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"What's Good for the Bees Will Be Good for Us!"—A Qualitative Study of the Factors Influencing Beekeeping Activity

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Abstract: Beekeepers play a crucial role in the survival of honey bee populations, so it is essential to understand the drivers behind their activities. This qualitative study aims to explore the factors influencing beekeepers' decision-making and to assess the relationship between beekeepers and their bees, to identify the relationship between them by building a theoretical model, and to assess the perception of pollination services as a potential source of income diversification among Hungarian beekeepers. Based on the grounded theory method, we created a paradigm model of beekeeping management based on semi-structured interviews with beekeepers in Hungary. In the analysis of the interviews, we first used open coding to develop categories according to the concepts used by the beekeepers, and then structured and linked these categories (axial coding). Finally, we identified the most relevant main categories (selective coding) and outlined the conceptual framework for beekeeping management. We mapped the strategies and beekeeping practices beekeepers use and the consequences they generate. The results show that several causal conditions influence beekeeping decisions and strategies. In an environment where beekeepers' costs are increasing and their incomes are decreasing while implementing adaptation strategies, more targeted measures are needed to protect bees and increase beekeepers' profitability.

Keywords: beekeeping management; decision-making; grounded theory; honey bees; human–bee relationship; Hungary

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1. Introduction

In recent years, explaining the high colony loss rate in *Apis mellifera* colonies has become a critical global research priority in beekeeping and agricultural sciences [1]. The beekeeper is vital in maintaining colony health and ensuring colony productivity. A structured understanding of beekeepers' motivations is essential to enabling policymakers and beekeeping organizations to develop widely accepted strategies for maintaining honey bee populations and wild pollinators [2].

The honey bee (*Apis mellifera*) is one of the most important pollinators of natural and agro-ecosystems. The honey bee is essential for the conservation of plant biodiversity, as well as being a bioindicator of environmental pollution. It is the only pollinator closely connected to humans. It is also valuable for the livelihoods of beekeepers, rural development and the global economy [3]. Pollination by bees is critical to the quantity and quality of fruit, nuts, oilseeds and other crops [4–6]. Animal pollination improves global crop yields by an additional USD 235–577 billion per year, with the most significant economic benefits in the Mediterranean region, South and East Asia and Europe [7]. Pollination is estimated to contribute at least EUR 5 billion annually to EU agricultural production [8,9].

Despite the essential positive roles played by honey bees, beekeepers who care for them face several challenges. These include land use changes, declining food sources (barriers to the availability of diverse, high-quality pollen and nectar), pesticides in agriculture, and the spread of pathogens [10–14]. Inhospitable living conditions for bees and other pollinators are evidence of problems affecting all life forms on the planet [15].

In Hungary, the number of bee colonies (in this study, we use the term bee colony; the term hive is also used) decreased by 12.5% between 2016 and 2022, with the highest number in 2017, which had declined 4.94% by 2022. The bee density in Hungary was 12.8 bee colonies/km^2 in 2022, which also shows a decreasing trend despite being high by European standards [16].

1.1. Decision-Making in Farm Management

To strive for a more sustainable future and remain competitive, farmers must adapt their decision-making processes to the challenges (economic, political, social, ecological) of a constantly changing global environment [17]. Fluctuating input and output prices, uncertain weather conditions, and rapidly evolving technology contribute to this complexity [18]. However, agriculture is very diverse and not all farmers are affected similarly when faced with a decision. For farmers, economic goals (production, profit maximization) are essential factors in the decision-making process, but they are not the only ones that matter. For example, producing a high-quality product or environmental considerations (reduction of chemical use) may play a role in decision-making [19,20]. Some studies emphasize the social, demographic, psychological and philosophical characteristics of the farmer, the characteristics of the farming household, the structure of the farming enterprise, the broader social environment, the indicators of the innovation to be implemented, and the willingness to continue the enterprise as factors influencing the decision [21–26]. Policies and financial support also influence the entrepreneur's decision-making [24,27–29].

Strategic decision-making on farm extension is influenced mainly by the type of decision (e.g., building investment, land acquisition, machinery investment, land lease, livestock investment, off-farm investment). In addition, this type of farming is a vital determinant of the factors that influence farmers' strategic decisions [18]. Financial factors are related to traditional economic theory, in which people make decisions to maximize utility and profit [21]. Non-financial factors are associated with a behavioral approach [30–32]. Financial factors may be profit maximization and taxation issues, whether there are resources for the planned investment or debt repayment capacity, and non-financial factors may be the evolution of day-to-day operational tasks or the impact of EU policies. Farmers are also influenced in their business decisions by the opinions of friends and family [33–36]. For example, farmers' social interactions and knowledge exchange with fellow farmers increase access to other markets and influence farmers' diversification decisions [37]. Non-financial goals such as enjoying the work, working with animals and producing a good, safe product are in some cases more highly valued factors than strictly economic goals, i.e., achieving maximum income [33]. This is particularly true for small family beekeeping, with a direct beekeeper–bee relationship. Those less optimistic about change are more conservative and tend to reject new rules and neglect legislation [38].

The link between effective decision-making and agricultural production practices is one of the most essential characteristics of farmers [39]. Farmers relate effective decision-making to internal factors such as farming practices, product marketing, economic reasons, attitudes, goals and sustainability. External factors include weather conditions, disease, prices, government management and policymaking.

European beekeepers need to be highly flexible in their decisions and adaptable to change, with the most significant challenge being the largely adverse effects of climate change [40]. This situation is further nuanced by regional differences (North–South Europe), type of beekeeper (hobby or professional), degree of beekeeping professional practice, and kind of bee pastures available (forest or other areas with flowering resources). The new beekeeping practices aim primarily at keeping bees alive and ensure that as many bees as possible survive, as the current agricultural model is "designed" for profit rather than health [15].

1.2. Human–Animal, Human–Bee Relationship

Animal care is central to farming, with livestock serving purposes that go beyond simply producing food or being a source of food, but their productive function cannot be overlooked [41,42]. Compared to other insects, humans have a special relationship with bees. This relationship between bees and humans is shaped by humans and influenced by the role of bees in human survival [43]. Honey bees are considered an essential factor for humans in honey production based on their ability to pollinate many crops and their other roles in the ecosystem [44]. The motivational factors for honey bee foraging are also complex due to their multiple roles. In addition to an ecocentric perspective and the contribution to biodiversity and environmental health, small-scale beekeepers, in particular, find beekeeping a relaxing activity (recreation) and a source of food for themselves and their families [44]. For this reason, small-scale beekeepers typically sell honey or other bee products on a limited, local scale [45]. Hobby beekeeping is not primarily profit-driven, yet it provides both economic and other benefits to beekeepers (e.g., the positive effects of being outdoors on mental health) and social benefits from the ecosystem services provided by managed bees [46].

Bees pollinate and produce honey, but in agri-food production, beekeepers shape the practice of beekeeping [47]. This interconnectedness illustrates the importance of studying bees, beekeepers and their collective practices. At the same time, bee behavior has not changed to accommodate beekeepers as animal keepers. Their collective identity is driven by the queen bee [48,49], and their existence can be understood collectively as a bee colony. Beekeepers experience their interactions with bees intensely (partly due to physical contact, such as bee stings), which suggests a strong bond and connection with their bee colonies [50]. They derive pleasure from their ability to interpret bee communication and the absence of stings, which they attribute to experience and competent management. Some research suggests that bees have recently become fashionable urban pets that must be saved [51]. It is an old Polish tradition that bees are treated as partners, not exploited. As a sign of this respect, when a bee dies, Polish beekeepers describe it with the verb *umrzeć* (to die), which is usually reserved for humans [52].

1.3. Pollination Services

The pollination function of beekeeping is now economically crucial in all agricultural systems and has been evaluated in several studies, e.g., [6,53–56]. From the beekeepers' perspective, honey production and commercial pollination services can be complementary, as the former tends to dominate in summer and the latter in spring [57]. Using beekeeping to pollinate crops benefits both the beekeeper and the farmer [58,59], but its economic value is difficult to quantify for beekeepers [60]. Pollination is considered commercial if it involves cultivated crops based on a pollination contract. The price of the pollination service is the fee paid by the farmer to the beekeeper for hiring the bee colony, except for wild crop pollination, where honey production and the provision of ecosystem pollination services are not traded together [57]. At the industrial (large-scale) level in the United States, pollination contracts have displaced honey production as the primary source of income for the beekeeping sector, despite an increase in honey consumption [61,62]. While imports can compensate for the shortfall in honey consumption, the shortfall in pollination services is more challenging to address [62].

In the global honey market, demand and prices fell sharply in 2023, leading to a sharp decline in the profitability of the European and, particularly, the Hungarian honey sector. This situation could raise the question of diversifying activities. The market for pollination services has been operating in many countries for a long time [63,64], but in the Hungarian context, the assessment is less clear.

A clear overview of the main activities performed by beekeepers and their role in the successful management of honey bees is only partially available [65]. No research on a qualitative method based on grounded theory has been found in the literature on this topic. The grounded theory was applied to beekeeping in a study investigating the

characteristics of Pakistan's honey value chain [66]. Also using this method, a doctoral dissertation investigated hobby beekeeping as a recreational activity and the need for beekeeping associations in Canada [67]. Using grounded theory, another dissertation examined the impact of a beekeeper training program among female beekeepers in the USA [68]. This study aims to investigate the factors influencing beekeepers' decision-making and evaluations of their bees, and to explore their relationships by building a theoretical model based on grounded theory. Furthermore, we examined how beekeepers in Hungary think about pollination services as an income diversification option. With the present research, we want to contribute to filling the knowledge gap on this topic.

2. Materials and Methods

This qualitative research study used grounded theory, often found in social science research, to analyze the data. Grounded theory is a research method from which theory develops, and is rooted in empirical data [69]. The aim is to generate theory, not to justify it [70]. In grounded theory, the theoretical framework is generated from the interviewees' responses based on their identified dimensions. Still, to develop a coherent conceptual framework, we also considered concepts and terms used in the literature [71]. Qualitative methods are used to answer questions about experiences, meanings and perspectives, most often from the participant's perspective. Qualitative research techniques also include interviewing, which asks for opinions and background information on a specific topic, i.e., it investigates specific situations [72]. Qualitative research usually includes data in words rather than numbers [73].

In the preparatory phase of the research, we conducted a literature review on the topic in the Scopus and Web of Science database using the following search terms [(decision-making) AND (agriculture) AND (farm management) AND (factors apiculture), and (honey bee OR honeybees OR Apis mellifera) AND (beekeeper) AND (relationship) AND (sustainability)]. The literature on farmer decision-making, farmer–animal relationships, and beekeeper–bee relationships provided the basis for developing the analytical framework.

In this study, we focused on beekeepers in the North Great Plain region of Hungary, which is spatially divided into three units, i.e., counties: the counties of Szabolcs-Szatmár-Bereg, Hajdú-Bihar and Borsod-Abaúj-Zemplén. Of the 19 counties in Hungary and the capital, Szabolcs-Szatmár-Bereg county has the highest number of beekeepers (9.7%) and bee colonies. In the national ranking, Borsod-Abaúj-Zemplén county is in 5th place (7.1%), and Hajdú-Bihar county is in 10th place (5.3%) [74]. Szabolcs-Szatmár-Bereg is a lowland area occupying the easternmost part of the Hungarian Great Plain, while Hajdú-Bihar is a less flat area belonging to the Great Plain. The southern part of Borsod-Abaúj-Zemplén county is flat; the northern part is hilly and mountainous. Due to its landscape and climatic conditions, the Great Plain is one of Hungary's most frequent transhumant areas from a beekeeping point of view.

2.1. Data Collection

To establish the research question, we conducted pilot interviews with two beekeepers, which helped to clarify the issues. To achieve the research objectives, data were collected through semi-structured interactive interviews in Hungarian between March 2024 and April 2024 with ten beekeepers in the Northern Great Plain region. Interview subjects were recruited using a snowball method [75], with the following county distribution, according to the size of the apiary (1–10 with different colors) (Figure 1). Two interviews took place in Borsod-Abaúj-Zemplén, four interviews in Szabolcs-Szatmár-Bereg and four interviews in Hajdú-Bihar county.

All interviews were confidential, and unique codes were used to present the results. Five (50%) interviews were conducted by telephone and five (50%) in person. Despite the different interview modes, there was minimal difference between the average length of telephone (1 h 16 min) and face-to-face (1 h 8 min) interviews, with the shortest interview lasting 50 min and the longest lasting 1 h 34 min.

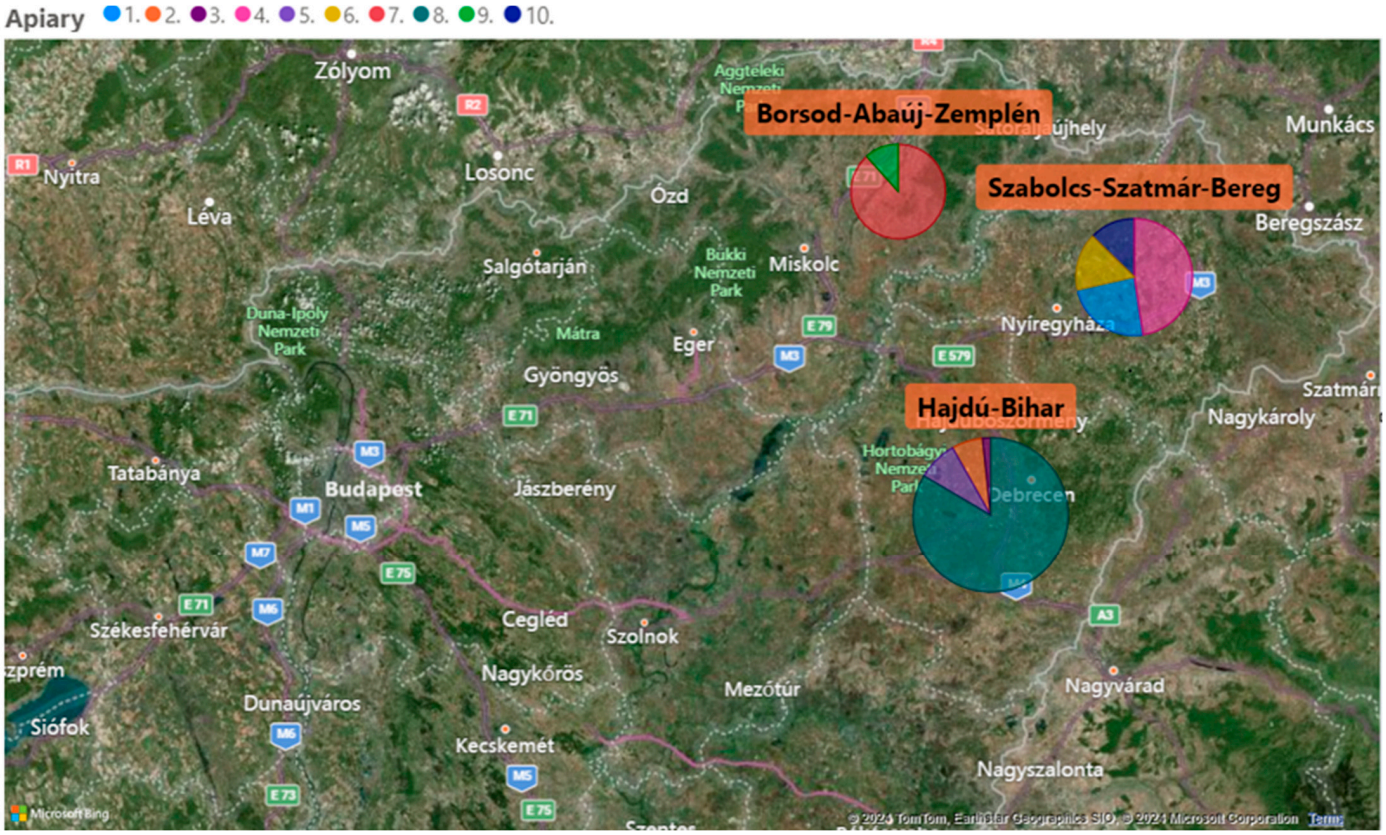

Figure 1. Representation of the total number of bee colonies and apiaries per county interviewed.

The face-to-face interviews were conducted at the beekeepers' home and the permanent apiary site. The interviewer built a rapport with interviewees in person and by phone and allowed time for an informal discussion about the research project before and after the interview. Interviews were recorded with the participant's permission, except in one case. In cases without audio recording, full details were recorded in writing. Immediately after the recorded interviews were conducted, the audio files were transcribed verbatim.

It is important to note that the sample does not represent the entire beekeeper population in Hungary. We applied the concepts of credibility, reliability, and interpretability to support the integrity of the qualitative data [43]. The small sample size of the study was selected to provide rich, relevant information to achieve the study objectives, similar to other qualitative studies that rely on similar sample sizes and methodologies to understand specific phenomena [40,41,43,76].

2.2. Data Processing

The interviews were analyzed using Atlas.ti version 24.1.0.30612 content analysis software. The coding followed the principles of grounded theory [77]. We first used open coding to create categories according to the concepts used by the beekeepers, and then structured and linked these categories (axial coding). Finally, we identified the most essential categories (selective coding) and outlined a conceptual framework for beekeeping management. In this case, the coding process consisted of defining the relationships between the categories developed and summarizing them in a model consisting of causal conditions, central phenomena, strategies, context, intervening conditions and consequences [77]. The number of interviews was sufficient to reach theoretical saturation. In other words, when no relevant new information emerges, theoretical saturation is reached, and the data collection process, coding and analysis are completed [78]. The repetition of the main aspects was observed throughout the research. Reliability measures were conducted for coding,

with the lead coder and the secondary coder achieving 85% agreement in constructing subcategories and categories based on the interviews [79].

The interview questions explored how beekeepers got involved in beekeeping, evaluated their work, and addressed what external and internal factors influenced their decisions, and what procedures they used to succeed. The beekeepers were also asked about their relationship with bees and their interactions with their bees. Questions included how beekeepers think about the future and the situation of pollination services in Hungary.

3. Results

Demographic data of the interviewees are presented in Table 1. Most (90%) are male; five interviewees indicated they have other jobs besides beekeeping, five are full-time beekeepers, and one stated that he is retired. Only two beekeepers were under 40 years of age, while seven beekeepers were aged 41–60 years, and one was over 60 years old. Most of the beekeepers in the sample are only involved in honey production; two are also engaged in raising bees, and one has to raise queen bees as its main activity. In addition to beekeeping, one of the interviewees also works as a bee health specialist (he checks the health of beekeepers' bee colonies in his area several times a year). One other beekeeper is a biobeekeeper; the rest of the sample are traditional beekeepers. The smallest apiary has 20 bee colonies, and the largest has 1000 bee colonies. According to the usual categories of holding size in Hungary, one beekeeper is a hobby beekeeper (<20 bee colonies; code BKH), five are part-time beekeepers (<150 bee colonies; code BKE), and four are professional beekeepers (>150 bee colonies; code BKP) [80].

Table 1. Demographics of beekeeper sample (n = 10).

Demographic Information	Average	Median	Range
Age (years)	51	52.5	37–67
Number of bee colonies	219	100	20–1000
Annual honey production (in tons)	10	4.5	0.7–60
Experience in beekeeping (years)	27	34.5	8–44

All but two beekeepers started beekeeping at a young age, either because of family or teachers. Two beekeepers' interests started in adulthood, again encouraged by family members or friends who already had bees. The beekeepers told us they initially helped with some of the work, such as repairing hives, making frames or extracting honey, and gradually acquiring two to six bee colonies. They further increased the bee population by learning beekeeping skills. As some have put it:

> *"I started to help my uncle in beekeeping, and that's how I started with one bee colony, and the next year I developed it to 4 colonies, and that's how I developed it year by year, and I started beekeeping in 1993." (BKP4)*

> *"Family motivation (...) I was given six colonies as a gift; I liked beekeeping and helped the family from a young age. At the time, it was just a hobby for a long time, but then I got interested in the profession." (BKP1)*

> *"In '83, I helped my paternal uncle in the winter to nail frames repair hives, then I got two bee colonies, in the spring of '84, I started with this one, which I improved to 4-6, then about six years later the stock was around 30 (...)." (BKP8)*

> *"My instructor invited me to his beekeeper's workshop to help him; he also invited me to extract honey. Then I got two bee colonies of bees at the age of 14." (BKE5)*

3.1. Categorisation of Interview Data

The interview transcripts were analyzed line by line. The data were analyzed using grounded theory using a continuous comparison across open, axial and selective coding stages [77]. Concepts, subcategories and categories were derived through open coding and

categorization. Seventy-seven subcategories and 22 categories were created by iterating the analysis until theoretical saturation was reached (Table 2). Axial coding was used to explore the relationships between subcategories and categories, and selective coding was used to derive the most important categories and formulate a grounded theory.

Table 2. System of subcategories and categories.

Subcategories	Categories
Complex relationship; domestic animal; farm animal	Beekeeper–bee relationship
Critical factor; geography; monoculture; overcrowding	Bee pastures
Pesticide effects; pests and diseases; negligent beekeeper; natural food source	Bee health
Critic; family and friends; beekeepers you know	Labor shortage
Qualifications; level of practical knowledge; development	Professional skills
Bee welfare; love; bee needs	"Bee-focused"
Seed production; pollination; environmental protection; indicators	Sustainability
Disease transmission; other farms; transhumance	Responsibility
Hobby; livelihood; business; extra income; pollination	Internal motivation
Selling difficulties (to traders); decrease in honey prices; increase in input prices; subsidies	External environment
Bees' adaptability; beekeeper's knowledge; cannot be influenced	Changeable weather
strong bee colonies for the overwintering; appropriate genetic bloodline; infection from other stock	Trends in bee losses
Competitiveness; risk; unsuccessful (financial); oversupply of honey	Honey adulteration, the influx of cheap imported honey
No pollination market; no subsidies; bee density	Underestimation of the importance of pollination
Profitability; guarantee; constraint; time pressure	Transhumance
Professional development; training; own methods	Developing professional skills
Providing food and water; mites treatments; queen bee; strong and healthy colonies	Bee health practices
Bee needs; rapid response; strive to maintain good relations with farmers; reduce need for live labor	Adaptability
Avoiding closure; trusting the future; clinging; reducing to a hobby	Persistence, waiting
Unprofitable; risks; unsuccessful	Pessimism
Giving up beekeeping; looking for other work; sales problems	Career changing
Cost reduction, keeping profitability, conservation	Development pressure

3.2. Structure of the Paradigm Model

The paradigm model of the categories identified based on the grounded theory for decision-making in beekeeping is shown in Figure 2.

Starting from the central phenomenon, this paradigm model includes causal, contextual and intervening conditions, strategies, consequences and the relationship between them [77]. The elements of the model are detailed below.

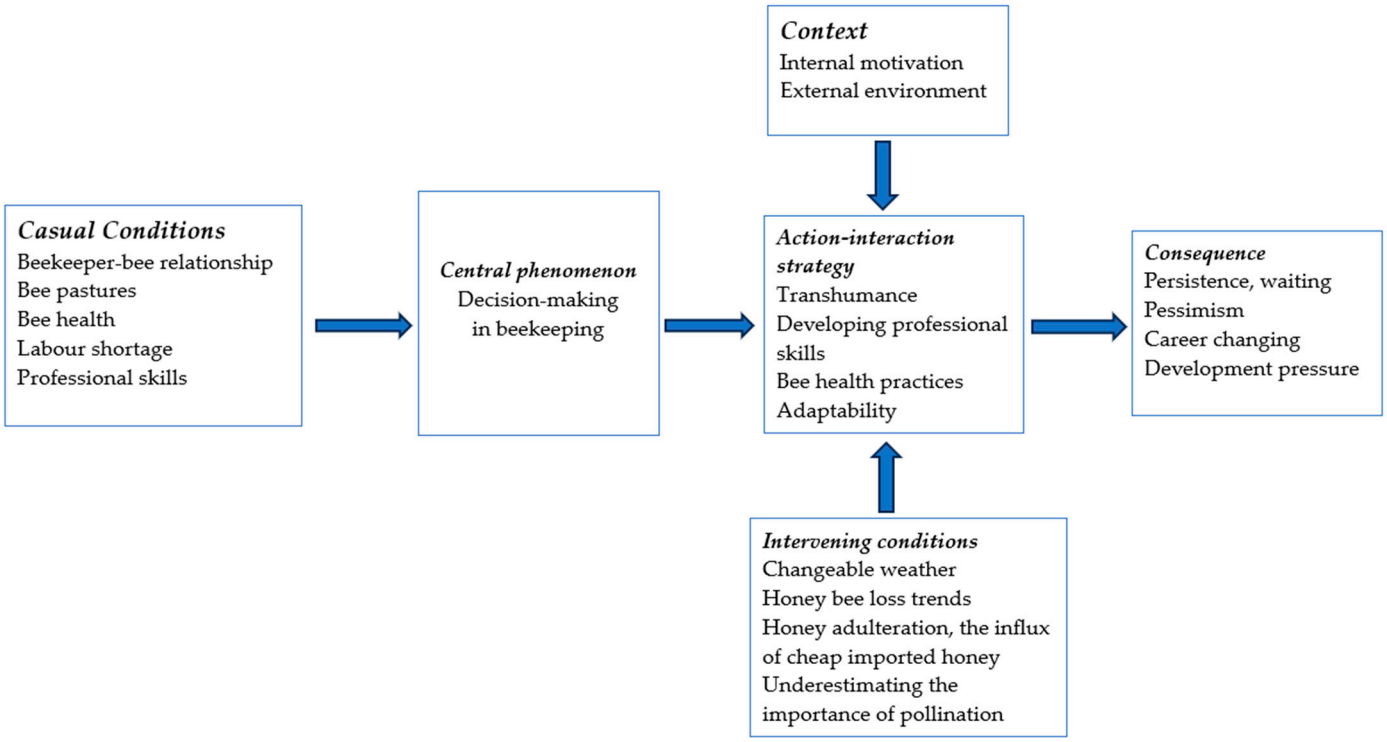

Figure 2. Paradigm model of decision-making in beekeeping.

3.2.1. Central Phenomenon

In this study, we have structured the central phenomenon around beekeepers' decision-making, the content of which has been determined based on the interviewed beekeepers' statements (Table 3). This forms the basis of the grounded theory, i.e., the theoretical model [81]. Beekeepers' decision-making is based on "bee-focused" management, i.e., the welfare of the bees is the primary concern. This is an emotional attachment and a particular way of thinking in which individual responsibility for sustainability plays an important role, as well as responsibility for others (e.g., other beekeepers and other farms nearby) and the environment.

Table 3. Definition of the central phenomenon's categories.

Categories	Determination "In Vivo"
"Bee-focused"	*"What is good for the bees is good for us (...) Because if there is honey, it is good for the bees that I keep them in a place where there is a flourishing culture, where there is a possibility to collect pollen, and where they produce honey. It's another question whether they produce enough honey for me to collect it, (...) I don't consider a good beekeeper to be someone who extracts X amount of honey, but someone who sees that bees are lacking something and tries to remedy it." (BKP4)* *"It has long been known that the welfare of the animal ensures the welfare of man." (BKP8)* *"Bees are a positive thing in my life, a calming activity. (...) I am an organic beekeeper, I don't use chemicals, synthetics, they get enough from nectar, pollen." (BKE9)* *"We have to adapt to the bees, not the other way round; we have to be able to use their skills." (BKP1)*
Sustainability	*"Theoretically, beekeeping, the beekeeper and the bee's life are intertwined and are the basis of our lives across pollination. Without it, you can't produce good seed; without it, you can't produce good fruit." (BKE5)* *"They are susceptible insects, probes of the state of the world. Maybe Einstein may have said that if the bees die, so does humanity. But not only because of pollination, but because by then there will be so much pollution on Earth that if the bee doesn't survive, then people will be destroyed." (BKP8)*
Responsibility	*"The priority is to make sure that my bees are not sick and do not catch or pass on disease to others." (BKE2)* *"They need human intervention and care as they are exposed to many negative effects." (BKE6)* *"I have to be a responsible beekeeper, for example, so that the sheep in the neighbourhood don't get stung and die because I am harming others." (BKH3)*

3.2.2. Causal Conditions

Causal conditions are the factors that cause or influence the central phenomenon, i.e., the events and situations that create and develop the present and raise related issues and concerns [77,82]. These factors are challenging to consider separately, as they are interdependent conditions, such as bee health and bee pastures providing healthy, natural food. For beekeepers, the relationship with bees is fundamental to their activities, with most of them having learned about and fallen in love with bees at a young age (Table 4). In addition to beekeeping's leisure and recreational functions, motivations such as business opportunities, extra income and livelihood came later. In beekeeping, the existence and quality of beekeepers were considered essential in providing bees as a natural food source. This has an impact on the health of the bees, the vitality and strength of the colonies, and thus their productivity. It also minimizes the need for artificial food supplementation, which means lower feed costs. As one beekeeper put it:

Table 4. Definition of causal conditions.

Categories	Determination "In Vivo"
Beekeeper–bee relationship	*"Not our tool, but our colleague." (BKP7)* *"I have a complex relationship with bees: as living beings, I find them fascinating (...) At the same time, I consider them to be central to productive activity." (BKE6)* *"I see them as pets because I love my animals." (BKP4)*
Bee pastures	*"This is the most important aspect. I always migrate to sunflowers, for example, so that they have flowers continuously in the summer. Where I overwinter, there are also bee pastures in the spring. So I have to feed less; the inputs are less." (BKP4)* *"Perhaps the same importance as the queen bee, bee health. The problem is that it's not diversified; it's becoming a monoculture, more wheat, more maise and more beekeepers." (BKP8)* *"There is a lot of pressure on beekeepers because there are so few. As much as I can, I am changing this by planting shrubs in my field that have pollen in the spring, I am also experimenting with what plants I don't need to treat but give nectar and pollen." (BKP7)*
Bee health	*"It's critical because of the coinciding flowering periods, the natural food source is not balanced at the right time (...) We don't take the second part of the sunflower honey for the third year now; we leave it for the bees because they are healthier, stronger and better able to grow in the spring; we only feed them when it's necessary." (BKE5)* *"This is the main thing. If it's like that, I'd rather not extract honey; I let it for them." (BKH3)* *"I go even if I can't collect honey (...) nectar, pollen is important for the bees, if there is not so much income, you still have to migrate." (BKE10)*
Labor shortage	*"It's getting harder and harder, there are three of us in the family, three of us spinning honey for three days." (BKE2)* *"I don't rely on that; that's why I switched to a loader hive and invested in honey extractors so that I would need as little help as possible. I do it with my wife and son." (BKH3)* *"We're going to do it the old way, which is to help each other." (BKE5)*
Professional skills	*"It would be important for everyone to have basic training, to have practice alongside an experienced beekeeper (...) I would only give support to those who have experience or previous training." (BKP1)* *"There is a lack of quality training (...), and there is a lack of humility in beekeepers towards the profession (...). Even if there were better training, the professional development of beekeepers would not improve much." (BKP7)* *"They have zero knowledge of bee biology; they only have practical knowledge, but they don't really know why they do what they do." (BKP8)*

> *"Bee pasture refers to the plants bees visit to provide food,* i.e., *pollen and nectar, for the bees. I think the basis of beekeeping is the existence of bee pastures; where there is a good bee pasture, the beekeeper will have good colonies and a good quantity and quality of honey." (BKE6)*

Regarding availability, if there is no land or forest of their own, an excellent personal relationship with the owner-donor is essential. However, the health of bees is threatened by other external factors, including the harmful effects of pesticides used in agriculture

and the increase in the rate of Varroa mite (*Varroa destructor*) infestation, which threatens bees. Among the beekeepers surveyed, those living in the Borsod-Abaúj-Zemplén county do not consider chemical use by farmers to be as much of a threat as those in the other two counties. This could be because they have their fields besides bees, and try to develop and involve their bee pastures in bee care. The other two counties have larger, contiguous agricultural areas.

The question of labor is also a factor that fundamentally determines the form in which the beekeeper can continue his activity, the extent to which he can rely on migration, the hive system or the size of the bee population. In addition to professional tasks, labor is needed, mostly in seasonal form. Full-time beekeepers or hobby beekeepers can rely on family and friends to help them, and large full-time beekeepers also try to minimize the use of external labor. In addition, there is a consensus that a minimum level of professional knowledge, practical knowledge from more experienced beekeepers and continuous training would be essential to start beekeeping. At present, in Hungary, no professional qualification is required for beekeeping. However, in terms of current opportunities, beekeepers perceive that it is not enough; *"it stops at a certain level of practical knowledge" (BKE2)*, and it is a matter of passing on knowledge at *"the level of a fairy tale"* (BKH3) at meetings.

3.2.3. Context

Interviews with beekeepers in Hungary's North Great Plain region provided the basis for this research. Context refers to conditions wherein a phenomenon or problem arises, and people respond to it with an action–interaction strategy [77,83]. In this case, internal motivations are determined depending on the ultimate goal of the activity, which frames the beekeeping (Table 5). These are leisure, additional income, livelihood and individual contribution to pollination.

Table 5. Definition of the context.

Categories	Determination "In Vivo"
Internal motivation	*"I am indeed doing what I love to do. I also love bees, and I love making a living." (BKP4)* *"It's a hobby now; you can't make money from it now. We do it for love, a bit for the money. Pollination of plants is also important." (BKE2)* *"Became a livelihood about 15 years ago, but still a hobby. Conservation of nature is important, pollination of crops." (BKP1)*
External environment	*"I'm not happy with the forms of support now; the price of sugar, the price of medicines, the price of all materials is going up every year. Beekeeping is not appreciated." (BKE2)* *"Bad economic conditions, in the honey market? 1 kg of honey is at the price of 1 kg of bread, and tobacco products are much more expensive. Old beekeepers used to say that honey was 3–4 times the price of sugar, which is not true now." (BKE9)* *"It is expensive to maintain in the current market conditions such as stagnant uptake, low purchase price, and high input costs. There is a need to curb honey adulteration, promote honey consumption, and punish negligent beekeepers to protect other beekeepers. Farmers' lack of interest in beekeepers and mindless crop protection is extremely depressing (...)." (BKE6)*

However, they are also determined by challenging external environmental conditions—honey marketing difficulties since 2022 and low honey prices in contrast to rising input prices. The competitiveness of Hungarian honey producers is further undermined by significant levels of international honey counterfeiting and the influx of cheap, low-quality imported honey. The modest size of Hungarian beekeeping subsidies regarding production value [84] is also part of the conditions determining the beekeepers' operating strategy.

3.2.4. Intervening Conditions

The broader conditions that shape and constrain beekeeping strategies limit or facilitate the effectiveness of beekeeping activities, whether they are honey production, bee breeding or queen bee raising (Table 6). They facilitate or accelerate the adoption of strate-

gies or make them more difficult [85]. The interviews identified the most severe factors affecting beekeepers, such as the presence of honey counterfeiting and the influx of imported honey at lower prices than producing honey, which depresses prices and thus makes beekeeping activities highly unprofitable. Equally critical is the underestimation of pollination and the work of bees and beekeepers in Hungary. As one interviewee said: "*Beekeeping is a neglected, tiny corner of agriculture.*" (BKE5). Weather variability (e.g., drought years, high rainfall, late frosts) was not considered significant, nor was the development of bee infestations. These factors appear to be manageable with adaptation and close control. In some cases, beekeepers have proposed solutions, which mostly depend on the authority of policymakers.

Table 6. Definition of intervening conditions.

Categories	Determination "In Vivo"
Changeable weather	*"We can't control it, we have to adapt, and that requires beekeeping experience." (BKP8)* *"I think bees can adapt to these conditions relatively well." (BKP1)*
Honey bee loss trends	*"Rather have fewer strong colonies than more weak ones, be strict, only bring strong ones into the winter." (BKE9)* *"There are two reasons for this: incompetence and financial reasons. The beekeeper cannot provide enough winter food or cover for his bees. Adequate winter cover is the first thing; what is left of the money can be spent on other things. Reproduction from your stock is the best, but you need adequate blood refreshment (...) You should take the trouble to bring a bee colony from a colleague beekeeper from far away, preferably a breed with which you do not make a bad cross." (BKE5)*
Honey adulteration, the influx of cheap imported honey	*"Honey adulteration is such a threat to beekeepers that they will not need honey. Counterfeiters will flood the market with cheap, fake honey, and we won't be able to sell the honey we produce." (BKP4)* *"Here is Ukrainian, Chinese honey, they tell you how bad it is, take it off and put it back on the shelf. They improve it with the good honey, the honey they buy at a quarter of the price." (BKE2)* *"Competitiveness is very affected." (BKE9)*
Underestimating the importance of pollination	*"There is no market for pollination in the country. There is no demand for it, and the farmer approaches no beekeeper. In the 1990s, they sought pollinating bees for sunflowers. They paid for it, not much money, but they paid something. We could make it easier for farmers to take pollination to heart. If they linked their agricultural subsidies to pollination, if the farmer had a contract with a beekeeper to pollinate his flowering crop with his bees, which had to be documented for the subsidy, there would be a market for this pollination. The farmer should pay the beekeeper, or at least set conditions that make it worth my while to go there." (BKP4)* *"When I was a child, we had a request for pollination; we had to pollinate melons; I don't know what we got, money or fruit. We were told then that there were more, bigger and juicier melons when we took a few families there. From the bees' point of view, it was not the point, but from the fruit's point of view, it was. Today, there is not enough emphasis on how many beneficial insects reach those plants." (BKP7)*

3.2.5. Strategies

Strategies are the targeted actions pursued to solve a problem and shape the phenomenon [77]. They are strategies that respond to controlling a central phenomenon (beekeeping management) and refer to the strategic behavior or action that attempts to cope with the phenomenon or event [86]. In this study, we have identified actions aimed at increasing the success of beekeeping activities, divided into the categories shown in Table 7. However, it should be noted that these strategy elements are closely interlinked. Transhumance as a strategy is significant in all but two of the beekeeping activities identified in the research. As costs increase, revenues decrease, so they try to reach as many bee pastures as possible to increase honey yields, but there are also costs. Transhumance is necessary to ensure a natural food source for bees, even if a particular beekeeper is not producing honey or if previous bee pastures have disappeared. This is linked to good beekeeping practices in providing adequate food and water. Here, opinions are more divided on the need for food supplementation, but establishing effective mite management practices is a priority for all beekeepers.

Adaptation is a critical factor in the strategy of beekeepers. In many situations, good situational awareness is required. Flexibility is needed to deal with the adverse effects of climate change; for example, changes in the quantity and quality of bee pastures, managing diseases in the bee population, using new options and methods, reducing the need for live labor, and developing personal relationships. Beekeepers need continuous training to improve their skills and knowledge to maintain success. They do this primarily through their methods (e.g., internet, trade magazines, textbooks, informal exchanges between beekeepers), and attendance at lectures given by beekeepers' associations is not a priority.

Table 7. Definition of strategies.

Categories	Determination "In Vivo"
Transhumance	*"If the beekeeper migrates little, he will break even; if he migrates, it is more costly. Unfortunately, the blossoms are clustered, making coordinating difficult (...) One of the pitfalls of honey production can be the cost of transhumance and transport; all beekeepers try to transhumance without cost." (BKE5)* *"I usually choose my migratory sites to be good for me in summer and autumn. I try to migrate in such a way that if I migrate home to acacia, it's two weeks, then I migrate back to sunflowers, which will open in another month, but there are wildflowers there, so that's good. I'll wait for the sunflowers, then for autumn there, when I'll migrate to a site again." (BKP4)* *"I am a transhumance beekeeper, we have three main migrations: rape, acacia, sunflower (...) it doesn't matter from an economic point of view, with the migration there is more honey." (BKE9)*
Developing professional skills	*"I read everything I can read. Everything is available on the internet, whether it's a foreign site or a Hungarian site. You can't know everything; you always have to learn, and you have to; it's a compulsive career. You have to know why things happen." (BKP4)* *"Professionally, I am never satisfied; there is always room for improvement and new opportunities. It is necessary to improve whether it's working more easily or doing phases of work in less time." (BKP7)* *"I ask other beekeepers for help; I read a lot." (BKH3)*
Bee health practices	*"(...) I use mite spray if necessary, and in case of poisoning, I inform the authorities." (BKP1)* *'Leave honey inside. At the summer's end, some sunflower honey is left inside. I am feeding, water if necessary. In my case, the most important thing is mite control; the bees are given medicated sugar syrup and pollen supplements in times of scarcity. I also disinfect the tools and, if necessary, the hives." (BKE2)* *"My basic principle is that they should always be healthy,* i.e., *pollen should be carried, not pollen replacer (...), and it is essential to protect against mites. I use oxalic acid strips on three occasions, and then when we are no longer extracting honey, then the permanent treatment against mites." (BKP8)*
Adaptability	*"I try to find another bee pasture when I can't; that year was so many, I have to adapt to have some honey there." (BKE2)* *"I think that climate change, the economic situation that we don't have any influence on, we have to exclude it and focus on our activities to adapt continuously." (BKE9)* *"For example, I can protect myself against these anomalies by covering, I heat the hive when raising queen bee, (...) we have insulated mating hives, they can keep the heat stable. (...) It can be solved if the situation is such that it is necessary to react; if we have plans with that animal, it is costly and laborious." (BKP7)* *"You have to be aware of a lot of things; you have to understand agricultural technology, you have to understand chemicals, if an agronomist tells you what to spray, you have to understand it, in the same way with mites treatments, you have to know the different preparations." (BKE5)*

3.2.6. Consequences

Consequences are the outcomes of strategies [77], actions and interactions [81]. More broadly, they apply to all actors in the context [83]. Given the current situation in the honey market (stagnant uptake, low sales prices, loss-making operations), most interviewees expressed a pessimistic vision of the future (Table 8). This could result in the cessation of beekeeping activities, leading to declining apiaries and bee colonies. Disappointed beekeepers may be forced to look for other employment. However, because of the attachment to bees, the majority will try to survive as long as possible, at worst, reducing their bee colonies to hobby level. This kind of attachment and perseverance forces large apiaries, in particular, to make improvements to reduce costs, e.g., using less live labor, reducing the number of migrating colonies, and introducing technological innovations.

Table 8. Definition of the consequences.

Categories	Determination "In Vivo"
Persistence, waiting	*"We don't have a vision for the future; we are waiting; if the price conditions remain like this, we will have to do something in the honey market to support ourselves and one employee. And the risk is huge; we should be able to finance at least two years of expenses; anything could happen." (BKP8)* *"I don't want to stop, that's for sure. I've grown so fond of this profession that maybe I won't go above 100 with a smaller staff, I won't go above 100. I'm hopeful for the future; it can't last forever, but maybe it will be better next year." (BKE2)*
Pessimism	*"The environmental impacts and chemical additives are a huge risk and are not worth doing. 600 HUF for mixed flower honey is 500 HUF for 1 kg of sugar. Ten years ago, it was 130 HUF; where are we now?" (BKE5)* *"I am planning a reduction due to the market situation. (....) My outlook is very pessimistic due to the current market conditions: stagnant uptake, low take-over price, high input prices, and expensive maintenance (...). I would expect more support for pollination." (BKP1)*
Career changing	*"I say if they don't change the support system, there won't be many beekeepers left. The conditions are not feasible; it's not a viable option." (BKE5)* *"Many people have liquidated their apiaries; I have heard of people who have simply abandoned their bees. I also know of beekeepers who have found a better job in the construction industry and have given up beekeeping." (BKE2)*
Development pressure	*"In beekeeping, I always try to learn new things, try new things, I breed the queen bees, I try to select them, I try to see which ones develop, reproduce, "produce" (...) I always develop my apiary, but if I don't develop it, it will go bankrupt (...) It has to be expanded." (BKP4)* *"I have plans for the future. I need more bees, (...) so I can produce other things." (BKE10)*

4. Discussion

This research investigated how beekeepers in Hungary's North Great Plain region make beekeeping decisions and what factors influence them. Building on studies on armers' decision-making and the role of animals in management, we also explored how beekeepers' relationships with their bees relate to these decisions. As in studies on farmer decision-making, beekeepers' decisions are influenced by a combination of external (economic, social, natural environment, weather, disease, policy) and internal factors (farmer mentality, adaptability, demographic, psychological characteristics, enterprise structure, type of decision) [35,36,43].

From the perspective of the beekeepers in this study, the most important external factors are the quantity and quality of pastures that are a natural food source for bees (land use change) and the problem of honey counterfeiting and cheap imports. The former is more critical for the health of bees and the strength of colonies, and the latter is for the economic sustainability of beekeeping. They also mentioned the adverse effects of climate change (extreme weather) and pesticides. Similarly, other studies have also found that beekeepers are unprotected from natural disasters, adversely impacting farmers [87]. Agrochemicals, diseases, and pests are critical limiting factors [88,89]. One of the significant problems beekeepers face is high winter bee losses [43]. Beekeepers respond to this problem by providing extra food and increased treatment against Varroa mites. However, the land for housing bees, or bee pastures, was not considered a significant issue. The severe weather events (e.g., extreme heat in winter and summer, reduced rainfall, spring frosts, and drought) cause direct and indirect damage to beekeepers [90,91]. Direct damage includes the weakening and death of colonies, the high infestation of Varroa mites and new biotic threats. Indirect damage has been defined as the scarcity of nectar and pollen sources, reduced production of honey and other bee products and reduced pollination activity. To solve these problems, beekeepers must find new solutions such as supplementary sugar feeding, more effective control of Varroa mites or bee colony migration [90].

Based on this study, the most important internal factors are the beekeepers' adaptability and professional knowledge, the type and size of the apiary and the beekeeping practices used (e.g., type of hive) [92]. Beekeepers are forced to adapt to increasing environmental and economic pressures. In the United States, large-scale beekeepers have developed new management practices aimed at keeping bees alive and keeping as many bees as possible, making their bees a commodity for them for economic reasons [15]. Similarly to other studies, the relationship of the beekeepers studied with their bees is complex; that is, in addition to their economic importance, their care is a recreation, a beneficial time spent in

nature. This relationship and the priority of caring for the health of the colonies are at the heart of beekeeping management. Some beekeepers refer to them as family, or as colleagues, and feel responsible for looking after them as best they can. This type of relationship is also reflected in other studies. Bees have acquired an undefined commodity status, positioned between traditional livestock and domestic animals [43,93–95].

Adaptation can be facilitated, for example, by colony-monitoring devices or the recent emergence of precision beekeeping, whereby the proposed solution is not intended to replace but rather to support the beekeeper, who will always remain a crucial factor in the proper management of honey bees [96–98]. Successful beekeepers can implement strategies that can limit the adverse effects of climate. Therefore, the beekeeping management practices used and the individual decisions of beekeepers are essential to the health of honey bee colonies, overwintering success and ultimately, productivity [90]. Good management practices can protect honey bees from health stresses, reduce colony mortality and increase productivity [99,100]. This ensures better colony vitality due to active Varroa management, reduced Varroa and virus loads, and higher labor and material costs [101]. From a managerial perspective, profitable small-scale beekeeping is also challenged by economies of scale, i.e., cost savings associated with increasing production levels, which may be hampered by a lack of expertise or market [101]. This study also demonstrates that for hobby beekeepers with small apiaries, economic goals are not the primary concern, while for professional beekeepers, this is not a negligible consideration. In the case of large-scale beekeeping, the nature of the challenges is different, as there is also the factor that beekeepers' livelihoods and income depend on bees [12,15,43].

There is a strong link between poor beekeeping management practices and colony losses. The main factors protecting honey bee colonies are the willingness of the beekeeper to improve management practices, the type of hive, the origin and hygiene of equipment, overwintering in appropriate conditions, the monitoring of Varroa infestation levels, and proper integrated pest management. The proper training of beekeepers can address the effects of inappropriate beekeeping management practices on honey bee health [1].

The beekeepers' philosophy, i.e., willingness to use chemicals to control pests and pathogens, and the size of the apiary are vital factors influencing beekeepers' management practices and goals [102]. Beekeeping organizations advise that all UK beekeepers should check their bee colonies weekly for signs of disease, treat for Varroa mites and use approved chemical treatments for disease. However, the motivations of UK beekeepers, including economic, social responsibility and ideological factors, result in different practices, some contrary to "official" advice [2].

In the beekeeping practices of beekeepers in Greece, an ecological approach is becoming increasingly prevalent, i.e., the gradual replacement of synthetic miticides with natural methods and materials, the annual replacement of queen bees, and the choice of a natural food source-rich apiary [103]. More broadly, engaging with the beekeepers' knowledge and environmental values, including their critiques of pollinator and agricultural policy and contemporary food systems, can support the transformations necessary to ensure a sustainable food system that provides food while supporting more comprehensive environmental benefits [104].

The beekeepers interviewed in the present study are not considered to be diversified in their activities and, except for one beekeeper, do not place much emphasis on diversification. This is partly due to economic reasons (lack of development resources, lack of demand) and partly to personal reasons (lack of time, lack of interest). Most of them are exclusively involved in honey production. One is a large-scale beekeeper involved in raising queen bee and bee breeding, and the other is only involved in beekeeping. There is also no market for pollination and services in Hungary, unlike in other countries such as the USA, Canada, Australia, New Zealand, Germany, and Thailand [63,105,106]. Some studies suggest that the decision to diversify is mainly related to economic factors [34]; others suggest that personal motivation is decisive [35,36,43].

5. Conclusions

The present study used a qualitative approach to beekeeping management based on the perception of beekeepers. Based on the grounded theory method, we developed a model of the beekeeping management paradigm from a semi-structured interview with beekeepers in Hungary. We explored the factors that influence beekeepers' decision-making in a fundamental and broader sense, placing beekeeping itself in context. We have mapped the strategies and beekeeping practices beekeepers use and the outcomes and consequences that arise from them. Thanks to their strong motivation, perseverance and knowledge, beekeepers have adopted strategies that have successfully addressed challenges such as difficulties in accessing good quality bee pastures, reducing Varroa mite infestations or the adverse effects of the economic environment. We examined the research results in similar areas, comparing them with the results of this study. Developing decision-making tools could form the basis for further research to enable beekeepers to make management decisions that align with their philosophy and economic sustainability. In an environment where beekeepers' costs increase and their income decreases when implementing adaptation strategies, more targeted measures are needed to protect bees and to increase beekeepers' profitability. To protect bees, it would be essential to preserve and expand the area of natural food sources, improve the monitoring of plant protection activities, raise awareness of the importance of pollination among farmers, and promote the use of good beekeeping practices by structuring the system of further training in beekeeping. Sectoral aid should be strengthened, and its fragmentation should be simplified to help the activity's profitability. For beekeeping to become a key sector in practice in Hungary, beekeepers must be able to cope more easily with the sector's challenges and the specific problems of managing bee colonies.

In this study, a paradigm model was presented based on the factors influencing the decision-making of beekeepers in Hungary. It should be pointed out that the limitation of the study is that the interviews were conducted with beekeepers in one region of Hungary, taking into account the production conditions in Hungary. The activities of the interviewed beekeepers are based on honey production or queen bee-raising, and are not diversified.

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