients

may be categorized differently across jurisdictions — as foods or dietary supplements — each with specific labeling requirements, safety documentation, and allowable claims. For small firms, navigating this regulatory patchwork is often costly, though the availability of practical guidance and shared compliance services can reduce barriers to entry. In Ukraine, the implementation of Law No. 4122-IX, aimed at harmonizing the national framework with EU standards, introduces a unified definition of "dietary supplement," establishes a notification procedure with a public register, authorizes the Ministry of Health to set permitted substances and maximum levels, and strengthens labeling, claim, and operator accountability. A transition period is provided before full enforcement. For bee-derived supplements, including pollen capsules, propolis extracts, and apiphytocompositions, compliance entails notification, adherence to composition limits, and verification of claims, while products classified as medicines or medical devices remain subject to separate regulatory regimes. Export-oriented producers must also consider EU novel food regulations and corresponding national rules.

High production costs and limited operational scale further restrict growth. Harvesting bee products is labor-intensive and yields are modest, resulting in premium retail pricing. Fragmented apiaries rarely achieve economies of scale or the capacity to supply large retail chains. Consequently, initial market strategies should focus on urban niches and export channels, while cooperatives can facilitate volume expansion.

Despite these challenges, demand for functional bee products is rising, presenting significant untapped potential. Global sales of functional foods are expanding, and Ukraine's apicultural heritage, combined with its image as a provider of "clean, natural" products, positions it well to capitalize on this trend. Diversifying beyond honey into products such as bee bread, pollen capsules, propolis sprays, and apiphytocompositions can increase profitability while supporting rural employment.

Value addition and innovation are central to enhancing market competitiveness. Transitioning from raw materials to branded, finished products enables producers to capture a larger share of the value chain. Combining bee-derived ingredients with locally sourced botanicals, such as sea buckthorn or mint, facilitates the creation of distinctive formulations targeting immunity, digestive health, or oral care. E-commerce platforms and direct-to-consumer distribution channels further strengthen brand presence and expand export potential.

Scientific and clinical evidence underpins the credibility of functional bee products. Increasing research on the antimicrobial and anti-inflammatory properties of propolis, along with studies demonstrating the gut health benefits of bee bread, supports evidence-based marketing and regulatory compliance. Collaborations with universities and clinical institutions can validate efficacy claims and facilitate product approvals within regulatory frameworks.

In conclusion, while barriers such as inconsistent supply, quality variability, and low consumer awareness exist, they are not insurmountable. By improving organization, adhering to quality standards, employing targeted marketing strategies, and leveraging modern sales channels, Ukrainian producers can overcome these constraints. The sector offers considerable opportunity: growing global demand for natural health products, the potential for premium pricing, and the capacity to transform Ukraine's abundant beekeeping resources into high-value branded products. Strategic initiatives by producers, supported by stakeholders including industry associations, government entities, and international partners, can convert these opportunities into measurable economic gains.

CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

The analysis presented in this study allows several key conclusions to be drawn regarding the economic efficiency and market potential of producing functional foods from beekeeping products. Globally, the market for bee pollen, bee bread, propolis, and apiphytocompositions is expanding, driven by growing consumer demand for natural, health-promoting foods. Ukraine's well-established beekeeping sector offers significant potential to diversify beyond honey production into higher-value functional products. Despite Ukraine's status as a leading honey producer, its functional food segment — particularly bee-based products — remains underdeveloped, highlighting a substantial opportunity for growth and value creation.

From an economic perspective, the production of functional bee-based foods can markedly increase returns for both beekeepers and processing enterprises. Bee bread, for example, may command up to five times the price of raw pollen without proportionally higher production costs, resulting in considerably higher profit margins. Similarly, propolis extracts and apiphytocompositions achieve premium pricing in both domestic and international markets. However,

realizing these advantages depends on ensuring consistent quality standards across production and processing stages.

Consumer trends in Europe and Ukraine further support the expansion of the functional bee product market. Health-conscious populations, particularly urban consumers, increasingly seek natural products with preventive health benefits. In Ukraine, the traditional familiarity with apitherapy reinforces this opportunity, yet consumer education and targeted marketing are required to bridge knowledge gaps, stimulate domestic demand, and facilitate export development.

The sector, however, faces a range of challenges, including unstable raw material supply, insufficient certification standards, regulatory constraints, and limited consumer awareness. These obstacles can be mitigated through the adoption of improved production technologies, the formation of cooperatives or clusters, the development of national quality and certification standards, and the implementation of awareness-raising campaigns. In addition, government support programs and international collaboration can accelerate sector development.

Ukrainian producers possess notable comparative advantages, including abundant natural resources, skilled labor, and relatively low production costs. By embracing innovation in product formulations, integrating local botanicals, and leveraging e-commerce and direct-to-consumer strategies, domestic producers can compete successfully in global markets. The development of functional bee products aligns with principles of sustainable, health-oriented agriculture, promoting diversification of production and increased income for rural communities.

In conclusion, the production of functional foods from apicultural resources in Ukraine is both economically viable and socially beneficial. Producers who adhere to quality and innovation standards have the potential to achieve returns significantly higher than traditional honey production while meeting the growing global demand for natural health products. Policy support, including training programs, subsidies, and certification schemes, will be critical to unlocking this potential and fostering sustainable sector growth.

Future research should focus on integrating economic, technological, and nutritional perspectives to further develop this emerging sector. Key directions include conducting detailed cost-benefit analyses of specific bee-derived functional products, exploring cooperative and cluster-based value chain models, implementing

standardized certification systems, and collaborating with medical and research institutions to scientifically validate the health effects of bee-derived foods. Such multidisciplinary investigations will be essential to ensure that functional bee products become a sustainable, competitive, and innovative component of Ukraine's food industry.

Література:

1. Височанська М. Я. Економічні аспекти збалансованості розвитку галузі бджільництва. *Український журнал прикладної економіки та техніки*. 2023. Т. 8, № 2. С. 387—393.
2. Давидова Г. І., Гоцька С. М., Постоєнко В. О., Акименко Л. І., Лазарева Л. М. Ключові аспекти створення апіфітокомпозицій. *Бджільництво України*. 2021. Т. 1, № 7. С. 4—10. DOI: <https://doi.org/10.46913/beekeeping-journal.2021.7.01>
3. Шкарупа О., Треус А. Економічні аспекти ведення бізнесу в сфері бджільництва в Україні. *Bulletin of Sumy National Agrarian University*. 2018. № 6 (76). С. 86—88.
4. Credence Research Inc. Bee Pollen Market Size, Share, and Key Drivers in the Global Health Industry. 2025. URL: <https://www.linkedin.com/pulse/bee-pollen-market-size-share-key-drivers-global-health-xlvyc/> (дата звернення: 04 січня 2026).
5. ERA-Ukraine. Ukrainian beekeeping cooperative receives prestigious award in Chile for innovations in beekeeping. 2023. URL: <https://era-ukraine.org.ua/en/ukrainian-beekeeping-cooperative-receives-prestigious-award-in-chile-for-innovations-in-beekeeping/> (дата звернення: 04 січня 2026).
6. Fidan M., Inal B., Tokgun O. et al. Propolis as a functional plant-derived food: antioxidant and anti-cancer properties from Sirnak and Hakkari Regions. *European Food Research and Technology*. 2025. Vol. 251. P. 2945—2958. DOI: <https://doi.org/10.1007/s00217-025-04806-x>
7. Grand View Research. Bee Bread Market Size, Share & Trends Analysis Report, 2024—2030. 2023. URL: <https://www.grandviewresearch.com/horizon/outlook/bee-bread-market-size/global> (дата звернення: 04 січня 2026).
8. Kaprelyants L., Yegorova A., Trufkati L., Pozhitkova L. Functional foods: prospects in Ukraine. *Food Science and Technology*. 2019. Vol. 13, no. 2. P. 85—95.
9. Kaur R., Sharma S., Mahajan S., Kaur S. Exploring the Nutritional and Physiological Benefits of Bee-derived Products: Honey and Pollen as Emerging Functional Foods. *Archives of*

Current Research International. 2025. Vol. 25, no. 8. P. 326—335. DOI: <https://doi.org/10.9734/acri/2025/v25i81421>

10. Maicelo-Quintana J. L., Reyna-Gonzales K., Balcazar-Zumaeta C. R., et al. Potential application of bee products in food industry: An exploratory review. *Heliyon*. 2024. Vol. 10, no. 1. e24056. DOI: <https://doi.org/10.1016/j.heliyon.2024.e24056>

11. Martinello M., Mutinelli F. Antioxidant Activity in Bee Products: A Review. *Antioxidants*. 2021. Vol. 10, no. 1. P. 71. DOI: <https://doi.org/10.3390/antiox10010071>

12. Mykhailova L., Hrytsenko V. Organizational and economic principles of functioning of the beekeeping market. *Ekonomika APK*. 2018. Vol. 25, no. 8. P. 35—43.

13. Straits Research. Functional Food Market Size, Share & Trends Analysis Report, 2025—2033. 2025. URL: <https://www.grandviewresearch.com/industry-analysis/functional-food-market> (дата звернення: 04 січня 2026).

14. Rearick T. Conversations with a Ukraine Beekeeper. *Bee Culture*. 2015. Feb. 1. URL: https://cdn.beeculture.com/wp-content/uploads/2023/05/December2015_V1.pdf (дата звернення: 04 січня 2026).

15. Yevhen Klopotenko. URL: <https://www.youtube.com/watch?v=xD3Mv-W4vG8> (дата звернення: 04 січня 2026).

References:

1. Vysochanska, M. Ya. (2023), "Economic aspects of balanced development of the beekeeping sector", *Ukrainian Journal of Applied Economics and Technology*, vol. 8, no. 2, pp. 387—393.

2. Davydova, H.I., Hotska, S.M., Postoienco, V.O., Akymenko, L.I. & Lazaryeva, L.M. (2021), "Key aspects of creating apifitocompositions", *Bdzhilnyctvo Ukrayiny*, vol. 1, no. 7, pp. 4—10. <https://doi.org/10.46913/beekeepingjournal.-2021.7.01>

3. Shkarupa, O. & Treus, A. (2018), "Economic aspects of beekeeping business in Ukraine", *Bulletin of Sumy National Agrarian University*, no. 6 (76), pp. 86—88.

4. Credence Research Inc. (2025), "Bee Pollen Market Size, Share, and Key Drivers in the Global Health Industry", available at: <https://www.linkedin.com/pulse/bee-pollen-market-size-share-key-drivers-global-health-x1vyc/> (Accessed 04 January 2026).

5. ERA-Ukraine (2023), "Ukrainian beekeeping cooperative receives prestigious award in Chile for innovations in beekeeping", available at: <https://era-ukraine.org.ua/en/ukrainian-beekeeping-cooperative-receives-prestigious-award-in-chile-for-innovations-in-beekeeping/>

award-in-chile-for-innovations-in-beekeeping/ (Accessed 04 January 2026).

6. Fidan, M., Inal, B., Tokgun, O., et al. (2025), "Propolis as a functional plant-derived food: antioxidant and anti-cancer properties from Sirnak and Hakkari Regions", *European Food Research and Technology*, vol. 251, pp. 2945—2958. <https://doi.org/10.1007/s00217-025-04806-x>

7. Grand View Research (2023), "Bee Bread Market Size, Share & Trends Analysis Report, 2024-2030", available at: <https://www.grandviewresearch.com/horizon/outlook/bee-bread-market-size/global> (Accessed 04 January 2026).

8. Kaprelyants, L., Yegorova, A., Trufkati, L. & Pozhitkova, L. (2019), "Functional foods: prospects in Ukraine", *Food Science and Technology*, vol. 13, no. 2, pp. 85—95.

9. Kaur, R., Sharma, S., Mahajan, S. & Kaur, S. (2025), "Exploring the nutritional and physiological benefits of bee-derived products: honey and pollen as emerging functional foods", *Archives of Current Research International*, vol. 25, no. 8, pp. 326—335. <https://doi.org/10.9734/acri/2025/v25i81421>

10. Maicelo-Quintana, J.L., Reyna-Gonzales, K., Balcazar-Zumaeta, C.R., et al. (2024), "Potential application of bee products in food industry: An exploratory review", *Heliyon*, vol. 10, no. 1, e24056. <https://doi.org/10.1016/j.heliyon.-2024.e24056>

11. Martinello, M. & Mutinelli, F. (2021), "Antioxidant activity in bee products: a review", *Antioxidants*, vol. 10, no. 1, p. 71. <https://doi.org/10.3390/antiox10010071>

12. Mykhailova, L. & Hrytsenko, V. (2018), "Organizational and economic principles of functioning of the beekeeping market", *Ekonomika APK*, vol. 25, no. 8, pp. 35—43.

13. Straits Research (2025), "Functional Food Market Size, Share & Trends Analysis Report, 2025—2033", available at: <https://www.grandviewresearch.com/industry-analysis/functional-food-market> (Accessed 04 January 2026).

14. Rearick, T. (2015), "Conversations with a Ukraine Beekeeper", *Bee Culture*, Feb. 1. available at: https://cdn.beeculture.com/wp-content/uploads/2023/05/December2015_V1.pdf (Accessed 04 January 2026).

15. Klopotenko, Y. (2025), YouTube channel. available at: <https://www.youtube.com/watch?v=xD3Mv-W4vG8> (Accessed 04 January 2026).

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