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Operational Scale Shapes the Socio-Economic Perceptions and Stakeholder Capacity of Cypriot Beekeepers

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Abstract: Beekeeping has traditionally been valued for honey production and other hive products, alongside its contribution to agricultural pollination. However, the role of beekeepers increasingly extends beyond conventional production activities, creating opportunities for participation in sustainable land management and pollinator conservation. This study investigates the socio-economic motivations, cultural perceptions and stakeholder relationships of beekeepers in Cyprus, examining how these characteristics differ according to operational scale. An anonymous questionnaire was completed by 137 beekeepers, comprising 85 small-scale and 52 large-scale operators. The findings indicate that recreational and commercial motivations coexist within Cypriot beekeeping, although their relative importance varies significantly between operational categories. Family traditions remain an important motivation for participation, while engagement with distinctive cultural practices and heritage-related activities appears comparatively limited among respondents. Differences were also identified in marketing practices, access to resources, information sources and collaboration with farmers. Larger-scale operators reported more extensive interactions with agricultural stakeholders and greater participation in certain cooperative activities. Nevertheless, operational scale was not significantly associated with reported efforts to encourage neighbouring landowners to adopt sustainable practices. These findings suggest that operational scale is associated with differences in beekeepers' socio-economic characteristics and opportunities for stakeholder engagement, without necessarily demonstrating greater environmental influence. The study highlights the potential value of strengthening cooperation between beekeepers, farmers and land managers, while recognising the diversity of motivations, resources and constraints within the Cypriot beekeeping sector.

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1. Introduction

The sustainable provision of ecosystem services is increasingly threatened by habitat degradation, biodiversity loss and the disruption of ecological networks (Billeter et al., 2008; Cardinale et al., 2012; Emmerson et al., 2016). Addressing these challenges requires coordinated action among stakeholders operating across different geographical, institutional and socio-economic contexts (Hein et al., 2006; Geijzenborgh and Roche, 2014). Pollinator decline represents a significant example of ecosystem-service deterioration, driven by interacting pressures such as habitat loss, pesticide exposure, parasites and reductions in floral resources (Potts et al., 2010; Vanbergen and the Insect Pollinators Initiative, 2013; Goulson et al., 2015; Moldoveanu et al., 2024). Although environmental policies and conservation initiatives increasingly promote sustainable land management and habitat restoration, their effectiveness depends on the ecological suitability of interventions and the participation of relevant stakeholders (Pe'er et al., 2014; Requier and Leonhardt, 2020; Runge et al., 2022; Thorsøe et al., 2024). Furthermore, the relationship between managed honeybees and wild pollinators is complex, with potential competition and ecological pressures requiring careful consideration (Moritz and Erler, 2016; Patel et al., 2021; Bertoni et al., 2025). Within this context, beekeepers may contribute to environmental stewardship through their practical knowledge, interactions with land managers and participation in agricultural decision-making. However, their capacity to influence sustainable land-use practices cannot be assumed solely from their involvement in beekeeping.

The Western honeybee (*Apis mellifera* L.) has longstanding agricultural, economic and cultural significance, contributing to pollination services and the production of honey and other hive products (De la Rúa et al., 2009). Archaeological evidence demonstrates the historical exploitation and exchange of honeybee products, highlighting the enduring relationship between beekeeping and human societies (Kvavadze et al., 2007; Bloch et al., 2010; Roffet-Salque et al., 2015; Dunne et al., 2021). Beyond production, beekeepers possess experiential knowledge of flowering resources, forage availability and landscape conditions, potentially positioning them as intermediaries between agricultural activities and environmental management (Zacepins et al., 2021; Maderson and Elsner-Adams, 2024; Shelton et al., 2026). Their perspectives have also contributed to public discussions concerning honeybee health, pesticide exposure and agricultural regulation (vanEngelsdorp et al., 2009; Chauzat et al., 2013; Vanegas, 2017; Durant, 2021). Nevertheless, beekeeping practices are shaped not only by ecological considerations but also by economic pressures, social relationships and cultural traditions (Phillips, 2014; Maderson and Wynne-Jones, 2016; Maderson, 2023; Pawłowska-Mainville, 2025). These dimensions are particularly relevant when examining whether beekeepers can participate meaningfully in environmental governance rather than remaining primarily producers of agricultural commodities.

Beekeepers do not constitute a homogeneous stakeholder group, as their motivations, management practices, economic resources and social relationships may differ considerably according to operational scale (Kahane et al., 2022; Feketéné Ferenczi et al., 2024; Bertoni et al., 2025; Geppert et al., 2025). Small-scale operators are frequently associated with recreational motivations, personal enjoyment and household-level production, whereas larger operations tend to demonstrate stronger commercial orientations and more extensive engagement with product markets (Andrews, 2020; Ellis, 2022). However, these distinctions should not be treated as absolute, since recreational and economic motivations may coexist within individual beekeeping practices. Operational scale may also influence access to information, equipment, forage areas and relationships with farmers and landowners, potentially shaping opportunities for stakeholder participation. Previous research has highlighted the importance of beekeepers' social networks and practical knowledge while also identifying barriers associated with communication, conflicting priorities and unequal influence over land-management decisions (Phillips, 2014; Breeze et al., 2019; Maderson, 2023). Consequently, evaluating beekeepers as potential environmental stakeholders requires attention to differences within the sector rather than treating their perceptions and capacities as uniform.

Against this background, the present study examines the socio-economic motivations, cultural perceptions and stakeholder relationships of beekeepers in Cyprus, with particular attention to differences associated with operational scale. Although European research has explored beekeeping practices, management challenges and environmental perceptions across various national contexts, the applicability of these findings to Cyprus requires further examination (Breeze et al., 2019; Perichon et al., 2024; Perichon et al., 2025). The study investigates whether small-scale and large-scale beekeepers differ in their motivations for participation, attitudes towards professional ethics and cultural heritage, access to resources, and relationships with farmers and land managers. It is hypothesised that operational scale is associated with differences in these socio-economic and cultural characteristics, as well as in opportunities for stakeholder engagement. An anonymous questionnaire was used to collect responses from 137 beekeepers, followed by supplementary group discussions intended to contextualise the survey findings. By examining these dimensions together, the study seeks to contribute to understanding the diversity of beekeeping practices in Cyprus and the potential opportunities and limitations associated with beekeepers' participation in sustainable agricultural land management.

Research Aim

This study aims to investigate how operational scale is associated with the socio-economic motivations, cultural perceptions and stakeholder relationships of beekeepers in Cyprus, with particular emphasis on their opportunities and limitations for participation in sustainable agricultural land management.

Research Questions

1. How do the socio-economic motivations, commercial practices and operational constraints of Cypriot beekeepers differ according to the scale of their beekeeping activities?
2. How do Cypriot beekeepers perceive professional ethics, cultural traditions and heritage, and to what extent are these perceptions associated with operational scale?
3. How does operational scale relate to beekeepers' social relationships, access to information and resources, and reported engagement with farmers and land managers?

Research Objectives

- To examine the socio-economic characteristics, motivations, marketing practices and operational constraints of small-scale and large-scale beekeepers in Cyprus.
- To investigate beekeepers' perceptions and reported practices concerning professional ethics, cultural traditions and heritage, identifying potential differences between operational categories.
- To assess the relationships between operational scale and beekeepers' access to information, support mechanisms, social networks and collaboration with agricultural stakeholders.
- To identify the opportunities and limitations associated with beekeepers' potential participation in sustainable agricultural land management, drawing on the differences and similarities observed between operational groups

Research Hypothesis

Operational scale is associated with differences in the socio-economic motivations, cultural perceptions and stakeholder relationships of Cypriot beekeepers, although the strength and direction of these associations may vary across the dimensions examined.

2. Material and Methods

2.1. Study Region

Cyprus is an island country situated in the eastern Mediterranean, characterised by a predominantly Mediterranean climate with hot, dry summers and mild, wetter winters (Ministry of Agriculture, Rural Development and Environment, 2024). These environmental conditions influence the seasonal availability of flowering vegetation and the management of honeybee colonies. Beekeeping represents a component of agricultural activity in Cyprus, encompassing operators with different levels of commercial involvement, experience and management capacity. The sector operates within the country's agricultural policy framework, including support measures implemented through the Common Agricultural Policy Strategic Plan 2023–2027 (Ministry of Agriculture, Rural Development and Environment, 2024; European Commission, 2022). Within this context, the present research examines differences in socio-economic motivations, cultural perceptions and stakeholder relationships according to the operational scale of Cypriot beekeepers.

The environmental and agricultural characteristics of Cyprus provide a relevant context for investigating the relationships between beekeeping activities and sustainable land management. Seasonal variations in floral resources, agricultural land use and access to suitable forage areas may influence beekeepers' management decisions and interactions with farmers and landowners. These considerations highlight the importance of examining how operational scale may be associated with differences in management practices, access to resources and relationships with agricultural stakeholders within the Cypriot beekeeping sector.

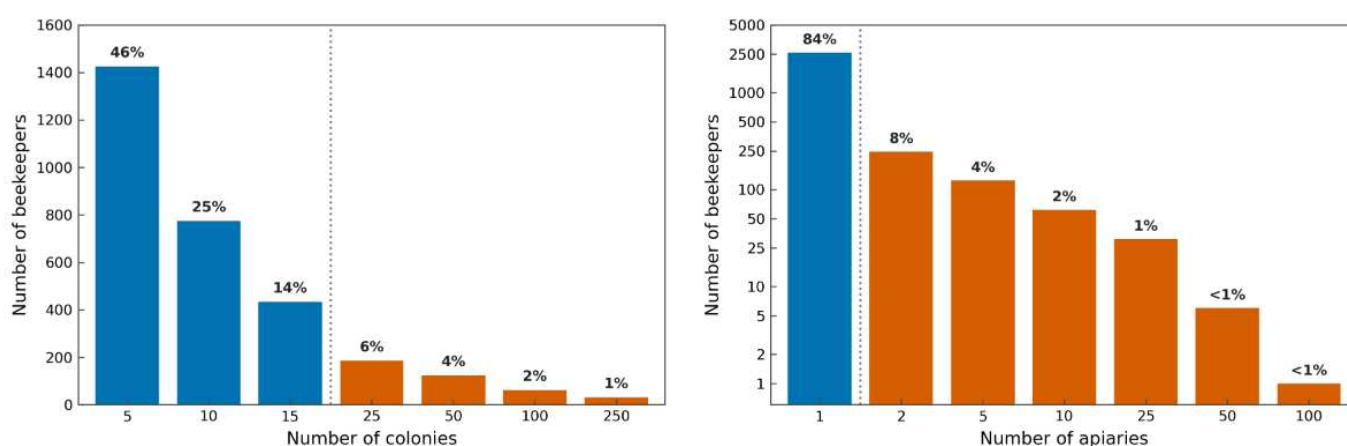


Figure 1. Distribution of registered beekeepers in Cyprus according to the number of honeybee colonies (a) and apiaries (b) in 2025. Values on the X-axis indicate the upper limits of the corresponding count categories. In panel (b), the Y-axis is presented on a logarithmic scale to improve readability. The dotted line indicates the operational-size threshold applied to classify beekeepers for the comparative analyses conducted in this study. Source: Department of Agriculture, Plant Protection and Beekeeping Branch (2025).

Beekeeping has a longstanding historical and cultural presence in Cyprus, where honey production and the management of honeybee colonies have formed part of traditional agricultural activities and rural livelihoods. Historical accounts of Cypriot honey production, together with traditional beekeeping practices and the use of locally constructed beehives, demonstrate the enduring relationship between apiculture, agricultural heritage and the island's cultural identity (Republic of Cyprus, 2022). Within the island's Mediterranean context, beekeeping practices have developed in relation to local environmental conditions, seasonal floral resources and agricultural traditions. International research has examined various dimensions of apiculture, including honeybee health, environmental pressures and chemical exposure (Cini et al., 2025; Nicholson et al., 2024; Raimets et al., 2022), as well as the composition and properties of honey (Kivima et al., 2021; Paluoja et al., 2025; Puusepp and Koff, 2014). Other investigations have explored beekeeping knowledge, professional traditions and relationships between beekeepers and their surrounding environments (Kalle, 2025; Kalle et al., 2025). Nevertheless, the extent to which these international findings reflect the socio-economic and cultural experiences of Cypriot beekeepers remains insufficiently established. Examining cultural heritage, traditional knowledge and stakeholder relationships within Cyprus therefore provides an opportunity to investigate how operational scale may be associated with differences in professional identity, management priorities and participation in sustainable agricultural land management.

2.2. Preparation and Distribution of the Survey Plan

The online questionnaire was designed to investigate the socio-economic characteristics, cultural perceptions and stakeholder relationships of beekeepers operating in Cyprus. The study was designed to respect the principles of voluntary participation, informed consent and participant confidentiality, with consideration given to the requirements of Regulation (EU) 2016/679 concerning personal data protection (European Parliament and Council of the European Union, 2016). Participants were provided with information about the research objectives, the intended use of the collected responses and their right to discontinue participation. Informed consent was obtained through an introductory questionnaire item, and respondents who did not provide consent were unable to proceed. The questionnaire was administered through the LimeSurvey platform, with anonymity settings applied to minimise the collection of identifying information.

The questionnaire was organised into three principal thematic subsections: background and management status, cultural heritage, and social connectivity. To facilitate questionnaire completion and subsequent analysis, items were presented using either single-choice or multiple-choice formats, allowing participants' responses to be systematically coded into categorical variables for subsequent statistical analysis. To minimise the time required for completion and facilitate consistent responses, opportunities for additional written comments were limited to a single open-text field at the end of the questionnaire. Preliminary testing was conducted with five beekeepers representing different operational scales, management arrangements and memberships of beekeeping organisations. These individuals received an inactive version of the questionnaire and were invited to assess the questions and corresponding response options. The feedback received primarily concerned minor stylistic modifications, which were subsequently incorporated into the final questionnaire. The translated final version is provided in the Supplementary Material.

The survey was disseminated through several recruitment waves between July and September 2025, using multiple communication channels, including beekeeping organisations, social media communities, physical events and direct email invitations. This approach was intended to reach respondents with differing levels of digital engagement and social networking participation. Initially, invitations were circulated through internal mailing lists maintained by principal Cypriot beekeeping organisations, including the Cypriot Beekeepers Association, the Cypriot Professional Beekeepers Association and the Cypriot Organic Beekeepers, together with several regional societies, such as those operating in Limassol, Paphos, Larnaca and Nicosia. Survey invitations were also distributed through three Facebook groups serving Cypriot beekeepers: *Department of Agriculture's Plant Protection and Beekeeping Branch* (approximately 12,000 members), *The Cyprus Association of Beekeepers* (approximately 4,000 members) and *Natural Bee Environmental Activity* (approximately 1,500 members). Posts containing the questionnaire link were published at the beginning of the survey period and repeated approximately one month before its closure. Additionally, printed questionnaires and QR-code access were provided at three beekeeping events to encourage participation among older beekeepers who were less active through electronic communication channels. Responses collected through printed questionnaires were subsequently entered into the electronic dataset and checked for completeness and potential duplication before statistical analysis. Personal email invitations were also sent to beekeepers from different regions of Cyprus, using contact information obtained through participating beekeeping associations. This additional recruitment strategy was intended to broaden geographical coverage and encourage participation among beekeepers operating at different scales across Cyprus. Nevertheless, an overall response rate could not be reliably calculated because the total number of individuals reached through the different recruitment channels was unknown.

Following the survey, three seminar-based discussions were conducted to provide additional context for interpreting the questionnaire findings. Each seminar was attended by approximately 20–50 participants, who were invited to share their perspectives during and following the presentations. As these discussions took place in an auditorium setting and most contributors remained unidentified, they were treated as informal contextual feedback rather than structured focus-group data.

2.3. Data Management and Analysis

A total of 138 completed questionnaires were collected. Following the conclusion of data collection, the dataset underwent a quality-control assessment to identify potentially duplicated submissions. This process involved examining submission timestamps and written responses provided in the questionnaire's open-text field. Where a potentially repeated submission was identified, the corresponding answers were compared with other questionnaire responses to assess the extent of overlap. One submission was considered highly likely to be a duplicate and was therefore excluded, leaving a final analytical sample of 137 valid questionnaires. Response completeness varied across questionnaire items, with some questions recording higher levels of non-response than others. Missing responses were identified and reported where applicable, and percentages were calculated using the number of valid responses for each question.

Participants were initially asked to categorise their beekeeping operations according to three holding-size groups. More detailed information concerning colony numbers was deliberately avoided because precise reporting could potentially compromise respondent anonymity, particularly given the relatively small population of large-scale beekeepers. Furthermore, colony numbers may vary considerably between years and throughout individual beekeeping seasons, an issue that generated uncertainty and confusion among participants during the questionnaire's preliminary testing. To ensure adequate sample sizes for statistical comparisons between operational categories, the original classification was subsequently reduced to two groups by combining the two larger holding-size categories. Of the 137 valid responses, 85 participants (62.0%) were classified as small-scale beekeepers,

comprising operations maintaining no more than 15 colonies. The remaining 52 participants (38.0%) were classified as large-scale beekeepers, comprising operations maintaining more than 15 colonies (Table S1). Information concerning the number of apiaries was considered separately to characterise the geographical distribution of beekeeping activities.

The analytical dataset comprised exclusively categorical variables. Statistical procedures were selected according to whether questionnaire items permitted single or multiple responses, with the objective of examining potential associations between response patterns and beekeeping operation size. For single-choice questions, relationships between the distribution of responses and holding-size categories were examined through log-linear analysis of contingency tables using Statistica version 9.1 (StatSoft Inc., Tulsa, OK, USA). Pearson's chi-square statistics associated with the interaction term were extracted to evaluate the presence of an association. Marginal effects were retained within the statistical models to ensure their contribution to the calculation of degrees of freedom for the interaction term; however, these effects were not interpreted because the marginal totals for operation size depended on the composition of the sample. For multiple-choice questions, associations with operation size were assessed separately for each response category, with individual options treated as binary outcomes indicating whether they had been selected or not selected. Accordingly, a 2×2 contingency table was constructed for every response option, and the statistical significance of its association with operation size was determined using the same log-linear analytical procedure. Because respondents could select multiple options within the same question, the resulting comparisons were not assumed to be mutually independent.

Questionnaire findings are presented as percentages calculated relative to the number of valid responses for each question or, where appropriate, the number of respondents within the corresponding beekeeping operation-size category. Differences between groups were evaluated using the significance levels obtained from the association tests, applying a critical threshold of $p < 0.05$. Because separate statistical tests were conducted for each single-choice question and each response category within multiple-choice questions, no adjustment for multiple testing was applied. Given the number of comparisons conducted without adjustment for multiple testing, statistically significant associations were interpreted cautiously, recognising the increased possibility of Type I errors. Throughout the reporting of results, the subscript accompanying the chi-square statistic (χ^2) indicates the degrees of freedom associated with the corresponding statistical test; for example, χ^2_2 denotes a test with two degrees of freedom.

3. Results

3.1. Beekeepers' Backgrounds

The majority of participants had considerable experience in beekeeping, with 53% reporting involvement for 5–25 years and a further 25% having practised for more than 25 years (Table S1). The remaining 22% were relatively new to beekeeping, having engaged in the activity for fewer than 5 years. Although only one respondent indicated in the additional comments that they had begun beekeeping within the previous year, their questionnaire responses nevertheless demonstrated relevant practical experience. A statistically significant difference in experience was identified between the two operation-size categories ($\chi^2_2 = 9.78$, $p = 0.007$). Among small-scale beekeepers, the three experience categories were comparatively well represented, accounting for 31%, 48%, and 21%, respectively. In contrast, relatively few large-scale beekeepers were at an early stage of their activity, with the corresponding proportions being 8%, 59%, and 33%.

Beekeeping was primarily regarded as a recreational activity by 63% of respondents, whereas 25% considered it a supplementary source of income and 12% identified it as their principal means of earning a living (Figure 2). Significant differences were observed between the operation-size categories ($\chi^2_2 = 55.6$, $p < 0.0001$). Among small-scale beekeepers, 86% characterised their involvement as a hobby, while the remaining respondents considered it a source of additional income (Table S1). Conversely, 42% of large-scale beekeepers reported beekeeping as supplementary income, and 33% depended on it as their primary income source. Nevertheless, 25% of this group continued to regard beekeeping predominantly as a recreational pursuit. During a subsequent informal seminar discussion involving professional beekeepers, one participant highlighted the financial demands associated with the activity, stating that “beekeeping is a very expensive hobby”.

The selection of marketing channels was significantly associated with the scale of beekeeping operations ($\chi^2_3 = 51.74$, $p < 0.0001$). Within the small-scale category, 31% of respondents did not participate in commercial marketing, instead retaining hive products for personal use or distributing them to others without selling them. Direct sales to consumers represented the principal marketing approach for 66% of small-scale beekeepers, while 3.5% combined direct sales with distribution through retailers (Figure 3, Table S1). Among large-scale beekeepers, 46% relied on direct consumer sales, while an equivalent proportion (46%) employed a combination of direct and intermediary-based marketing channels. The remaining 8% marketed their products exclusively through retailers. Overall, these findings indicate that direct consumer sales represented an important marketing channel across both operational categories, although larger-scale beekeepers were more likely to combine direct sales with intermediary-based distribution.

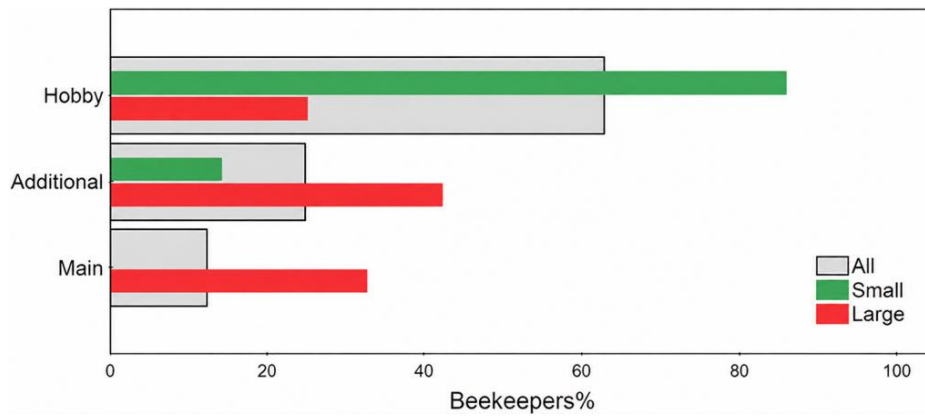


Figure 2. Distribution of respondents' perceptions of beekeeping as a source of income, presented for the overall sample and according to operation size. A statistically significant difference in response distributions was observed between small-scale and large-scale beekeepers.

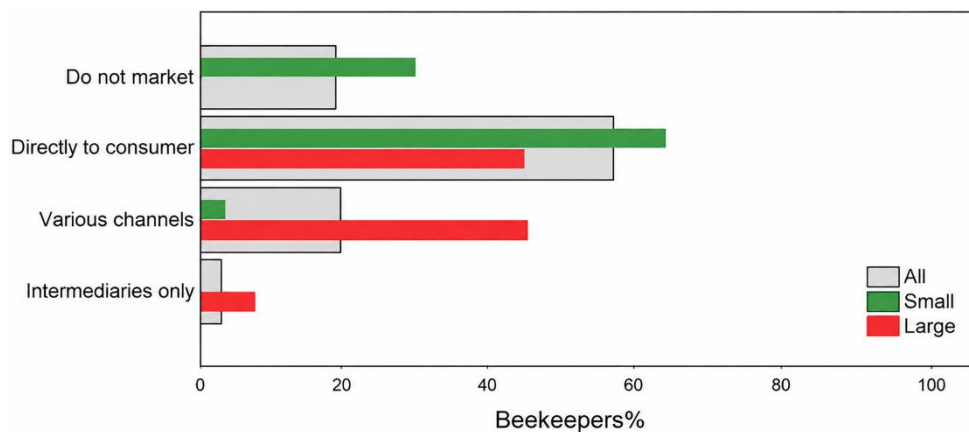


Figure 3. Distribution of beekeepers' responses concerning the marketing channels used for bee products, presented for the overall sample and by operation size. Statistically significant differences in response distributions were identified between small-scale and large-scale beekeepers.

Respondents were presented with multiple-choice questions to identify the motivations underlying their decision to begin beekeeping. The most frequently reported reasons were the anticipation of beekeeping becoming a rewarding hobby (57%) and the continuation of a family tradition (50%) (Figure 4, Table S2). The expectation of pursuing beekeeping as a hobby was significantly more common among small-scale beekeepers than among those operating on a larger scale (Figure 4, 65% vs. 44%, $p = 0.037$, Table S2). A smaller proportion of participants (6%) indicated that their initial motivation was the prospect of engaging in an 'additional productive activity'. Several open-ended responses provided further insight into the personal motivations and emotions associated with starting beekeeping, including statements such as “a needs-based action to...”, “I needed honey for medical treatment, free of alien sugars...” and “a sweet pastime”. Additionally, two respondents explained that they had taken up beekeeping to enhance the pollination of their cultivated crops. One participant also identified concerns regarding adulterated honey as an initial reason for becoming involved in beekeeping.

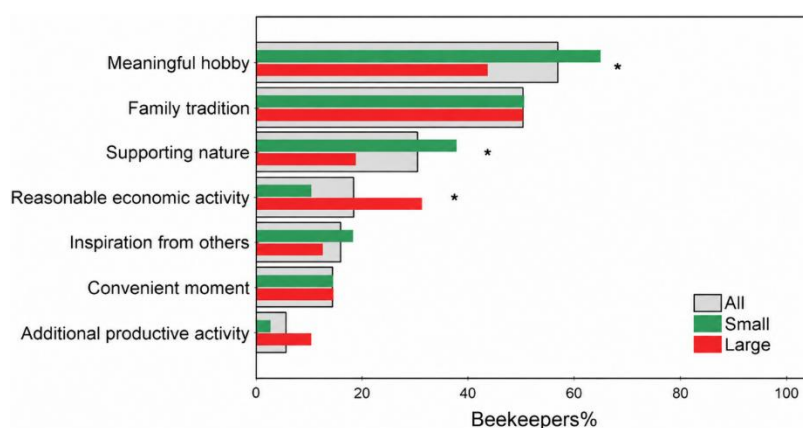


Figure 4. Distribution of beekeepers' multiple-choice responses concerning their reasons for engaging in beekeeping, presented for the overall sample and according to operation size. Asterisks denote statistically significant differences in response proportions between small-scale and large-scale beekeepers within individual response categories

Two additional motivations demonstrated statistically significant differences between small-scale and large-scale beekeepers. The perception of beekeeping as an opportunity 'to support nature' represented the third most frequently reported motivation overall (30%). However, this proportion was largely influenced by the comparatively high response rate among small-scale beekeepers (38%) (Figure 4), whereas only 19% of large-scale beekeepers identified this motivation ($p = 0.037$, Table S2). Conversely, the perception of beekeeping as 'a reasonable economic activity' demonstrated the opposite pattern, ranking as the third most frequently selected motivation among large-scale beekeepers (31%), while being considerably less common among small-scale operators (10%) ($p = 0.003$). During subsequent focus group discussions, the proportion of respondents who had initially anticipated reasonable economic returns frequently prompted amusement, as participants retrospectively regarded such expectations as somewhat unrealistic.

Encouragement from neighbouring beekeepers or other acquaintances was identified as the initial motivation by 16% of respondents, irrespective of their current operational scale, potentially suggesting a relatively limited influence of social networks on the decision to begin beekeeping. Overall, 14% of participants indicated that they had entered beekeeping following favourable circumstances, including access to affordable equipment, the availability of bee colonies or specific support opportunities. Additional comments illustrated these circumstances through statements such as "the matter of conditions, as the beekeeper died", "had to continue the dad's work, after he passed away" and "we purchased a countryside house". Several respondents who did not identify with any of the predefined response categories provided alternative explanations, including "bees themselves found the way to me", "a heritage", "a relative brought beehives to us, as he no longer had a suitable place" and "there were poor times and, being a member of the beekeepers cooperative, it was possible to get extra 0.5 kg of sugar per month".

The principal constraints affecting the expansion of existing beekeeping operations were the limited capacity to manage additional colonies (58%) and difficulties associated with product marketing, including insufficient market opportunities or low profitability (49%) (Figure 5). Marketing-related challenges were reported more frequently by large-scale beekeepers, although the difference between operational categories was relatively marginal (42% vs. 60%, $p = 0.045$, Table S2). Written comments and subsequent focus group discussions further indicated that beekeeping generates relatively low financial returns, while marketing difficulties arise from challenges in attracting customers and maintaining adequate selling prices, partly associated with the presence of adulterated honey. Respondents also identified the need for more advanced equipment as a constraint on operational expansion (34%). Among small-scale beekeepers, 43% indicated that increasing their number of hives was unnecessary, compared with 14% of large-scale beekeepers ($p = 0.0008$). Inadequate subsidies and financial assistance were identified as limiting factors by 24% of all respondents, without a statistically significant difference between the two operational categories. Finally, the limited availability of additional forage areas was the least frequently reported constraint among small-scale beekeepers (9%), whereas it represented a significantly greater concern for large-scale operators (30%, $p = 0.0016$).

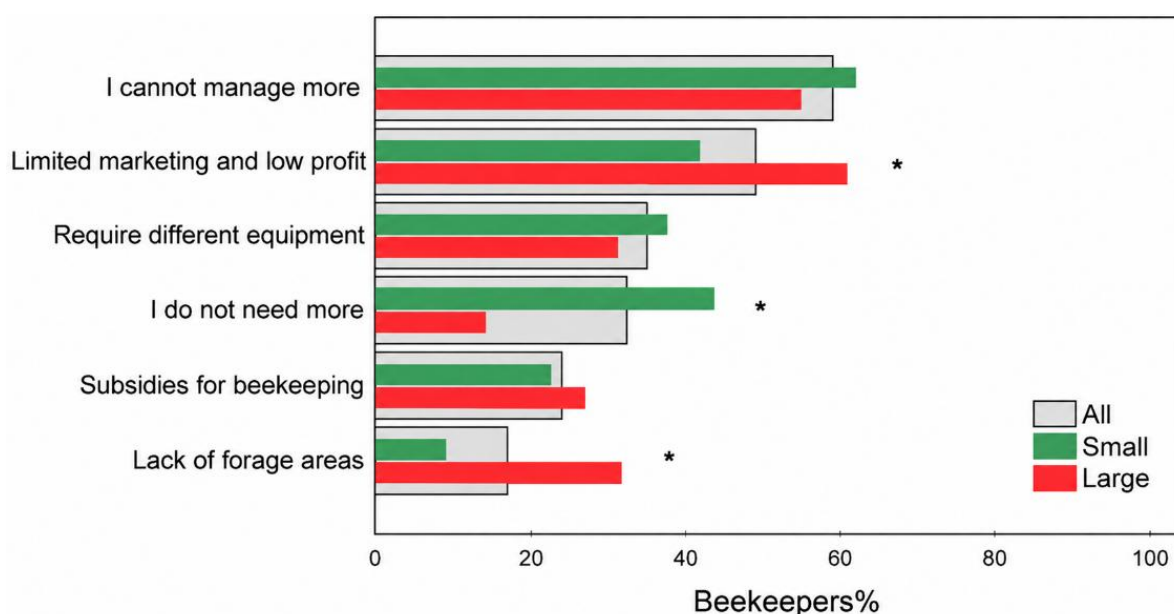


Figure 5. Distribution of beekeepers' multiple-choice responses concerning the factors limiting the expansion of their beekeeping activities, presented for the overall sample and by operation size. Asterisks denote statistically significant differences in response proportions between small-scale and large-scale beekeepers within each response category.

3.2 Professional Attitude, Cultural Traditions, and Heritage

Unwritten conventions and ethical principles were regarded as highly important by 29% of beekeepers, while an additional 62% considered them to have some relevance to their activities. However, a statistically significant difference was observed between the two operation-size groups ($\chi^2_2 = 8.42$, $p = 0.015$). Large-scale beekeepers were more than twice as likely (43%) as small-scale beekeepers (20%) to report systematically applying informal rules and professional ethics in their work. Conversely, 70% of small-scale beekeepers indicated that their practices were influenced to some extent by unwritten conventions, established traditions and professional ethical standards, compared with 49% of large-scale beekeepers. Across the overall sample, approximately 10% of respondents attributed no importance to unwritten rules or ethical principles.

For the remaining questions within this section, no statistically significant differences in perceptions were identified between small-scale and large-scale beekeepers. Only 19% of respondents agreed that national beliefs, traditional customs and the incorporation of particular objects or symbols into beekeeping contributed to the preservation of Cypriot cultural heritage, whereas 27% disagreed with this statement. The largest proportion of participants (54%) expressed uncertainty regarding this relationship.

The majority of beekeepers (73%) either did not incorporate nationally distinctive customs into their activities or were unfamiliar with such practices. Only 13% reported actively using these traditions, while a further 14% acknowledged their existence but indicated that they were never applied in their own beekeeping activities. Nine respondents did not provide an answer to this question.

The frequent application of traditional knowledge, cultural beliefs, inherited wisdom and omens in everyday beekeeping was reported by only 12% of participants. Almost half (46%) indicated that they incorporated a limited number of these practices, whereas 42% stated that they did not apply any of them.

Responses concerning the use of lucky charms or protective amulets indicated that 1.5% of beekeepers reported regular use, while a further 2% indicated occasional use. Additionally, 61% stated that they did not use such objects and considered them irrelevant to their beekeeping activities.

Only 2% of beekeepers reported following traditional calendar holidays and/or lunar phases, while 14% observed these practices occasionally. The overwhelming majority (84%) indicated that they did not take such traditions into consideration.

Almost half of the respondents (48.5%) were confident that their bee-forage areas did not contain sacred locations or culturally significant objects, such as sacred stones, trees, stands or family sites. A further 28% acknowledged being unaware of whether such places existed, while 23.5% confirmed their presence within the surrounding landscape. The association with operation size approached but did not reach statistical significance ($p = 0.061$), providing only a possible indication that large-scale beekeepers might be less familiar with these locations. Five participants did not answer this question. Where sacred sites or places of particular cultural significance were present, 57% of beekeepers expressed willingness to adapt their practices and consider these locations when positioning their hives, provided that doing so was feasible. Only 9% stated that they would categorically avoid placing hives near sacred locations or objects, whereas approximately one-third (33%) indicated that the presence of such sites would not influence their decisions.

Regarding the maintenance of ancient or semi-wild honeybee breeds, 14% of participants did not respond to this question. Among those who provided an answer, nearly one-third (31%) believed that these breeds no longer existed, while only 2.5% reported currently keeping them.

3.3. Beekeepers' Social Status

The geographical placement of hives and apiaries differed significantly between the two operation-size categories, as demonstrated by the single-choice responses ($\chi^2_1 = 66.86$, $p < 0.0001$). Most small-scale beekeepers (85%) maintained their hives in close proximity to their residences, while 11% located them exclusively at more distant sites. In contrast, 58% of large-scale beekeepers managed apiaries both near their homes and across more extensive geographical areas, whereas 27% maintained their apiaries solely at distant locations (Figure S2). Notably, 15% of large-scale beekeepers reported that all their hives were situated "close to home". However, closer examination of the original responses indicated that these participants operated medium-sized holdings comprising 2–4 apiaries, suggesting that their beekeeping locations could remain relatively close to their residences.

Information sources used to assess forage conditions also varied significantly between small-scale and large-scale beekeepers, with statistically significant associations identified across all comparisons ($\chi^2_1 > 29$, $p < 0.0001$). Direct familiarity with the surrounding landscape was the predominant approach among small-scale beekeepers (93%), although it was also reported by a considerable proportion of large-scale operators (40%) (Figure 6). Only 8% of small-scale beekeepers obtained information through discussions with farmers and neighbours or by responding to public requests, compared with 52% of large-scale beekeepers. Similarly, electronic information platforms, including government-provided geographical information system (GIS) services, were used by 5% of small-scale beekeepers and 42% of large-scale beekeepers.

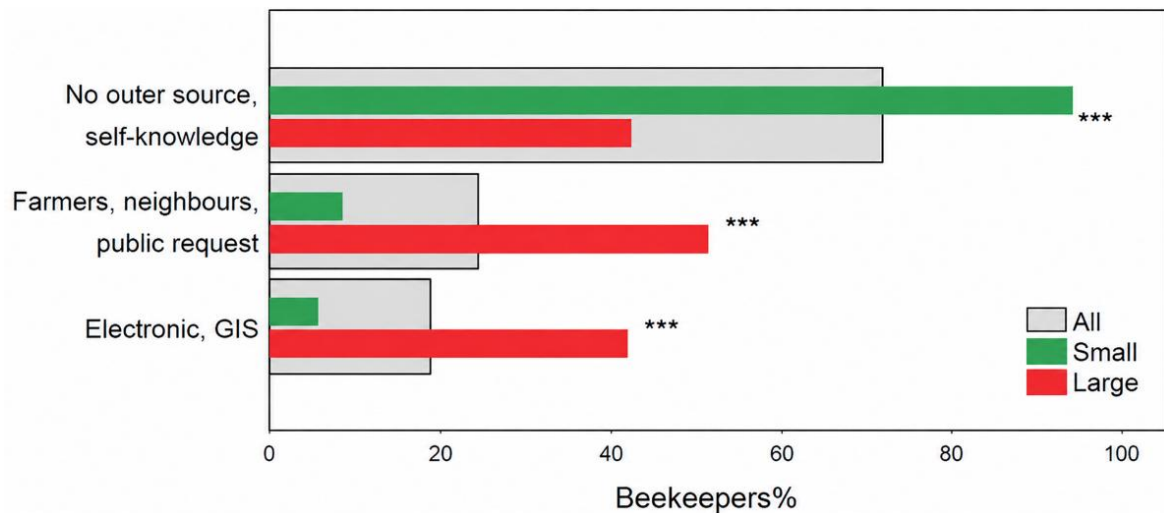


Figure 6. Distribution of beekeepers' multiple-choice responses concerning the sources of information used to determine apiary locations, presented for the overall sample and according to operation size. Asterisks denote statistically significant differences in response proportions between small-scale and large-scale beekeepers within each response category.

A considerable proportion of beekeepers reported relatively limited engagement with governmental support mechanisms in recent years, although participation differed significantly according to operation size ($\chi^2_2 = 26.9$, $p < 0.0001$). Small-scale beekeepers demonstrated lower levels of engagement than their large-scale counterparts, with 41% neither applying for nor receiving financial assistance or subsidies. A further 55% obtained only modest payments, such as standard per-hive support, while just 3.6% submitted applications for more substantial compensation. Conversely, only 3.8% of large-scale beekeepers had not applied for financial assistance, whereas 75% received basic support payments and 21% obtained higher levels of financial support or compensation.

Efforts to encourage neighbouring landowners and land managers to adopt more sustainable land-management practices were relatively uncommon, with 59% of respondents indicating that they had never undertaken such activities. Nevertheless, 26% of beekeepers reported actively encouraging neighbouring landowners to implement more sustainable approaches or recommending specific measures to farmers, while an additional 15% expressed willingness to engage in similar initiatives. No statistically significant difference was identified between small-scale and large-scale beekeepers in this respect ($\chi^2_2 = 2.93$, $p = 0.231$).

Respondents generally characterised their neighbours' attitudes towards their beekeeping activities as neutral or favourable, with 89% reporting that they had never encountered negative feedback. Only 4% indicated experiencing explicitly negative comments or direct conflicts with neighbouring residents, while a further 7% had occasionally received indications of potential concerns. Differences between operation-size categories were relatively limited, although the association reached marginal statistical significance ($\chi^2_2 = 6.17$, $p = 0.046$). More specifically, large-scale beekeepers reported experiencing some form of negative feedback, combining occasional indications of concern and explicitly negative responses, somewhat more frequently (10%) than small-scale beekeepers (6%).

Experiences of collaboration with farmers varied considerably between small-scale and large-scale beekeepers, with a statistically significant association identified between operation size and reported experiences ($\chi^2_3 = 20.87$, $p = 0.0001$). The absence of collaboration was substantially more common among small-scale beekeepers (65%) than among large-scale operators (26%) (Figure 7). Explicitly negative experiences with farmers were uncommon across both groups, accounting for only 3% of responses overall. In contrast, positive experiences were reported more frequently by large-scale beekeepers (40%) than by small-scale beekeepers (13%). Similarly, mixed experiences, described as "a bit of both", were more commonly identified by large-scale operators (32%) than by their small-scale counterparts (18%). During subsequent post-analysis discussions, professional beekeepers observed that establishing mutual understanding and coordinating management practices was generally easier when working with larger agricultural holdings. Conversely, smaller farms were more frequently associated with difficulties, including the inappropriate use of agricultural chemicals.

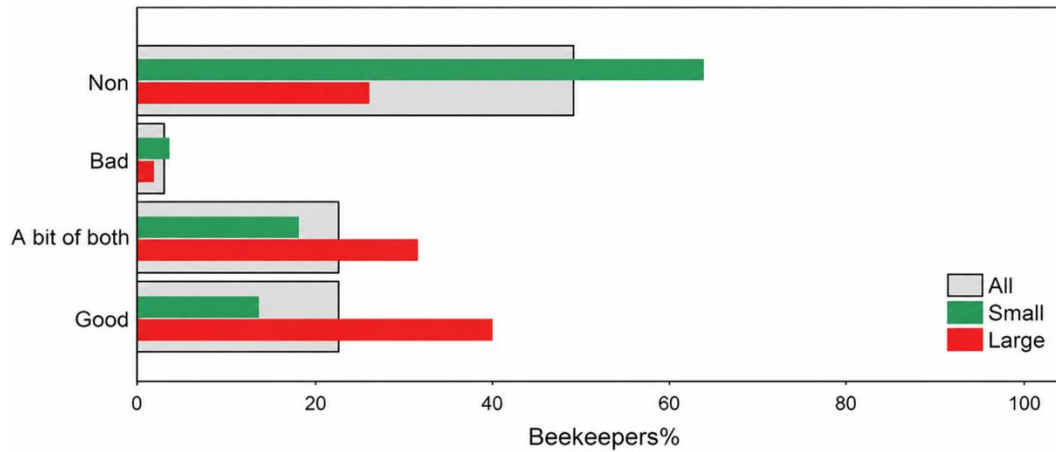


Figure 7. Distribution of beekeepers' responses concerning the quality of their existing collaboration with farmers, presented for the overall sample and according to operation size. Statistically significant differences in response distributions were observed between small-scale and large-scale beekeepers.

Most beekeepers (86%) expressed a favourable attitude towards cooperating with farmers, particularly in relation to the establishment of bee-forage fields, whereas 14% explicitly rejected the possibility of such collaboration. Almost one-quarter (24%) of large-scale beekeepers were already participating in these cooperative arrangements, while no small-scale beekeepers reported comparable involvement ($\chi^2_2 = 19.14$, $p < 0.0001$, Figure 8). During subsequent post-analysis discussions, participants explained that farmers generally took the initiative in establishing these partnerships by approaching beekeepers and suggesting appropriate locations and crop varieties. Respondents further observed that, when disagreements arose concerning the selection of flowering crops, farmers' preferences typically took precedence.

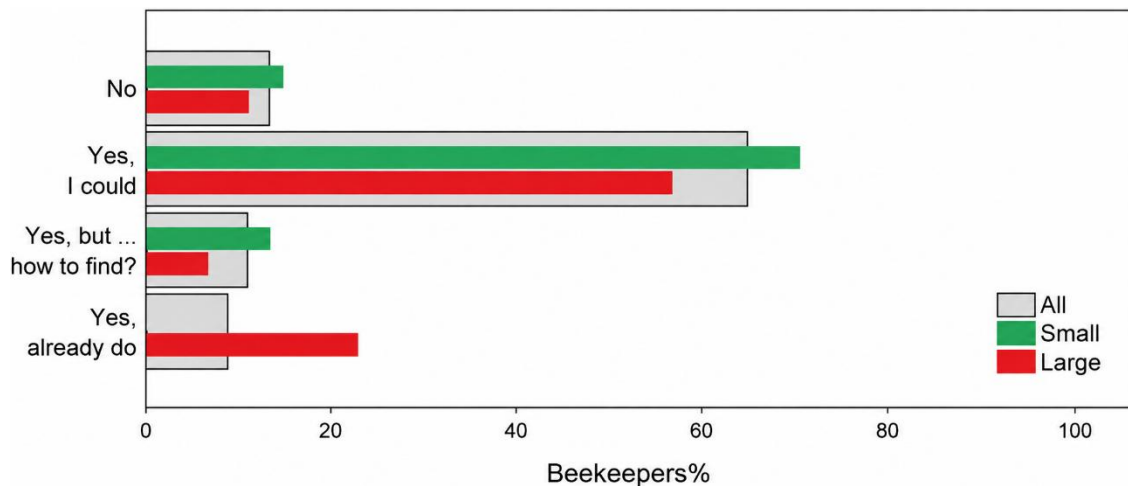


Figure 8. Distribution of beekeepers' responses concerning their willingness to cooperate with farmers in establishing bee-forage crops, presented for the overall sample and according to operation size. Statistically significant differences in response distributions were identified between small-scale and large-scale beekeepers.

4. Discussion

4.1 The Perception of Beekeeping

The way beekeeping is perceived differs according to the scale of individual operations, suggesting that studies in which small-scale beekeepers constitute the majority of respondents may risk producing conclusions that cannot be accurately generalised to the wider beekeeping population (Chauzat et al., 2013). To minimise the possibility of interpretations being disproportionately influenced by

a single operational category, the present study explicitly examined differences between small-scale and large-scale beekeepers. Nevertheless, even when operational size was considered, the findings indicated that economic considerations remained prominent, particularly in relation to product marketing and the factors restricting operational expansion.

Small-scale holdings account for the majority of registered beekeeping operations in Cyprus, reflecting broader patterns documented across Europe and North America (Morawetz et al., 2026), where beekeeping is more commonly understood as a recreational pursuit or a form of ‘relaxing playful work’, and the commercial marketing of bee products is comparatively less widespread (Chauzat et al., 2013; Ellis, 2022; Perichon et al., 2025). In Cyprus, most small-scale beekeepers initially became involved in the activity with the expectation of pursuing a meaningful hobby and continue to regard it primarily as a leisure activity. However, this recreational perspective does not necessarily exclude commercial interests, as approximately two-thirds of small-scale beekeepers sell their products or services. Conversely, most large-scale beekeepers entered the sector with the intention of developing an economically sustainable activity, with many operating at least as part-time entrepreneurs and actively participating in the marketing of their products and services. Nevertheless, for a substantial proportion of large-scale beekeepers, the activity continues to represent only a supplementary income source or what some participants described as an “expensive hobby”. This illustrates the ambiguity associated with defining beekeeping exclusively through its recreational character. The commercially oriented perspectives identified among Cypriot beekeepers are comparable to the ‘pragmatic’ beekeeper profile described in the United Kingdom (Kahane et al., 2022), as well as the characteristics documented among beekeepers in geographically remote regions of Hungary and Italy (Bertonni et al., 2025; Feketéné Ferenczi et al., 2024; Geppert et al., 2025). These comparisons indicate that regional geographical marginality and the density of beekeeping operations may influence practitioners’ economic perspectives. Similar distinctions have been identified internationally, particularly when comparing beekeepers operating in Europe and North America with those in Asia and Latin America (Morawetz et al., 2026). Geographical location, access to forage resources and exposure to market competition may influence the economic circumstances of beekeepers, although these relationships are likely to vary according to regional production conditions, market structures and the scale of individual operations. Additional anecdotal evidence of this economically driven perspective emerged during post-survey informal seminar discussions, in which two participants explained that they had discontinued beekeeping because maintaining the activity simultaneously as productive recreation and a meaningful income source required an excessive commitment of time.

Additional constraints were identified regarding the expansion of existing beekeeping operations. Among Cypriot small-scale beekeepers, limitations were predominantly associated with personal circumstances or individual perceptions, frequently expressed through the statement, “I do not need more”. In contrast, large-scale beekeepers were more commonly restricted by economic considerations and difficulties associated with product marketing. Although many beekeepers, irrespective of operational size, reported being unable to manage additional colonies, they also frequently identified limitations arising from the capacity of their existing equipment. These findings correspond with research conducted in other geographical contexts, where the financial demands of small-scale beekeeping have been identified as significant constraints, particularly when practitioners aim to implement recognised best-practice management approaches (Perichon et al., 2025; Tubene et al., 2023). Large-scale beekeepers may possess greater operational resources than small-scale practitioners; however, their capacity for further expansion remains constrained by economic pressures, marketing difficulties and the availability of suitable forage areas. Across Europe, previous studies have identified a diverse range of factors restricting beekeeping activities, indicating that no single overarching explanation can adequately account for the challenges experienced throughout the sector (Perichon et al., 2025). Consequently, the present findings suggest that the principal factors influencing beekeeping practices and honeybee well-being are determined not only by regional characteristics (Perichon et al., 2024) but also by the operational scale of individual beekeeping holdings.

4.2. Ethics and Cultural Values of Beekeeping

Professional ethics and informal traditional conventions remain important to many Cypriot beekeepers, although the extent to which these principles are recognised and followed differs between operational categories, with large-scale beekeepers demonstrating comparatively stronger adherence. This commitment may be associated with the personal motivations underpinning participation in beekeeping, particularly the influence of family traditions. Approximately half of the surveyed Cypriot beekeepers identified the continuation of a family tradition as a motivation for entering the activity, while encouragement from neighbouring beekeepers or acquaintances was reported by 16% of respondents. In comparison, family connections account for an average of only 17% of beekeepers across other European countries (Perichon et al., 2025). Hungary represents a notable exception, where a comparable proportion (40%) of beekeepers belong to at least the second generation of beekeeping families (Feketéné Ferenczi et al., 2024). Environmental concern constitutes another important emotional motivation, with approximately one-third of Cypriot small-scale beekeepers identifying the intention to support nature as a reason for becoming involved in beekeeping. This finding corresponds with similar motivations documented among Hungarian beekeepers (Feketéné Ferenczi et al., 2024).

Despite their recognition of professional ethics, the Cypriot beekeepers participating in the survey generally did not perceive themselves as custodians of national cultural heritage, demonstrating relatively limited engagement with inherited customs, traditional practices and mystical beliefs. This apparent disconnection between contemporary beekeeping practices and inherited cultural traditions warrants further consideration. Historical and ethnographic studies conducted in other European contexts have documented relationships between beekeeping, folklore and traditional knowledge (Eesti Rahva Muuseum, 1933; Kõiva, 2023). However, these findings cannot be directly generalised to Cyprus, where the relationship between contemporary beekeeping

practices and locally specific cultural heritage requires further investigation. Contemporary beekeepers also appear to lack consistently established behavioural conventions concerning sacred natural locations and culturally significant objects. These findings may indicate a separation between present-day beekeeping practices and inherited cultural traditions, corresponding to the concept of a myth gap described by Evans (2017). The resulting separation between everyday practices and locally inherited cultural knowledge is not exclusive to Cyprus but has also been observed across Europe. Consequently, this myth gap presents challenges for incorporating traditional knowledge and cultural heritage into contemporary environmental stewardship (Pawłowska-Mainville, 2025; Ojeda et al., 2022; Martin et al., 2026) and the commercial positioning of products through cultural identity and heritage-based marketing (Jurenienė and Radzevičius, 2014; Hafstein and Pétursson, 2026).

Large-scale beekeepers may nevertheless offer opportunities for strengthening the relationship between contemporary beekeeping and traditional cultural practices, particularly because they already demonstrate comparatively strong commitments to unwritten professional conventions and ethical principles. Their established ethical orientation, combined with the continued presence of direct relationships with consumers, could provide opportunities to incorporate traditional narratives and cultural practices into product marketing and sustainable land-use approaches (Phillips, 2014). Supporting such integration would require agricultural policies and food regulations to avoid excessive reliance on standardised European or global approaches to knowledge and production, placing greater emphasis instead on locally distinctive heritage and traditional production characteristics that reinforce the geographical and cultural identity of products (Pawłowska-Mainville, 2025). An illustrative relationship between traditional practices and contemporary beekeeping has been documented in the United Kingdom, where small-scale beekeepers continue to maintain locally established honeybee breeds in the belief that doing so supports colony health and reduces the risk of introducing unfamiliar pests (Kahane et al., 2022). Similarly, the deliberate conservation and management of the European dark honeybee have attracted increasing attention in other European regions (Orlovskytė et al., 2025; Niklasson et al., 2024; Hassett et al., 2018). In contrast, the present study indicates that the reported maintenance of ancient or semi-wild honeybee breeds was uncommon among surveyed Cypriot beekeepers, while responses to this question also revealed considerable uncertainty.

4.3. Social Status

The findings suggest that Cypriot beekeepers generally experience neutral or favourable relationships with neighbouring residents, with relatively few respondents reporting negative comments or direct conflicts. Although these results indicate a comparatively low level of reported neighbourhood tension, they do not necessarily establish the broader social status of beekeepers within rural communities. This favourable perception contrasts with attitudes documented in other geographical contexts, where beekeeping has occasionally been associated with negative social narratives. Such interpretations range from concerns about health-related risks in the United States to representations of honeybees as carriers of undesirable genetic material and portrayals of beekeepers as ‘bee parasites’ or ‘landscape parasites’, reflecting perceptions that honey production involves exploiting honeybee colonies without possessing the land on which they forage (Lezaun, 2011; Forrester et al., 2018). These perspectives can undermine the social capital of beekeepers and reinforce their comparatively disadvantaged position within rural communities, particularly in relation to landowners and other agricultural stakeholders (Durant, 2021; Maderson and Wynne-Jones, 2016).

Despite their generally positive public image, Cypriot beekeepers frequently occupy a subordinate position in their relationships with landowners. Across both operational categories, most respondents demonstrated relatively limited initiative in developing social relationships, often adopting an opportunistic approach in which they depended on farmers to establish initial contact. During post-presentation discussions, participants explained that farmers generally assumed responsibility for initiating communication and determining crop selections, field locations and/or hive placement, leaving beekeepers with restricted opportunities to negotiate these decisions. Consequently, their capacity to influence arrangements was reduced, with passive refusal frequently representing their only available response. Nevertheless, most respondents described their relationships with farmers in positive terms, emphasising the benefits of collaboration and coexistence, while only a small minority reported distinctly negative experiences. These findings highlight the need to address the unequal distribution of influence within communication and decision-making processes involving beekeepers and agricultural landowners (Maderson and Wynne-Jones, 2016).

Approximately one-quarter of the surveyed beekeepers reported actively encouraging neighbouring landowners to adopt more sustainable practices, while an even smaller proportion expressed an intention to undertake similar initiatives. This relatively limited level of social engagement contrasts with the active dissemination of environmental knowledge documented among small-scale beekeepers in Hungary (Feketéné Ferenczi et al., 2024), whose practices resemble the environmentally engaged beekeeper profile identified among semi-urban practitioners in Massachusetts, United States (DiDonato and Gareau, 2022). Such comparisons suggest that the environmental awareness associated with beekeeping does not necessarily translate into active participation in broader community-level sustainability initiatives. Nevertheless, previous research has emphasised the potential of beekeepers to facilitate multidirectional social–ecological interactions and strengthen reciprocal relationships between human communities and natural environments (Ojeda et al., 2022; Martin et al., 2026).

Greater participation in collaborative activities and more effective engagement with other rural stakeholders could strengthen beekeepers’ social capital and increase their influence within agricultural communities (Perichon et al., 2024; Maderson, 2023). Developing stronger social networks and establishing more direct relationships with landowners and consumers are particularly important for enabling beekeepers to influence land-use decisions and encourage improvements in forage availability for managed honeybees, potentially generating indirect benefits for wild pollinator populations (Feketéné Ferenczi et al., 2024). Achieving these

outcomes would require beekeepers to capitalise more effectively on their generally favourable public reputation, assume a more proactive role in sustainability governance (Phillips, 2014), and recognise the importance of co-creation and collaborative decision-making in achieving productive outcomes (Lemos et al., 2018). However, the effectiveness of these approaches remains dependent on the willingness of other stakeholders to participate in mutually beneficial arrangements.

The capacity of beekeepers to develop and maintain social relationships may also be influenced by the scale of their operations. Among small-scale beekeepers, direct engagement with farmers and other landscape managers is likely to remain comparatively limited because apiaries are generally situated near residential properties rather than being distributed across more distant agricultural landscapes. Furthermore, these practitioners frequently depend on personal familiarity and accumulated experience when assessing available forage resources, reflecting practices similarly documented among keepers of the European dark honeybee in the United Kingdom (Kahane et al., 2022). By contrast, large-scale Cypriot beekeepers reported using a broader range of communication channels and demonstrated greater involvement in applications for agricultural subsidies and financial compensation. These characteristics suggest a stronger capacity to identify emerging opportunities and respond to changing public expectations or regulatory requirements. Additional insights emerged during post-analysis informal seminar discussions, in which participants perceived large-scale farmers as more adaptable to collaborative arrangements than their small-scale counterparts. Taken together, these findings suggest that large-scale beekeepers may be better positioned to become influential stakeholders within rural communities, drawing upon their broader operational experience and greater capacity to shape future land-management practices through targeted interventions and adaptive strategies (Phillips, 2014).

5. Conclusion

This study examined the motivations, social relationships and perceptions of cultural heritage among Cypriot beekeepers, identifying several distinctions between small-scale and large-scale operators. The findings demonstrated that motivations for engaging in beekeeping ranged from recreational interests to economic objectives, with these differences associated with operational scale. Although respondents generally reported neutral or favourable relationships with neighbouring residents, their interactions with other rural stakeholders were frequently characterised by limited initiative in establishing partnerships and a comparatively restricted role in decisions concerning land use and forage availability.

Large-scale beekeepers generally possessed more extensive practical experience, utilised a wider range of communication channels and demonstrated greater engagement with farmers and institutional support mechanisms. These characteristics may provide opportunities for strengthening their participation in collaborative land-management initiatives. Nevertheless, the findings also suggested a potential disconnection between contemporary beekeeping practices and inherited cultural traditions, reflected in limited engagement with certain customs and heritage-related practices. Greater recognition of locally distinctive cultural knowledge could offer opportunities to strengthen the cultural identity of beekeeping and support heritage-based product communication, although the practical effectiveness of such approaches requires further investigation.

Overall, the findings highlight the importance of strengthening relationships between beekeepers, local communities, land managers and policymakers. Encouraging more proactive participation in collaborative decision-making, alongside greater recognition of cultural heritage, may contribute to improving beekeepers' engagement within rural communities and supporting the long-term sustainability of beekeeping in Cyprus.

Author Contributions & Declarations

- **Author Contributions:** Conceptualization, S.S.D. and G.N.; methodology, S.S.D. and G.N.; validation, S.S.D. and G.N.; formal analysis, S.S.D. and G.N.; investigation, S.S.D.; resources, S.S.D. and G.N.; data curation, S.S.D. and G.N.; writing—original draft preparation, S.S.D.; writing—review and editing, S.S.D. and G.N.; visualization, S.S.D. and G.N.; project administration, S.S.D.; All authors have read and agreed to the submitted version of the manuscript.
- **Funding:** This research received no external funding.
- **Institutional Review Board Statement:** The study was conducted in accordance with applicable ethical principles governing research involving human participants and the requirements of Regulation (EU) 2016/679 (General Data Protection Regulation). The research protocol was reviewed by the Cyprus National Bioethics Committee (Protocol No. EEBK EII 2026.01.44), with the ethical review process completed on 13 August 2026. The study procedures were designed to safeguard participant confidentiality, ensure voluntary participation and protect the information collected through questionnaires and supplementary focus-group

discussions. The research was undertaken in accordance with the applicable provisions of the Cyprus Bioethics Law of 2010 (Law 53(I)/2010) and the relevant regulatory framework (K.Δ.Π. 228/2022).

- **Informed Consent Statement:** Informed consent was obtained from all participants involved in the study. Participants received information concerning the research objectives, the voluntary nature of their participation, the confidentiality of their responses and the intended use of the collected data. Participation was based on informed agreement, and the information collected was managed in accordance with the approved research procedures and applicable data protection requirements.
- **Consent for Publication:** Not applicable to research participants, as the study does not include identifiable participant information. Both authors have reviewed and approved the final manuscript and consent to its submission for publication.
- **Availability of Data and Materials:** The datasets described in this study comprise questionnaire responses and associated analytical results. The underlying participant-level data are not publicly available because of confidentiality considerations. Requests for access to anonymised data may be directed to the corresponding author and will be considered in accordance with participant consent, applicable ethical restrictions and data protection requirements.
- **Competing Interests:** The authors declare no competing financial or non-financial interests associated with this research.
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- **Code Availability:** No custom software code was developed specifically for this study. Statistical analyses were undertaken using the analytical procedures and software described in the methodology section.
- **Clinical Trial Registration:** Not applicable. This study did not involve a clinical trial.
- **Conflicts of Interest:** The authors declare no conflicts of interest.

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