

## **Improving agricultural Extension services provided to Beekeepers in the holy Karbala governorate**

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DOI: <https://doi.org/10.36077/kjas/2026/v18i1.17831>

Received date: 27/10/2024

Accepted date: 12/1/2025

### **Abstract**

The research aims to improve agricultural extension services provided to beekeepers in Holy Karbala Governorate, Iraq. A random sample of 100 beekeepers in the governorate was taken. A questionnaire was prepared, including six main areas: suggestions for improving the agricultural extension system, improving the marketing, improving the equipment, improving the innovation stimulation, improving the policies and the enabling environment, and improving the financing. The results have shown a high level of agreement among beekeepers on the suggestions of improving the Agricultural Extension Services (AESs) provided to them. Consequently, this high level of approval and satisfaction with the suggestions presented in the research must be matched by an organized process to put these suggestions into actual practice by decision-makers. This will significantly and effectively contribute to solving the problems faced by beekeepers and achieving the desired economic, social, and environmental aims of beekeepers in Holy Karbala Governorate.

**Keywords:** Improving, Agricultural Extension Services, Beekeepers.



## Introduction

Agricultural Extension Services (AESs) have very importance role in rural environment as they provide the information and services needed by farmers and breeders to develop and improve their organizational, managerial, and technical knowledge and skills, that ultimately leading to improve livelihoods and well-being for them (2 and 14).

Therefore, improving the Agricultural Extension Services (AESs) provided to beekeepers consider very importance in our current time. This vital sector plays an important role in facing food shortages, controlling desertification, and preserving the natural environment. This is attributing to the direct role of bees in increasing agricultural production, improving the quality of agricultural produce, and ensuring plant biodiversity through their crucial role in pollination (7 and 15). This means that bees have become crucial in achieving food security within the economic system because of their role in efficiently pollinating plant flowers, improving their quality, and increasing the yield of plants and crops (3 and 12). Statistics indicate that more than 100 crops depend on honeybees for pollination, saving at least \$200 billion globally (9).

Additionally, the value of crop pollination services and natural honey production provided by honeybees had reached between \$182 billion and \$577 billion annually in 2020 (11). Moreover, bees play a significant role in providing various honey products (pollen, royal jelly, beeswax, bee venom, honey vinegar, etc.), which have numerous medical uses (13).

Honey is considered a functional food with protective and therapeutic properties. It is a natural source of antioxidants that may reduce the risk of diseases by limiting or neutralizing the formation of free radicals,

thereby producing beneficial effects on human health. Honey mainly contains carbohydrates, water, minerals, proteins, amines, enzymes, vitamins, organic acids, and other phytochemicals (8).

In 2023, honey production across Iraq, excluding the Kurdistan Region, reached 855 tons (6). Meanwhile, in 2022, the Kurdistan Region alone produced 850 tons. This production significantly helps in achieving self-sufficiency and provides job opportunities for those interested in beekeeping. It also represents an important step towards reducing honey product imports and reinvesting import funds into improving other agricultural sectors. In 2022, the quantity of imported bees' products included 4,000kg of natural honey, costing approximately \$17,750, 13,000kg of beeswax, costing approximately \$19,500, 11,605kg of artificial honey, costing approximately \$47,174, and 6,000kg of natural honey enriched with royal jelly, costing approximately \$60,000 (10).

Despite the aforementioned environmental, health, and economic importance of beekeeping, beekeeping projects in Iraq have faced numerous challenges that negatively impact the production work of beekeepers. These challenges include the decline in the growth of flowers and fruit trees, and the impact of pests and diseases on bees (1). Some of these problems may be attributed to increasing issues related to maintaining the agricultural environment from pollution, such as the excessive use of chemical fertilizers and the overuse of water by some farmers (5).

Additionally, beekeeping projects in Iraq are affected by marketing problems, funding issues for beekeeping projects, and the policies adopted by governments, among other factors (1).



Thus, in our current research, we will attempt to highlight the most important suggestions that aim to improve the Agricultural Extension Services (AESs) provided to beekeepers. These suggestions are based on the priority needs of the beekeepers and, when implemented by decision-makers, will achieve the highest effectiveness and efficiency in this vital sector. Therefore, the current research aims to answer the following research question: What are the suggestions for improving the Agricultural Extension Services provided to beekeepers in Holy Karbala Governorate?

Accordingly, the research has aimed to determine suggestions for improving the (AESs) related to the agricultural extension system, determine suggestions for improving the (AESs) related to marketing, determine suggestions for improving the (AESs) related to equipment, determine suggestions for improving the (AESs) related to innovation stimulation, determine suggestions for improving the (AESs) related to policies and the enabling environment, determine suggestions for improving the (AESs) related to financing.

## Materials and Methods

### 1. Research Methodology

The descriptive approach is considered the most suitable research approach for conducting the current research. The most appropriate research technique within this approach is the diagnostic-analytical

technique, which has been adopted to determine suggestions for improving the (AESs) provided to beekeepers in Holy Karbala Governorate. This type of research approach has proven effective in various fields, including political, economic, and social areas, among others. The technique involves using data collection method and interpreting information through a questionnaire (4).

### 2. Research Population and Sample:

The research population included all beekeepers in Holy Karbala Governorate, totaling 593 beekeepers, distributed across eight agricultural divisions within Holy Karbala Governorate. A simple random sample was taken, representing 42.86% of the agricultural divisions in the governorate, to represent the research population.

Consequently, the sample included the Husayniyah Agricultural Division, the Al-Jadwal Al-Gharbi Agricultural Division, and the Agricultural Divisions of Hur and the Center, as they represent the largest agricultural divisions in terms of the number of beekeepers. Therefore, the number of beekeepers (apiarists) in the research sample was 391 beekeepers. A simple random sample of beekeepers within these agricultural divisions was then taken, representing approximately 25%, resulting in a final research sample of 100 beekeepers, as shown in the following table:

**Table 1. Distribution of the research population and sample according to the distribution of beekeepers across agricultural divisions**

| N o. | Agricultural Division | Total Number of Beekeepers | Sample of Beekeepers | %    | Data Collection Sample | Division Specification |
|------|-----------------------|----------------------------|----------------------|------|------------------------|------------------------|
| 1    | Husayniyah            | 208                        | 208                  | 53.2 | 53                     | Final Collection       |
| 2    | Aun                   | 41                         | -                    | -    | -                      | -                      |



| N o. | Agricultural Division | Total Number of Beekeepers | Sample of Beekeepers | %     | Data Collection Sample | Division Specification |
|------|-----------------------|----------------------------|----------------------|-------|------------------------|------------------------|
| 3    | Hur + Center          | 76                         | 76                   | 19.44 | 20                     | Final Collection       |
| 4    | Al-Jadwal Al-Gharbi   | 107                        | 107                  | 27.37 | 27                     | Final Collection       |
| 5    | Hindia                | 57                         | -                    | -     | 30                     | Preliminary Test       |
| 6    | Al-Khayrat            | 80                         | -                    | -     | -                      | -                      |
| 7    | Ain Al-Tamr           | 24                         | -                    | -     | -                      | -                      |
|      | Total                 | 593                        | 391                  | 100%  | 100                    |                        |

### 3. Research Tool, Data Collection and Statistical Methods

To develop a scale for determining suggestions to improve the (AESs) provided to beekeepers, a set of scientific sources and previous studies in the field of beekeeping were adopted. Additionally, the opinions of researchers specializing in agricultural extension and beneficial insects (economic entomology) were considered. Field visits and personal interviews were conducted with a group of beekeepers in Holy Karbala Governorate, and the internet was used to access relevant scientific articles and previous studies.

Thus, six research areas were determined which included the following: (19) suggestions for improving the agricultural extension system, (17) suggestions for improving marketing, (9) suggestions for improving equipment, (12) suggestions for improving innovation stimulation, (11) suggestions for improving policies and the enabling environment, and (6) suggestions for improving financing.

The approval or agreement of these suggestions was measured using a three-level Likert scale (Agree, Somewhat Agree, Disagree), with scores of 3, 2, and 1 assigned to the scale items, respectively. Thus, the total scale score ranged between 74 and 222 points.

The face validity and content validity of the questionnaire were verified, and modifications were made in accordance with the suggestions of the experts and the results of the pre-test. The pre-test was conducted From January 1st to 6th of the year (2024) using the final questionnaire on a random sample consisting of (30) beekeepers in Hindia agricultural division, who was excluded from the final data collection process. The Cronbach's Alpha ( $\alpha$ ) equation was used to examine the reliability and the results showed that the reliability coefficient of the six axes of the suggestions were all reasonable and acceptable, which ranged between (0.815) minimum and (0.901) maximum. Pearson Linear Correlation Coefficient was used to examine the validity of the internal consistency between each statement of the axis and the total score of the axis itself. The results showed that all correlation coefficients were statistically significant, at significance level of (0.01) and (0.05). The minimum of the correlation coefficients was (0.366) while the maximum was (0.819). Accordingly, all the statements of each axis are internally consistent with the axis to which they belong, which has proved the validity of the internal consistency of the axes and statements that belong to each axis.

Thus, the results have shown that the questionnaire has a high degree of validity

and reliability, and can be relied upon for field application to achieve the research aims.

After completing all stages of the preparation and development of the questionnaire, the data for the research were collected using the final questionnaire, which was distributed to beekeepers within the agricultural divisions representing the research sample. The data collection process took approximately 25 days, from January 7<sup>th</sup>, 2024, to February 1<sup>st</sup>, 2024. All questionnaire forms were successfully obtained from the beekeepers in the research sample.

Appropriate statistical methods were used to achieve the research objectives, including the arithmetic mean, counts and

percentages, as well as the weighted average in analyzing and presenting the research results.

### Results and Discussion

Suggestions for improving the Agricultural Extension Services (AESs) provided to beekeepers in Holy Karbala Governorate were determined across all six previous areas, indicating the level of agreement among beekeepers. The research results have shown that the highest numerical value for beekeeper agreement was 222 points, while the lowest numerical value was 146 points, with a mean and standard deviation of 206.59 and 18.729 points, respectively, as shown in the following table:

**Table 2. Distribution of beekeepers' responses according to their overall agreement level on suggestions for improving agricultural extension services (AESs)**

| No. | Agreement Level on the Six Suggestion Areas | Categories | Counts | (%)  | Average | Notes            |
|-----|---|------------|--------|------|---------|------------------|
| 1   | Low Agreement                               | 74 – 123   | 0      | 0    | 0       | Max = 222        |
| 2   | Medium Agreement                            | 124– 173   | 5      | 5    | 156.60  | Min = 146        |
| 3   | High Agreement                              | 174 – 222  | 95     | 95   | 209.22  | S.D = 18.729     |
|     | Total                                       |            | 100    | 100% |         | Average = 206.59 |

From the table above, we have concluded that the level of agreement among beekeepers on the suggestions for improving the Agricultural Extension Services (AESs) provided to them has described as high by the vast majority of beekeepers, with an arithmetic mean of 209.22 points, which is higher than the overall average of 206.59 points. This may reflect the realism and objectivity of the suggestions that discussed in the research.

Therefore, the high level of agreement and satisfaction with these suggestions is likely to facilitate and ensure the successful implementation by decision-makers, represented by the Ministry of Agriculture in all its specialized formations, as well as

other supporting ministries. This will undoubtedly contribute significantly and effectively to achieving the economic, social, environmental, and health objectives desired from beekeeping in Holy Karbala Governorate. Here, the results of the agreement on these suggestions will be detailed, covering the six areas with some depth and discussing the possible reasons behind their ranking, as follows:

#### 1. Determine suggestions for improving the (AESs) related to the agricultural extension system:

The research results have shown that all suggestions related to the agricultural



extension system have received approval from the vast majority of beekeepers (Table 3). The overall average of the weighted averages for this area is 2.819, indicating a high level of agreement on these suggestions. It is worth noting that this area has the highest level of agreement among the six areas, based on the overall average of the weighted averages.

Also, the results in Table (3) have shown that the suggestion ranked first had a weighted average value of 2.91, which is higher than the overall average of the weighted averages for this area. This can be attributed to the priority need of beekeepers to produce sufficient quantities of selected queens with good traits, as well as the need to produce large quantities of

high-quality royal jelly in a short time. This can be achieved using the Gunter device, a modern technology currently used to meet these needs. Additionally, the use of the nuclei method to produce larger quantities of divisions is a successful traditional method for increasing the number of colonies in the apiary in a short period. This method can be used later for honey production or sold as divisions to gain a good financial return. Therefore, there is a genuine and significant desire among beekeepers to develop their skills in these areas through practical field demonstrations or training courses conducted by the agricultural extension system.

**Table 3. Distribution of beekeepers according to their agreement on improvement suggestions related to the agricultural extension system**

| No. | Suggestions for Improving the Agricultural Extension System  | Weighted Average | Rank |
|-----|--|------------------|------|
| 1   | Increase focus on topics that address improving the skills of beekeepers during practical field demonstrations or training courses, such as how to make divisions using nuclei and how to use the Gunter device.   | 2.91             | 1    |
| 2   | The necessity of involving representatives of beekeepers when planning extension activities related to beekeeping.   | 2.88             | 3    |
| 3   | The necessity of holding extension seminars or symposiums to introduce the most important diseases and pests newly introduced to the Iraqi environment that affect bees and how to diagnose them, such as Nosema Ceranae, Sacbrood disease, Varroa disease, etc. | 2.88             | 3    |
| 4   | The necessity of holding extension seminars or symposiums to introduce the importance of using the Gunter device for queen rearing and royal jelly collection.   | 2.88             | 3    |
| 5   | It is essential to consider the timing of bee service operations when setting the topics for the extension seminar or symposium, such as the timing of sugar and protein feeding in winter, early spring, and in summer after honey harvest.                     | 2.87             | 5    |
| 6   | Good and prior preparation for extension seminars or symposiums, such as selecting a suitable hall equipped with modern extension tools like data show or smart screens, as well as comfort and hospitality facilities.  | 2.83             | 7    |
| 7   | Establish a regular schedule for field visits that suits all parties, with the possibility of a surprise visit when there is suspicion of an epidemic.   | 2.83             | 7    |

| No.   | Suggestions for Improving the Agricultural Extension System   | Weighted Average | Rank |
|---|---|------------------|------|
| 8   | Increase the number of specialized technical staff (both men and women) in diagnosing bee diseases and responsible for carrying out field visits.   | 2.83             | 7    |
| 9   | Intensify training courses for rural young people or those interested in entering this vital sector, especially in the preparation and setup of materials and equipment needed for work and how to use them.  | 2.82             | 9    |
| 10  | Intensify training courses for rural young people or those interested in entering this vital sector, especially in diagnosing bee pests and diseases and how to treat them.   | 2.81             | 10   |
| 11  | Intensify training courses for rural young people or those interested in entering this vital sector, especially in bee service and rearing operations.  | 2.8              | 11.5 |
| 12  | Hold conferences and workshops addressing modern challenges in the bee sector, especially with the rampant use of chemical pesticides and the emergence of new pests like Nosema Ceranae.   | 2.8              | 11.5 |
| 13  | Select university lecturers or scientific researchers specialized in the seminar topic with high expertise and skills, and successful in fieldwork.   | 2.79             | 14   |
| 14  | Distribute specialized extension leaflets on the seminar or course topic (not general) to beekeepers during the extension activity.   | 2.79             | 14   |
| 15  | Intensify training courses for rural young people or those interested in entering this vital sector, especially in explaining the factors necessary for the success of establishing a beekeeping project.   | 2.79             | 14   |
| 16  | The necessity of holding extension seminars to introduce artificial insemination (pollination) technology in bees.  | 2.78             | 16.5 |
| 17  | Pay attention to small beekeepers, especially women working in beekeeping, during field visits.   | 2.78             | 16.5 |
| 18  | Establish pioneering and distinguished beekeeping projects at the level of government extension farms, and then hold field days to introduce the presence to the type of queens bred in this apiary, such as (Italian, Carniolan, or hybrid), their productivity and features, as well as the procedures followed in rearing and service. | 2.77             | 18   |
| 19  | Increase the number of field visits conducted by extension workers to beekeepers' apiaries to ensure their follow-up, diagnose their conditions continuously, and propose proper solutions for them.  | 2.73             | 19   |
| Overall average of the weighted averages = 2.819  |   |                  |      |
| 1 – 1.66 = (Low Agreement), 1.67 – 2.33 = (Medium Agreement), 2.34 – 3 = (High Agreement) |   |                  |      |

By reviewing the research results in Table (3), we have observed that the suggestions ranked last had weighted average values of 2.77 and 2.73, respectively, which are lower than the overall average of the weighted averages for this area. This reflects the urgent need for beekeepers to learn about advanced or modern methods

in beekeeping and to see the economic feasibility of the results of modern technologies in practice. Human nature tends to believe what the eyes see and the ears hear more than what is written or published in a book, leaflet, or scientific article. Moreover, beekeepers have a critical need for continuous field



follow-up, advice, and support to overcome their challenges. They also need encouragement and guidance towards adopting modern technologies in their production practices. This underscores the importance of field visits, which the agricultural extension workers should increase and maintain according to regular schedules to achieve the desired objectives.

## 2. Determine suggestions for improving the (AESs) related to marketing:

The research results have shown that all suggestions related to marketing have received approval from the vast majority of beekeepers. The overall average of the weighted averages for this area is 2.770,

indicating a high level of agreement on these suggestions, as shown in table 4. The results have revealed that the suggestion ranked first had a weighted average value of 2.85, which is higher than the overall average of the weighted averages for this area. This can be attributed to the significant importance of promotion in marketing bee products. Promotional offers often encourage consumers to purchase and try the product, and subsequently, consumers may promote the product to friends and relatives after verifying its quality. This will increase sales volume as well as the revenues and profits for beekeepers.

**Table 4. Distribution of beekeepers according to their agreement on improvement suggestions related to marketing**

| No. | Suggestion for Improving the Marketing  | Weighted Average | Rank |
|-----|---|------------------|------|
| 1   | Encouraging beekeepers by agricultural extension workers to offer promotional deals such as discounts or special coupons aimed at gaining consumer trust in local products.   | 2.85             | 1    |
| 2   | Awareness and training on improving product quality for the local or external market by enhancing breeding, feeding, storing, and packaging methods.  | 2.83             | 2.5  |
| 3   | Establishing centers by the Agriculture Directorates or Extension Center for marketing bee products from the province beekeepers in consumer cooperative associations, central markets, or direct sales outlets of the Ministry of Agriculture. | 2.83             | 2.5  |
| 4   | Commercial relations and agreements between beekeepers and traders should be in writing and protected by law, excluding verbal agreements to safeguard both parties' rights.  | 2.8              | 4    |
| 5   | Increasing the number of exhibitions related to the bee sector (whether seasonal or annual) organized by the Agriculture Directorate or Extension Center, which help beekeepers promote and market their various products.                      | 2.79             | 5.5  |
| 6   | Raising awareness among beekeepers by agricultural extension workers about the importance of putting commercial identification labels on products.  | 2.79             | 5.5  |
| 7   | The Ministry of Agriculture should increase the number of laboratories for testing the quality of bee products and encouraging beekeepers to test their products and obtain quality certificates.   | 2.78             | 7.5  |

| No.   | Suggestion for Improving the Marketing  | Weighted Average | Rank |
|---|---|------------------|------|
| 8   | Creating a competitive environment among beekeepers to help them market their products successfully by organizing competitions for the best types of honey, the largest bee colonies, the best bee strains, etc.  | 2.78             | 7.5  |
| 9   | Establishing marketing links (commercial contracts) between beekeepers supported by agricultural associations, with the necessity of encouraging everyone to join and interact with these associations.   | 2.77             | 9    |
| 10  | Advising beekeepers to use indirect marketing channels (from the producer to manufacturing companies to the final consumer) when selling beeswax, propolis, or pollen to achieve higher profits from processed or packaged products, i.e., added value. | 2.76             | 10   |
| 11  | Creating official or semi-official platforms or websites to monitor the movement of bee product prices in local and international markets.  | 2.75             | 11.5 |
| 12  | Advising beekeepers to use direct marketing channels (from the producer to the consumer) to sell honey.   | 2.75             | 11.5 |
| 13  | Awareness and emphasis on the necessity of having commercial relations or connections between beekeepers and exporters, with agricultural extension contributing to achieve that.   | 2.73             | 13.5 |
| 14  | Advising beekeepers to use indirect marketing channels (from the producer to the wholesaler to the retailer to the final consumer) when there is abundant production and a desire to expand sales volume and marketing scope.                           | 2.73             | 13.5 |
| 15  | Educating beekeepers on the importance of choosing the right time to market their products locally, avoiding times of production abundance like July and October unless there is a local market need.   | 2.72             | 15.5 |
| 16  | Proposing an optimal legal framework for the mechanism of concluding sales or partnership contracts between producers and exporters, encouraging parties to follow it in their commercial dealings.   | 2.72             | 15.5 |
| 17  | Increasing efforts to establish special or general unions for producers to market their products and organize their affairs.  | 2.71             | 17   |
| Overall average of the weighted averages = 2.770  |   |                  |      |
| 1 – 1.66 = (Low Agreement), 1.67 – 2.33 = (Medium Agreement), 2.34 – 3 = (High Agreement) |   |                  |      |

The results have indicated that the suggestions ranked in the last three positions received weighted averages lower than the overall average for this area. However, they still fall within the high agreement category. This may be attributed to the need to inform and educate beekeepers on presenting their products in the local market according to the principle

of supply and demand. In other words, beekeepers should avoid selling or marketing their entire stock in the local market all at once, as this can lead to price drops below cost levels, causing significant economic losses for some beekeepers. Additionally, it can slow down the marketing or discharge of bee products in the local market. Despite recognizing the urgent need for some beekeepers to gain quick financial returns (during periods of



abundant production) to meet their financial obligations, whether commercial or familial, but it is essential to encourage and educate them to sell part of their products during periods of abundance and to retain or keep the rest for marketing when the product is scarce or when prices are high. This would help achieve a balance in supply and demand, as well as ensure substantial profits that enable beekeepers to sustain their apiaries and continue their production activities. These results also emphasize the need to establish an optimal legal framework (proposed by legal entities within the Ministry of Agriculture) to protect the rights of both producers and traders (marketers), stressing the importance of avoiding verbal agreements. Additionally, the results highlight the necessity of creating special or general unions for producers to market their products domestically or internationally. These unions would also provide support and advice when needed.

### 3. Determine suggestions for improving the (AESs) related to equipment:

**Table 5. Distribution of beekeepers according to their agreement on improvement suggestions related to equipment (supply)**

| No | Suggestions for Improving the equipment (supply) Process   | Weighted Average | Rank |
|----|--|------------------|------|
| 1  | The necessity for the Ministry of Agriculture, in cooperation with the Ministry of Trade, to diversify the materials and supplies provided, according to the needs of beekeepers, especially treatments and sugar (used in manufacturing protein and sugar pastes needed to feed bees during times of food scarcity).                              | 2.88             | 1    |
| 2  | The necessity of activating and expanding the work scope of the artificial insemination center for honeybee queens and increasing the number of specialists at the governorate level to provide beekeepers with their queen needs at reasonable prices and high quality, which will cause a significant qualitative leap in the beekeeping sector. | 2.84             | 2    |
| 3  | Providing beekeepers with hives containing high-quality honeybee queens, ensuring the supply includes marginalized groups such as small-scale beekeepers, rural young people, and rural women.   | 2.83             | 3    |

The research results have shown that all suggestions related to equipment (supply) have received approval from the vast majority of beekeepers. The overall average of the weighted averages for this area is 2.809, indicating a high level of agreement on these suggestions, as shown in Table 5.

The suggestions that ranked in the top three positions had weighted averages higher than the overall average for this area. These results indicate that the priority needs requiring immediate equipment (supply) include treatments for diseases and pest prevention, sugar used for feeding (especially during the winter), and beehives containing high-quality honeybee queens. These should be provided in the required quantities by activating the work of the artificial insemination center at the governorate level. Additionally, the supply process should ensure coverage of all beekeepers in the governorate, including both large-scale and small-scale beekeepers, male and female.

| No  | Suggestions for Improving the equipment (supply) Process  | Weighted Average | Rank |
|---|---|------------------|------|
| 4   | The necessity for specialized committees to focus their work on small-scale beekeepers to equip them with all the necessary basic breeding equipment.   | 2.82             | 4    |
| 5   | Increasing the number of specialized committees to study the actual needs of beekeepers before supplying them with necessities.   | 2.81             | 5    |
| 6   | The necessity for the Agricultural Extension Department, in coordination and cooperation with horticultural departments, to supply beekeepers with appropriate quantities of flowering plant seedlings or seeds, such as Sidr seeds ( <i>Ziziphus spina-christi</i> ), Eucalyptus seeds ( <i>Eucalyptus obliqua</i> ), and Borage seeds ( <i>Borago officinalis</i> ), etc. | 2.78             | 7    |
| 7   | The necessity for specialized committees to follow an easy and fast supply mechanism (such as using electronic forms) to encourage beekeepers to go to the relevant authorities to obtain available supplies.   | 2.78             | 7    |
| 8   | Specialized committees should conduct regular follow-up on the supplies provided to ensure their use by beekeepers (i.e., not selling them after supply), as well as identifying obstacles and problems and giving the necessary correct guidance.  | 2.78             | 7    |
| 9   | Creating a special electronic card to supply beekeepers with their needs to ensure that beekeepers do not receive more than the allocated share according to regular schedules, in a manner that achieves transparency in supply and combats favoritism.  | 2.76             | 9    |
| Overall average of the weighted averages = 2.809  |   |                  |      |
| 1 – 1.66 = (Low Agreement), 1.67 – 2.33 = (Medium Agreement), 2.34 – 3 = (High Agreement) |   |                  |      |

#### 4. Determine suggestions for improving the (AESs) related to innovation stimulation:

The research results have shown that all suggestions related to innovation

stimulation have received approval from the vast majority of beekeepers. The overall average of the weighted averages for this area is 2.768, indicating a high level of agreement on these suggestions, as shown in the table 6.

**Table 6. Distribution of beekeepers according to their agreement on improvement suggestions related to innovation stimulation**

| No. | Suggestions for Improving Innovation Stimulation  | Weighted Average | Rank |
|-----|---|------------------|------|
| 1   | The necessity for agricultural extension workers to reward and honor innovators of beekeepers to encourage them by inviting and presenting them at gatherings and seminars organized by the agricultural extension system, to commend their innovative ideas, publicize (disseminate) their innovations, and support them monetarily and morally. | 2.81             | 1    |
| 2   | Agricultural extension workers should experiment with new innovations in front of beekeepers to increase their confidence in their usefulness, ensure their effectiveness and results, and pave the way for their dissemination among other beekeepers in the near future.  | 2.79             | 2.5  |

| No.   | Suggestions for Improving Innovation Stimulation  | Weighted Average | Rank |
|---|---|------------------|------|
| 3   | Training beekeepers on the new prevailing innovations in the region.  | 2.79             | 2.5  |
| 4   | Agricultural extension workers, in their seminars, field visits, etc., should raise awareness and explain the meaning and importance of innovation, encouraging beekeepers to adopt it to help improve production in terms of quantity, quality, and timing.  | 2.78             | 5    |
| 5   | Agricultural extension workers should create a database of innovative beekeepers and their innovations.   | 2.78             | 5    |
| 6   | Holding special seasonal or annual exhibitions for the latest innovations in beekeeping.  | 2.78             | 5    |
| 7   | Developing field mechanisms to encourage rural young people and women to innovate in beekeeping by organizing special gatherings for marginalized groups in the apiaries of innovative beekeepers, where innovators present details of their innovations and the steps that had led them to achieve them. | 2.77             | 8    |
| 8   | Agricultural extension workers should coordinate with the Ministry of Science and Technology to help register innovations in the names of their owners and assist in achieving intellectual property protection for the innovations.  | 2.77             | 8    |
| 9   | Agricultural extension workers should train innovative beekeepers on how to protect the intellectual property of their innovations.   | 2.77             | 8    |
| 10  | The Ministry of Agriculture should provide administrative and financial facilities for innovative investors in beekeeping to encourage them to adopt and disseminate the innovations of beekeepers in their areas.  | 2.73             | 10   |
| 11  | Agricultural extension should support the establishment of gatherings or cooperatives at the district or central level to support creative and innovative ideas.  | 2.72             | 11.5 |
| 12  | Agricultural extension workers should communicate with innovative investors in beekeeping to encourage them to hold field days to widely disseminate innovations in their work areas.   | 2.72             | 11.5 |
| Overall average of the weighted averages = 2.768  |   |                  |      |
| 1 – 1.66 = (Low Agreement), 1.67 – 2.33 = (Medium Agreement), 2.34 – 3 = (High Agreement) |   |                  |      |

The results have shown also that the suggestions ranked in the top three positions had weighted averages higher than the overall average for this area. This may be attributed to the significant role that both moral and financial reward play in motivating and encouraging innovative beekeepers to continue presenting more innovations in the future. These innovations, undoubtedly, contribute to

improving production in terms of quantity, quality, or both (as they stem from real problems), benefiting either the innovative beekeeper or other beekeepers in neighboring areas.

Agricultural extension workers play a key role in this process by demonstrating these innovations (technologies) to other beekeepers in the region, allowing them to see the results firsthand. They then train and equip beekeepers with the necessary knowledge and skills to use these

innovations in their fields, ensuring the achievement of the desired economic, social, environmental, and health benefits across the region as a whole.

### 5. Determine suggestions for improving the (AESs) related to policies and the enabling environment:

The research results have shown that all suggestions related to policies and the enabling environment received approval

from the vast majority of beekeepers. The overall average of the weighted averages for this area is 2.812, indicating a high level of agreement on these suggestions. It is noteworthy that this area ranks as the second highest among the six areas in terms of agreement on its suggestions, based on the overall average of the weighted averages for all areas, as shown in Table 7.

**Table 7. Distribution of beekeepers according to their agreement on improvement suggestions related to policies and the enabling environment**

| No | Suggestions for Improving Policies and the Enabling Environment  | Weighted Average | Rank |
|----|--|------------------|------|
| 1  | The necessity for the Ministry of Agriculture, in cooperation and coordination with other ministries, to stop the problem of agricultural land and orchard dredging.   | 2.86             | 1.5  |
| 2  | Increasing coordination and cooperation between agricultural extension workers and security agencies to facilitate the transportation of beehives from one area to another during production seasons, for example, by issuing special identification cards (badges) for migratory beekeepers to ease their movement between agricultural areas for grazing purposes.             | 2.86             | 1.5  |
| 3  | The necessity for the Ministry of Agriculture to find mechanisms for coordination and cooperation with the Ministry of Education to establish awareness programs aimed at rural young people (both males and females), especially in public schools, focusing on the importance of the beekeeping sector for human life, the environment, and its contribution to food security. | 2.84             | 3    |
| 4  | The necessity of increasing private sector participation in providing extension services to beekeepers in the governorate (adopting the principle of plurality).   | 2.83             | 4.5  |
| 5  | The Ministry of Agriculture should establish and find specialized research centers for beekeeping and quality testing of its products.   | 2.83             | 4.5  |
| 6  | The necessity for agricultural extension workers to collaborate with other responsible bodies (such as the Ministry of Trade and National Security) in monitoring the local market and limiting the dumping of imported bees' products.  | 2.81             | 6    |
| 7  | The necessity for the Ministry of Agriculture to adopt agricultural policies to promote the use of insect growth and reproduction inhibitors targeting a specific pest or disease and to spread their use as an alternative treatment protocol instead of chemical pesticides by farmers.  | 2.8              | 7    |
| 8  | The necessity for the Ministry of Agriculture to encourage agricultural  | 2.79             | 8.5  |

| No  | Suggestions for Improving Policies and the Enabling Environment  | Weighted Average | Rank |
|---|--|------------------|------|
|   | extension workers to adopt modern extension methods, such as field schools, training and visits, and university extension, which ensure direct, continuous, and successful communication with beekeepers, in line with modern global trends.   |                  |      |
| 9   | The necessity for the Ministry of Agriculture, in cooperation and coordination with the Ministry of Municipalities, to push towards the creation of natural or semi-natural protected areas to be used as alternative sites for relocating bees when necessary.  | 2.79             | 8.5  |
| 10  | The necessity for the Agricultural Extension and Training Department to encourage extension workers to conduct specialized training courses on adopting methods of using insect growth and reproduction inhibitors or integrated pest management methods as alternatives to chemical control, which negatively affect beekeeping and its production. | 2.78             | 10   |
| 11  | The necessity for the Agricultural Extension and Training Department to provide an electronic database of the most important civil society organizations and private sector entities working in the field of beekeeping, to enable beekeepers to communicate with them, involve them in work, or obtain extension services from them.                | 2.74             | 11   |
| Overall average of the weighted averages = 2.812  |  |                  |      |
| 1 – 1.66 = (Low Agreement), 1.67 – 2.33 = (Medium Agreement), 2.34 – 3 = (High Agreement) |  |                  |      |

The results in Table (7) have shown that the suggestions ranked first received weighted averages higher than the overall average of the weighted averages. This may be attributed to the significant economic and environmental damages that beekeepers have suffered as a result of the dredging of agricultural lands and orchards across the governorate. This situation requires urgent intervention from the Ministry of Agriculture, the Ministry of Municipalities, and the Ministry of Interior to stop these violations, which have harmed agriculture in general, and directly impacted beekeeping and honey production.

These results also highlight the need for successful alternatives for natural beekeeping grazing areas (a large proportion of which have been dredged). This can be achieved through coordination between the Ministry of Agriculture and

the Ministry of Interior to issue identification cards that facilitate and ease the movement of beekeepers (avoiding harassment, security bans, or complex routine procedures) between different natural grazing areas in the governorate. This is particularly important for grazing bees during times of drought or when there is a scarcity of vegetation in the beekeepers' current locations.

The results in Table (7) revealed that the suggestion ranked last had weighted averages lower than the overall average of the weighted averages, but they still fall within the high agreement category. This may be attributed to the significant and direct damage caused by chemical pest control on beekeeping (in addition to environmental harm). Excessive chemical control in agricultural areas can sometimes lead to the loss of entire bee colonies. This situation calls for the adoption of an alternative agricultural policy (the seventh

suggestion in Table 7) based on the use of insect growth and reproduction inhibitors or integrated pest management methods. These methods can mitigate or limit the severe environmental, economic, and health impacts of chemical control. It is also crucial to train farmers to use these methods in their crop management practices. Additionally, the last suggestion emphasizes the need for an electronic database of reputable and competent organizations or companies working in the beekeeping field. This would allow beekeepers to easily connect with reliable sources to obtain the extension services or supplies they need.

It is worth clarifying and emphasizing that all the suggestions mentioned in Table (7)

are of high importance. Therefore, it is essential to pay attention to them and consider them in the process of improving policies and the enabling environment. This will ensure the enhancement of the agricultural extension services provided to beekeepers in Holy Karbala Governorate.

#### **6. Determine suggestions for improving the (AESs) related to financing:**

The results have shown that all suggestions related to financing received approval from the vast majority of beekeepers. The overall average of the weighted averages for this area is 2.752, indicating a high level of agreement on these suggestions, as shown in table 8.

**Table 8. Distribution of beekeepers according to their agreement on improvement suggestions related to financing**

| No  | Suggestions for Improving Financing   | Weighted Average | Rank |
|---|---|------------------|------|
| 1   | The necessity for agricultural extension workers to contribute in determining the necessary financial funding for each project based on the circumstances or specific criteria of the beekeeper and their project.  | 2.88             | 1    |
| 2   | The necessity for agricultural extension agencies to propose to financing bodies and beekeepers to adopt a new financing formula based on participation in the production process from start to finish, and then sharing profits or bearing losses equally in the case of non-negligence or proven non-negligence by the beekeeper. | 2.75             | 2.5  |
| 3   | The necessity for the Ministry of Agriculture to attract investors and agricultural companies interested in the beekeeping sector and provide them with administrative facilities to invest in this sector.   | 2.75             | 2.5  |
| 4   | The necessity to provide a sufficient number of technical specialists, especially women, to contribute in determining the economic feasibility and the amount of financial funding for each project based on the circumstances and capabilities of women beekeepers.  | 2.71             | 5    |
| 5   | The necessity for agricultural extension programs to include recommendations and advice on determining the most suitable and optimal ways to spend the financial funding.   | 2.71             | 5    |
| 6   | The necessity for agricultural extension workers to follow up on the disbursement of financial loans to ensure that the funds are spent on beekeeping project operations.   | 2.71             | 5    |
| Overall average of the weighted averages = 2.752  |   |                  |      |
| 1 – 1.66 = (Low Agreement), 1.67 – 2.33 = (Medium Agreement), 2.34 – 3 = (High Agreement) |   |                  |      |

The results in Table (8) have shown that the suggestion ranked first had a weighted average higher than the overall average of the weighted averages. This result clearly indicates the urgent need of the majority of beekeepers for assistance from agricultural extension workers in planning beekeeping projects. This involves conducting a comprehensive feasibility study before project implementation, including determining financial costs, essential material requirements, and the nature of the technology to be introduced. Additionally, it includes developing appropriate marketing plans and estimating the expected profit and loss margins before starting the beekeeping project. Such planning ensures the highest effectiveness and efficiency in implemented beekeeping projects and protects beekeepers from the risk of losing capital and materials due to poor planning.

The results also have indicated that the two suggestions ranked second had weighted averages higher than the overall average of the weighted averages. These results highlight the urgent and increasing need of beekeepers for the vital element of commercial operations: capital. This involves finding new ways to finance their beekeeping projects, whether to expand production, introduce new innovations (or technologies), or cover expenses for any losses that may occur during operations. This can be achieved by involving agricultural banks or investors as contributing partners in beekeeping projects, adopting the principle of partnership and profit-sharing in the production process. This means bearing the production costs and then sharing the economic profits or bearing the losses if it is proven that the beekeeper was not at fault. This approach ensures the continuity

and sustainability of beekeeping operations in the present and future.

## Conclusion

There are several suggestions that can improve the Agricultural Extension Services (AESs) provided to beekeepers in the holy Karbala Governorate, which have been ranked according to a priority system. The area that has the greatest approval of agreement is the suggestions area for Agricultural Extension System, followed by the suggestions area for Policies and the Enabling Environment, then the suggestions area for Equipment (supply), then the suggestions area for Marketing, then the suggestions area for Innovation Stimulation, then, in the last order the suggestions area for Financing. This is based on the value of the overall weighted average.

## Conflict of Interest

There is no conflict of interests regarding the publication of this research.

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