ID: 789

Sustainable Beekeeping Through a Data-Driven Web-Based Management System Approach

Sahin Aydin[1,*], Samet Okuyan[2], Serhat Solmaz[2], and Hasan Kivrakdal[1]

[1]Işık University, Faculty of Economics, Administrative and Social Sciences, Department of Information Technologies, 34980, Istanbul, Türkiye.
[2] Apiculture Research Institute, 52200, Ordu, Türkiye.

Abstract

Sustainable and traceable beekeeping practices are essential for protecting colony health, improving production efficiency, and strengthening sectoral knowledge sharing. However, current beekeeping practices still suffer from insufficient record keeping, difficulties in colony monitoring, limited data sharing, and weak integration among stakeholders. This study proposes a data-driven and web-based management system approach to support sustainable beekeeping activities through an integrated digital infrastructure. The proposed system includes colony registration and tracking, activity monitoring, colony health assessment, production and cost management, and open data sharing components within a unified structure. In the developed approach, colony information and field activities are digitally managed through quick response code–based tracking and web-based interfaces. The system architecture is designed using a multilayered Model-View-Controller software structure combined with open data technologies to support scalable and sustainable data management. The proposed approach enables systematic collection, management, visualization, and sharing of beekeeping data among different stakeholders. In addition, the system is expected to support data-driven decision-making processes for reducing colony losses, improving production efficiency, and strengthening sustainable beekeeping practices. The study demonstrates that integrating web-based management systems and open data approaches into beekeeping activities can contribute to the digital transformation of the sector and support the wider adoption of digital agriculture technologies in sustainable apiculture management.

Keywords: *Digital Agriculture, Sustainable Beekeeping, Web-Based Information System, Open Data, Colony Monitoring, Data-Driven Management*