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Business efficiency of using “therapeutic bee beds in a pyramid” in health improvement of the American population

Abstract. The purpose of this study was to analyse the economic prospects for the development of beekeeping in the United States of America, specifically to explore the possibilities of integrating apitherapy into the agricultural sector and the wellness industry. The focus was on the effects of beekeeping on the economy, the analysis of demand for bee products, and the commercialisation potential of innovative apitherapy methods. The methodology included statistical data analysis, assessment of honey production dynamics, study of market trends, and evaluation of the economic efficiency of new bee product-based treatments. The study found that honey production in the United States in 2023 was 139 million pounds, 11% more than in 2022, despite a 6% decrease in the number of bee colonies. At the same time, the average honey yield per colony increased by 17%. The main producing states continue to be North Dakota, South Dakota, and California. Demand for honey and other bee products stays consistently high, while honey imports have fallen by 25% due to tighter product quality controls. The contribution of bee pollination to agriculture was estimated separately at over 18 billion USD annually. Particular attention was paid to the prospects for apitherapy. Analysis revealed that the market for alternative medicine and wellness services in the United States is estimated at over 1.5 trillion USD and is showing steady growth. Innovative technologies, such as the “therapeutic bee bed in a pyramid”, have strong commercial potential due to the demand for natural therapeutic methods. It was estimated that the introduction of this technology in wellness centres and eco-hotels would break even within 6-12 months. The practical significance of this study lies in the fact that the findings can be used by entrepreneurs, investors, and specialists in beekeeping, alternative medicine, and the wellness business to assess the profitability of expanding business models based on apitherapy technologies

Keywords: honey; health improvement; wellness industry; medicine; bioeconomy

INTRODUCTION

Beekeeping is a prominent component of the agro-industrial complex, which not only provides honey and other products, but also plays

a key role in pollinating agricultural crops. The beekeeping market is showing steady growth, but changing economic, environmental, and

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social factors require innovative approaches to its improvement. One promising area is the integration of bee products into alternative medicine, particularly apitherapy, which not only expands the range of applications for bee products but also increases the profitability of the industry. The relevance of the present study is driven by the growing interest in natural therapeutic methods in society, the increase in demand for organic products, and the need to improve the economic efficiency of beekeeping.

The development of beekeeping as an element of the agricultural sector and its economic efficiency were the subject of the present study. Specifically, considerable attention was paid to the organisational and economic aspects of the functioning of beekeeping enterprises, the effects of the market on the profitability of the industry, and the possibilities for diversifying beekeepers' incomes through the introduction of the latest technologies and the expansion of sales markets. Various aspects of the development of beekeeping and the integration of apitherapy into the economic and tourism sectors are actively researched in scientific literature. N. Melnyk & N. Bidochko (2024) focused on the potential for the development of apitourism in Ukraine, where beekeeping could become not only a prominent part of the agricultural sector, but also a significant element of the tourism industry. This study opened new perspectives for the use of bee products for recreational and educational purposes, which may be useful for expanding activities in the wellness sector. T.O. Parfinenko (2023) examined the concept of wellness as an innovative area for the organisation of hospitality businesses. This approach contributed to the growing popularity of natural healing methods, such as apitherapy, which may become a valuable part of the hotel business offering, especially in the context of new tourism trends.

I. Svyynous *et al.* (2023) covered the organisational and economic foundations of beekeeping, exploring the key factors determining the effectiveness of beekeeping activities. The researchers focused on the relationship between investment policy, marketing strategies, and the competitiveness of beekeeping products. T. Mirzoeva & L. Ilkiv (2023) addressed the risks and

prospects for the development of beekeeping, analysing the effects of climate change, market fluctuations, and regulatory policy on honey production. The study demonstrated that the need to adapt to modern economic challenges is driving the search for innovative approaches to increasing the profitability of the industry.

S.A. Vinichenko (2021) highlighted the marketing aspects of beekeeping enterprises, examining the development of effective marketing strategies to increase demand for the industry's products. The researcher stressed the significance of branding, environmental certification, and participation in international markets to improve the competitiveness of beekeeping products. A study by G.L. Tyufanov (2024) on business process optimisation in agriculture was also noteworthy, as the researcher analysed the possibilities of reengineering in beekeeping. G.L. Tyufanov noted that the automation of apiaries, the improvement of logistics, and the introduction of innovative technologies can markedly increase the efficiency of honey production. A separate area of research concerns the role of beekeeping in the sustainable development of rural areas. R. Prodanović *et al.* (2024) stressed that beekeeping can be a powerful tool for stimulating regional economic development, contributing to biodiversity conservation and creating new jobs in rural areas.

A.H. Harianja *et al.* (2023) examined the global prospects for beekeeping, assessing the effects of the industry on the socio-economic status of farms. The researchers emphasised that the development of beekeeping positively influences not only on the agricultural sector, but also the environmental sustainability and food security. An interesting concept is that of apitourism as part of rural tourism development, which was explored by I. Atmazhov & A. Atmazhova (2024). The researchers considered the potential for integrating beekeeping farms into tourist routes, which could become an extra source of income for beekeepers. In the context of the economic role of beekeeping at the international level, the conclusions of O. Etxegarai-Legarreta & V. Sanchez-Famoso (2022) were important. The researchers considered the intersectoral impact of beekeeping, including its contribution to the food system,

environmental protection, and socio-cultural development of regions.

R. Sharma *et al.* (2023) outlined the practical aspects of running a beekeeping business, providing a detailed overview of apiary management methods, production profitability, and the characteristics of the honey market. A.B. Ferreira *et al.* (2023) addressed the untapped potential of the beekeeping business, emphasising that diversification of production could be a key factor in increasing the profitability of apiaries. D. Singh (2020) also considered commercial beekeeping as an industry with high profit potential, especially in the context of growing demand for natural products. M. Wakgari & G. Yigezu (2021) investigated the major constraints and future prospects of beekeeping, emphasising the need to improve technologies and market strategies.

The purpose of the present study was to analyse the economic prospects of introducing apitherapy in the United States as a factor in stimulating agribusiness and the development of beekeeping. For this, the following objectives were set: to analyse the demand for bee products and market opportunities for the development of apitherapy methods, particularly innovative technologies such as the “therapeutic bee bed in a pyramid”; to assess the profitability of apitherapy methods and their economic feasibility for businesses in the agricultural and wellness sectors.

MATERIALS AND METHODS

The study analysed data covering the 2021-2024 period. The research focused on analysing the economic potential of integrating apitherapy into the agricultural sector and wellness industry in the United States. The study was based on statistical data obtained from official sources, such as the National Agricultural Statistics Service (2023), as well as analytical reports from leading international organisations, including Grand View Research (2023) and the Global Wellness Institute (2024). Particular attention was paid to the analysis of honey market data published by the National Agricultural Statistics Service in 2023-2024, which reflected the dynamics of honey production and consumption.

The honey market analysis was based on data from the National Agricultural Statistics

Service, which showed that despite a decline in the number of bee colonies in 2023, honey production increased by 11%. This was caused by an increase in the average honey yield per bee colony. The data was supplemented with information from Pasika.News (Gurman, 2022) and Gornich (International honey market..., 2022; International honey market..., 2023), which highlighted trends in honey demand in the United States, including record honey consumption in 2021 and a decline in imports driven by tighter product quality controls. Furthermore, the Gornich report contains information on the dynamics of the international honey market in 2024, which was used to understand the global context.

The analysis of the effects of bee pollination on the agricultural sector was based on data from the National Agricultural Statistics Service. According to SuperAgronom (Pollinating crops, bees..., 2020), crops such as almonds, watermelons, and apples have the greatest economic benefit from pollination. Additional data on income from renting bee colonies for pollination was obtained from the AgroPortal report (Sweeter than honey..., 2020), which described the role of commercial beekeeping in providing sustainable income for farmers. The wellness services market research was based on reports by Grand View Research (2023) and the Global Wellness Institute (2024). The Global Wellness Institute report highlighted the significant role of natural therapeutic methods, such as apitherapy, in meeting the demand for health and wellness services. Particular focus was placed on the analysis of innovative technologies, such as the ‘therapeutic bee bed in a pyramid’ presented by Bienenpyr (n.d.). Technical documentation posted on the company’s official website provided detailed information on the effectiveness and commercial application of this technology.

Statistical analysis methods were employed for the analysis, specifically the Student’s t-test to assess changes in honey production and regression analysis to forecast the market potential of apitherapy in the wellness industry. All calculations were performed using Microsoft Excel and SPSS Statistics software. The analysis results were presented in graphs and tables, making them clear and accessible for further interpretation. The study was based on official reports and

open sources, including the National Agricultural Statistics Service (2023) and Bienenpyr (n.d.). This ensured the reliability, relevance, and completeness of the findings obtained. All collected data were analysed according to the research objectives, which helped to determine the economic efficiency of apitherapy and the prospects for its integration into the US market.

RESULTS

Overview of beekeeping

as an agricultural industry in the United States

Beekeeping is a prominent part of agriculture in the United States, providing honey and other products and playing a key role in pollinating crops (Bienenpyr, n.d.). According to the National Agricultural Statistics Service (2023), honey production in the United States was 125 million pounds in 2022, down 1% from 2021. The number of bee colonies involved in honey production was 2.67 million, also down 1% from the previous year. The average honey yield per colony stayed stable at 47 pounds.

However, honey production increased in 2023. Total production reached 139 million pounds, up 11% from 2022. Although the number of bee colonies decreased by 6% (to 2.51 million), the average honey yield per colony increased by 17% to 55.2 pounds (Grand View Research, 2023). The key honey-producing states are North Dakota, South Dakota, and California. In 2021, these three states saw a 25% decline in production compared to 1991. Overall, honey production in the United States in 2021 was the lowest since 1991 (Gurman, 2022). The development of beekeeping in the United States largely depends on geographical conditions, as climate and the availability of honey plants affect honey production levels. Some states have more favourable conditions for beekeeping and are leaders in honey production. Specifically, North Dakota, South Dakota, and California consistently stay among the largest honey producers in the country (Grand View Research, 2023). Figure 1 presents the main honey-producing states in the United States for 2024.

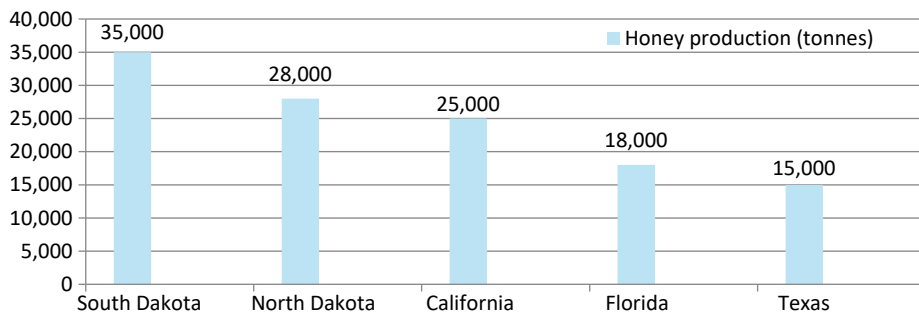


Figure 1. Major honey-producing states in the United States (2024)

Source: developed by the authors of this study based on the Grand View Research (2023)

As Figure 1 shows, North Dakota is the undisputed leader in honey production, accounting for the largest share of the market. This is explained by its favourable climate and abundance of natural pastures, which serve as a source of nectar for bees. South Dakota and California also play a significant role in honey production, while Florida and Texas, despite marked levels of beekeeping, lag behind the top three states. Notably, regional differences in honey production affect pricing and profitability in the industry. For example, in states with

warm climates and longer flowering seasons, beekeepers have more opportunities to harvest honey, which can positively influence economic performance. Knowledge of the regional distribution of honey production is significant for entrepreneurs considering investing in the beekeeping business, as it allows them to assess the competitiveness of individual states and the potential for development of this industry in different regions of the United States.

Furthermore, in 2021, demand for honey in the United States reached 618 million pounds

(approximately 280,000 t), equivalent to 1.98 pounds per capita. However, honey imports in the first seven months of 2022 fell by 25%. The key reasons for this decline were stricter measures to combat honey adulteration, the introduction of anti-dumping duties against key exporting countries, and the impact of the COVID-19 pandemic (International honey market..., 2022). Bees play a valuable role in pollinating over 100 crops in the United States, including almonds, fruits, berries, melons, and pumpkins. Insect pollination is considered essential for stable yields of many crops, and its economic value is estimated to be significant (Shvorak & Filiuk, 2021). Pollinators add more than 18 billion USD to the annual value of crops produced in the United States. Individual estimates showed that in 2009, the economic value of honeybee pollination in the United States was approximately 11.68 billion USD. Agricultural research revealed substantial improvements in crop yields when bees were used for pollination. For instance, five of the seven crops under study, such as blueberries, apples, cherries, almonds, and watermelons, produced greater yields when pollinated by bees. The economic effect of pollination was estimated at 1.06 billion USD for apples, 146 million USD for watermelons and 50 million USD for blueberries (Pollinating crops, bees..., 2020).

Considering the growing demand for natural products and environmentally friendly solutions in medicine, the introduction of the latest technologies and methods of apitherapy is a promising area for the development of beekeeping. Apart from the conventional production of honey, propolis, royal jelly, and bee venom, there has been increased interest in recent years in alternative methods of treatment and healing based on bee products. In this context, innovative developments such as the 'therapeutic bee bed in a pyramid' may be promising. Such technologies can be used in the wellness industry, eco-hotels, and alternative medicine centres. They combine conventional apitherapy practices with ecological design concepts, which is in line with current trends in the US health services market.

Beekeeping is a vital part of the US agricultural economy, providing honey and other products, but also playing a key role in pollinat-

ing crops. Recent years showed some fluctuations in honey production, but overall demand for bee products continues to be consistently high. The economic value of beekeeping extends beyond the direct production of honey, as pollination contributes to higher yields for many crops. Innovative approaches, including apitherapy, can expand the market for bee products and create new opportunities for entrepreneurs in the industry. Thus, the further development of beekeeping in the United States has considerable economic potential, including its integration into the health and wellness industry.

Economic analysis of the US beekeeping industry

Beekeeping in the United States is a commercially significant industry that combines the production of honey, other bee products, and pollination services for agricultural crops. Honey production continues to be the primary activity of American beekeepers, although they derive a sizeable portion of their income from commercial pollination (Šeráková, 2019). According to the National Agricultural Statistics Service (2023), in 2022, the average price of honey was 2.96 USD/pound, with premium organic honey costing up to 5-7 USD/pound. Apart from honey, a growing demand for products such as propolis, royal jelly, and bee venom is observed, which are used in medicine, cosmetics, and alternative therapies.

Renting bees for pollination is another significant source of income for American beekeepers. In 2023, the average fee for pollinating almonds was 220 USD per hive, the greatest of any crop (Sweeter than honey..., 2020). Other crops, such as apples, blueberries, and watermelons, also require active pollination by bees, which substantially affects yield levels. The contribution of bee pollination to the gross output of US agriculture is estimated at around 18 billion USD. Demand for bee products in the United States stays consistently high, driven by increased interest in natural products and the growing popularity of apitherapy. At the same time, the market structure is changing. Honey imports in 2022 fell by 25% due to tighter controls on counterfeiting, the introduction of anti-dumping duties, and lower production

volumes in major exporting countries (International honey market..., 2023). Still, the segment of niche bee products, such as honey from exotic plants, honey with added functional components, and apitherapeutic honey, is expanding.

The honey market in the United States is experiencing significant price fluctuations, which are caused by both internal production factors and the influence of imports. Due to increased

demand for natural honey and the introduction of anti-dumping duties, prices for imported honey have risen in recent years, creating new opportunities for American beekeepers. At the same time, the average cost of local honey stays stable, ensuring relative predictability in beekeepers' incomes. Table 1 below compares the average prices of American and imported honey for 2021-2024.

Table 1. Dynamics of average prices for American and imported honey in the United States (2021-2024)

Year	Average price of American honey (USD/pound)	Average price of imported honey (USD/pound)
2021	6.6-7.8	5.89
2022	6.6-7.8	7.58
2023	6.6-7.8	11.55
2024	6.6-7.8	13.93

Source: developed by the author of this study based on the International honey market as of May 2023 (2023)

As the table 1 shows, the price of American honey has stayed stable at around 6.6-7.8 USD/pound over the last four years. At the same time, prices for imported honey have risen markedly, which can be explained by the introduction of new trade restrictions, US customs policy, and the intensification of the fight against counterfeit products. While imported honey cost 5.89 USD/pound in 2021, its average price in 2023 was already 11.55 USD/pound, more than double the 2021 figure. These changes create favourable conditions for the development of internal honey production in the United States. The decrease in the share of cheap imports contributes to the growth of competitiveness of local beekeepers and an increase in their profits. At the same time, the rise in the cost of imported honey may stimulate the emergence of new producers on the American market, which will require beekeepers to adapt their business strategies to maintain their competitive advantages.

Despite positive economic indicators, beekeeping in the United States faces a series of challenges. The decline in the bee population, which is linked to climate change, pesticide use, and the degradation of natural honey-producing lands, is negatively affecting honey yields and the efficiency of crop pollination. Furthermore, the honey market is affected by alternative

sweeteners that compete for consumers. At the same time, rising production costs due to greater equipment, labour, and transport costs are forcing beekeepers to look for new business models.

The prospects for the development of beekeeping in the United States are linked to the expansion of the product range and the introduction of innovative technologies. Interest in natural methods of treatment is opening new opportunities for the development of apitherapy, which is becoming part of the wellness industry. The increased use of honey in pharmacology and cosmetology is creating more sales channels for bee products. The development of eco-hotels and eco-farms contributes to the popularisation of apitherapy as part of a comprehensive approach to health improvement, including new methods such as the ‘therapeutic bee bed in a pyramid’.

Research on demand for bee products in the US market

Beekeeping in the United States provides a wide range of products, including honey, propolis, royal jelly, wax, and bee venom. Honey stays the most popular product, used as a natural sweetener and ingredient in cooking. According to the National Agricultural Statistics Service (2023), annual honey production in the United States

exceeds 70 million kg. However, in 2020, production declined by 6%, leading to a 2% increase in the average price to 5 USD/kg. Apart from honey, American consumers are showing growing interest in other bee products. Propolis is known for its antimicrobial properties and is widely used in traditional medicine. Royal jelly is used as a dietary supplement due to its high content of biologically active substances. Beeswax is used in the production of candles, cosmetics, and skin care products, while bee venom is used in apitherapy to treat inflammatory diseases and rheumatic disorders (Gurman, 2022).

The market for bee products in the United States shows stable demand for various types of products, among which honey stays the undisputed leader in terms of consumption. This is caused by its wide use in the food industry, medicine, and cosmetology. However, other bee products, such as propolis, wax, and royal jelly, are also finding their place in the commercial sector, especially in the pharmaceutical and wellness industries. Figure 2 illustrates the demand structure for the key bee products in the United States for 2023, helping to assess which of them have the greatest economic potential.

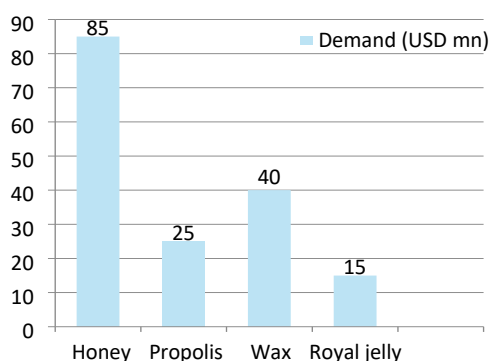


Figure 2. Demand for major bee products in the United States (2024)

Source: developed by the author of this study based on the Grand View Research (2023)

Demand for bee products in the United States stays consistently high, driven by the growing popularity of natural and organic products. Honey is a key product in the market, demonstrating the greatest level of consumption due to its wide application in the food industry, medicine, and

cosmetology. Propolis and wax occupy a prominent place in the cosmetic and pharmaceutical industries, which determines their significant commercial potential. At the same time, demand for royal jelly, albeit lower, continues to grow due to interest in biologically active supplements and natural health products. These trends create new opportunities for entrepreneurs working in beekeeping and apitherapy. The expansion of the use of bee products in the wellness industry and alternative medicine opens prospects for the creation of innovative products and services. Thus, the economic potential of the industry remains high, which contributes to the further development of the beekeeping business and its integration into related industries.

Consumer trends in the United States suggest an increased interest in natural and organic products, which is driving demand for bee products. During the COVID-19 pandemic, Americans used honey more actively in their daily diet, which led to an increase in its sales. Consumers viewed honey as a natural remedy for strengthening the immune system, which was particularly noticeable among health-conscious consumers (Gurman, 2022).

Bee products are also being integrated into the health and medical industries. Honey, propolis, royal jelly, and bee venom are used in apitherapy for the prevention and treatment of various diseases, including respiratory and skin disorders. Furthermore, bee products are used in cosmetics and pharmaceuticals due to their antioxidant and antimicrobial properties. Demand for these products is growing due to increasing consumer interest in natural health care and cosmetic products without synthetic additives.

Innovative trends in apitherapy: “Therapeutic bee bed in a pyramid” and their economic feasibility

Recent years have been marked by growing interest in natural medicine and alternative treatments, which markedly increased the popularity of apitherapy. The use of bee products for medical and health purposes has a long history, but modern technologies allow creating new therapeutic methods with greater efficacy and commercial potential. In the context of the global trend towards healthy lifestyles and

environmental awareness, apitherapy is viewed as a promising area of development from both a medical and business perspective.

One example of the latest technologies in apitherapy is the ‘therapeutic bee bed in a pyramid’ presented by Bienenpyr (n.d.). This technology is based on combining the natural vibrations and bioenergetic properties of beehives with the unique effect of a pyramid structure. According to data provided by the company, this therapy helps normalise blood pressure, improve metabolism, strengthen the immune system, and treat respiratory diseases and nervous disorders.

Innovative apitherapy techniques are already being successfully commercialised in various countries. Specifically, there are numerous api-houses in Germany and Switzerland where patients undergo therapy using bee vibrations and the aromas of beehives. Analogous practices are actively developing in Austria and Canada, where many people turn to alternative medicine to treat stress, insomnia, and chronic diseases. In the United States, the alternative medicine and wellness industry is growing rapidly, creating favourable conditions for the introduction of techniques such as bee therapy.

From an economic standpoint, apitherapy techniques have significant commercial potential. The integration of such technologies into wellness centres, eco-hotels, and sanatorium-resort complexes allows expanding the range of services and attracting new customers. The use of a ‘therapeutic bee bed in a pyramid’ can become a vital part of recovery and wellness programmes in specialised institutions, contributing to their profitability. Additionally, consumers seeking natural treatments are willing to invest in such services, which increases the profitability of the alternative medicine sector.

The growing popularity of apitherapy services is driving demand for key bee products such as honey, propolis, wax, bee venom, and royal jelly. This is expanding sales markets and creating new premium product segments. According to Grand View Research (2023), the inclusion of honey in wellness service programmes can increase the average margin to 35%-50% compared to conventional retail sales. Propolis and bee venom, thanks to their pharmacological properties, increase in price by 70%-90% when integrated into cosmetic and therapeutic products (Table 2).

Table 2. Comparison of the profitability of bee products by sales channels

Product	Conventional market (USD/kg)	Wellness sector (USD/kg)	Margin growth (%)
Honey	6.6-7.8	10-12	+45-60
Propolis	35	60-70	+70-100
Royal jelly	110	160-180	+45-65
Bee venom	300	500-550	+70-83

Source: developed by the author of this study based on the Grand View Research (2023), Global Wellness Institute (2024), Bienenpyr (n.d.)

Table 2 shows that the sale of bee products in the wellness sector is markedly more profitable than in the conventional market. The largest margin growth is observed in propolis (+70%-100%) and bee venom (+70%-83%), which suggests their high value in the field of health and cosmetology. Honey and royal jelly also show pronounced growth in profitability (+45%-60% and +45%-65%, respectively), but in absolute terms, bee venom (500-550 USD/kg) and royal jelly (160-180 USD/kg) stay the most expensive products. A shift towards the wellness sector could substantially increase the income of bee product producers.

The development of apitherapy positively influences the diversification of beekeepers' income. Apiaries that have introduced apiary huts or bee beds report an increase in annual profits of 30%-40% without a substantial expansion of bee colonies. This model allows transforming an apiary into a multifunctional health and agricultural facility that includes not only production but also services. For example, in Montana, an apiary with 100 hives that also provides apitherapy services earns approximately 30,000-45,000 USD in additional annual income (Grand View Research, 2023). This far exceeds the profits of a conventional apiary operating exclusively

within the food market. Thus, the economic feasibility of apitherapy lies not only in the potential for increasing income in the wellness sector, but also in the comprehensive stimulation of beekeeping development, modernisation of production, and expansion of the niche market for natural products.

The introduction of innovations in apitherapy also contributes to the development of beekeeping as an industry, as the increased demand for bee products stimulates the production of honey, propolis, bee venom, and other apitherapeutic components. Thus, the commercialisation of the latest techniques in this field is a promising area from both a medical and economic standpoint, opening new opportunities for the agricultural and health businesses. The modern development of apitherapy is aimed at creating new therapeutic methods that combine traditional knowledge with innovative approaches. One such solution is the 'therapeutic bee bed in a pyramid', which combines the effects of natural bee therapy with the architectural properties of the pyramidal shape. This technology is based on the principle of using the bioenergy of bees in combination with the design features of the pyramid. The patient lies on a special bed installed directly above a beehive, without direct contact with the insects. The vibrations created by the bees, as well as the volatile components of honey, wax, and propolis, spread throughout the interior of the bed, promoting relaxation, improving blood circulation, and normalising the nervous system. The pyramid structure can act as an energy amplifier for natural biological processes (Bienenpyr, n.d.).

From a market perspective, the introduction of the 'therapeutic bee bed in a pyramid' could become a competitive advantage for the rapidly growing wellness industry in the United States. Over the past decade, alternative medicine and natural healing methods have gained widespread recognition among American consumers, as evidenced by the growing demand for natural therapeutic techniques. Owners of wellness centres, eco-resorts, and medical sanatoriums, who are constantly looking for new opportunities to expand their range of services, are particularly interested in unconventional methods.

The integration of this technology into apitherapy practice in the United States has several promising areas. Firstly, it can be implemented in specialised wellness centres and apitherapy clinics that use natural healing methods. Secondly, the concept of a 'therapeutic bee bed in a pyramid' can be adapted for ecotourism and rural wellness holidays, which are especially popular among consumers seeking harmony with nature. Furthermore, individual wellness programmes could be created to include this technology as part of a comprehensive approach to the treatment and prevention of diseases of the nervous and respiratory systems and the overall strengthening of the immune system.

From an economic standpoint, the introduction of the 'therapeutic bee bed in a pyramid' could become a source of new income for apitary owners and entrepreneurs in the wellness business. The demand for innovative relaxation and therapy methods in the United States is showing steady growth, making such technologies attractive to investors and businesspeople. Specifically, the use of this method in the wellness industry allows creating package wellness services that include comprehensive treatment using natural methods.

Since the American alternative medicine market is one of the largest in the world, the further development of apitherapy in the United States may include the introduction of the 'therapeutic bee bed in a pyramid' as a new standard for wellness programmes. The successful commercialisation of this technology in European countries such as Germany and Austria demonstrate its potential for international expansion. With growing interest in natural treatments, this technology could become a valuable element in the development of apitherapy and contribute to expanding economic opportunities in the beekeeping industry.

Business aspects of the "therapeutic bee bed in a pyramid" in the United States

The alternative medicine and wellness industry in the United States is showing steady growth, creating favourable conditions to introduce innovative apitherapy techniques. The "therapeutic bee bed in a pyramid" could become a new business tool for expanding the range of

wellness services in various sectors. One of the most promising areas is the wellness industry, which includes spa complexes, fitness centres, medical resorts, and health resorts. In the United States, the wellness services market is estimated at over 1.5 trillion USD and is growing by 5%-10% annually (Global Wellness Institute, 2024). Considering the popularity of speleotherapy, cryotherapy, sensory deprivation, bee bed technology may find its niche as a new method of deep relaxation and nervous system restoration.

Another area is eco-tourism and eco-hotels, which focus on natural health methods. Hotels and sanatoriums offering organic food, microclimate therapy, and energy-efficient solutions are actively introducing natural methods of treatment and relaxation. The integration of bee beds as part of specialised wellness programmes can increase the competitiveness of such establishments and attract a new category of customers. The third promising segment is alternative medicine centres working in the field of prevention and rehabilitation. The popularity of non-drug treatments is growing in the United States, and apitherapy is already in steady demand among patients with chronic inflammatory processes, nervous system disorders, and respiratory problems. The introduction of the ‘therapeutic bee bed in a pyramid’ in such centres can help expand the range of services and increase the average customer spend.

From an investment standpoint, the commercialisation of this technology looks promising. The average cost of an apitherapy session in the United States ranges from 50 USD to 200 USD, depending on the level of the facility and the duration of the procedure. Assuming that an average wellness centre conducts 20 sessions per day at an average cost of 120 USD per procedure, this yields a potential daily income of 2,400 USD, and per month (working 25 days) – 60,000 USD. The costs of implementing the technology include the purchase of equipment, setting up the premises, and marketing. The approximate cost of installing a single ‘therapeutic bee bed in a pyramid’ can range within 10,000-30,000 USD, depending on the configuration and location. Thus, the return on investment can be 6-12 months, which is quite fast for the wellness business.

Furthermore, this technology can be monetised through franchising. Owners of successful wellness centres can implement this concept as a separate business project, offering franchises to operators of wellness centres or tourist complexes. An analogous model is already working in Europe, where wellness techniques based on bee products are used in medical resorts and eco-residences. Thus, the ‘therapeutic bee bed in a pyramid’ has high commercialisation potential in the United States due to its combination of an innovative approach, stable growth in the wellness services market, and the possibility of a quick return on investment. This technology could become a new standard in alternative medicine, expanding business opportunities and creating additional economic incentives for the development of apitherapy and beekeeping in general.

Beekeeping and apitherapy are vital components of the US agricultural industry with a promising growth potential. Demand for bee products continues to be consistently high due to growing interest in natural foods and alternative medicine. Apart from the conventional production of honey, propolis, wax, and other bee products, the sector is expanding into the commercialisation of apitherapy, opening new opportunities for agribusiness. The introduction of innovative apitherapy methods allows expanding the scope of application of bee products, integrating them into the wellness industry, eco-tourism, and alternative medicine. Growing consumer interest in natural treatments is stimulating investment in new therapeutic solutions, which may positively influence the economic attractiveness of beekeeping as an industry. Considering the size of the alternative medicine and wellness services market in the United States, which is estimated at over 1.5 trillion USD and continues to grow, apitherapy can scale up and integrate into medical and tourism business models.

One example of a successful innovative development in this field is the ‘therapeutic bee bed in a pyramid’, which combines traditional apitherapy methods with elements of energy architecture. Its commercial potential lies in its potential for implementation in wellness centres, eco-hotels, and alternative medical facilities. The demand for new health improvement

methods among American consumers creates favourable conditions for the commercialisation of this technology. To fully cover the economic aspect of introducing the innovative technology of the ‘therapeutic bee bed in a pyramid’, it

is advisable to analyse not only the potential income but also the main costs associated with its implementation. Table 3 presents approximate financial indicators for the implementation of this technology in an average wellness centre.

Table 3. Financial analysis of the implementation of the “bee bed” technology in the wellness business

Indicator	Value
Average cost per session	120 USD
Number of sessions per day	20
Daily income	2,400 USD
Monthly income (25 working days)	60,000 USD
Approximate cost of equipment	10,000-30,000 USD
Expenses for maintaining bee colonies (per year)	2,000-4,000 USD
Personnel expenses (per month)	3,000-4,500 USD
Energy costs, rent, other (per month)	1,500-2,500 USD
Total monthly expenses	4,500-7,000 USD
Net monthly profit	53,000-55,500 USD
Payback period, considering costs	6-12 months

Source: compiled by the author of this study based on marked data and assessments from Bienenpyr (n.d.)

As Table 3 demonstrates, with moderate operating costs and a stable customer flow, the payback period is 6-12 months. Net profit can exceed 50,000 USD per month, which indicates the high profitability of the project. Another advantage is the possibility of upscaling – installing several beds, creating service packages, or combining with other wellness programmes. Thus, investments in the introduction of bee beds have a high return on investment and contribute to the development of both apitherapy and related industries, specifically beekeeping.

Thus, the development of beekeeping and apitherapy in the United States is not only of agricultural but also of economic significance. The introduction of innovative techniques allows expanding the range of uses for bee products, creating new business models and opportunities for entrepreneurs. The commercialisation of apitherapy through the introduction of technologies such as the “therapeutic bee bed in a pyramid” can contribute to the economic growth of the industry and strengthen its position in the alternative medicine and wellness industry in the United States.

DISCUSSION

The obtained results confirmed the significance of institutional support in the development

of beekeeping, which was consistent with the findings of P. Šeráková (2019), who studied successful examples in the Czech Republic and Switzerland. However, in the United States, the role of government support was less significant, and commercial pollination became the key factor. E. Oyedokun & B. William (2025) analysed the role of honey in ensuring sustainable livelihoods in Niger, where beekeeping has become a prominent factor in supporting the local economy and improving social conditions. This was consistent with the findings of the present study, which confirmed the value of beekeeping development as a factor of economic stability that stimulates not only honey production but also the creation of new jobs and opportunities for sustainable development of rural areas. A. Kuś (2025) emphasised the significance of innovative management in Polish apiaries.

In the United States, this approach has been partially implemented through the integration of beekeeping into large agro-industrial complexes, which differs from the predominantly farming nature of the industry in the Balkan region. The development of apitherapy and apitourism, studied by B.P. Koç & G. Özgürel (2023), opens new opportunities for integrating bee products into wellness programmes. The results of the study confirmed the promise of technologies

such as the ‘therapeutic bee bed in a pyramid’ in the United States. J. Mota-Gutierrez *et al.* (2024) showed that sustainable beekeeping stimulates demand among environmentally conscious consumers in Belgium. An analogous trend was observed in the United States, where an emphasis on environmental friendliness contributed to the popularity of beekeeping products.

The results of a study on the effects of sustainable beekeeping on agribusiness confirmed the conclusions of F. Lazzari (2023), who proposed guidelines for sustainable beekeeping that improve environmental quality. As the results of empirical analysis showed, the greening of technologies in beekeeping correlated positively with the economic efficiency of farms and contributed to the preservation of agrobiodiversity. The study emphasised the value of introducing sustainable practices, particularly the avoidance of excessive pesticide use, the conservation of natural land, the integration of nature-friendly approaches to apiary location, and the development of plant-oriented systems. The findings confirmed that these factors contribute to increased honey yields, reduced bee colony losses, and stabilisation of the industry’s economic profitability.

S. Akyürek (2022) focused on the potential of apitourism to promote beekeeping through interactive exhibitions, including the creation of specialised museums, demonstration apiaries, and educational centres. This approach helps to create a positive image of beekeeping among a wide audience, raise environmental awareness, and stimulate demand for beekeeping products. The present findings were partly consistent with this approach, especially in the context of expanding the functional load of apiaries, particularly through the integration of apitherapy, demonstration procedures, and tourist services. In the United States, such integration proved to be an effective model for diversifying income, combining conventional honey production with health and tourism initiatives. According to the analysis, the creation of recreational infrastructure elements such as apiary houses based on apiaries not only provides added income but also enhances the sustainability of rural areas.

M. Vercelli *et al.* (2023) investigated the trade-off between sustainable beekeeping and profitability in the implementation of biotechnical methods of controlling the *Varroa destructor*

mite. The researchers emphasised that although such methods require extensive initial investment and a greater level of professional training for beekeepers, their use reduces the toxic load on the ecosystem, preserves the health of bee colonies, and increases the long-term productivity of apiaries. In the United States, this practice is already gaining support, especially among organic honey producers, but high implementation costs continue to be a deterrent for small farms.

The study results confirmed that the development of the beekeeping market is a promising area for stabilising the agricultural business, which coincided with the conclusions of A. Chmil (2023). The researcher analysed the role of beekeeping in the context of global challenges, particularly in Ukraine, where the focus was on optimising the production and marketing of honey and other bee products. B. Dukhnytskyi & V. Dukhnytskyi (2020) analysed Ukraine’s role in the global honey market. The authors emphasised the export orientation of the industry and the need to diversify beekeeping products, which is consistent with the idea of introducing innovative apitherapy technologies. Their findings confirm that the development of beekeeping has significant economic potential and can be effectively combined with the wellness sector, as studied in the example of the United States. Analogous trends were observed in the United States, although the market size and level of technological development differed significantly. V.R. Monastyrskyi *et al.* (2023) pointed out the significance of developing apitourism as an innovative area that combines beekeeping and the tourism industry. In the United States, analogous observations revealed that integrating beekeeping into tourism through apitherapy and excursion programmes can substantially diversify farm income. The difference was that the American market focused more on health services, such as ‘therapeutic bee bed in a pyramid’.

Researchers A.A. Cucu *et al.* (2022) focused on the bioactive properties of *Calluna vulgaris*, emphasising its value for apitherapy. The findings of this study confirmed that apitherapy has promising potential for expanding the market for bee products, including the development of new products based on plant components. This is consistent with the growing demand for

natural health products in the United States. G.O. Ominde (2014) focused on the added value of beekeeping products for improving the welfare of farmers in Kenya. The findings of this study coincided with the findings in the current study, which showed that the introduction of innovations in the production of bee products (such as apitherapy technologies) can markedly increase beekeepers' incomes and contribute to the diversification of agribusiness. B. Bekić & M. Jovanović (2015) investigated the role of beekeeping in the sustainable development of the Danube region. Their study emphasised that the integration of beekeeping into local economic systems contributes to job creation and the conservation of natural resources. Analogous trends were observed in the United States, where the use of bee products for pollination of agricultural crops and the introduction of sustainable practices contributed to the profitability of agribusinesses.

R. Prodanović *et al.* (2024) emphasised the value of beekeeping for the sustainable development of rural areas, particularly through the creation of additional sources of income and the promotion of social stability. These findings were confirmed in the present study, which found that commercial pollination in the United States not only improves crop yields but also supports the development of rural regions. V. Patel *et al.* (2021) emphasised the value of bees for achieving sustainable development goals, particularly through their contribution to food security. The results of the present study confirmed that pollination by honeybees is a key factor for stable food crop production in the United States.

J. Hinton (2021) noted that the stability of honey prices in the United States is a result of the established market infrastructure, an efficiently functioning logistics system, cooperative associations of beekeepers, and the existence of a developed quality certification system that guarantees consumer confidence in locally sourced products. The findings obtained in the present study confirmed these observations, demonstrating the stability of average prices for American honey within 6.6-7.8 USD/pound over the past few years. At the same time, as evidenced by the analysis of statistical data, prices for imported honey showed rapid growth. While in 2021 the average price was 2.67 USD/kg (5.89 USD/pound), by 2023 it reached

5.24 USD/kg (11.55 USD/pound), more than double the previous value. This price increase occurred against the backdrop of tighter quality control, the introduction of anti-dumping duties against certain exporting countries, and changes in foreign trade regulation policy. According to M. Bie *et al.* (2025), such measures are a manifestation of growing protectionism in the US agri-food sector and are in line with the global trend of protecting internal markets from low-quality or subsidised imports. The researchers emphasised that trade barriers, including tariff and non-tariff restrictions, became a substantial factor in the rise in prices for imported agricultural products. In this context, the situation on the US honey market is indicative: on the one hand, tighter import controls helped to increase the competitiveness of domestic producers, but on the other hand, they drove up consumer prices.

M.S. Younis & E.A. Ali (2024) pointed to the significance of sustainable practices as a key factor in improving the profitability of beekeeping in the face of modern challenges in agricultural production. The researchers emphasised that the introduction of environmentally friendly approaches, such as reducing chemical pollution, optimising seasonal movement of apiaries, and preserving honey-producing flora, positively influences both the productivity of bee colonies and the quality of the final product. In the United States, these approaches are being implemented through a transition to organic beekeeping, zoning of beekeeping activities, introduction of biological control of diseases and pests, and enhanced cooperation between beekeepers, agricultural producers, and regulatory bodies.

The development of apitherapy and apitourism, studied by S.B. Wibowo *et al.* (2024), also found confirmation in the United States, where interest in these areas is growing. The integration of apitherapy into health programmes opens new opportunities for the commercialisation of bee products, which is consistent with the findings of E. Clemente Alves & C. Rimoli (2022) on innovative approaches in small businesses in the beekeeping sector. These findings also point to the significance of expanding markets and introducing innovative technologies to support the stability and development of beekeeping.

The obtained findings confirmed that beekeeping has prominent potential to stimulate

economic development, social stability, and preserve ecological balance. In the United States, thanks to developed infrastructure and sales markets, barriers to the development of beekeeping were significantly lower, which allowed the industry's potential to be effectively utilised for economic development. The integration of innovative technologies, such as the introduction of sustainable practices, increased the efficiency of the industry. The study also confirmed the value of introducing apitherapy and apitourism to diversify beekeepers' incomes and develop rural areas. However, despite the positive outcomes, some regions faced economic challenges caused by the prohibiting costs of introducing innovative technologies. Overall, the sustainable development of beekeeping contributed to improving the economic efficiency of agribusiness and preserving biodiversity.

CONCLUSIONS

The study comprehensively analysed the economic prospects for the development of beekeeping and apitherapy in the United States, which allowed identifying key trends, determining the commercialisation potential of bee products, and assessing the profitability of introducing innovative methods in the industry. The study found that beekeeping plays a major role in the US agro-industrial complex, providing not only honey production but also pollination services, the value of which to the agricultural sector is estimated at over 18 billion USD annually. Honey production in 2023 increased by 11% compared to 2022, reaching 139 million pounds, despite a 6% reduction in the number of bee colonies. The key production regions continue to be North Dakota, South Dakota, and California, confirming the stability of the regional distribution of the beekeeping industry. Market analysis revealed that demand for honey and other bee products stays consistently high. A gradual 25% reduction in honey imports was observed, driven by tighter product quality controls, creating favourable conditions for the expansion of internal production. At the same time, the commercial potential of niche bee

products such as propolis, wax, and royal jelly, which are in high demand in the pharmaceutical and cosmetics sectors, is growing.

Particular attention was paid to the prospects for the development of apitherapy. The study found that the market for alternative medicine and wellness services in the United States is estimated at over 1.5 trillion USD and is showing steady growth. The demand for natural therapeutic methods is driving the expansion of the apitherapy segment, opening opportunities for the integration of bee products into the field of health and non-drug treatment. The study also confirmed the high commercial potential of introducing the ‘therapeutic bee bed in a pyramid’ as an innovative apitherapy method. The analysis showed that its integration into wellness centres, eco-hotels, and medical institutions can help expand the range of services and attract new customers. Profitability estimates suggest that the average payback period for the technology is 6 to 12 months, making it economically viable for businesses.

A limitation of this study was the lack of long-term data on the economic effects of introducing the ‘therapeutic bee bed in a pyramid’, which requires further analysis in the future. At the same time, further research could focus on expanding the analysis of the international market for bee products, studying the effects of climate change on honey production, and the long-term economic efficiency of the latest apitherapy methods. The findings confirmed that the development of beekeeping and apitherapy has considerable economic potential and opens new opportunities for the commercialisation of natural treatment methods in the United States.

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Бізнес ефективність використання «бджолиного лікувального ліжка в піраміді» у сфері оздоровлення населення Америки

Анотація. Метою дослідження було проаналізувати економічні перспективи розвитку бджільництва в Сполучених Штатах Америки, зокрема вивчити можливості інтеграції апітерапії в аграрний сектор та wellness-індустрію. Основна увага приділялася впливу бджільництва на економіку, аналізу попиту на продукти бджільництва та можливостям комерціалізації інноваційних методів апітерапії. Методологія включала аналіз статистичних даних, оцінку динаміки виробництва меду, вивчення ринкових тенденцій та оцінку економічної ефективності нових методів лікування на основі бджолопродуктів. У ході дослідження встановлено, що виробництво меду в Сполучених Штатах Америки у 2023 році становило 139 мільйонів фунтів, що на 11 % більше, ніж у 2022 році, попри зменшення кількості бджолосімей на 6 %. Водночас середній медозбір на одну сім'ю зріс на 17 %. Основними штатами-виробниками залишаються Північна Дакота, Південна Дакота та Каліфорнія. Попит на мед та інші продукти бджільництва залишається стабільно високим, при цьому імпорт меду скоротився на 25 % через посилений контроль за якістю продукції. Окремо було оцінено внесок бджолозапилення у сільське господарство, що оцінюється у понад 18 мільярдів доларів щорічно. Особливу увагу було приділено перспективам апітерапії. Аналіз показав, що ринок альтернативної медицини та wellness-послуг у Сполучених Штатах Америки оцінюється у понад 1,5 трильйона доларів і демонструє стабільне зростання. Інноваційні технології, зокрема «бджолине лікувальне ліжка в піраміді», мають високий комерційний потенціал завдяки попиту на натуральні терапевтичні методи. Оцінено, що впровадження цієї технології у wellness-центрах та еко-готелях може окупитися в межах 6-12 місяців. Практична значимість дослідження полягала у тому, що отримані результати можуть бути використані підприємцями, інвесторами та фахівцями у сфері бджільництва, альтернативної медицини та wellness-бізнесу для оцінки рентабельності розширення бізнес-моделей на основі апітерапевтичних технологій

Ключові слова: мед; оздоровлення; wellness-індустрія; медицина; біоекономіка

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