

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 4; April 2026; Page No. 181-185

Received: 16-01-2026
Accepted: 19-02-2026

Indexed Journal
Peer Reviewed Journal

Impact of Mahabaleshwar Madhotpadak Sahakari society on beekeepers

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DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i4c.3467>

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Abstract

Beekeeping has emerged as a viable subsidiary agricultural enterprise contributing to income diversification, rural livelihoods, and ecological sustainability in India. The present study was undertaken to assess the impact of the Mahabaleshwar Madhotpadak Sahakari Society on its beneficiary beekeepers in Satara district of Maharashtra. An ex-post facto research design was employed, and a total of 320 respondents (160 members and 160 non-members) were selected through proportionate random sampling from Mahabaleshwar, Wai, and Jaoli tehsils. Data were collected using a structured interview schedule and analyzed using statistical tools such as frequency, percentage, correlation coefficient, and Z-test. The findings revealed that the cooperative society had a strong positive impact on its members, with an overall impact score of 88.46 percent. Among various dimensions, the highest impact was observed in the economic dimension (97.07%), followed by agriculture (96.14%) and vulnerability reduction (95.31%), indicating significant improvements in income, productivity, and resilience. Moderate to high impacts were also observed in psychological, social, and human competency dimensions, while livelihood sustainability recorded comparatively lower impact (76.65%). The Z-test analysis indicated significant differences between members and non-members in terms of beekeeping experience, cost of production, income, risk orientation, marketing behaviour, and overall impact, favoring cooperative members. The study concludes that cooperative membership plays a crucial role in enhancing economic efficiency, technical knowledge, and livelihood opportunities among beekeepers. However, further efforts are needed to strengthen livelihood sustainability and environmental aspects. The findings emphasize the importance of strengthening cooperative institutions, promoting capacity building, improving market linkages, and integrating technological interventions for sustainable development of the beekeeping sector.

Keywords: Beekeeping, cooperative society, livelihood sustainability, honey production, impact

1. Introduction

Beekeeping has emerged as an important subsidiary agricultural enterprise in India, contributing significantly to rural livelihoods, income diversification, and ecological sustainability (Food and Agriculture Organization, 2013) [2]. As a low-investment and high-return activity, it is particularly suitable for small and marginal farmers, landless labourers, and rural youth. Beyond economic benefits, beekeeping plays a crucial role in enhancing agricultural productivity through pollination services, with honeybees contributing to the pollination of a majority of global food crops (Klein *et al.*, 2007) [3], thereby supporting food security and biodiversity conservation. However, individual beekeepers often face challenges such as limited technical knowledge, inadequate access to quality inputs, pest and disease incidence (e.g., *Varroa destructor*), poor

market linkages, and vulnerability to environmental and economic risks (Singh & Singh, 2020) [5]. In this context, cooperative institutions have gained prominence as effective mechanisms for strengthening the beekeeping sector. Beekeepers' cooperative societies facilitate collective action by enabling members to pool resources, access training and extension services, adopt improved technologies, and engage in organized marketing (Trebbin, 2014) [6]. Such institutional support enhances productivity, reduces input costs, and improves income stability by minimizing the role of intermediaries. Moreover, cooperatives promote value addition, quality control, and better market integration, thereby increasing the competitiveness of bee products in both domestic and international markets (Chauhan & Sharma, 2016) [1]. The Mahabaleshwar Madhotpadak Sahakari Society in Satara district of Maharashtra represents

expected to contribute to policy formulation and strengthening of cooperative-based approaches for sustainable rural development (National Bee Board, 2020)^[4].

The present study was conducted using an ex-post facto research design. The study area was Mahabaleshwar, Wai, and Jaoli tehsils of Satara district, Maharashtra, where the Mahabaleshwar Madhotpadak Sahakari Society operates. A total of 320 respondents were selected, comprising 160 members and 160 non-members, using a proportionate random sampling method. The data were collected through a structured and pre-tested interview schedule by personal interview method. The variables included personal, socio-economic, and psychological characteristics as independent variables, while the impact of the cooperative society was considered as the dependent variable. The collected data were classified and analyzed using frequency, percentage, range method, correlation coefficient, and Z-test.

Sr. No.	Tahsils	Tahsil wise total number of beneficiaries	Number of respondents selected for study
1.	Mahabaleshwar	866	83
2.	Wai	461	44
3.	Jaoli	341	33
	Total	1668	160



The dimension-wise mean impact percentage was calculated to assess the extent of impact of the beekeepers' cooperative society across various dimensions such as honey production, social, economic, psychological, and others. For each dimension, the total obtainable impact score (A) and the actual obtained impact score (B) were computed based on respondents' scores. Obtained score from each dimension is divided by the obtainable score from respective individual dimension then multiplied by hundred. In this way score of impact percentage of each dimension has calculated. The overall mean impact percentage value has been calculated by aggregating the percentage impact score of all the dimensions considered in schedule for the study. This method converts the obtained scores into percentage form, allowing easy comparison across different dimensions. Higher percentage values indicate greater impact of the cooperative society in that particular dimension. The overall impact percentage was also calculated using the same formula by considering total scores of all dimensions. Thus, this statistical approach provides a clear and comparative understanding of the dimension-wise and overall impact of the beekeepers' cooperative society on its members. The percentage impact for each dimension was calculated

$$\text{Impact Percentage (C)} = \frac{B}{A} \times 100$$

- **A**= Total obtainable impact score
- **B**= Actual obtained impact score
- **C**= Percentage impact score

The Z-test is a statistical tool used to determine whether there is a significant difference between sample and population means or between two sample means, when the sample size is large and the population variance is known or assumed. It helps in testing hypotheses and making decisions about the significance of results.

$$Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

- Z = Z value (test statistic)
- $\bar{X}$ = Sample mean
- μ = Population mean
- σ = Population standard deviation
- n = Sample size

The findings of the study as well as relevant discussion given below.:

3.1 Impact of Beekeepers Cooperative Society on Beekeepers

3.1.1 Dimension-wise Mean Impact Percentage Score of Beekeepers Cooperative Society

Table 2 presents the dimension-wise mean impact percentage of the beekeepers' cooperative society on its

members. The impact has been evaluated across several dimensions using total obtainable scores (A), actual obtained scores (B), and their corresponding percentage impact (C), highlighting its influence across social, economic, psychological, and environmental aspects.

Table 2: Dimension wise mean impact percentage

Sr. No.	Impact Dimension	Total obtainable impact score	Actual obtained impact score	Percentage impact score
		A	B	B/A x 100=C
1	Impact on Honey Production	10240	8834	86.26
2	Impact on Social Dimension	1920	1685	87.76
3	Impact on Economic Dimension	2560	2485	97.07
4	Impact on Psychological Dimension	1920	1803	93.90
5	Impact on Political Dimension	1600	1375	85.93
6	Impact on Agriculture	1920	1846	96.14
7	Impact on Livelihood Sustainability	2240	1717	76.65
8	Impact on Human Competencies	1600	1448	90.50
9	Impact on Women Empowerment	1280	1120	87.50
10	Impact on Environment	1280	1095	85.54
11	Impact on Vulnerability Reduction	1280	1220	95.31
	Overall Impact	27840	24628	88.46

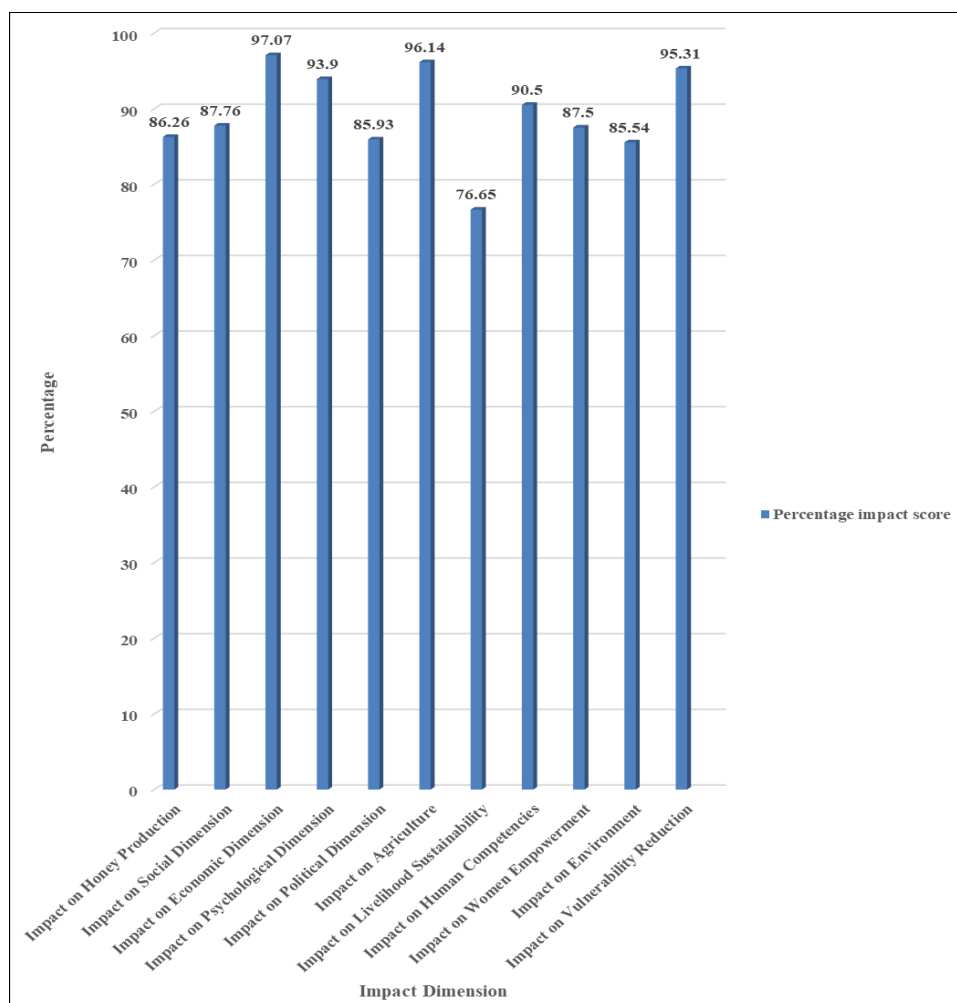


Fig 1: Dimension wise mean impact percentage

Overall impact including technical skills in beekeeping, managerial and organizational abilities. From table 16, we can scrutinize each dimension of impact of beekeepers cooperative society on beekeepers as; 'Impact on Economic

Dimension' reflects the maximum mean impact percentage score (97.07%) amongst all 11 impact dimensions, followed by 'Impact on Agriculture' (96.14%), 'Impact on Vulnerability Reduction' (95.31%), 'Impact on

Psychological Dimension' (93.90%), 'Impact on Human Competencies' (90.50%), 'Impact on Social Dimension' (87.76%), 'Impact on Women Empowerment' (87.50%), 'Impact on Honey Production' (86.26%), 'Impact on Political Dimension' (85.93%), 'Impact on Environment' (85.54%) and 'Impact on Livelihood Sustainability' falls under lowest score (76.65%) of impact dimension, by considering all these dimensions we found the overall impact (88.46%) of beekeepers cooperative society on beekeepers.

It is also showed that, among all the dimensions of impact; impact on economic dimension (97.07%) has the highest impact among all dimensions, indicating exceptional economic benefits such as increased income from beekeeping, better market access and price realization, reduced input costs through collective purchasing, the beekeepers cooperative society plays a vital role in enhancing the financial stability and profitability of its members. 'impact on agriculture' dimension shows the second highest mean impact percentage score (96.14%). A very high impact is seen on agriculture, indicating: Improved crop productivity due to pollination services, integration of beekeeping with farming systems, increased awareness of sustainable agricultural practices, this highlights the dual benefit of beekeeping in both honey production and agricultural enhancement. Third highest impact dimension with mean percentage score of 95.31 per cent was 'impact on vulnerability reduction' shows that, A very high impact is observed in reducing vulnerability, suggesting: Improved resilience against economic shocks, reduced dependency on a single income source, better coping mechanisms during adverse conditions, the cooperative acts kind of safehouse for its members. It is also observed that, 'impact on psychological dimension' had mean impact percentage score of 93.90 per cent. The high psychological impact reflects positive changes in: Confidence and self-esteem, motivation and decision-making ability, sense of security and satisfaction, participation in the cooperative likely empowers beekeepers mentally and emotionally. It is found that, 'impact on human competencies' had mean impact percentage score of 90.50 per cent. The beekeepers cooperative society significantly enhances, knowledge of improved practices, training and capacity-building programs seem to be highly effective.

It is also observed that, 'impact on social dimension' had mean impact percentage score of 87.76 per cent. A strong impact is observed in the social dimension, reflecting improvements in: Social participation and networking, group cohesion and cooperation among beekeepers, enhanced status within the community, the cooperative likely acts as a platform for social interaction and mutual support, strengthening community bonds. It is also revealed that, 'impact on women empowerment' had mean impact percentage score of 87.50 per cent. The cooperative has a strong role in empowering women by: Providing income-generating opportunities, increasing participation in decision-making, enhancing social and economic independence, this reflects inclusive development within the cooperative framework. The mean impact percentage score of dimensions related 'impact on honey production' shows 86.26 per cent impact on beekeepers.

The impact on honey production is notably high, indicating that the cooperative society has effectively contributed to improving productivity of honey, adoption of improved beekeeping practices, access to better equipment and inputs, this indicates that members gain advantages from technical guidance, training, and collective resource utilization, though there remains potential for further enhancement.

It is also found that, 'impact on political dimension' had mean impact percentage score of 85.93 per cent. The cooperative has moderately strengthened political aspects, including awareness of rights and government schemes, participation in local governance or decision-making, although significant, this dimension shows slightly lower impact compared to others, suggesting room for greater political empowerment. It is revealed that, 'impact on environment' dimension had mean impact percentage score of 85.54 per cent. The environmental impact is positive, indicating promotion of biodiversity through pollination, adoption of eco-friendly practices, increased awareness of environmental conservation. However, there is still scope to further strengthen environmental sustainability practices. It is observed that, the least impacted dimension was 'impact on livelihood sustainability' had lowest score of 76.65 per cent for impact dimension, This is the lowest impact dimension, suggesting: Some limitations in ensuring long-term livelihood security, possible challenges such as market fluctuations, climate risks, or dependency on seasonal income, this area requires focused interventions to ensure stable and sustainable livelihoods.

It is observed that, the 'overall impact' score is 88.46 per cent, indicating that the cooperative society has had a highly positive and significant influence on the beekeepers. The overall impact score clearly indicates that the beekeepers' cooperative society has: Significantly improved economic conditions, strengthened social and psychological well-being, enhanced agricultural productivity and resilience. However, livelihood sustainability and political empowerment remain areas where further improvement is needed.

Members show a higher overall impact score than non-members, highlighting the greater socio-economic and livelihood benefits of membership. Findings of the present study are in line with the studies conducted by Food and Agriculture Organization (2013), International Food Policy Research Institute (2018), and National Bee Board (2020)^[4], which reported that beekeeping cooperatives improve income levels, strengthen livelihood security, enhance agricultural productivity through pollination, and contribute to socio-economic and psychological empowerment of rural households.

3.2 Z test comparison between members and non-members of beekeepers regarding different variables

Table 3 presents the Z-test comparison of various socio-economic and beekeeping-related variables between member and non-member farmers, along with their levels of significance. This analysis allows us to determine if the differences between the two groups are statistically meaningful. It highlights an important point, when comparing scores of two groups, the difference between their means should be evaluated in the context of the variability or dispersion of the scores.

Table 3: Z test comparison between members and non-members of beekeepers regarding different variables

Sr. No.	Category	Member respondents (N=160) mean	Non-member respondents (N=160) mean	'z' statistic
1	Age	49.89	41.56	6.760**
2	Education	10.29	9.26	2.232*
3	Gender	1.13	1.07	0.184 ^{NS}
4	Family Size	5.63	5.9	-1.610 ^{NS}
5	Occupation	2.26	2.17	2.154*
6	Land holding	2.23	2.12	0.810 ^{NS}
7	Beekeeping Experience	23.5	16.53	7.033**
8	Cost of honey production	3100	3350	-6.362**
9	Annual income	260175	189200	3.374**
10	Income from beekeeping	47018.75	19256.25	11.760**
11	Indebtedness	5.51	5.65	-3.429**
12	Risk orientation	19.28	18.39	5.119**
13	Marketing behaviour	17.46	16.35	8.205**
14.	Overall impact	153.92	145.05	21.498**

Note: ** =Significant at 0.01%

* =Significant at 0.05% NS = Non Significant

The Z-test analysis reveals clear differences between member and non-member beekeepers, indicating the positive impact of cooperative membership. Members are generally older, better educated, and possess significantly higher beekeeping experience compared to non-members. They also differ in occupational pattern, showing greater engagement in diversified or professional activities. Economically, members demonstrate clear advantages, including lower cost of honey production, higher annual income, and substantially greater income from beekeeping, along with relatively lower indebtedness, reflecting better financial management. Behaviourally, members exhibit higher risk orientation and superior marketing behaviour, suggesting greater openness to innovation and improved market engagement. However, no significant differences were observed in variables such as gender, family size, and land holding, indicating similar socio-demographic characteristics across both groups. Overall, the findings highlight that cooperative membership plays a crucial role in enhancing economic efficiency, technical experience, and entrepreneurial behaviour, ultimately resulting in a significantly higher overall impact on the socio-economic status and livelihood of member beekeepers compared to non-members.

4. Conclusion

The study concludes that the beekeepers' cooperative society has a significant positive impact on its members, particularly in improving income, reducing production costs, enhancing market access, and promoting adoption of scientific beekeeping practices. Members are comparatively better positioned than non-members in terms of economic status, experience, risk orientation, and marketing behaviour, indicating the effectiveness of cooperative interventions. The impact is most prominent in economic and agricultural dimensions, while moderate improvements are observed in social and psychological aspects. However, challenges remain in ensuring long-term livelihood sustainability and environmental awareness. Overall, the cooperative system provides inclusive benefits, as most socio-economic characteristics show minimal influence on the extent of impact.

5. Implications

The findings highlight the need to strengthen cooperative-based interventions for greater impact. Emphasis should be placed on capacity building through need-based training, improved disease management, and use of ICT-based advisory services. Provision of insurance schemes and subsidized inputs through cooperatives can reduce risks and production costs. Strengthening marketing systems, including price stabilization and value addition, is essential for improving income security. Incorporating beneficiary feedback in programme planning can enhance effectiveness. Overall, stronger institutional support, policy interventions, and technological adoption are crucial for improving sustainability, profitability, and resilience of beekeeping enterprises.

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