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Effect of Beekeeping Vocational Training on Knowledge Enhancement and Entrepreneurial Adoption among Farmers in Palghar District of Maharashtra

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Abstract: ***Beekeeping is a low-cost, eco-friendly subsidiary enterprise with immense potential to enhance rural livelihoods and agricultural productivity through pollination services. The present study assessed the social and economic profile of trainees and evaluated the impact of on-campus beekeeping vocational training on knowledge enhancement, perception, and enterprise adoption among farmers in Palghar district of Maharashtra. The study was conducted at Gokhale Education Society's Krishi Vigyan Kendra (KVK), Kosbad, during 2018–2023. A total of 146 trainees who successfully adopted beekeeping enterprises were selected for detailed analysis. Data were collected using a structured and pre-tested questionnaire. The results revealed that the majority of trainees belonged to marginal landholding, low-income, and tribal categories. (44.5%) young and (40.4%) middle-aged participants reflect their greater inclination towards skill-oriented vocational training and entrepreneurial activities. Chi-square analysis showed a significant difference in trainees' perception regarding topics covered during training ($\chi^2 = 116.56$, $p < 0.01$). Paired samples t-test indicated a highly significant increase in knowledge level after training ($t = 21.46$, $p < 0.01$). The findings confirm that vocational training significantly enhances knowledge, skills, and entrepreneurial orientation, thereby promoting beekeeping as a sustainable livelihood option in rural and tribal areas.***

Keywords: Beekeeping, vocational training, knowledge gain, perception, KVK, rural livelihoods

1. Introduction

Agriculture continues to be the primary source of livelihood for nearly 65–80 per cent of the Indian population, particularly in rural areas. The economy of this sector depends upon agriculture for livelihood. (Lal et.at, 2012). But due to increasing population and industrialization the per capita land holding is decreasing day by day. Also, a large population of youth, particularly in rural areas, is unemployed due to no opportunities of jobs in the government sector, lack of skill for creating self-employment. With the gradual decrease in per capita land holding and rising unemployment people need to explore other profitable enterprises within the agriculture sector, such as beekeeping, mushroom production, nursery, dairy farming, poultry etc. to boost their family income. Among these, beekeeping stands out as it requires relatively small capital investment with small space and time. It is a vital activity for strengthening the livelihoods of rural communities, offering a promising non-farm venture that can significantly enhance the income of smallholders and contribute to the national economy. Beekeeping holds great potential to uplift the economy of Indian farmers (Singh et.al.2010). In addition to providing honey and other bee products, honeybees also play an important role in increasing the crop production by pollination activity. Honeybee helps not only to increase the yield of horticulture/ agriculture crops but also improve the quality of seeds & fruits, increase fruit setting, improve seed germination, increase the oil per cent in oil seed crops etc. (Sahane & Jadhav 2016). Singh (2000) and Monga & Manoch (2011) reported that the honeybee increased agriculture productivity to the tune of 30 to 80 per cent annually through cross pollination. It is being increasingly realized that honeybees could be less expensive input for promoting sustainable and eco-friendly agriculture and enhancing crop productivity. Training is recognized as a major catalyst for human resource development and entrepreneurship. Krishi Vigyan Kendra (KVK) play a pivotal role in skill development through vocational training programs. Considering the importance of beekeeping for income generation and ecological sustainability, the present study was undertaken to evaluate the impact of beekeeping training on knowledge enhancement and enterprise adoption among farmers in Palghar district of Maharashtra.

2. Materials and Methods

Study Area

The present study was conducted in Palghar district of Maharashtra, India, situated between 72.45° to 73.48° E longitude and 19.41° to 20.20° N latitude. The district is bordered by the Arabian Sea on the western side, Gujarat State to the north, Thane and Mumbai districts to the south, and the Sahyadri hill ranges with extensive forest cover in the eastern part. The total geographical area of the district is 517,634 ha. Palghar district comprises eight blocks, namely Vasai, Jawhar, Vikramgad, Wada, Talasari, Palghar, Mokhada, and Dahanu, of which six blocks are predominantly tribal.

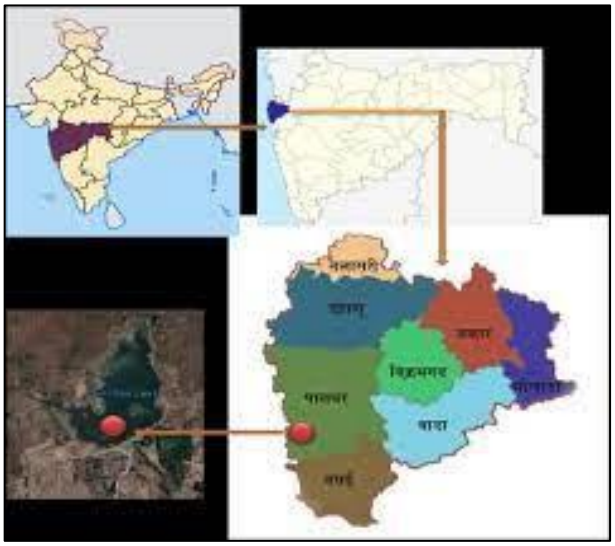

Figure 1: Location of study area

Selection of Respondents and Data Collection

A total of 146 trainees who had successfully completed the beekeeping training programme and subsequently adopted beekeeping as an enterprise were selected purposively for the study. Primary data were collected through personal interviews using a structured and pre-tested questionnaire. The questionnaire included information on socio-economic characteristics, assessment of the training programme, perception of trainees towards training topics, and knowledge level before and after training. Knowledge was assessed using a set of objective questions related to beekeeping practices.

Training Intervention

The training programme was conducted for a duration of three days, comprising both theoretical and practical sessions. The training modules covered biology and management of *Apis cerana indica*, *Apis mellifera*, and stingless bees, conservation of indigenous honeybee species, colony management including pest and disease control, and honey extraction, processing, value addition, and marketing. Emphasis was given to skill development and entrepreneurial orientation.

Statistical Analysis

The collected data were coded, tabulated, and analyzed using appropriate statistical tools.

1) **Descriptive Statistics**

Frequency and percentage were used to analyze socio-economic characteristics, training assessment, and perception of trainees.

Percentage was calculated using the formula:

$$\text{Percentage (\%)} = \left[\frac{\text{Number of respondents in a category X 100}}{\text{Total number of respondents}}\right]$$

2) **Chi-Square Test**

The chi-square test was employed to analyze the perception of trainees regarding different training topics.

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where:
c= Degree of freedom
O = Observed frequency
E = Expected frequency
The level of significance was tested at **1 per cent probability**

3) **Paired Sample *t*-Test**

To assess the effectiveness of the beekeeping training programme, pre- and post-training knowledge scores of the trainees were compared using a paired samples t-test.

$$= \frac{\overline{d}}{S_d / \sqrt{n}}$$

Where:
$\bar{d}$ = Mean difference between pre- and post-training scores
Sd = Standard deviation of the differences
n = Number of respondents

3. Results and Discussion

Social Profile of the Respondents

Table 1. provide information of trainees which are crucial for understanding their learning behavior and adoption potential. with respect to sex, a majority of the respondents were male (76.71%), while 23.29 per cent were female. The participation of women, although comparatively lower, indicates a good initiative of rural women in beekeeping as a supplementary income-generating activity.

In terms of age, the respondents were predominantly in the young age group (18–35 years), accounting for 44.52 per cent, followed closely by the middle-aged group (36–49 years) with 40.41 per cent. Only 15.07 per cent of the respondents belonged to the old age category (50 years and above). The predominance of young and middle-aged participants reflects their greater inclination towards skill-oriented vocational training and entrepreneurial activities.

Regarding educational status, 40.41 per cent of the respondents had education up to under-matric level, followed by 27.40 per cent who were matriculates (10+2). About 17.12 per cent of the respondents were illiterate, while 12.33 per cent and 2.74 per cent were graduates and post-graduates, respectively. The educational distribution indicates that the training programme effectively catered to participants with varying literacy levels, emphasizing the importance of practical, hands-on learning approaches.

The caste composition of the respondents revealed that a majority belonged to the Scheduled Tribe category (57.53%), followed by Other Backward Class (17.81%) and General Caste (16.44%), while 8.22 per cent belonged to the Scheduled Caste category. This highlights the inclusive nature of the training programme and its focus on tribal and socially disadvantaged communities.

Table 1: Social profile of the trainees (N=146)

S. No.	Parameters	Category	Nos.	Percent (%)
1	Sex	Male	112	76.71
		Female	34	23.29
		Total	146	100.00
2	Age	Young age (18-35 years)	65	44.52
		Middle age (36-49 years)	59	40.41
		Old age (50 & above)	22	15.07
		Total	146	100.00
3	Education	Illiterate	25	17.12
		Under matric	59	40.41
		Matriculate (10+2)	40	27.40
		Graduate	18	12.33
		Post Graduate	4	2.74
		Total	146	100.00
4	Caste	SC	12	8.22
		ST	84	57.53
		OBC	26	17.81
		Gen	24	16.44
		Total	146	100.00

Economic Profile of the Trainees

The economic characteristics of the trainees are presented in Table 2. The majority of the respondents were engaged in farming (58.90%), followed by self-employment (16.44%) and agricultural labour (15.75%), while students constituted 8.90 per cent of the total trainees. This occupational distribution indicates that most participants were directly involved in agricultural and allied activities. landholding pattern revealed that 65.75 per cent of the trainees belonged to the marginal farmer category (≤1.0 ha), while 26.03 per cent were small farmers (1.0–2.0 ha). Only a small proportion of trainees owned medium (6.85%) and large landholdings (1.37%), suggesting the dominance of marginal and small farmers among the respondents.

With regard to annual income, more than half of the trainees (56.85%) belonged to the low-income group with an annual income of less than ₹1 lakh. The medium-income group (₹1–2 lakh) accounted for 25.34 per cent, whereas 17.81 per cent of the trainees reported an annual income of more than ₹2 lakh. Overall, the results indicate that the trainees predominantly belonged to economically weaker sections, characterized by small landholdings and low-income levels.

Table 2: Economic profile of the trainees

Sr. No.	Parameters	Category	Nos.	Percent
1	Occupation	Farming	86	58.90
		Self employed	24	16.44
		Laboure	23	15.75
		Student	13	8.90
		Total	**146**	**100.00**
2	Land holding	Marginal (≤1.0ha)	96	65.75
		Small (1.0-2.0 ha)	38	26.03
		Medium (2-10ha)	10	6.85
		Large (≥10 ha)	2	1.37
		Total	**146**	**100.00**
3	Annual income (Rs.in Lakh)	Low (<1)	83	56.85
		Medium (1-2)	37	25.34
		High (>2)	26	17.81
			146	**100.00**

Assessment of Beekeeping Training Programme

The assessment of the beekeeping training programme revealed a high level of satisfaction among the trainees (Fig 2.). A majority of the respondents (76.71%) perceived the training as very useful, while an additional 15.07 per cent rated it as useful. This indicates that the training programme effectively met the practical and knowledge needs of the participants. With respect to coverage of subject matter, fig 3. indicates approx. 66% of the trainees reported that the content was widely covered, whereas 28.08 per cent indicated moderate coverage. The limited proportion of respondents (6.16%) who perceived slight coverage suggests that the training curriculum was largely comprehensive and well-structured.

Fig 4. Showed response regarding the overall excellence of the programme, an overwhelming majority (83.56%) rated the training as excellent, followed by 12.33 per cent who rated it as very good. The consistently high ratings reflect the effectiveness of the training methodology, clarity of instruction, and adequate practical exposure provided during the programme

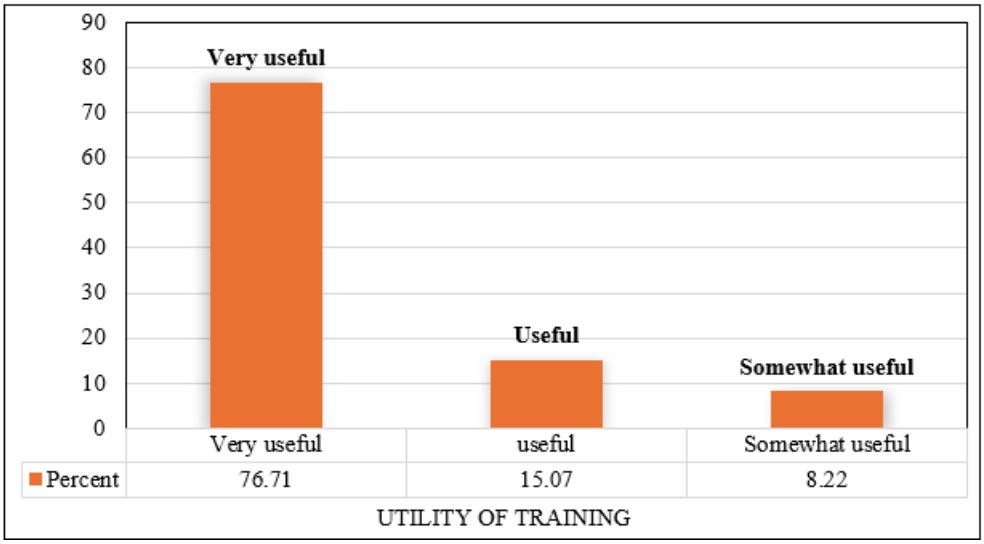

Figure 2: Assessment of utility of training programme

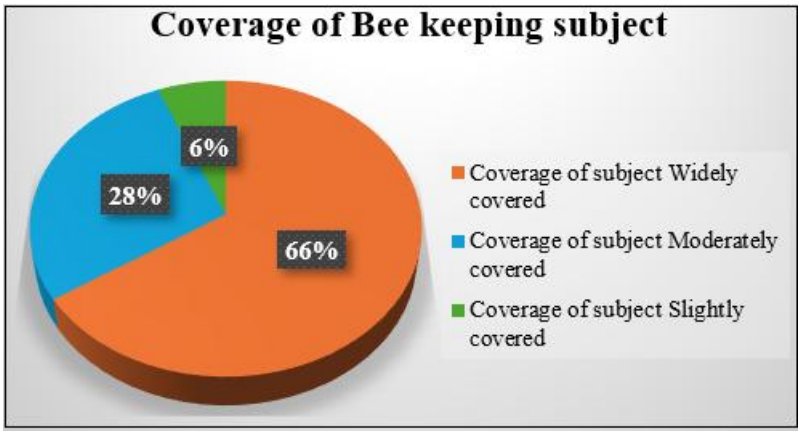

Figure 3: Response regarding coverage of Bee keeping subject in training duration

Figure 4: Response regarding excellence level of subject in training duration

Perception of Trainees Regarding Topics Covered in Training

Table 3: Perception of Trainees Regarding Topics Covered in Training

Topic	O	E	O − E	(O − E)²	(O − E)² / E
Importance of beekeeping for crop pollination	108	48.67	59.33	3519.89	72.33
Honey production Process	33	48.67	−15.67	245.53	5.05
Honey products marketing	5	48.67	−43.67	1907.13	39.18

$X^2 = 72.33 + 5.05 + 39.18$
$X^2 = 116.56$

Table 3. indicated that 73.9 % (108) perceived the importance of beekeeping for crop pollination as the most relevant topic, followed by honey production process by 22.6 % (33) trainees. The calculated chi-square value ($\chi^2 = 116.56$) with two degrees of freedom was found to be highly significant at the 1 per cent level of significance ($p < 0.01$), indicating that trainees' perception of training topics was not uniformly distributed. The results revealed a strong preference for understanding the importance of beekeeping in crop pollination.

Knowledge Gain Through Beekeeping Training

Table 4: Knowledge gained through on campus beekeeping training

Sr No	Particular	Pre evaluation (%)	Post evaluation (%)	Gain in Knowledge (%)
1	General information about beekeeping	25.22	94.02	68.8
2	Bee sting & its importance	15.98	88.23	72.25
3	Seasonal management of indigenous bees	12.68	80.24	67.56
4	Conservation of indigenous bees	25.65	95.52	69.87
5	Insect, disease & their management	12.13	74.23	62.1
6	Role bees in pollination	23.15	96.22	73.07
7	Bee products	14.24	90.23	75.99
8	Honey extraction & its processing	18.12	79.25	61.13
9	Honey extraction from wild bees A. dorsata	13.12	78. 5	65.43
10	Indiscriminate use of pesticides during flowering season of Mango & oilseed crops	48.55	90.2	41.65

Table 5: Paired Samples T-Test Result of Pre-training & Post-training Knowledge Gain

Paired Variables	Mean Difference	Std. Deviation	Std. Error Mean	t-value	df	Sig. (2-tailed)
Post-training – Pre-training	65.79	9.69	3.06	**21.46**	9	**0**

Table 4. presented a substantial improvement in trainees' knowledge levels across different aspects of beekeeping after participation in the training programme. In particular, knowledge related to honey extraction from wild bees **(***Apis dorsata***)** increased from 13.12 per cent in the pre-training evaluation to 78.5 per cent in the post-training evaluation**,** resulting in a knowledge gain of 65.43 per cent.

Similarly, awareness regarding the indiscriminate use of pesticides during the flowering season of mango and oilseed crops increased from 48.55 per cent before training to 90.20 per cent after training**,** registering a knowledge gain of 41.65 per cent**.** These findings indicate that the training programme was highly effective in improving knowledge even in technically complex and environmentally sensitive aspects of beekeeping.

The results of the t-test (Table 5) revealed a mean difference of 65.79 per cent between post-training and pre-training knowledge scores, with a standard deviation of 9.69 and a standard error of 3.06. The calculated t-value (21.46) with 9 degrees of freedom was found to be highly significant ($p = 0.000$) at the 1 per cent level of significance. It is statistically significant enhancement in knowledge clearly demonstrates the effectiveness of the structured on-campus beekeeping training in strengthening technical understanding, environmental awareness, and scientific management practices among the trainees.

4. Discussion

The integration of social and economic profiles with knowledge gain analysis demonstrates that structured vocational training effectively empowers marginal, low-income, and tribal farmers. Despite limited education and social participation, trainees exhibited significant knowledge enhancement, reflecting the strength of practical, need-based training approaches. The preference for pollination-related topics highlights farmers' production-oriented outlook. These findings corroborate earlier studies emphasizing training as a key driver of adoption and livelihood improvement.

5. Conclusion

The study concludes that beekeeping vocational training conducted by KVK Kosbad significantly enhanced trainees' knowledge, perception, and entrepreneurial orientation. The programme effectively reached marginal, low-income, and tribal farmers and enabled them to adopt beekeeping as a sustainable subsidiary enterprise. Strengthening post-training support, market linkages, and input availability will further improve adoption and income generation. Promotion of beekeeping through structured institutional training can play a vital role in rural livelihood enhancement and ecological sustainability.

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