

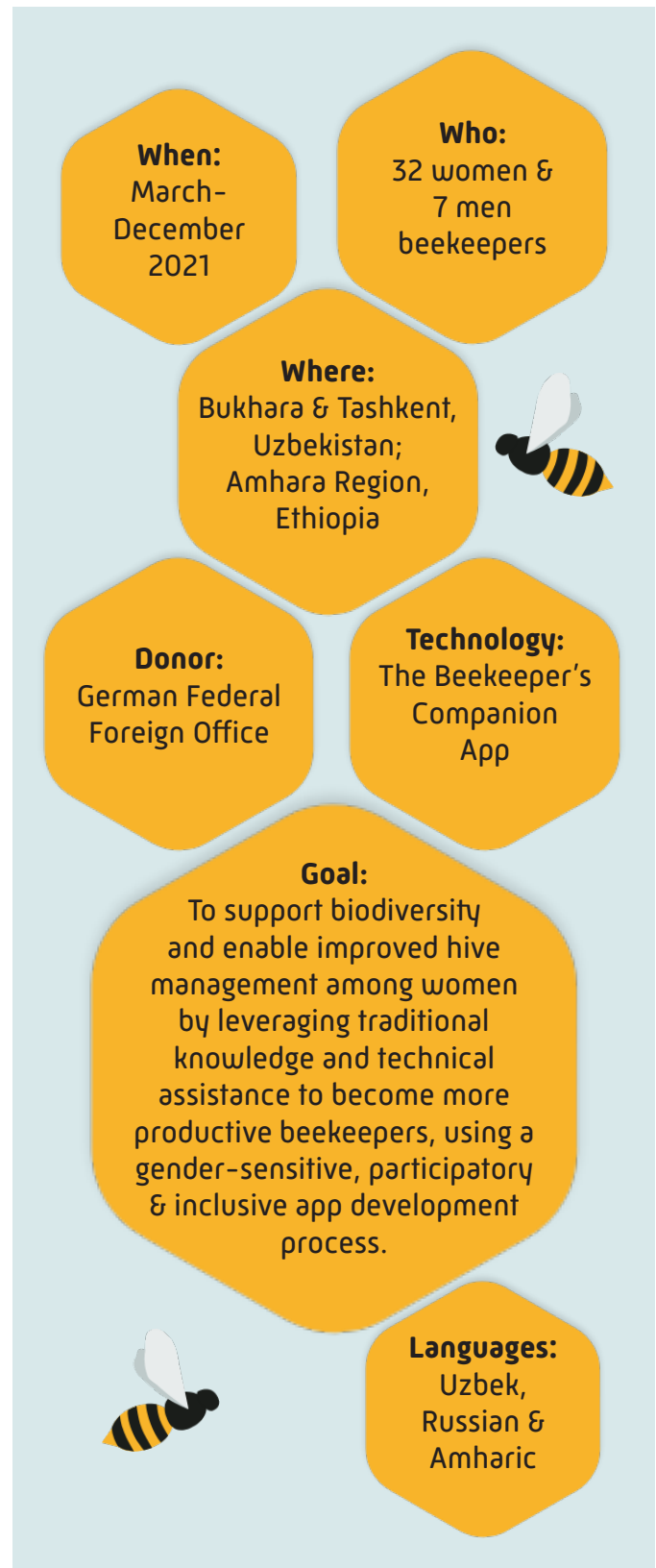
AI-DRIVEN CLIMATE-SMART BEEKEEPING FOR WOMEN IN ETHIOPIA AND UZBEKISTAN

Final Project Brief | 2021

With climate change, loss of biodiversity, and global food security challenges; agriculture, especially rural smallholder farmers, face many challenges. Disproportionately impacted are people already living in vulnerable situations — including women, children, the poor, minorities, migrants, indigenous peoples, and persons with disabilities. However, there are opportunities for these groups to not only protect and grow their own livelihoods, but to also strengthen their local ecosystems in the process. Beekeeping is unique in that it does not require land ownership but can still provide women with a source of income and a kind of labor opportunity that can be performed at home while taking care of other caregiving responsibilities.

A rising demand for progressive and flexible solutions that help beekeepers adapt to quickly changing market and climate conditions, digitalization creates opportunities. Notably, enhanced access to and sharing of information, needs-based advisory services, transparency, and product traceability fuel the economic empowerment of smallholder producers.

In 2021, the AI-Driven Climate-Smart Beekeeping (AID-CSB) for Women project worked with 39 beekeepers in Uzbekistan and Ethiopia to co-design and localize the “Beekeeper’s Companion”, a climate-smart information communication technology for development (ICT4D) app designed to support beekeepers’ hive management practices and improve honey production. The project leverages the participation of women beekeepers and national experts and incorporates their traditional and local knowledge into algorithms that trigger automatic recommendations and notifications for beekeepers. Recognizing that rural women and women smallholder farmers should be given the opportunity to participate fully in project activities that affect their livelihoods and resilience, the majority of project beekeepers are women, who participated in all stages of the project (from design to use).



The Beekeeper's Companion App

Launched in 2010, the first HiveTracks' app was designed to help beekeepers manage hive data that had traditionally been recorded by hand and was often difficult to assess longitudinally and therefore of limited value both to the beekeeper or the scientific community. Originally designed as a web app for North American beekeepers, the words, symbols, hive types, queen types, pest species and even the logics of use were US-centric, despite this version of the app being used in 150 countries.

Through the AID-CSB project, the new version of the app—the Beekeeper's Companion—underwent iteration to localize the app for Uzbekistan and Ethiopia. Currently the app is offline capable (helpful for rural or migratory beekeepers) and supports beekeepers' hive management. In the future it will send recommendations and notifications based on regional beekeeper activity, season, location, and reminders to help beekeepers protect their hives from weather and climate risks, pests, disease, and nutritional deficiencies and malpractices.



The Beekeeper's Companion App:

- Features an intuitive inspection process
- Facilitates record-keeping practices
- Helps beekeepers plan beekeeping tasks
- Provides in-app guidance

Project Methods

The AID-CSB project leveraged a 3-step process to localize the Beekeeper's Companion app, that independently supported the mitigation of bias and protection of user privacy:

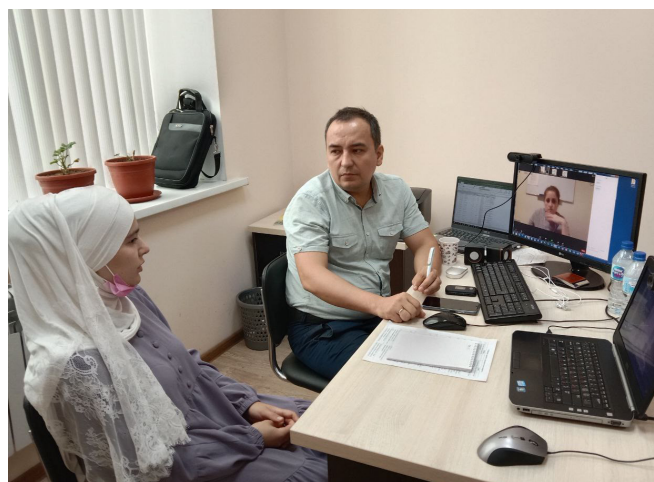
Desk research was conducted to gather both a general understanding of the honey sector and beekeeping practices, as well as collect specific data points to be used later on in the app development, such as local flowering calendars.

Preliminary user interviews were conducted to understand the day-to-day beekeeping experience, practices, and challenges of project beekeepers in order to design the app prototype.

Prototype testing enabled women beekeepers to interact directly with the app prototype to identify problems and areas of improvement early, so designers could make the necessary changes prior to development and build products that meet user needs and expectations. During the testing, which was conducted via Zoom, the user experience/user interface (UX/UI) designer requested the beekeeper to complete certain tasks or test certain functions of the app, and observed their real-time navigation choices, while collecting verbal feedback. The participants were not exposed to any version of the app or to the wireframe prototypes prior to testing to minimize bias. For simplicity, to avoid creating stress for the participants, and to include those users who did not yet have access to a smartphone, the prototype(s) were displayed on a laptop and screen-shared during testing. This process promoted feedback on the user interface and, with the support from a translator, sharing of technical beekeeping information in users' native language(s), which is one way to be gender-inclusive during technology design processes.

The AID-CSB project participants included 24 beekeepers in Uzbekistan (20 women and four men) across two regions: Tashkent (agricultural/rural) and Bukhara (desert). In Ethiopia, 15 beekeepers (12 women and three men) were selected from icipe's Young Entrepreneurs in Silk and Honey (YESH) project across three sites in the Amhara region. While the focus was on women, men were included in interviews because the app will be made available for use by all beekeepers, regardless of gender. Including men also amplified the gender-specific differences that might affect adoption or use of the app, which enabled us to address them during iterations of the prototype. The AID-CSB project and participatory design model helps raise awareness among men too and facilitates perceptual shifts and cultural norms around women and technology that will give women access to the tech they need.

The project interviews and prototype testing uncovered key challenges in both countries, which highlighted the demand for hive management support and key factors to account for in the app design.



UX/UI designer conducts Uzbekistan user interview with a beekeeper and translator. (Credit: ICARDA).

Uzbekistan Beekeeper Challenges

The most pressing challenges for beekeepers generally were disease, pesticides or chemicals from nearby manufacturing plants or farms, and pests. Combatting the varroa mite, Foulbrood, and Nosemosis (nosema) were the top disease concerns.

Pesticides were deeply concerning to all interviewees and composed a significant part of every interview. Not only do pesticides pose risks for hive death, but they also contaminate honey, which means that Uzbek beekeepers cannot meet the import standards of other countries, limiting sales channels and economic potential. Several beekeepers expressed the need for more and better quality laboratories for honey composition testing and help communicating the risks of pesticide use to farmers. Presently, there is no countrywide communication network connecting beekeepers with farmers and so there are limited cross-sector conversations about pesticide use and its effects on local biodiversity, bees, and crops.

When asked about challenges specific to women beekeepers, interviewees remarked that beekeeping is physically demanding. Women beekeepers have to move heavy hive boxes to reposition hives for better access to forage and to extract honey, which is time-consuming and physically exerting. The responsibility of raising a family makes it difficult for beekeepers to balance caring for their bees with caring for their families as it is viewed as culturally unacceptable for women to stay at apiaries past dark in traditional households; thus, there is particular importance on the flexibility needed for improved timing of beekeeping practices.



Beekeepers in Uzbekistan inspect their hives (Credit: ICARDA).

Ethiopia Beekeeper Challenges

In Ethiopia, one of the main challenges to overcome is the gender digital divide, in which rural, low-income women are less likely to be able to access and use digital technologies. To better understand the baseline level of beekeepers' digital knowledge and plan project activities accordingly, a survey was conducted with the 15 beekeepers on their use and comfort using technology. Four women had never used a smartphone, and only two women felt 100% confident using a smartphone. However, all but two beekeepers actively used social media, which requires many of the same digital skills as the Beekeeper's Companion app.

Considering these findings, an ICARDA intern developed and implemented smartphone training to build off beekeepers' existing knowledge and familiarity with similar concepts (e.g. social media and basic mobile phone functions such as sending a text message and making a call.) Today, the beekeepers exchange beekeeping photos in a Telegram group, practicing their new skills and sharing information and experiences.

Beekeepers stated that the practice of catching swarming colonies is difficult for women. Additionally, as the subspecies of *Apis mellifera* bee in Ethiopia are more aggressive than their European or American counterparts, apiary visits and inspections need to be conducted in the evening hours when bees are more relaxed, but doing so increases danger to women because their apiaries are often situated in remote areas. Furthermore, most hives are traditional and thus are located on tall trees, and some do not believe the practice of climbing the tree or otherwise accessing and controlling the beehive is an appropriate activity for women.

As with Uzbekistan, traditional gender roles do not encourage women to express their opinions or speak up. This challenge was anticipated and mitigated by including many peer-to-peer smartphone exercises in which women could practice directly

with one another or family members, thus increasing their agency but also normalizing their use of technology. Nonetheless, this experience underscores the importance of one-on-one prototype testing sessions and highlights the broader barriers to inclusive and participatory design.



Top photo: Participating beekeepers in Ethiopia receive beekeeping equipment kits. **Bottom photo:** Ethiopian beekeepers participate in smartphone training (Credit: icipe).

Achievements & Conclusions

The desk research, interviews, and prototype tests enabled the co-design and localization of the following features of the app:

- Language (Uzbek, Russian, Amharic)
- Beekeeping terminology & practices
- Apiary environment
- Gender-neutral translations and visuals
- Hives, bee species, pests, nectar and pollen sources

Key achievements of the project in 2021 included addressing the digital divide through smartphone provision and training; gathering and integrating beekeepers' input through user interviews and prototype testing; and generating localized versions of the app for Uzbekistan and Ethiopia. Encouraged through one-on-one dialogue, women's input was at the center of the project's development process, informing how the interface, content, and gender-sensitive translations should be designed to best support their livelihoods as beekeepers. This

innovative, participatory, and gender-responsive design process has proven to be essential to achieving the AID-CSB 2021 goal.

As the app is used by beekeepers for the honey harvesting seasons in 2022, the AID-CSB team will monitor incoming data and feedback regularly and make adjustments to further localize the app and support easy use. It will be crucial to monitor the use of the app through supporting data, including online metrics, and continuing the dialogue with women beekeepers to ensure that the app continues to satisfy user's needs.

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Beekeepers, researchers, and agriculture stakeholders gather after the final project workshop in Tashkent (Credit: ICARDA).

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