

Impact of IPARD Support on Beekeeping Performance: The Case of Van province, Türkiye

Impacto del apoyo del programa IPARD en el desempeño de la apicultura: El caso de la provincia de Van, Turquía

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ABSTRACT

This article examines the structural, productive, and managerial changes in beekeeping enterprises that have benefited by the European Union's Instrument for Pre-Accession Assistance in Rural Development. The research was conducted using data obtained from 72 beekeeping businesses operating in Van province and receiving Instrument for Pre-Accession Assistance in Rural Development support, and the production capacity, productivity and management indicators of the businesses were compared in the pre-support and post-support periods. The Wilcoxon signed-rank test and the McNemar test were performed using SPSS 25.0 software in the analysis of the data. Analysis results showed that the number of hives, honey yield per hive, and total honey production increased statistically significantly in the post-support period compared to the pre-support period ($P < 0.001$). The effect size coefficients calculated for these statistically significant variables revealed that the observed differences are also practically important. While the increase in the number of employees was statistically significant, it remained at a lower level compared to other indicators ($P < 0.01$). Furthermore, the production of secondary bee products, the adoption of quality control practices, and the rate of hive insurance increased significantly in the post-support period ($P < 0.001$). Although the impact on marketing activities was limited, Instrument for Pre-Accession Assistance in Rural Development support substantially enhanced production performance and technical capacity. In conclusion, the study findings demonstrate that Instrument for Pre-Accession Assistance in Rural Development is an effective tool for promoting sustainable development and provides valuable information for the formulation of future rural support policies.

Key words: Instrument for pre-accession assistance in rural development; beekeeping; impact analysis; production efficiency; Van province

RESUMEN

Este artículo examina los cambios estructurales, productivos y de gestión en las explotaciones apícolas que se han beneficiado del Instrumento de Ayuda de Preadhesión para el Desarrollo Rural de la Unión Europea. La investigación se llevó a cabo utilizando datos obtenidos de 72 explotaciones apícolas que operan en la provincia de Van y que reciben apoyo del Instrumento de Ayuda de Preadhesión para el Desarrollo Rural, y se compararon los indicadores de capacidad productiva, productividad y gestión de las explotaciones en los períodos previo y posterior al apoyo. Los datos fueron analizados mediante el uso de las pruebas de rangos con signo de Wilcoxon y de McNemar, empleando el software SPSS 25.0. Los resultados del análisis mostraron que el número de colmenas, el rendimiento de miel por colmena y la producción total de miel aumentaron de manera estadísticamente significativa en el período posterior al apoyo en comparación con el período previo al apoyo ($P < 0,001$). Los coeficientes de tamaño del efecto calculados para estas variables estadísticamente significativas revelaron que las diferencias observadas también fueron importantes desde un punto de vista práctico. Aunque el aumento en el número de trabajadores fue estadísticamente significativo, este se mantuvo en un nivel inferior en comparación con otros indicadores ($P < 0,01$). Asimismo, la producción de productos apícolas secundarios, la adopción de prácticas de control de calidad y la tasa de aseguramiento de colmenas aumentaron de forma significativa en el período posterior al apoyo ($P < 0,001$). Aunque el impacto sobre las actividades de comercialización fue limitado, el apoyo del Instrumento de Ayuda de Preadhesión para el Desarrollo Rural mejoró de manera sustancial el desempeño productivo y la capacidad técnica. En conclusión, los hallazgos del estudio demuestran que el Instrumento de Ayuda de Preadhesión para el Desarrollo Rural es una herramienta eficaz para promover el desarrollo sostenible y proporciona información valiosa para la formulación de futuras políticas de apoyo rural.

Palabras clave: Instrumento de ayuda de preadhesión para el desarrollo rural; apicultura; análisis de impacto; eficiencia productiva; provincia de Van

INTRODUCTION

The Program Instrument for Pre-Accession Assistance in Rural Development (IPARD) is the rural development part of the Instrument for Pre-Accession Assistance (IPA) that was established for the European Union's (EU) accession candidate countries. The program aims to promote the sustainability of the agricultural sector, modernize production infrastructure, and encourage economic diversification in the rural regions [1, 2].

Beyond financial support, the program encourages producers to comply with EU standards and to develop institutional capacity. The fundamental tenets of IPARD are local development, participation, and environmental sustainability [3].

As one of the priority animal production activities, beekeeping is found to have a low investment cost, high biological value production, and is a sustainable contribution to ecosystem services [4, 5]. Besides honey, pollen, propolis, and royal jelly production, beekeeping is a natural production process, which directly contributes to the multidimensional goals of rural development by promoting the continuity of plant production [5, 6].

Particularly for small family farms, beekeeping promotes economic diversification and facilitates the effective utilization of women's labor and the family workforce in rural areas [7].

Van province, with its diverse flora, transhumance tradition, and natural conditions favorable for migratory beekeeping, is one of Türkiye main beekeeping areas and one of the provinces that receive the greatest level of program support in IPARD [8].

IPARD has also reformed the infrastructure of many beekeeping enterprises with improved production volumes and increased product diversity [7, 8]. Nonetheless, the degree to which these supports lead to economic efficiency and also mitigate structural challenges in the industry has not been thoroughly evaluated [1].

Although the IPARD implementations overall have been good in Türkiye, the outcomes have varied in different recipient countries. North Macedonia did not benefit from IPARD I for the anticipated impact owing to implementation difficulties, underdeveloped institutions, and low participation rates [9]. The infrastructure and capacity deficiencies in Serbia limit the effectiveness of rural development policies [3].

The assessment of the socio-economic structure and production potential of IPARD-supported beekeeping enterprises in Van province, Türkiye, is important for the understanding of the local practices and of the localization of EU rural development policies [1].

The structural characteristics and production performance of beekeeping enterprises receiving IPARD support are analyzed in this study. The results will help clarify whether the program is working in the beekeeping sector and can increase the efficiency of implementing rural development policies.

MATERIALS AND METHODS

Study area

The study was conducted in Van province (Eastern Anatolia), which has favorable ecological conditions and rich flora for beekeeping (FIG. 1). Van ranks among the leading provinces in terms of IPARD-supported projects, and beekeeping is a key source of rural livelihood.



FIGURE 1. The geographical location of Van province in eastern Türkiye. The map illustrates the administrative boundaries of Türkiye, with the dark-shaded area indicating Van province

Sample size and selection

The study population consisted of 84 beekeeping enterprises in Van that received either IPARD I (24 enterprises) or IPARD II (60 enterprises) support, according to data obtained from the Van Provincial Coordination Unit of Agriculture and Rural Development Support Institution. All enterprises were operational before receiving support and continued production thereafter. Sampled with simple random sampling at a 95 % confidence level and 5 % margin of error, using Yamane's formula,

$$n = \frac{N}{1 + N(e^2)}$$

where n is the sample size, N is the population size (84), and e is the margin of error (0.05) [10]. Consequently, the minimum sample size was 69. Data were collected from 72 enterprises via face-to-face interviews to minimize sampling error and enhance reliability.

Data method collection

In 2025 data were collected using face-to-face interviews with 72 beekeeping enterprises in Van that were provided with IPARD support. The demographic structure, production capacity level, type of activities, pre- and post-support variation, and satisfaction levels were addressed.

Statistical analysis

The data were processed using SPSS 25.0. Descriptive statistics are reported, and normality was examined by Kolmogorov-Smirnov and Shapiro-Wilk tests. $P < 0.05$ suggests

non-normal distribution and thus parametric assumptions were not met [11].

Due to paired variables (pre- and post-support) the Wilcoxon signed-rank test was carried out as the continuous variable comparison coefficient ($P < 0.05$). Effect size (r) was computed as Z/\sqrt{N} , which indicates practical significance for variables showing significant differences. According to Cohen, r values between 0.1 and 0.3 indicate small effect, 0.3-0.5 medium effect, and values greater than 0.5 a large effect [12]. This made it possible to determine any statistical and practical significance.

Furthermore, the McNemar test was used to test for differences in nominal (binary) variables, across the pre- and post-IPARD support periods. For variables that have sufficient transition frequencies (these were defined to be $b + c \geq 10$), significance was calculated at a $P < 0.001$ level. Analyses excluded variables with insufficient transition frequencies [11].

RESULTS AND DISCUSSION

The average age of the beekeepers found in the study was 44.15 years, ranging from 23 to 70 years, meaning that IPARD support was very widely distributed. A previous study by Van reported a lower average age (36.4) [1], possibly because of the greater number of young producers. Other non-IPARD studies reported higher averages [13, 14, 15]. Overall, the IPARD seems to benefit experienced and young beekeepers and spur generational renewal in the field.

The socio-economic profiles of beekeepers who take advantage of IPARD support are reported (TABLE I).

In this study, it was determined that beekeeping activities were mostly carried out by men (77.8 %), indicating that beekeeping in Van province is largely a male-dominated sector (TABLE I). Similar results were reported in previous studies [1, 15, 16]. However, the presence of female beekeepers indicates that women also take part in field.

Beyond gender, the educational background of participants also serves to describe the profile of beekeepers in the region. Primary school graduates accounted for 40.3 % of the participants, suggesting that beekeepers had a generally low level of formal education (TABLE I). The present results are in line with those in previous research [7, 13, 17]. Low level of education tends to be considered as a limiting factor in accessing and applying technical knowledge which can translate directly to work in production processes.

Most participants, 90.3 percent, engaged in migratory beekeeping, due largely to the ecological diversity and seasonal floral richness of Van (TABLE I). This result is in line with the literature previously found [15, 18]. Alternatively, stationary beekeeping was more prevalent in studies with chestnut honey-producing regions in the Black Sea environment, which stems from reliance on a single, locally specific floral source requiring beekeepers to stay in designated areas [19].

At 54.2 % of participants, they had no social security coverage, implying the lack of access to formal welfare systems and the vulnerability of the producers to socio-economic vulnerabilities

(TABLE I). This also speaks to broader structural fragility of rural livelihoods.

TABLE I Socio-economic profile of IPARD-supported beekeepers			
Variable	Category	Frequency	%
Gender	Male	56	77.8
	Female	16	22.2
	Literate	4	5.6
Education	Primary school	29	40.3
	Middle school	14	19.4
	High school	18	25.0
	University	7	9.7
Type of Beekeeping Activity	Migratory	65	90.3
	Stationary	7	9.7
Social Security Coverage	Yes	33	45.8
	No	39	54.2
Membership in Cooperative/ Union	Yes	65	90.3
	No	7	9.7
Training in Beekeeping Activities	Yes	59	81.9
	No	13	18.1
Other Income Sources	Beekeeping only	48	66.7
	Agriculture and livestock	4	5.5
	Other	20	27.8
Professional Experience	1–5 years	0	0.0
	6–10 years	16	22.2
	11 years and above	56	77.8

IPARD: Instrument for Pre-Accession Assistance in Rural Development

Although the absence of social security reflects structural weaknesses, the high membership rate with cooperative or union illustrates an opposite strength in the level of the organizational participation. There was high (90.3 %) cooperative/union membership, indicating that organizational structures are well established among the participants of the IPARD in Van (TABLE I). The same pattern has been reported in prior work [4, 18]. The precise impact of such memberships on creating economic returns, enabling knowledge sharing, or enhancing market access needs to be more closely examined, however.

Most participants (81.9 %) were found to have received training in beekeeping (TABLE I). This result shows that the IPARD helps in capacity enhancement and knowledge transfer in the sector. However, the presence of an untrained minority among the respondents suggests long-standing gaps in the distribution of technical material; this has been reported in previous research [1].

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Two-thirds (66.7 %) of participants cited beekeeping as their only form of income in this study, suggesting that the IPARD community was mainly professional, full-time beekeepers (TABLE I). In contrast, previous research revealed lower rates of full-time dependency [1, 4, 20], probably due to wider sampling frames that included part-time or recently established producers.

The majority of beekeepers (77.8 %) had greater than 11 years of professional experience, suggesting that the identified supported enterprises are established (TABLE I). The same findings reported in prior studies [21], also support the narrative that IPARD funds have gone to experienced producers with a significant sectoral involvement.

Following the socio-economic findings, the assessment of the impact of IPARD support on the production capacity and productivity of beekeeping enterprises was conducted. Changes in the number of hives, number of populated hives, honey yield per hive, total honey production, and number of workers were analyzed graphically and numerically (FIGS. 2 and 3; TABLE II).

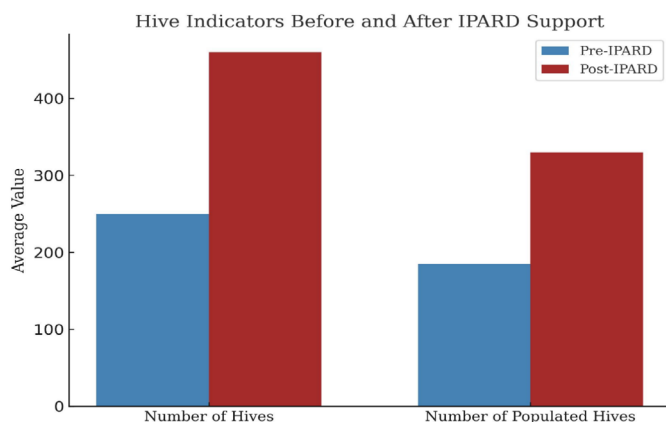


FIGURE 2. Number of hives and populated hives (pre/post-IPARD)

The pronounced increase in both the number of hives and populated hives indicates that the number of supported enterprises has grown to a considerable scale (FIG. 2). The fact that previous research indicates the low average of populated hives—298 in Van [1] and 191.2 in Erzurum-Kars-Ağrı provinces [22]—supports the suggestion that IPARD has served as a significant factor in increased beekeeping activities in the district of the research.

TABLE II Production indicators (pre/post-IPARD, mean ± SD)		
Production Indicator	Pre-IPARD Mean ± SD	Post-IPARD Mean ± SD
Number of Hives	249.88 ± 148.62	468.31 ± 71.32
Number of Populated Hives	188.01 ± 127.30	332.01 ± 102.40
Honey Yield per Hive (kg)	12.44 ± 6.95	14.56 ± 7.40
Total Honey Production (ton)	2.81 ± 3.01	4.89 ± 3.10
Number of Workers	1.50 ± 0.98	1.63 ± 0.98

SD: Standard Deviation. IPARD: Instrument for Pre-Accession Assistance in Rural Development

A rise in honey yield per hive, total honey production, number of workers represents the positive trends in the productivity and scale. Moreover, the increase in honey yield per hive indicates greater production (FIG. 3).

However, the yield levels have shown considerable variation in the previous literature. For the studies, higher averages have been reported [15, 18]; but less drastic outcomes have been reported [19, 20]. There may be differences in floral diversity, climatic conditions, production techniques and management systems among regions. Thus, results of IPARD on production need to be assessed in the particular context.

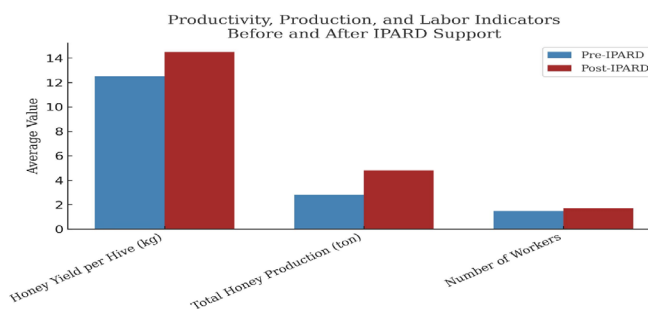


FIGURE 3. Changes in honey yield, total production, and number of workers (pre/post-IPARD)

The increase in total honey production further supports the view that the IPARD has promoted production efficiency. Alternatively, the small difference in number of workers indicates that this growth occurred primarily through technological and organizational development, not more input from labour. This suggests that the program is facilitating a shift in beekeeping from traditional, old school to more modern and effective methods.

The statistical measures of the production indicators further validating the positive impact of IPARD support in the post-support period. Significant increases in hives, populated hives, and total honey production were identified, indicating that the IPARD assistance has helped the expansion of the enterprises and the efficiency in production. Increase in honey yield per hive also indicates productivity enhancements. By contrast, the small change in the number of workers indicates these gains were largely a function of better resource utilization and adoption of new technologies, rather than increased labor input (TABLE II).

Differences between production indicators before and after IPARD support were analyzed using the Wilcoxon signed-rank test (TABLE III).

The Wilcoxon test results revealed significant improvements in all key indicators after IPARD support ($P < 0.05$). The P-values obtained for hive number, total honey production, and honey yield confirmed the strong effects of the support on capacity and productivity ($P < 0.001$). But with a smaller (albeit still significant) increase in workers' numbers, it suggests that supporting development predominantly enhanced infrastructure and efficiency as opposed to employment.

TABLE III
Wilcoxon signed-rank test results for production indicators

Variable	Z Value	P-Value	Significance Level
Number of Hives	-6.966	0.000	P < 0.001
Number of Populated Hives	-6.985	0.000	P < 0.001
Honey Yield per Hive	-4.189	0.000	P < 0.001
Total Honey Production	-5.818	0.000	P < 0.001
Number of Workers	-2.714	0.007	P < 0.01

Overall, though the increase in the number of workers was statistically significant, it was smaller than the other indicators (TABLE III; P < 0.01). Thus this indicates that the support program actually facilitated more in physical infrastructure and technical efficiency than more direct jobs growth. Based on this, IPARD support seems to have increased productivity mainly by introducing modern equipment, knowledge transfer and the transition to more orderly production methods.

The practical significance of the IPARD support for production indicators was assessed by calculating the effect size (r) for the variables that showed statistically significant differences via the Wilcoxon test (FIG. 4).

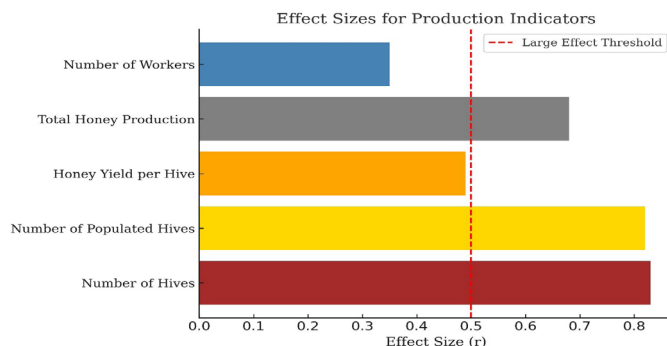


FIGURE 4. Effect size (r) values from the Wilcoxon signed-rank test

Large effect sizes were recorded for the number of hives (r = 0.821), number of populated hives (r = 0.823), and total honey production (r = 0.686); also moderate effect sizes were observed for honey yield per hive (r = 0.494) and number of workers (r = 0.320).

Effect size analysis showed that IPARD support resulted not only in statistically significant improvements but also in practically meaningful changes (P < 0.05). For certain structural relevant attributes, such as number of hives and total honey production, large effects (r > 0.5) were observed, suggesting significant improvements in production capacity. Instead, moderate effect sizes for productivity and labor force (0.3 < r < 0.5) suggest that operational efficiency and employment are changing less rapidly. In sum, the effect size result suggests that IPARD leads to production increases in the short run and structural development in the long run in the beekeeping sector.

These results show that rural development programmes, such as IPARD, may not only lead to an increase in production volumes but also to greater efficiency in the operation in the case of these investments. The findings provide a solid and practical foundation for shaping the future of rural support policy development.

The effect of IPARD support on beekeeping enterprises was evaluated through a comparative analysis of pre- and post grant support time periods. Table IV summarizes the results on practices such as record-keeping, production of secondary products, honey quality analysis, insurance of populated hives, and disease control in bees.

TABLE IV
Status of beekeeping practices before and after IPARD support (%)

Variable	Status	Before IPARD		After IPARD	
		Frequency	%	Frequency	%
Record Keeping	Yes	3	4.2	9	12.5
	No	69	95.8	63	87.5
Production of Secondary Bee Products	Yes	11	15.3	28	38.9
	No	61	84.7	44	61.1
Honey Quality Analysis	Yes	20	27.8	33	45.8
	No	52	72.2	39	54.2
Insurance of Populated Hives	Yes	18	25.0	40	55.6
	No	54	75.0	32	44.4
Control of Bee Diseases	Yes	69	95.8	72	100
	No	3	4.2	0	0.0

IPARD: Instrument for Pre-Accession Assistance in Rural Development

The impact of the IPARD assistance on processing results was manifested in technical and economic capacities as well as in behavioral patterns of the enterprises (TABLE IV). Significant progress has been made in quality analyses of honey, in using hive insurance, and in secondary bee products. However, the rate of record keeping rose from 4.2 % to 12.5 % after the intervention, although it is still low in absolute terms and lower than that reported in other studies [17, 23].

This means that regional dynamics and producer characteristics might limit these practices. Apart from changes in technical habits, changes have also been observed in the production of different bee products. According to the increase in production of secondary products like propolis and pollen, IPARD encourages product diversification and supports alternative income sources. In previous studies, similar patterns of participation in secondary product production [18, 21, 24] were reported, indicating that market opportunities, enterprise scale, and producer knowledge are major factors.

Better quality production and improvements in management of risks at the enterprise level are also positive. Improvement of the honey quality means higher producers' competence and availability of analytical services. In the same way, the significant rise in insured hives may also be, in part, attributable to the

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programmatic requirements of IPARD and align with previous results of overall low baseline insurance rates [18, 25, 26, 27]. Generally, supports appear to enhance diversification and risk reduction strategies.

Disease control is a critical component of enterprise health management. The already high rate of disease control practices prior to IPARD support indicates producers already had high awareness, and an increase to 100 % after the program indicates enhanced sustainability of health practices. Nevertheless, how these self-reported practices translate into actual implementation should be assessed with sound monitoring and assessment methods. Likewise, findings from a previous study conducted among beekeepers in Adiyaman reported

widespread adoption of animal health measures, consistent with findings here [28].

Moreover, the number of insured hives indicates some small but substantial improvements in animal health and enterprise security. While these improvements were not among the program's primary objectives, they appear to stem from indirect effects due to the institutional support and training.

To examine the statistical significance of the observed changes in selected operational practices between the pre- and post-support periods, the McNemar test was performed (TABLE V).

TABLE V
McNemar test results for changes in practices

Variable	b (yes before → no after)	c (no before → yes after)	Total Transitions (b + c)	P-value	Significance Level
Honey Quality Analysis	13	0	13	0.000	P < 0.001
Insurance of Populated Hives	24	2	26	0.000	P < 0.001
Production of Secondary Bee Products	17	0	17	0.000	P < 0.001

b: yes → no; c: no → yes; (b+c): total number of transitions between categories

The McNemar test results indicated statistically significant increases in honey quality analysis, production of secondary bee products, and insurance of populated hives (TABLE V; P < 0.001). On the other hand, variables such as record-keeping and disease control were excluded from the analysis due to their low transition frequencies.

Key operational practices that were prominent were indicated to be significantly more widely occurring after the IPARD support. Increased honey quality analysis, diversification of products, and hive insurance efforts illustrate that the program extended well beyond volume production to include quality control, market orientation, and risk management strategies. Increasing quality of honey and a higher degree of quality analysis could indicate better marketing potential and improved consumer trust.

Although record-keeping and disease control were not included in the McNemar test insufficient variability, their status remains relevant. There was already a very high rate of disease control before the program. As it is, the contribution of the program in this context was probably more towards the maintenance than initiation of the practice.

This study presents the satisfaction levels and evaluations of marketing indicators of enterprises benefiting from IPARD support (TABLE VI).

The vast majority of beekeepers who received IPARD support reported satisfaction with the program and indicated that they would recommend it to others. However, the anticipated improvements in marketing opportunities and sales prices were not fully achieved.

In addition to practical gains, beneficiary satisfaction is also important. The findings of this study reflected a high level of satisfaction with IPARD support, which is consistent with the

findings of previous research [22]. This finding shows that IPARD has a positive impact not only on economic outcomes, but also on perceptions of and trust in the program.

TABLE VI
Beneficiary satisfaction and marketing indicators (%)

Variable	Response	Frequency	Percentage(%)
Satisfaction with IPARD Support	Yes	69	95.8
	No	3	4.2
Would You Recommend IPARD Support to Others?	Yes	68	94.4
	No	4	5.6
Improvement in Honey Sales Prices (post-IPARD)	Yes	24	33.3
	No	48	66.7
Improvement in Marketing Channels (post-IPARD)	Yes	10	13.9
	No	62	86.1

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On the other hand, data related to marketing mentioned limited impact of the program on structural changes in channels of sale. Fewer than one-third of the participants reported an increase in honey sales prices, and improvements made in marketing channels have been modest. These results emphasize both production and marketing dimensions of beekeeping need to be addressed.

For sustainable development, methods should not only aim to raise output, but should also strengthen the position of the product within the value chain. Evaluation of perceptions of producers must also be carried out. A previous study revealed that the IPARD affects primarily rural development perceptions

[29]. In contrast, this study reported significantly improved levels of production, productivity and capacity among supported beekeeping enterprises in Van, suggesting that IPARD led to perceptual and measurable improvements.

Notwithstanding the difficulties encountered at the commencement of implementation, meaningful results have been achieved in the field. A similar study described Türkiye situation early on to be characterized by a failure to effectively utilise funds provided by the EU through structural obstacles on IPARD application [30]. However, the study from the Van province in this research found that IPARD has had substantial effects on productivity, capacity, and quality in beekeeping. These new findings imply that the program has produced real, concrete progress through tangible goals in the face of initially great obstacles.

To place Türkiye in perspective: cross-country comparisons are required for the experience of Türkiye. IPARD has also continued to be in its developmental phase in Serbia and has thus far shown little impact in Serbia [3]. In contrast, SAPARD and IPARD in Croatia increased productivity, turnover, value added, and capacity, although improvements in profitability and employment were modest [31]. Likewise, the current study in Van found that there were enhancements in capacity, productivity, and quality, with modest positive consequences on employment. These findings indicate that Türkiye is working as a more effective, outcome-focused intervention model which should provide advice for policy and practice in other transitioning countries.

In light of the literature on IPARD-supported beekeeping, the implications of this study are consistent with broad observations on the degree to which the program improves productivity and modernizes beekeeping. Nevertheless, in contrast to previous research that is typically based on single-period or descriptive data [1, 7, 8, 22], this study offers a comparative view that facilitates a refined interpretation of alterations attributed specifically to IPARD interventions.

CONCLUSION AND IMPLICATIONS

This study reveals that IPARD support has had significant impacts not only on production outputs in the beekeeping sector but also on enterprise scale, efficiency, and technical capacity. The increase in the number of hives and populated hives indicates scale enlargement, while the rise in honey yield per hive and total production reflects gains in productivity.

The modest increase in the use of labor might suggest that the increase was not accompanied by a translating growth in employment, which could imply the rise was efficiency related. A closer look at effect size also confirms that these differences are meaningful both in a statistical and a practical sense. The findings illustrate how programs of rural development (e.g., IPARD) have to be implemented and scaled in a strategic way - most notably with regard to technical infrastructure, traceable production systems and product range expansion.

However, structural shortcomings in marketing and producer organization continue to limit the full effectiveness of such support. Addressing these gaps through dedicated program components would enable progress in branding, traceability,

and demand-oriented production models, thus facilitating a transition toward high value-added and sustainable production. In this context, complementary interventions by cooperatives, local governments, and private sector actors, along with education and extension services, can further strengthen IPARD's impact on market integration, risk management, and producer behavior.

Conflict of interest statement

The authors declare no conflict of interest (financial, personal, commercial, political, institutional, or academic) related to this manuscript.

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