International Partnership on Innovation

SAMS - Smart Apiculture Management Services

Deliverable D2.1

Report on Needs Assessment and Evaluation

Work package 2

SAMS User Centered Design Cycles and Business Development

Horizon 2020 (H2020-ICT-39-2017)

Project N°780755

This project has received funding from the European Union´s Horizon 2020 research and innovation programme under **grant agreement N° 780755.** The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the EU.

This project has received co-funding from the Germany Federal Ministry for Economic Cooperation and Development.

Project information		
Lead partner for the deliverable	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (Germany)	
Document type	Report	
Dissemination level	Public	
Due date and status of the deliverable	Due date 31.08.2018	Status 31.03.2019
Author(s)	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, UNPAD, CV.Primary, ICEADDIS, UNIKAS	
Reviewer(s)	HOLETA	

This document is issued by the consortium formed for the implementation of the SAMS project under Grant Agreement N° 780755. SAMS consortium partners

Logo	Partner name	Short	Country
	Deutsche Gesellschaft für internationale Zusammen-arbeit (GIZ) GmbH (Coordinator)	GIZ	Germany
	University of Kassel	UNIKAS	Germany
	University of Graz (Institute for Biology)	UNIGRA	Austria
	Latvia University of Life Sciences and Technologies	UNILV	Latvia
	ICEADDIS – IT-Consultancy PLC	ICEADDIS	Ethiopia
	Oromia Agricultural Research Institute, Holeta Bee Research Center	HOLETA	Ethiopia
	University Padjadjaran	UNPAD	Indonesia

PRIMARY	Commanditaire Vennootschap (CV.) Primary Indonesia	CV.PI	Indonesia

List of Abbreviations

AB	Advisory Board
ASS	Advisory Support System
DSS	Decision Support system
GSM	Global System for Mobile Communication
HCD	Human Centered Design
HMF	Hydoxymethylfufural
ICT	Information and Communication Technology
IoT	Internet of Things
SDG	Sustainable Development Goals
UCD	User Centered Design
UX	User experience

Summary of the project

SAMS is a service offer for beekeepers that allows active monitoring and remote sensing of bee colonies by an appropriate and adapted ICT solution. This system supports the beekeeper in ensuring bee health and bee productivity, since bees play a key role in the preservation of our ecosystem, the global fight against hunger and in ensuring our existence. The high potentials to foster sustainable development in different sectors of the partner regions are often used inefficient.

Three continents - three scenarios

(1) In Europe, consumption and trading of honey products are increasing whereas the production is stagnating. Beside honey production, pollination services are less developed. Nevertheless, within the EU 35% of human food consumption depend directly or indirectly on pollination activities.

(2) In Ethiopia, beekeepers have a limited access to modern beehive equipment and bee management systems. Due to these constraints, the apicultural sector is far behind his potential.

(3) The apiculture sector in Indonesia is developing slowly and beekeeping is not a priority in the governmental program. These aspects lead to a low beekeeper rate, a low rate of professional processing of bee products, support and marketing and a lack of professional interconnection with bee products processing companies.

Based on the User Centered Design the core activities of SAMS include the development of marketable SAMS Business Services, the adaption of a hive monitoring system for local needs and usability as well as the adaption of a Decision Support System (DSS) based on an open source system. As a key factor of success SAMS uses a multi stakeholder approach on an international and national level to foster the involvement and active participation of beekeepers and all relevant stakeholders along the whole value chain of bees.

The aim of SAMS is to:

- enhance international cooperation of ICT and sustainable agriculture between EU and developing countries in pursuit of the EU commitment to the UN Sustainable Development Goal (SDG N°2) “End hunger, achieve food security and improved nutrition and promote sustainable agriculture”
- increase production of bee products
- create jobs (particularly youths/ women)
- trigger investments and establish knowledge exchange through networks

Project objectives

The overall objective of SAMS is to strengthen international cooperation of the EU with developing countries in ICT, concentrating on the field of sustainable agriculture as a vehicle for rural areas. The SAMS Project aims to develop and refine an open source remote sensing technology and user interaction interface to support small-hold beekeepers in managing and

monitoring the health and productivity in their own bee colonies. Highlighted will be especially the production of bee products and the strengthening of resilience to environmental factors.

Specific objectives to achieve the aim:

- Addressing requirements of communities and stakeholder
- Adapted monitoring and support technology
- Bee related partnership and cooperation
- International and interregional knowledge and technology transfer
- Training and behavioural response
- Implementation SAMS Business cooperation

Contents

List of Figures

List of Tables

1 Introduction

1.1 Motivation for User Centered Design Approach

SAMS is a multi-national, interdisciplinary project. Goal is to apply IoT technology for precision apiculture in beehives located in tropical regions in order to achieve active monitoring for beekeeping improvements.

Primary success factor for SAMS is to develop solutions that are understandable and useable for all user groups, beekeepers as well as scientist and commercial users. Furthermore, SAMS will be of high interest for political and commercial stakeholders in the countries. Their interests have to be taken into consideration to ensure their support.

The partner countries Indonesia and Ethiopia are quite divergent in culture and other preconditions. Therefore, a team of local experts will analyze requirements in each country. Methods of UCD are suitable to organize effective and efficient collaboration between the partners.

1.2 Country Focus for User Research Phase One

The context of user information on beekeeping in Europe is sufficiently documented and easy to access. Therefore, a LeanUX approach was selected, which means that a lot of data for the context of use analysis especially in Europe can be based on known models from previous projects and available literature. These data will be used as the basis for the scientific consideration in the EU.

These are for example:

- ITApic – Application of Information Technologies in Precision Apiculture[1]: the direct preceding project of SAMS
- EPILOPEE – Study on honey bee colony mortality[2]: benefits for beekeeping and European and national surveillance systems
- EFSA – Bee Health[3]: bee mortality surveillance studies to gather further information on the loss of colonies in the EU for beekeeping

[1] ITApic (2019): Application of Information Technologies in Precision Apiculture. URL: http://www.itapic.eu/index.php (access: 31.1.2019)
[2] EPILOBEE (2016): A pan-European epidemiological study on honeybee colony losses 2012-2014. URL: https://ec.europa.eu/food/sites/food/files/animals/docs/la_bees_epilobee-report_2012-2014.pdf (access: 31.1.2019)
[3] EFSA (2018): Bienengesundheit: URL: https://www.efsa.europa.eu/de/topics/topic/bee-health (access: 31.1.2019)

- EFSA – EU Bee Partnership[4]: communication strategies for bee health facts
- SMARTBEES[5]: crucial facets of honeybee resistance to colony losses – needs for local beekeeping practices
- SWARMONITOR[6]: monitoring tool within the beehive for the effective small and hobby beekeepers' management of bees
- SUPER-B[7]: joint research of scientific and societal communities involved in conservation and sustainable management of ecosystem services on bees and other pollinators – relevant to all European countries, disseminated to scientists, farmers, beekeepers, industry, policy-makers, NGOs and the public
- BEE DOC[8]: research network of honey bee pathology, chemistry, genetics and apicultural extension to improve honey bee health – transfer of results to apicultural practice in the world community of beekeepers
- ALARM[9] and STEP[10]: assessment of the impacts pollinator declines are having on agriculture, biodiversity and wider society and development of mitigation strategies to protect pollinators – for a wide range of stakeholders
- BEE SHOP[11]: manual for beekeepers on hygiene of the hive and outcomes on the potential to increase bee resistance to viruses and parasites
- COLOSS COST[12]: network of researchers and stakeholders in Europe to follow the evolution of colony losses

To gather more information about the scientific user research on bees in Europe, a scientific survey with selected European Universities will be done. Furthermore, the SAMS project complements to the EU Pollinators Initiative[13] by making a research contribution to improve the knowledge of pollinators via the monitoring tool DSS.

The focus of the user research described in this paper is on the context of user analysis in non-EU partner countries – Ethiopia and Indonesia.

[4] EFSA (2018): Terms of reference for an EU Bee Partnership. URL: https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2018.EN-1423 (access: 31.1.2019)
[5] European Commission: Research Projects. URL: https://ec.europa.eu/food/animals/live_animals/bees/research_en (access: 31.1.2019)
[6] Cordis (2012-2015): Swarmonitor. URL: http://cordis.europa.eu/projects/rcn/105847_en.html (access: 1.2.2019)
[7] Cost European Cooperation in Science and Technology: SUPER-B. Sustainable Pollination in Europe. URL: http://superb-project.eu/show/about_11124/ (access: 1.2.2019)
[8] Bees in EuropE and the Decline Of honey bee Colonies: BEE DOC. URL: http://www.bee-doc.eu/index.php (access: 1.2.2019)
[9] Department of Community Ecology: Assessing LArge scale Risks for biodiversity with tested Methods. URL: http://www.alarmproject.net/contact.php (access: 1.2.2019)
[10] STEP (2019): Status and Trends for European Pollinators. URL: http://www.step-project.net/ (access: 1.2.2019)
[11] Bees in EuropE and Sustainable HOney Production: BEE SHOP. URL: http://www2.biologie.uni-halle.de/zool/mol_ecol/bee-shop/index.html (access: 1.2.2019)
[12] Coloss honey bee research association (2018): Coloss. URL: https://coloss.org/ (access: 1.2.2019)
[13] European Commission (2018): EU Pollinators Initiative. The EU approach to tackle pollinator decline. URL: http://ec.europa.eu/environment/nature/conservation/species/pollinators/index_en.htm (access: 28.3.2019)

1.3 Scope of Deliverable

Concerning Task 2.1a technical requirements for SAMS hardware products it became clear very fast that they will be subject to refinement with growing knowledge about the future users and their context of use. Presently the team at University of Kassel develops a hardware prototype that will already consider learnings about the context of use from user research phase 1. These learnings include environmental factors as well as constraints for availability and maintainability of the technical components. The available technical documentations beginning with D3.1 – manual on Beehive Construction and Operation will have to be revised as soon as the user requirements for the different SAMS Systems are identified and published.

This document focuses on Task 2.1b and describes the planned and already realized steps of the User Centered Design process (UCD) for SAMS products. It shows how the UCD approach was planned with its iterations and its close consideration of the anticipated product and service scope.

Based on two phases of user research and on one workshop for each of the two target regions West–Java and Ethiopia, specific context of use descriptions are under development for each of the regions. This paper describes the methodological approach used for the user research and reports the current result status. This includes first research results concerning the SAMS value chain in West-Java by UNPAD.

Finally, it describes conclusions for future development steps, particularly for the definition of user requirements and software-prototyping.

2 Plan the User Centered Design Process

SAMS applies User Centered Design to ensure, that needs, demands and limitations of end users are major focus in all steps of the development.

DIN ISO 9241-210 recommends a 4-step process to apply this user (human) centric approach. Design solutions are only produced after the context of use has been analyzed and user requirements are thoroughly specified. Design solutions (low-fidelity as well as high

fidelitprototypes) are always evaluated against user requirements. The process iterates until the user requirements are met.

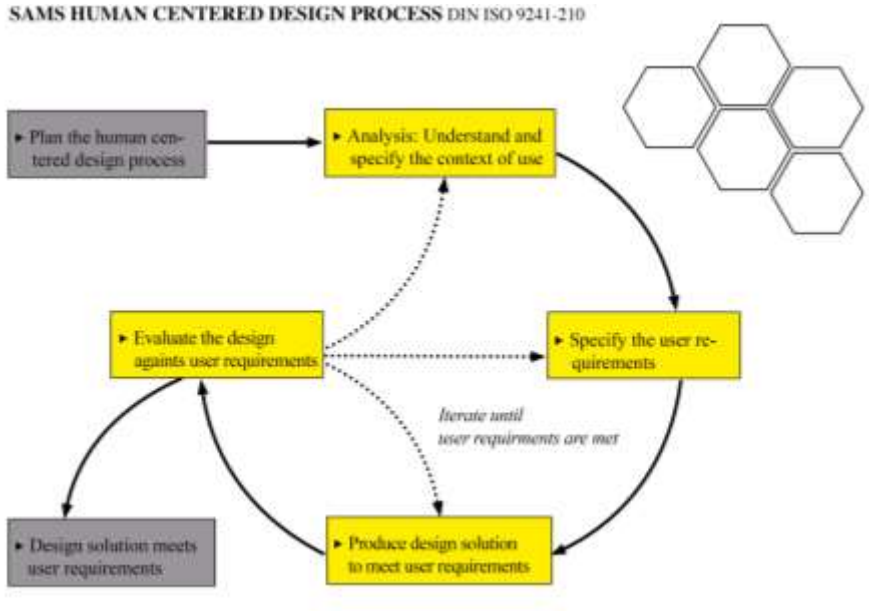


Figure 1: SAMS Human Centered Design Process (DIN ISO 9241-210)

This recommendation describes the product development cycle for **one product**, hardware as well as software. SAMS as service demands the development of several products and services. Therefore, planning was dedicated to find synergies and efficient strategies.

2.1 LEAN UX Approach

Lean UX *is a keyword used to describe an approach for human-centered design that is based on a combination of different approaches (agile development, design thinking, lean startup) and tries to integrate principles and methods for usability and user experience into agile development, thereby achieving economic advantages from a cost-benefit perspective.* (Geis, Polkehn, Molich, & Kluge, 2016)

The SAMS team has professional experience in all components of Lean UX. UNPAD and CV.Primary Indonesia can contribute with their Design Thinking experience as well as with knowledge in agile development. The same applies to the Ethiopian partner ICEADDIS. All partners have adapted the lean startup practice of rapid prototyping.

This opens up the opportunity to create a common understanding of the SAMS product development strategy very fast and use methods for research, prototyping and documentation that are already known and established.

2.2 Anticipated SAMS Product Scope and Consequences for the UCD Process

The project title SAMS (Smart Apiculture Management Services) already indicates that the team is facing multi-product development challenges.

To verify, that the team has a common understanding of the product scope, a diagram of SAMS products was created and reviewed.

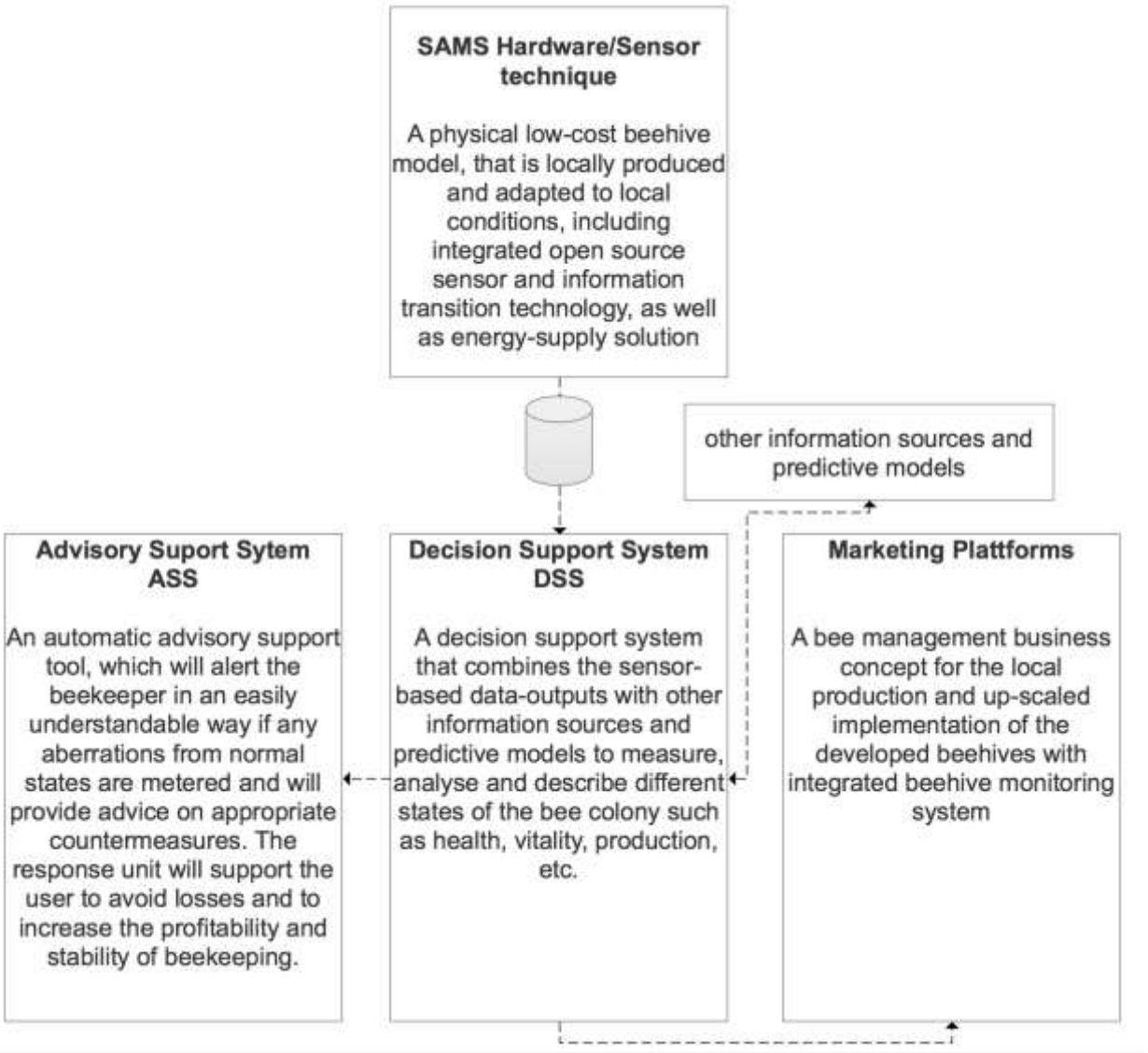


Figure 2: Anticipated SAMS products and their relations

SAMS beehive hardware and sensor technique is described as one product in this context. Its components are the beehive itself, the measurement devices with single board computer technology, information transition technology and energy supply. In fact, the individual components will probably require separate prototyping iterations. Due to observations in partner countries, the first low fidelity SAMS system is currently in process of adaption to minimize the error prone.

SAMS Bee-Management will be developed parallel with SAMS products and locally adapted based on learnings from site visits and interviews partly described in 5.1 in close cooperation with WP5.

2.2.1 Software Development

DSS – Decision Support System is the SAMS data processing brain. It is the system software experts will use to analyze SAMS data-outputs and put them in context with other scientific information. A second function of DSS will be to provide data and conclusions suitable to feed into the ASS. An anticipated technical key requirement of DSS is to design it for devices with large and high-resolution screens in order to visualize and process large data amounts.

ASS – Advisory Support System is the software, beekeepers with SAMS systems use to get advice in order to improve their beekeeping practice. An anticipated functional key requirement of ASS is to make it available on mobile devices, so it can be used on site.

2.2.2 Service Design

Marketing Platforms can be understood as bee management business concepts for local production adapted to local needs. Part of these platforms can be service integrated software solutions. In addition to the promotion and marketing of SAMS itself, partners in Ethiopia and Indonesia plan to develop a new local range of honey products.

Education and Promotion is a field of service design that was specified earlier in the project as part of a user centered approach to introduce the SAMS System to future users who will be directly approached and trained. The SAMS team believes that the introduction of monitoring systems in beehives can help to raise awareness for beekeeping and the related environmental and nutritional issues on a broader range. An example user group would be schoolteachers using SAMS data in classrooms or journalists reporting of local environmental issues.

2.2.3 Consequences – Parallel Processes and Prioritization

Conclusion is, that results of the analyze phase, “understanding and specifying the context of use”, **if carried out comprehensively** can be base for all SAMS products. Starting with the second step, specification of user requirements related to the future product, each product needs to follow its own specific human centered design process.

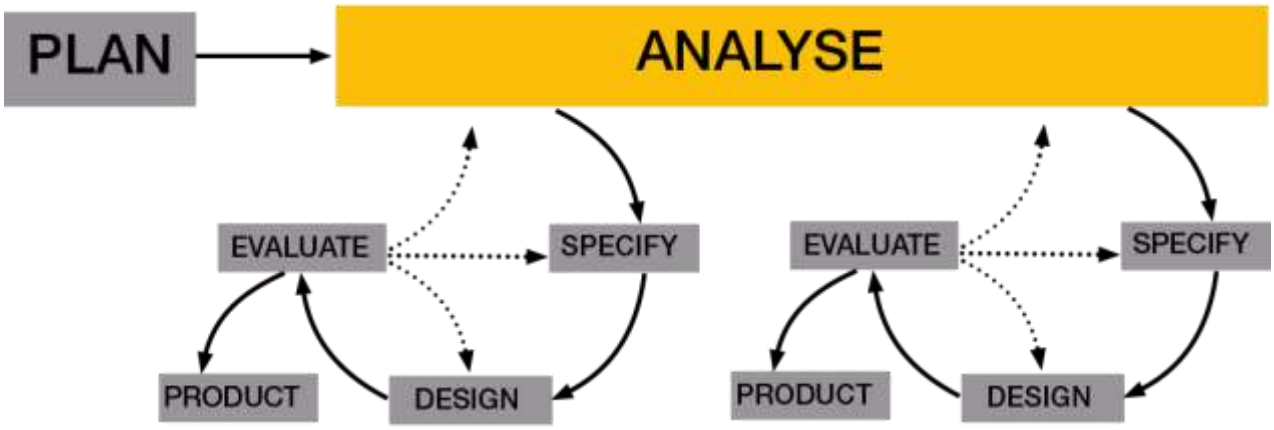


Figure 3: Parallel Human Centered Design processes for each product

Prioritization of product developments is partly self-evident. The first hardware prototype has to be implemented before DSS specifications can be finalized. However, in a first iteration, DSS user requirements can be predicted based on previous scientific expertise and data of previous projects. Design processes for DSS and ASS systems can run almost parallel as they are focusing on two different user groups.

Service designs for marketing and other sectors can be concepted by team members specialized in those fields, in division of labor with those responsible for the SAMS hardware, DSS and ASS.

2.3 Project Organization

The project management faces the challenge to organize a multi-disciplinary, multi-cultural team that produces several products, locally adapted to two countries. To ensure that resources are used smartly, and synergies can be recognized and used, the SAMS team on the one hand uses a “living time line” that is regularly reviewed and changed according to the progress of the project, on the other hand the team agreed on a communicating strategy to make sure information flow between team members is efficient. Generally, communication in the project is subject to high technical risks considering problems with internet connection and power supply.

2.3.1 Project Timeline

For the SAMS UCD project timeline, the steps of the human centered design process are arranged and synchronized with mayor project milestones. It also shows the responsibility for the different project phases on a team level, the intended results and documentation strategies.

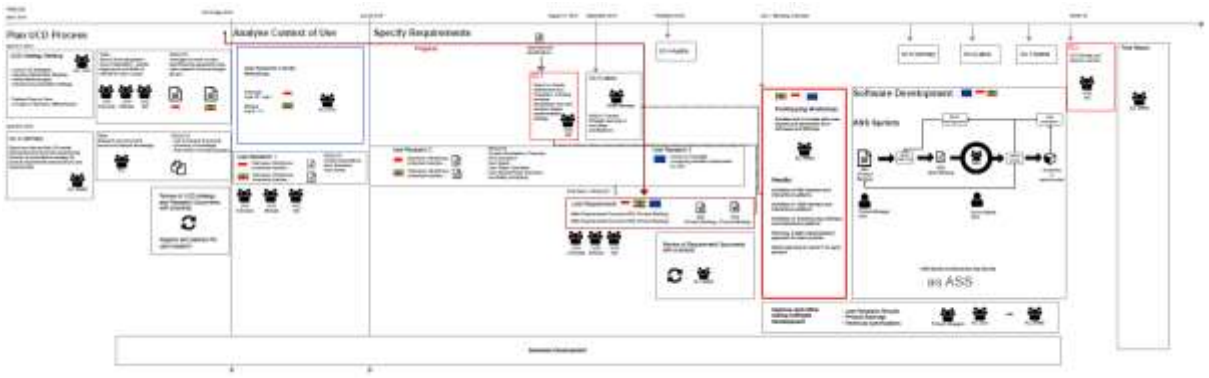


Figure 4: Project Timeline for User Centered Design steps in Indonesia und Ethiopia - Overview

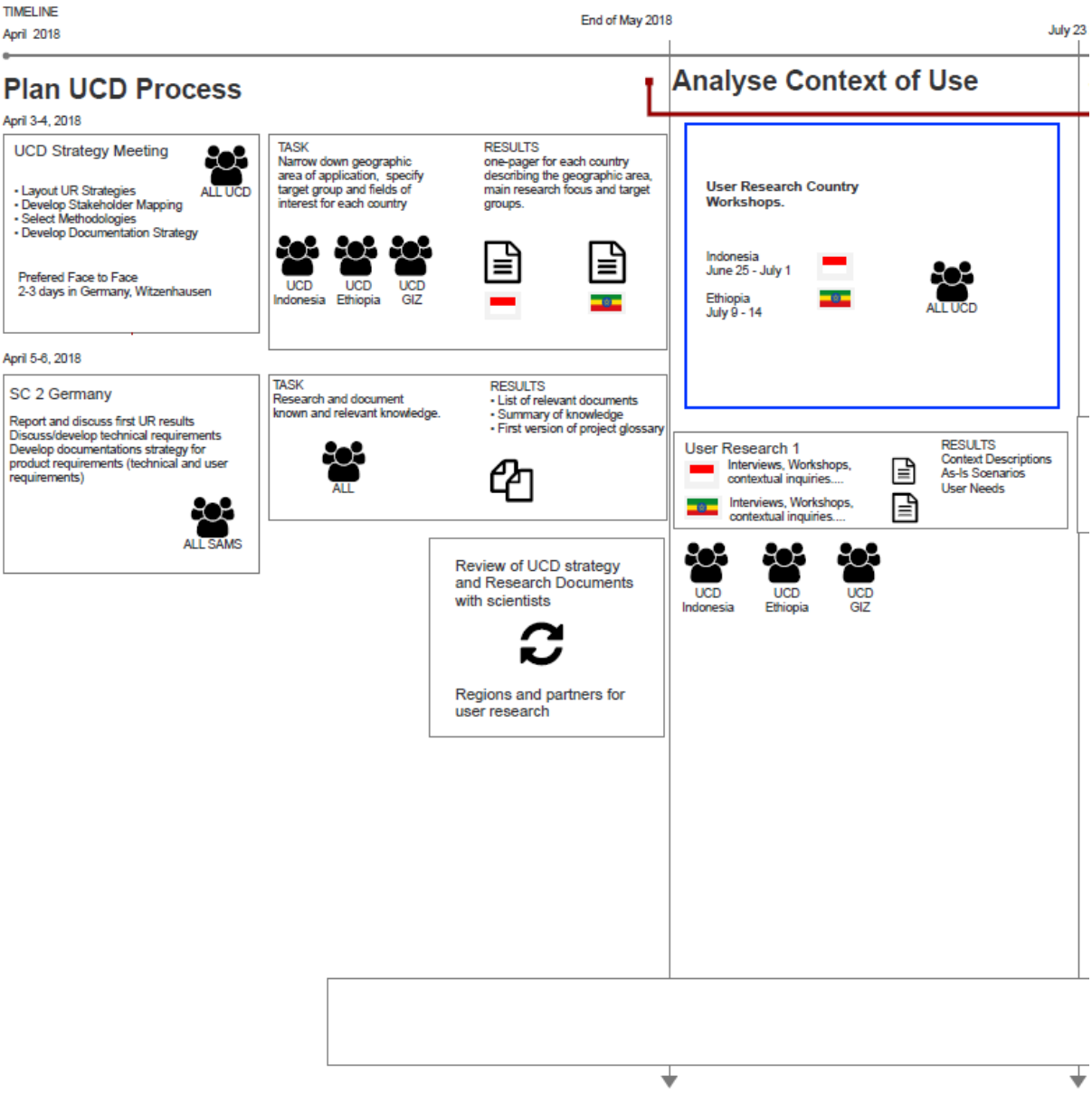


Figure 5: Project Timeline – Detailed View of Planning and User Research Phase One

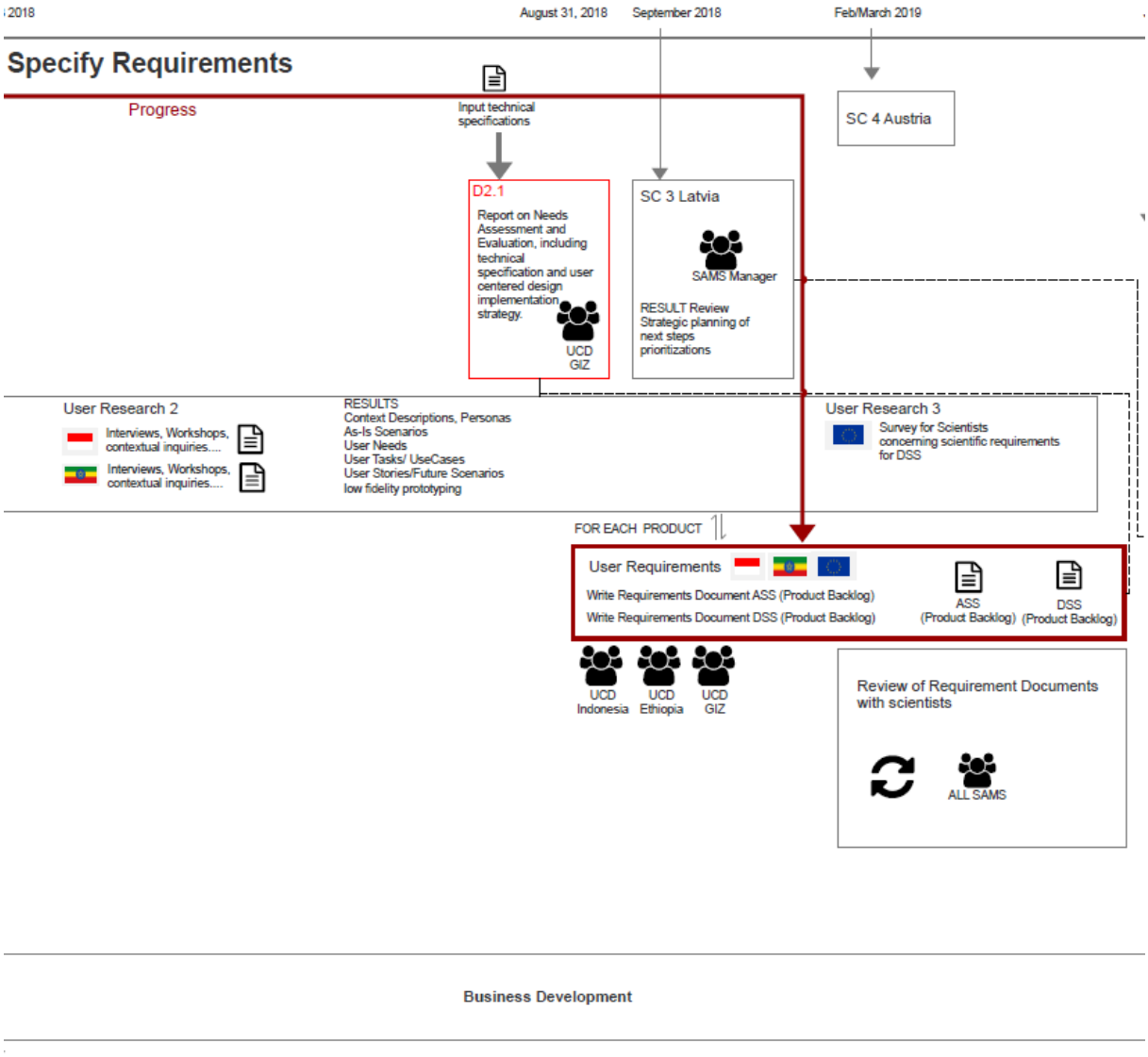


Figure 6: Project Timeline – Detailed View of User Research Phase Two and User Requirements

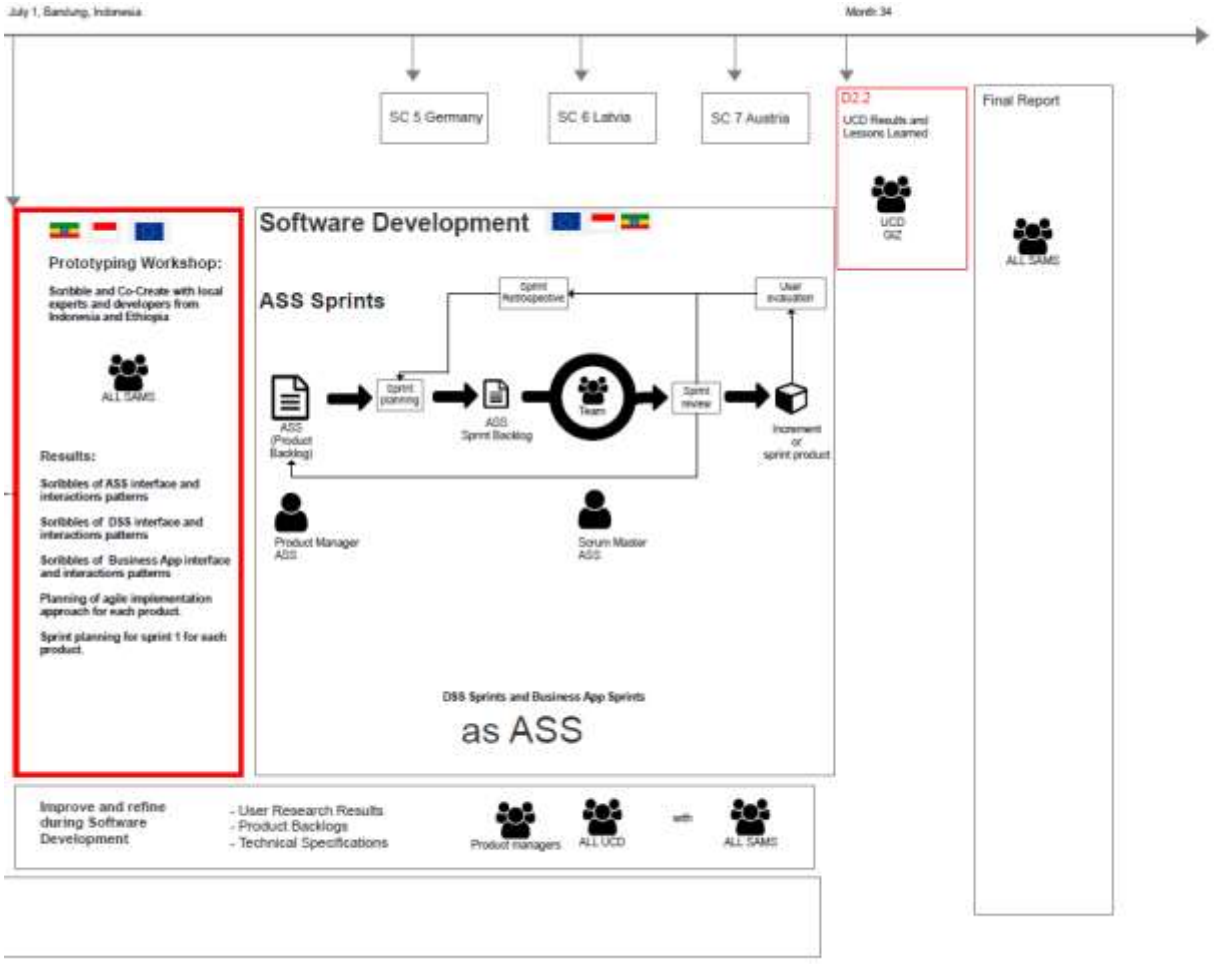


Figure 7: Project Timeline – Detailed View of Future Iterative Product Prototyping

2.3.2 Communication Strategies to Support the UCD Process

2.3.2.1 Low-Threshold Exchange of Information between SAMS Team Members

The collaborative approach of UCD requires frequent communication between team members: one-to-one, one-to-many, many-to-many, from country to country as well as country/ partner team internal.

For cross-national and multidisciplinary communication as well as for management issues the SAMS team decided to use the Slack collaboration hub. Slack allows setting up unlimited message channels dedicated to special tasks or topics.

This makes it easy to follow specific conversations. Another advantage is that conversations can be asynchronous which makes it easier to bridge time differences between Indonesia and Africa/ Europe.

2.3.2.2 Sharing and Reviewing Documents and Co-Working on Documents

The SAMS team agreed on a process to share and review documents. Each document that is produced on international level is reviewed by delegates from each country to avoid

misunderstandings and ensure correctness over the disciplines. For important documents, especially result reports or requirements, the according experts perform a co-creation process.

2.3.2.3 Glossary for Professional Terms

To manage the challenge that important terms suffer from different use and understanding in different professional communities (e.g. between designers and computer scientists) or with different methodological approaches, a glossary on the SAMS websites will serve as a place to inform and discuss about this and at the same time define meaning, usage and connected actions like forms of documentation. This glossary will grow throughout the project and will be accessible for all project members.

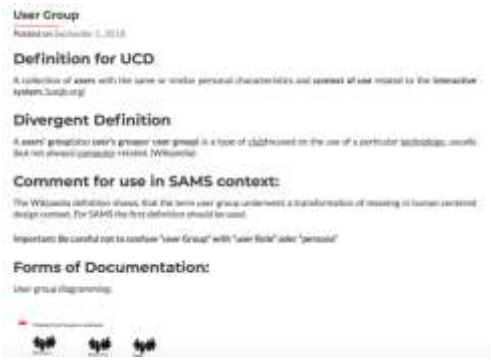


Figure 8: Glossary on SAMS Website

2.4 Risk Management

In the proposal, the following risks concerning WP2 and other work packages are described. In the planning phase, some of those risks were reviewed and checked compared to actual developments.

2.4.1 Technical Risks

2.4.1.1 Data Availability

Anticipated: medium risk

Access to bee related data & databases, quality of data transmission

Project participants are data/ knowledge owners, beekeepers are secured via project partners in target regions, quality data transmission will be secured by a 3-step adaption strategy from lo-fi to pilot system and proximity of pilots to GSM networks. (SAMS proposal)

Current Situation:

Ethiopia: high risk

Supply of mobile internet or telecommunication is not reliable/ stabile in the country. This applies to cities and worsens in remote areas.

Perspective: The new Prime Minister wants to change that – one plan is to allow private companies in telecommunication to have more competition and to foster growing of landlines.

Conclusion: For SAMS local data storage and traditional transfer on data media need to be planned. Connection to the SAMS consortium will be difficult – mentioned Skype meetings to communicate and understand the ongoing activities are very demanding for the Coordinators and the UCD team at all. Currently communication is maintained by email and text messaging, whenever audio meetings are not feasible.

Indonesia: low risk

Coverage of mobile services is of good quality in West Java. Telkomsel is the most stabile mobile service provider for remote areas, but sometimes other providers give better coverage in certain remote areas. However, partners in Indonesia report sometimes bad internet connection in remote areas, which can actually affect especially beekeeping sites in forest regions.

EU: This risk is not applicable for the EU – low risk

2.4.1.2 Technical Feasibility

Anticipated: medium risk

Lack of technical components in target countries

Standard components are being used, via adaption, local availability will be considered in re-design.

Current Situation:

Ethiopia: high risk

Almost no electronic components can be produced or easily purchased in the country.

Conclusion: SAMS partners in Ethiopia will cooperate with authorities to realize custom free import of electronic components. A longer time for purchasing and import is planned.

Indonesia: very low risk, all components are available in the country

EU: This risk is not applicable for the EU – low risk

2.4.2 Political and Regulatory Risks

2.4.2.1 Changing Political Priorities, Lack of Interest of Governments, Political Instability in Partner Countries, etc.

Anticipated: low risk

Violent/ armed conflicts, theft of on-site equipment

All regions are peaceful, specific locations for pilots will be selected by consideration of security with all affected stakeholders. Political sector is integrated within AB and extended associated participants. Within UCD, any changes in law and politics will be considered and reflected in SAMS development. For Indonesia, access to EU-market will provide project-friendly political environment. For Ethiopia, project is in line with political goals and therefore backed by national strategies. (SAMS Proposal)

Current Situation:

Ethiopia: situation insecure with hope of positive development

On one hand, Ethiopia undergoes changes concerning political Development. The new Prime Minister Abiy Ahmed Ali started a peace process with Eritrea as well as many other changes to a more democratic development. However, ethnic conflicts continue, especially between Oromo and ethnic minorities. In September 2018 the situation escalated in Addis Ababa, were the OLF (Oromia Liberation Front) caused violent protests. This affected the local project team, because traveling was not safe for some time.

Indonesia: low risk

Conclusion: Regardless of low risks at the moment, a comprehensive analysis of political stakeholder is planned, and it is intended to collaborate with political institutions in both countries.

Theft of on-site for equipment is a possible risk in both countries. In Ethiopia as well as in Indonesia, some farmers/ beekeepers have the custom to keep the beehives close to the house, which could prevent theft. Beehives in forest areas are unwatched most of the time. Prevention measures will be elaborated with local beekeepers and partners during project implementation.

EU: This risk is not applicable for the EU – low risk

2.4.3 Management Risks

An important task of project management during implementation is tracking and monitoring of known risks, identifying new risks, executing risk response plans, and evaluating their effectiveness through the project life cycle. GIZ will steer the risk management in close cooperation with all project participants.

2.4.4 Delays against Schedule as indicated in the Gantt-plan

Anticipated: medium risk

WP-Leader will timely report to Coordinator possible delays in delivery of activities and outputs. If delays can trigger further delays in other activities, members of SC will join in order to discuss risk mitigation measures. Significant deviations from work schedule will be reported to Commission and discussed with responsible project officer.

Current Situation:

Planning the UCD approach has uncovered how challenging it is to keep the work schedule. Already the local adaption of SAMS hardware will probably take more time than expected due to newly identified requirements. At the SC meeting, SAMS consortium will discuss this issue and develop a strategy to manage possible delays. The Lean UX approach of rapid low-fidelity prototyping based on scientifically valid assumptions offers methodological measures for such cases.

3 Analyze Context of Use – Status Report

According to the timeline, a user research phase one ran from May to July 2018 and was finalized with one user research workshop in each country end of June/ July 2018. This phase served to collect first context of use descriptions and was very important to establish team collaboration.

One learning from user research phase one was, that complexity of future SAMS products and diversity of regions in every country requires a more thorough investigation of the context of use factors. Therefore, both country teams currently work on user research phase two were they perform more in-depth interviews and observations. This user research is still in progress.

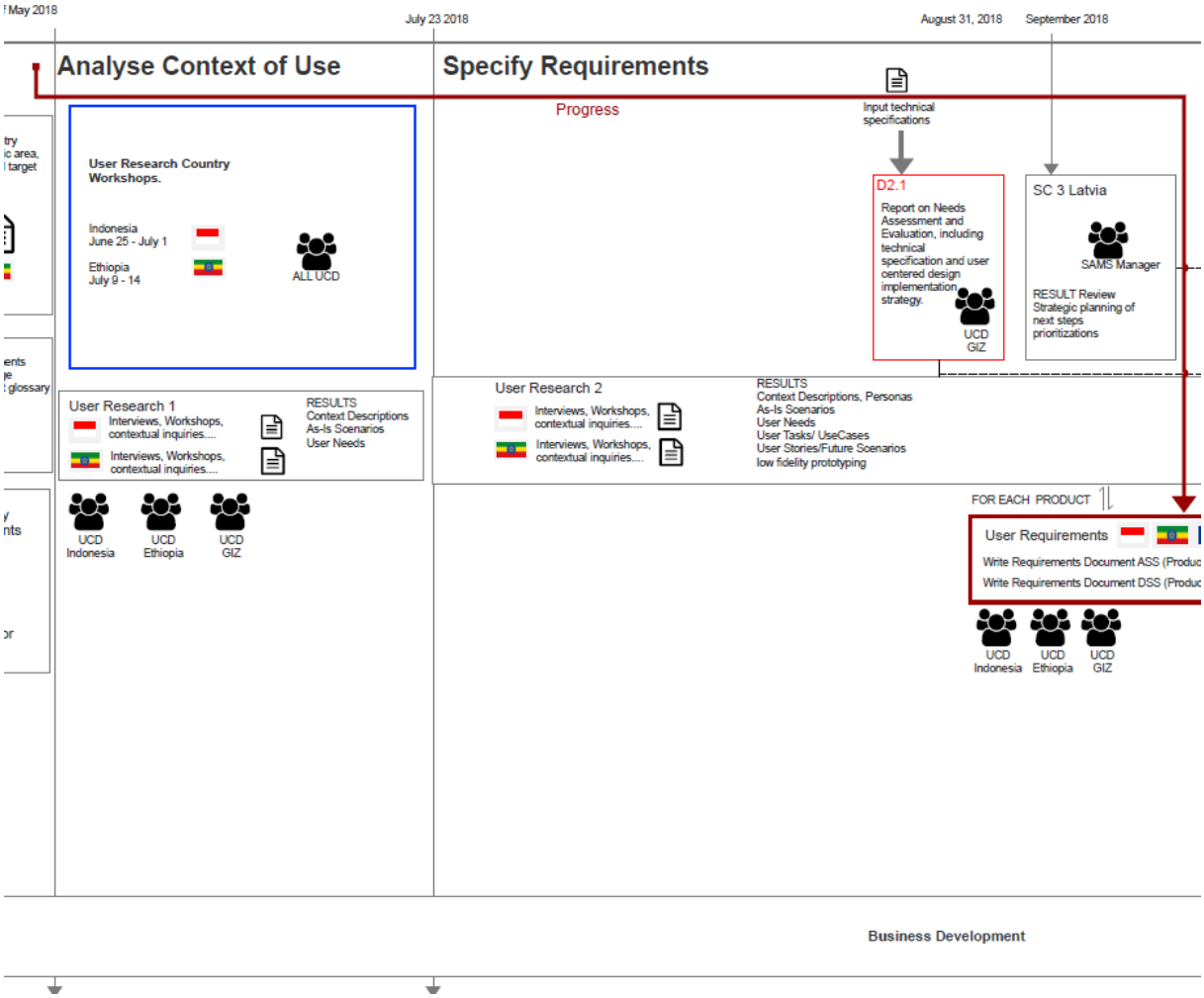


Figure 9: User Research Phase one in the timeline

3.1 User Research Phase One – Result Summary

3.1.1 Identification of possible SAMS Sites and Partners

Along with planning the product development process, both countries conducted first site visits and networking activities in their countries in order to identify suitable regions and partners to

setup the SAMS system. They established or deepened the contact to local stakeholders, beekeepers and organizations.

As a result, the team was able to start the context of use analysis or user research activities were the future partners probably situated.

For the process, a set of criteria for site selection was suggested and sent to the partners.

Table 1: Criteria for Site Selection

A	Geographic Area(s)
B	Local Project Partner(s)
C	Target groups
D	Stakeholders
E	Description of beekeeping as-is situation
F	Project Goals
G	Business ideas

Sites visited and considered for SAMS implementation in Indonesia

The following sites have been visited and are under ongoing assessment whether the effectivity and efficiency of the location is suitable in order to deploy SAMS hive:

- Kampong Cieter/ Mekarwangi Village, Sindangkerta District, West Bandung Regency (Y: -7.0688, X: 107.4153, Z: ±1.300 mdpl);
- Cijangkar Village, Nyalindung District, Sukabumi Regency (X: -6.989277778, Y: 106.9407722, Z: ±569 mdpl);
- Ciomas Village, Tenjo District, Bogor Regency (X: -6.4297, Y: 106.5266, Z: ±85 mdpl);
- Kampong Negla, Lemahputih Village, Lemahsugih District, Majalengka Regency (X: ,Y: ,Z:)
- Hutan Diklat Jampang Tengah, Balai Diklat Kehutanan Bogor, Badan Penyuluhan dan Pengembangan SDM Kehutanan, Jl. Raya Ciareuy, Sindang Resmi Village, Jampang Tengah District, Sukabumi Regency (X: 106.800855, Y: -7.028402, Z:)
- Other locations will be updated soon

Sites visited and selected for SAMS implementation Ethiopia

- Holeta
- Bako
- Gedo

All three sites for first SAMS implementation are research sites of the Oromia Agricultural Research Institute. They have educated technical staff with experience in beekeeping and very good experience in education of local beekeepers. They will share their knowledge about running test systems and help to include local beekeepers in the project later.

Sites visited and selected for SAMS implementation EU

The focus is to set up the SAMS system in Indonesia and Ethiopia. Therefore, the sites for the 20 SAMS systems to be implemented in the EU have not been chosen yet in total. This will be done after the prototyping Phase in Indonesia and Ethiopia. Some hives were already installed in Witzenhausen, Germany and Jelgava, Latvia to adapt the user requirements from the UCD phase 1.

3.1.2 Stakeholder Analysis

3.1.2.1 Stakeholder Mapping at Project Start

For each country a collaborative stakeholder mapping was performed with the goal to visualize all stakeholders and their relations to SAMS services.

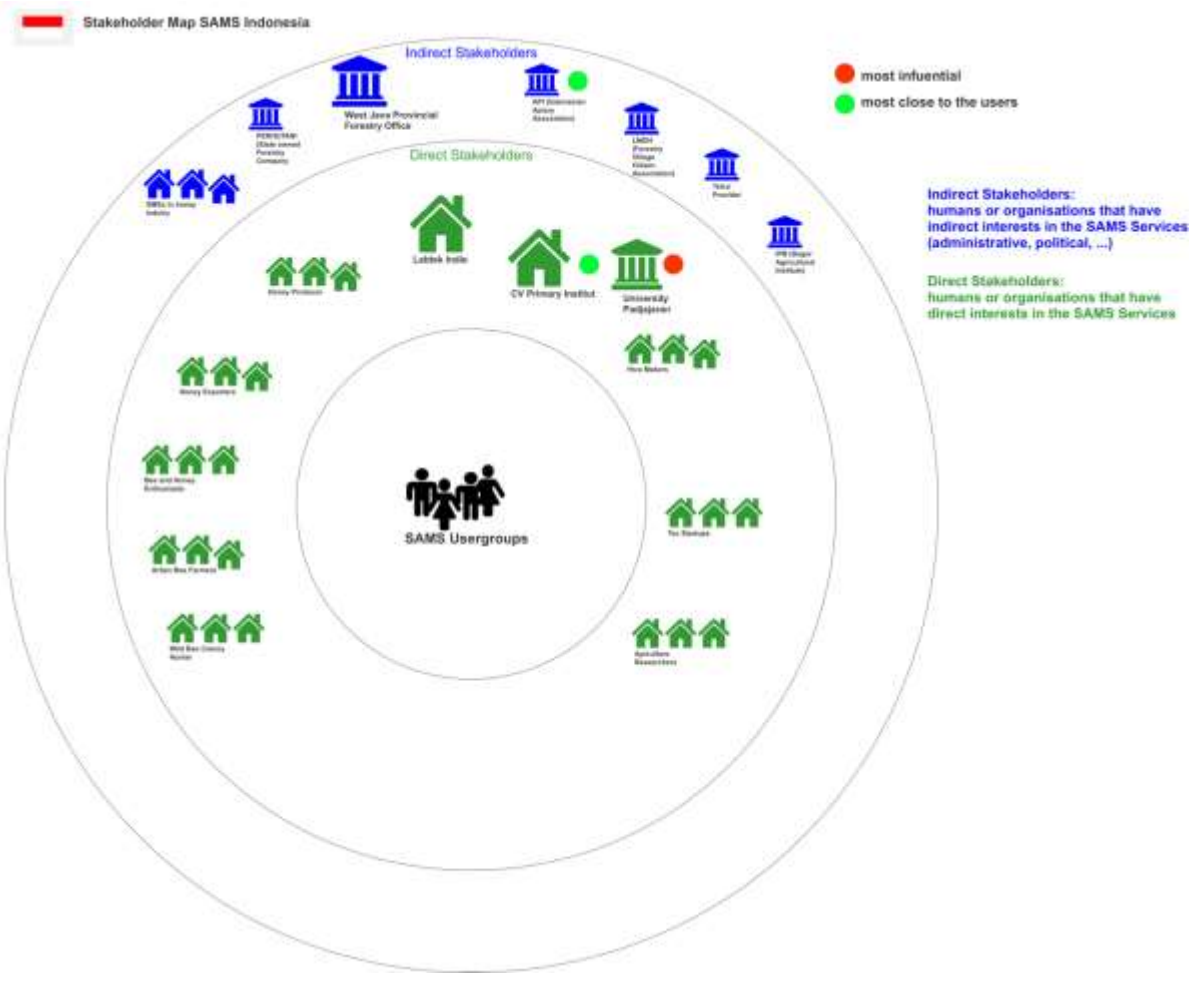


Figure 10: Stakeholders in Indonesia – first approach

This initial stakeholder mapping is currently under revision in Indonesia. The coming update will be more detailed and more specific to selected sites.

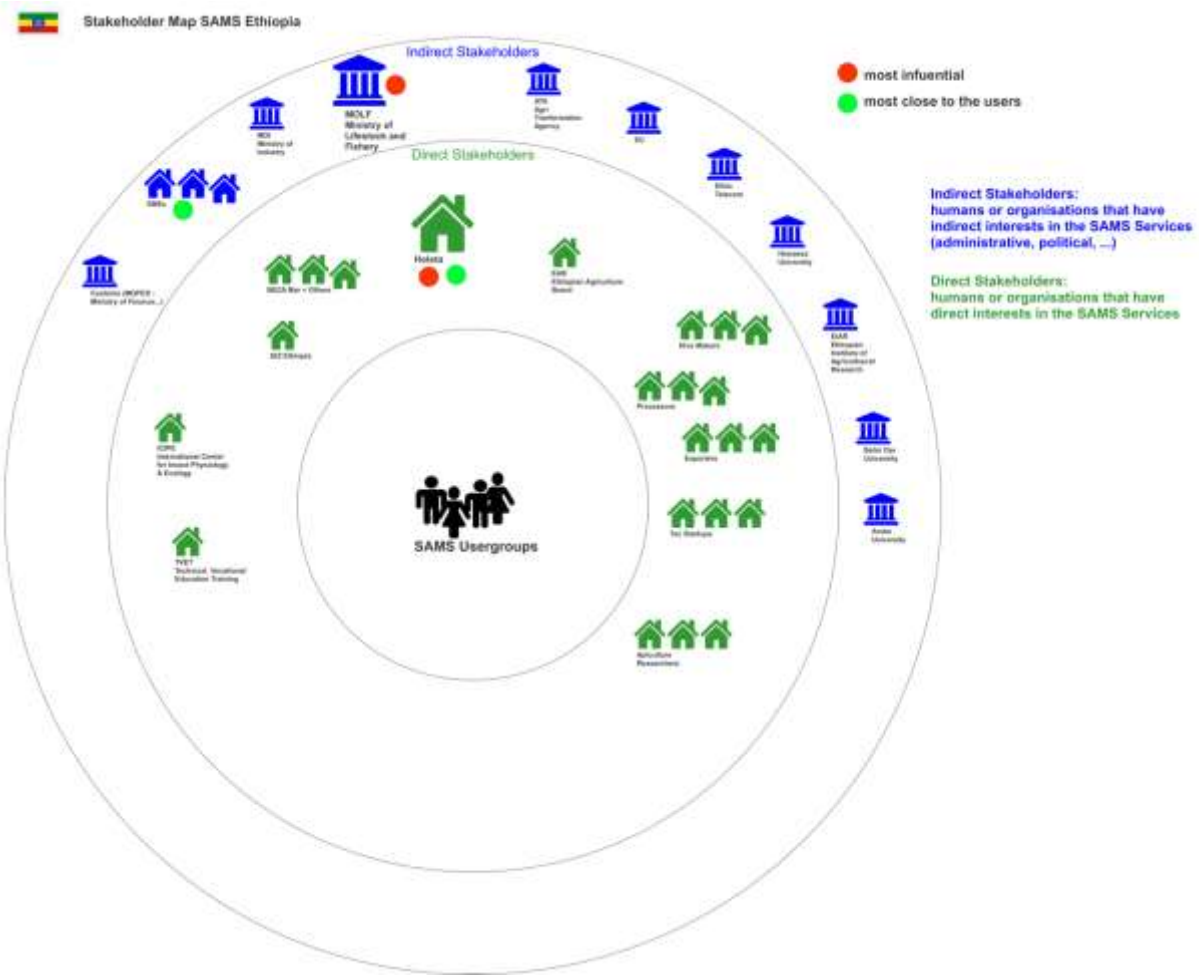


Figure 11: Stakeholders in Ethiopia – first approach

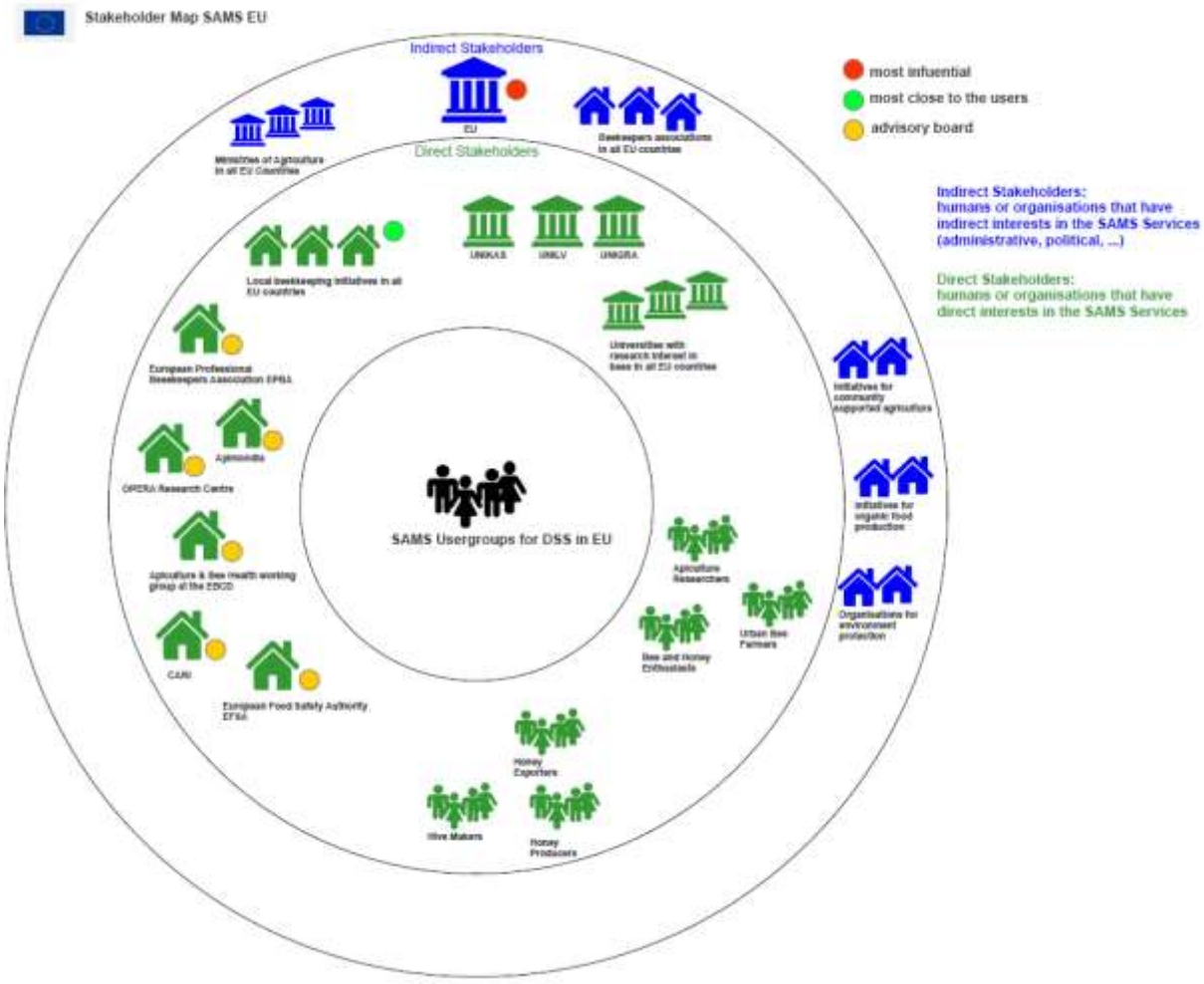


Figure 12: Stakeholders in EU – first approach

3.1.2.2 Methodological Approach to Stakeholder Mapping

Goal of the mapping is to show which stakeholders are relevant for each country, who of them have indirect and who direct interest in SAMS and who are most influential and closest to future SAMS users.

In UCD, stakeholders are defined very specifically. They are individuals or organizations having a right, share, claim or interest in an **interactive system** or in its possession of characteristics that meet their needs and expectations.

Therefore, it is very important to differentiate between stakeholders for the whole SAMS project context who can be for example political or organizational and those who are presumably directly interested on one or more of the SAMS products.

To understand how stakeholder's interests will influence the future SAMS products and services it is important to perform a very thorough and site-context specific research. This research is presently ongoing. The product and context specific stakeholder analysis will be completed and detailed during user research phase two.

3.2 Context of Use Analysis

3.2.1 The European Apiculture Sector – Preconditions and Regulations

3.2.1.1 Quality Requirements

The European Union defines specific composition and quality rules/ criteria for honey (Council Directive 2001/110/EC). The following criteria are set out: Sugar content (Fructose and Glucose content, Sucrose content), Moisture content, Water-insoluble content, Electrical conductivity, Free Acidity, Diastase activity and Hydoxymethylfufural content (HMF). Requirements for labelling, presenting and advertising of foodstuffs as honey are also set out under Directive 2001/110/EC. In addition, the EU Regulation No 1169/2011, which provides food information to consumers, is also applicable to bee products.

Honey with traces of pollen from genetically modified crops need special authorization and labelling before importing to the EU (Regulation 503/2013).

European Union legislation recommends that the honey sector support the development of guidelines based on relevant codes of practice of the Codex Alimentarius.

The Directive 2014/63/EU clarifies the labelling requirements where honey originates in more than one EU country or a non-EU country.

Directive 2014/63/EU allows the European Commission to adopt further laws (delegated acts) laying down two parameters for the criterion of 'mainly' as regards the floral or vegetable origin of honey and the minimal content of pollen in filtered honey following removal of foreign inorganic or organic matter.

The EU Regulation 2017/625 contains measures that could help to fight honey adulteration fraud by producers both in and outside the EU.

3.2.1.2 Market Structure [14]

Even as the second biggest honey producer, the EU cannot cover the demand of customers in the EU market. In 2017, there were around 600,000 beekeepers, with 17 million beehives, which produces between 200,000 t and 250,000 t of honey and the deficit to the actual demand were covered by imports from other countries as China or Ukraine. Under consideration of the SAMS project, Ethiopia and Indonesia does not play a key role as import countries for the EU

[14] European Parliament (2017): At a glance. The EU's beekeeping sector. URL: http://www.europarl.europa.eu/RegData/etudes/ATAG/2017/608786/EPRS_ATA%282017%29608786_EN.pdf (access: 19.9.2018)

yet. Besides the fact that the EU cannot cover its own demand, they also do export around 20,000 t to e.g. Japan, USA or Switzerland. [15]

Through threats to bee health and market, competition the economic viability of apiculture has reached a critical stage. Outbreaks of animal diseases, intensive agriculture, exposure to chemicals as well as habitat loss and adverse climatic conditions can threaten the productive capacity of beehives and production costs of EU beekeepers in comparison to international competitors. Available honey products in the EU are not just honey, but also pollen, propolis, royal jelly and beeswax. The EU promotes beekeeping and sustainable agriculture through different policies.

3.2.1.3 Laws and Regulations

Regulations to strengthen beekeeping are directly or indirectly anchored within agricultural policies. The aim is to improve farming activities and to have a sustainable impact on beekeeping. That is why the EU has funds for apiculture activities, like research or monitoring, available. Overall the EU provides 216 million € (allocated to no° of beehives) between 2017 – 2019 to their member states to facilitate sustainable activities to ensure application of food and feed law, rules on animal health and welfare, plant health and plant protection products (Regulation (EU) 2017/625). [16]

EC Directives and Regulations concerning Honey:[17]

- Honey Directive 2001/110/EC
- Regulation 470/2009 (Residues of pharmaceutical active substances)
- Regulation 37/2010 (MRLs of pharmaceutical active substances)
- Regulation 396/05 amended by 149/2008 (Pesticides)
- Regulation 178/02 (Food Safety)
- Regulations 852/04, 853/04 and 854/04 (Hygiene)
- Directive 96/23/EC (Monitoring Programme)
- Decision 2010/327/EC (List of Third Countries)

[15] European Parliament (2018): Key facts about European's honey market (infographic). URL: http://www.europarl.europa.eu/news/en/headlines/economy/20180222STO98435/key-facts-about-europe-s-honey-market-infographic (access: 19.9.2018)

[16] European Commission: National Apiculture Programmes. URL: https://ec.europa.eu/agriculture/honey/programmes_en (access: 19.9.2018)

[17] Quality Services International GmbH (2010): Vietnam Symposium. URL: https://www.apimondia.com/symposia/2010/vietnam/Honey%20quality%20requirements%20of%20the%20European%20market%20-%20Klaus%20Beckmann%20-%20Hanoi%202010.pdf (access: 19.9.2018)

3.2.1.4 Trading Schemes

Based on the fact that production costs for EU beekeepers are high compared to international standards, the EU does not focus on exporting honey. Compared to 1 kilo exported EU honey (5.69 €), one kilo of imported honey does only costs 2.23 €.

Imports to Europe have to comply with these legally binding requirements. In addition, the products have to be traceable, hygienic and fulfil certain control aspects (General Food Law of the European Union - Regulation (EC) No 178/2002). Imported honey must be accompanied by a health certificate signed and stamped by a veterinary officer authorized by the relevant authorities of the exporting country (Regulation (EC) 1664/2004) and should not exceed the EU Maximum Residue Levels (MRLs) for pesticides in food products (Regulation 396/2005). Honey with traces of pollen from genetically modified crops needed special authorization and labelling before importing to the EU (Regulation 503/2013).[18]

European Union legislation recommends that the honey sector support the development of guidelines based on relevant codes of practice of the Codex Alimentarius.[19]

The EU Regulation 2017/625 contains measures that could help to fight honey adulteration fraud by producers both in and outside the EU.[20]

3.2.2 The Ethiopian Apiculture Sector

Around 1.8 million beekeeper and beekeeper associations are existing in Ethiopia, but limited by access to modern beehive equipment, low organization and networking among beekeepers regarding knowledge-exchange, collaboration and low access to markets to increase revenues[21]. Additional, pesticides in agriculture limit bee-health and subsequently revenues. According to the IMPS project[22], Ethiopia was one of the five biggest beeswax exporters to the world market in 2000. The apiculture sector is behind his potential due to lack of improved bee management systems, low quality of hive products and lack of skill by beekeepers. In 2004, Ethiopia exported 15,720 t honey and 305 t beeswax. A survey among beekeepers showed high interest in an uptake of modern technology training, demonstration and support is being

[18] European Commission: Trade and Import. URL: https://ec.europa.eu/food/animals/live_animals/bees/trade_en (access: 21.9.2018)
[19] European Commission: Trade and Import. URL: https://ec.europa.eu/food/animals/live_animals/bees/trade_en (access: 21.9.2018)
[20] European Parliament (2017): At a glance. The EU's beekeeping sector. URL: http://www.europarl.europa.eu/RegData/etudes/ATAG/2017/608786/EPRS_ATA%282017%29608786_EN.pdf (access: 19.9.2018)
[21] Klas (2016): Innovation Factory – Part 1. A closer look at the buzz around bees in Ethiopia
[22] Shiferaw A., Jaleta M., Gebremedhin B., Hoekstra D. (2010): Increasing economic benefit from Apiculture through value chain development approach: The case of Alaba special district, Southern Ethiopia. Project "Improving Productivity and Market Success of Ethiopian farmers (IPMS)", Canadian International Development Agency & International Livestock Research Institute Ethiopia, March 2010

provided. Current performance is low due to low quality products and usage of agricultural chemicals at times when bees are active. Currently beekeepers are thinly scattered all over the country due to lack of beekeeping knowledge, shortage of trained manpower, shortage of beekeeping equipment, pests and predators as well as inadequate research and extension services.

These are:

- No recorded data on location of beekeepers, yield, production rate, frequency of harvest, problems of apiculture, market linkages and market systems
- No relationships between beekeeper or beekeeper associations, marketing institutions
- Management of beehives needs attention and improvement
- Transitional beehives (unlike modern beehives) does not need accessories for harvest therefore farmers find it more attractive compared to pure honey price extracted from modern beehives

Land access is critical challenge for unemployed youth and women, beekeeping gives them an opportunity to build their own businesses and reduce their dependency on diminishing land access. Within Ethiopia, the Ministry of Agriculture 2013 (MoA 2013) identified specific targets by 2025[23] these targets are:

- Increase of annual honey production from 50,000 t to 200,000 t (500,00 t potential)
- Increase of annual beeswax production from 3,800 t to 12,000 t (50,000 t potential)
- Increase of annual honey export from 400 t to 2,400 t and annual export revenues from 1.5 million US$ to 8 million US$ Increase of annual beeswax export from 400 t to 1,000 t and annual export revenues from 1.4 million US$ to 5 US$

The MoA 2013 calls for training and capacity building to overcome poor pre- and post-harvest management as well as extension of bee products processors (currently 14 in Ethiopia) and access to marketing options for small-scale beekeepers. The vulnerability to climate change shall be overcome by development of resilience mechanism for Ethiopian beekeepers. SAMS can be a decisive tool to trigger these challenges and to achieve the national target for 2025.

[23] Ministry of Agriculture (2013): Apiculture value chain vision and strategy for Ethiopia , International Livestock Research Institute, Addis Ababa, ISBN: 92–9146–410–4

3.2.3 The Indonesian Apiculture Sector

According to Madu Bina Apiari (2015) [24], Indonesia has huge natural and human resources for beekeeping with tropical rain forests of ca. 105 Mio ha and Mangrove forest of ca. 3.5 Mio ha, rubber (3.5 Mio ha), oil palms (6 Mio ha), coffee, tea, nuts, citric fruits, rice, corns, beans etc. The European honeybee was introduced 40 years ago, but due to plantations (eucalyptus, palm oil and rubber), the domestic honeybees such as Apis Dorsata and Apid Cerana Indica are more common known. The apiculture sector is developing slowly by two constrains: 1st weak beekeeper rate of organisation among each other (market power) and 2nd low rate of professional processing, support and marketing (know-how) such as in China (small beekeepers are organized in big-scale organisation, providing training, funding, queen-bees, equipment, bee-medicine and marketing). Reasons for these constraints are the lack of governmental support and funding, as beekeeping is not the priority program, which corresponds with weak research and development activities as well as high rates of self-organisation, marketing and no professional interconnection with bee products processing companies. Geographically, Indonesia consists of more as 17,000 islands, making transport and smart organisation difficult.

Directives and regulations concerning honey and honey business are not developed and therefore not comparable to EU (or US, Australian etc.) requirements. This is a challenge for exporters of honey products.

Quality assurance and certification of honey and honey products are among the major goals of SAMS partners in Indonesia. EU regulations can most likely not be adapted immediately one-to-one because of very specific tropical and cultural conditions and enormous diversity of Indonesian island regions.

SAMS will be implemented in Central Java, where many beekeeping initiatives have been initiated and promoted by government owned organizations.

For SAMS it is valuable to look more closely into the frame conditions for beekeeping in possible implementation areas. The Partner CV.Primary describes the situation for Gunung Arca as followed:

> Like many other beekeeping areas in Indonesia, the beekeeping activity in Gunung Arca is allocated and initiated by PERHUTANI, a government owned company under the Ministry of Forestry.
>
> PERHUTANI has the duty and authority to carry out planning, management, exploitation and protection of forests in its working area. In the 70s, Indonesia's Ministry of Forestry instructed a preservation of Gunung Arca by planting Calliandra on it, as it was believed that Calliandra

[24] Madu Pina Apiari (2018): Development of Beekeeping in Indonesia. URL: http://madubinaapiari.co.id/development-of-beekeeping-in-indonesia/ (access: 21.9.2018)

could start the growth of other plants. This Calliandra plantation then became the attraction for bees to swarm to Gunung Arca in the 80s.

This occurrence led an opportunity for PERHUTANI to invest in beekeeping in order to gain profit. With the support from the government and foreign aid at that time, Indonesia was able to import Apis Mellifera from Australia. The supporting ecosystem of Gunung Arca then started Gunung Arca's glorious era for beekeeping activities in the 90s. Gunung Arca then became one of Indonesia's largest development centres for beekeeping.

In the 2000s, the beekeeping trends in Gunung Arca started to go downhill. This condition was caused by many things, few of them are:

- the impact of climate change in 2010, it was raining season all year long,
- foreign aid discontinuity,
- Orders from the government which demanded PERHUTANI to gain larger profit from export. Meanwhile Indonesia's honey quality still could not meet international standards yet**.**

Support from government also gradually decreased, combined with the unsynchronized policies from across relevant ministries who had intersected interests.

Until now, PERHUTANI still keeps the beekeeping training center building at Gunung Arca but discontinued the activities and the maintenance of the facility.

PERHUTANI's effort was to increase Indonesia's export earnings through pine export, therefore pine plantation increased. This effort took up Calliandra plantation area. As the amount of Calliandra has decreased, the sustainability of beekeeping ecosystem was reduced.

At the same time, the Ministry of Forestry instructed the development of goat breeding. Because of the unorganized allocation of the goat breeders, goats had endangered the bee's ecosystem by eating the same plants that sustain bees' lives. Unstable and unorganized proportions of goat's existence eventually contributed to harming the sustainability of the bee's ecosystem.

3.2.4 Preconditions for SAMS Beehives

In Europe, the modern beehive or Dadant beehive is usually used by beekeepers. Partners in Kassel developed the SAMS hardware based on modern beehives. Therefore, research on beehive types used in non-EU partner countries was performed in user research phase one.

From site visits during user research phase one and in context with the user research country workshops a lot of information about the as-is situation of beekeeping was collected and documented.

A thorough report about preconditions for beehives can be found in Deliverable 5.1 – Bee-Management and Bee-Health Indicators. The following chapter summarizes some learnings from inquiries done during user research phase one and workshop site visits.

3.2.4.1 Availability of Beehive Modules

Table 2: Current Beehive Modules in Ethiopia and Indonesia

Ethiopia	**Indonesia**
Type of Beehives in Use	
Three types of hives are used in Ethiopia, traditional hives, transitional hives and modern box beehives. Some beekeepers use all three types of hives, because modern beekeeping is still in a process of introduction.  Figure 13: Traditional Hives in Ethiopia  Figure 14: Transitional Hives in Ethiopia  Figure 15: Modern Hives in Ethiopa	In Indonesia, we found mostly one Chamber box beehives in use.  Figure 16: Box Beehives in Indonesia

Conclusion:

In Ethiopia, SAMS has to be implemented in modern beehives, a manual on beehive construction is described in D3.1 – SAMS Manual on Beehive Construction and Operation. This will require to provide beekeepers with suitable hives and to train them to manage those hives.

In Indonesia SAMS systems can basically be integrated in the used box beehives. The usage of a SAMS beehive would be preferable because the box beehives in use are of different size.

Concerning beehive management and honey harvesting, practices are divers and strongly dependent on hive type, bee type, available technical equipment and education of the beekeepers.

As SAMS beehives will require a constant and professional beehive management, the integration, education and support for beekeepers is essential.

First SAMS systems need to be set up where there is professional management or close supervision by professional apiculture experts. This fact was considered for the decision on first site location.

3.2.4.2 Economic Framework

3.2.4.2.1 Energy

Energy supply with photovoltaic technology is only feasible for locations with enough sun exposure. Beehives, which are located in forests, might not met this requirement.

Conclusion: Alternative concepts of remote energy supply or battery usage have to be considered.

3.2.4.2.2 Telecommunication

In Indonesia, telecommunication and mobile internet is available in all regions.

In Ethiopia, supply of mobile internet or telecommunication is not reliable/ stabile. This applies to cities and worsens in remote areas.

Conclusion: For SAMS local data storage and traditional transfer on data media need to be planned.

3.2.4.3 Climate and Environmental Factors

Especially in Indonesia the on-site measurement of local climate and environmental data like air temperature, humidity, precipitation etc. are considered to influence the research of climate and environmental changes on SAMS beehives.

3.2.5 Social Structures

3.2.5.1 Cultural Background

3.2.5.1.1 Categorization according to Hofstede[25]

The following diagram shows four of six cultural dimensions according to Hofstede (Hofstede, 2018) – *Germany represents the EU Partners for the Hofstede-Analysis*.

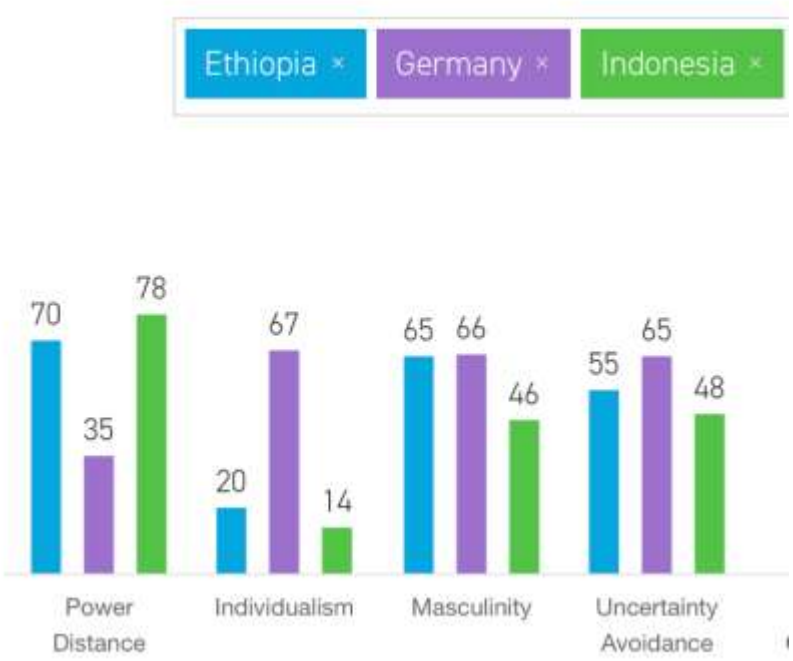


Figure 17: Cultural Dimensions according to Hofstede

Analysis of cultural dimensions generated by Hofstede, 2018[26]:

POWER DISTANCE

This dimension deals with the fact that not all individuals in societies are equal – it expresses the attitude of the culture towards these inequalities amongst us. Power Distance is defined as ***the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally***. (Hofstede, 2018)

[25] Hofstede Insights (2018): Compare Countries. URL: https://www.hofstede-insights.com/product/compare-countries/ (access: 21.9.2018)
[26] Hofstede Insights (2018): Compare Countries. URL: https://www.hofstede-insights.com/product/compare-countries/ (access: 21.9.2018)

Ethiopia scores high on this dimension (score of 70) which means that people accept a hierarchical order in which everybody has a place, and which needs no further justification. Hierarchy in an organization is seen as reflecting inherent inequalities, centralization is popular, subordinates expect to be told what to do and the ideal boss is a benevolent autocrat. (Hofstede, 2018)

Indonesia scores high on this dimension (score of 78) which means that the following characterizes the Indonesian style: Being dependent on hierarchy, unequal rights between power holders and non-power holders, superiors in-accessible, leaders are directive, management controls and delegates. Power is centralized and managers count on the obedience of their team members. Employees expect to be told what to do and when. Control is expected and managers are respected for their position. Communication is indirect and negative feedback hidden. High Power Distance also means that Indonesian co-workers would expect to be clearly directed by the boss or manager – it is the classic Guru-Student kind of dynamic that applies to Indonesia. Westerners may be considerably surprised with the visible, socially acceptable, wide and unequal disparity between the rich and poor. (Hofstede, 2018)

Germany Highly decentralized and supported by a strong middle class, Germany is not surprisingly among the lower power distant countries (score 35). Co-determination rights are comparatively extensive and have to be taken into account by the management. A direct and participative communication and meeting style is common, control is disliked and leadership is challenged to show expertise and best accepted when it is based on it.

INDIVIDUALISM

The fundamental issue addressed by this dimension is ***the degree of interdependence a society maintains among its members***. It has to do with whether people´s self-image is defined in terms of "I" or "We". In Individualist societies people are supposed to look after themselves and their direct family only. In Collectivist society's people belong to 'in groups' that take care of them in exchange for loyalty.

Ethiopia, with a score of 20 is considered a collectivistic society. This is manifest in a close long-term commitment to the member 'group', be that a family, extended family, or extended relationships. Loyalty in a collectivist culture is paramount, and over-rides most other societal rules and regulations. The society fosters strong relationships where everyone takes responsibility for fellow members of their group. In collectivist societies offence leads to shame and loss of face, employer/employee relationships are perceived in moral terms (like a family link), hiring and promotion decisions take account of the employee's in-group, management is the management of groups. (Hofstede, 2018)

Indonesia, with a low score of (14) is a Collectivist society. This means there is a high preference for a strongly defined social framework in which individuals are expected to conform to the ideals of the society and the in-groups to which they belong. One place this is visible clearly is in the aspect of the Family in the role of relationships. For example, In Indonesia, if one wishes to marry, it is important to meet a woman's family because the family is so important to her. If a man wants to be taken seriously by a woman, he has to visit the latter's family and introduce himself formally to the parents of the girl. It is inappropriate to court a woman and

formalize the relationship without informing the parents of the girl first. Another example of collectivist culture of Indonesia is in the equation between child and parent (Hofstede, 2018)

Indonesian children are committed to their parents, as are the parents committed to them all their growing lives. Their desire is to make their parents' life easier. There is a desire to take care of parents and give them support in their old age. There is an Asian saying that is accepted in Indonesia, "You can get another wife or husband but not another mother or father". This family loyalty is also apparent in the fact that Indonesian families keep elders (such as grandparents) at home instead of sending them to any institution. In Individualist societies, the focus is on the nuclear family only. (Hofstede, 2018)

The **German** society is a truly Individualist one (67). Small families with a focus on the parent-children relationship rather than aunts and uncles are most common. There is a strong belief in the ideal of self-actualization. Loyalty is based on personal preferences for people as well as a sense of duty and responsibility. This is defined by the contract between the employer and the employee. Communication is among the most direct in the world following the ideal to be "honest, even if it hurts" – and by this giving the counterpart a fair chance to learn from mistakes. (Hofstede, 2018)

MASCULINITY

A high score (Masculine) on this dimension indicates that the society will be driven by competition, achievement and success, with success being defined by the winner / best in field – a value system that starts in school and continues throughout organizational life.

A low score (Feminine) on the dimension means that the dominant values in society are caring for others and quality of life. A Feminine society is one where quality of life is the sign of success and standing out from the crowd is not admirable. ***The fundamental issue here is what motivates people, wanting to be the best (Masculine) or liking what you do (Feminine)***.

Ethiopia scores 65 on this dimension and is thus a Masculine society. In Masculine countries people "live in order to work", managers are expected to be decisive and assertive, the emphasis is on equity, competition and performance and conflicts are resolved by fighting them out.

Indonesia scores (46) on this dimension and is thus considered low Masculine. While not entirely like most North European countries, who are very low in Masculinity and thus considered Feminine, Indonesia is less masculine than some other Asian countries like Japan, China and India. In Indonesia, status and visible symbols of success are important but it is not always material gain that brings motivation. Often it is the position that a person holds which is more important to them because of an Indonesian concept called "gengsi" – loosely translated to be, "outward appearances". It is important that the "gengsi" be strongly maintained thereby projecting a different outward appearance aimed at impressing and creating the aura of status.

In Feminine countries the focus is on "working in order to live", managers strive for consensus, people value equality, solidarity and quality in their working lives. Conflicts are resolved by

compromise and negotiation. Incentives such as free time and flexibility are favored. Focus is on well-being, status is not shown. An effective manager is a supportive one, and decision-making is achieved through involvement. In contrast, Masculine countries and to an extent lower Masculine countries that do not score too low on the scale to be called Feminine countries, display the traits of the Masculine societies but in a lesser degree.

With a score of 66 **Germany** is considered a Masculine society. Performance is highly valued and early required as the school system separates children into different types of schools at the age of ten. People rather "live in order to work" and draw a lot of self-esteem from their tasks. Managers are expected to be decisive and assertive. Status is often shown, especially by cars, watches and technical devices. (Hofstede, 2018)

UNCERTAINTY AVOIDANCE

The dimension Uncertainty Avoidance has to do with the way that a society deals with the fact that the future can never be known: should we try to control the future or just let it happen? This ambiguity brings with it anxiety and different cultures have learnt to deal with this anxiety in different ways. ***The extent to which the members of a culture feel threatened by ambiguous or unknown situations and have created beliefs and institutions that try to avoid these*** is reflected in the score on Uncertainty Avoidance.

Ethiopia received an intermediate score of 55 on this dimension.

Indonesia scores (48) on this dimension and thus has a low preference for avoiding uncertainty. This means that there is a strong preference in Indonesia toward the Javanese culture of separation of internal self from external self. When a person is upset, it is habitual for the Indonesian not to show negative emotion or anger externally. They will keep smiling and be polite, no matter how angry they are inside. This also means that maintaining work place and relationship harmony is very important in Indonesia, and no one wishes to be the transmitter of bad or negative news or feedback. Another aspect of this dimension can be seen in Conflict resolution. Direct Communication as a method of conflict resolution is often seen to be a threatening situation and one that the Indonesian is uncomfortable in. A tried and tested, successful method of conflict diffusion or resolution is to take the more familiar route of using a third-party intermediary, which has many benefits. It permits the exchange of views without loss of face as well as since one of the main manifestations of Indonesia's Uncertainty Avoidance is to maintain the appearance of harmony in the workplace; an intermediary removes the uncertainty associated with a confrontation. (Hofstede, 2018) Perhaps one very key phrase in Indonesia that describes how this works is "Asal Bapak Senang" (Keep the Boss Happy). The reason is multifold; but if you extrapolate to UAI dimension, you can see that keeping the boss happy means you will be rewarded and if you are rewarded you have no economic or status uncertainty, as you will keep being a valuable member of the company. (Hofstede, 2018)

Germany is among the uncertainty avoidant countries (65); the score is on the high end, so there is a slight preference for Uncertainty Avoidance. In line with the philosophical heritage of Kant, Hegel and Fichte there is a strong preference for deductive rather than inductive approaches, be it in thinking, presenting or planning: the systematic overview has to be given in order to proceed. This is also reflected by the law system. Details are equally important to

create certainty that a certain topic or project is well thought out. In combination with their low Power Distance, where the certainty for own decisions is not covered by the larger responsibility of the boss, Germans prefer to compensate for their higher uncertainty by strongly relying on expertise.

Conclusions on cultural related challenges:

The partner countries show significant cultural differences compared to Germany (which was chosen as a representative for EU countries for the analysis), especially concerning power distance and individualism versus collectivism. This has to be considered always, when communication with stakeholders as well as for the organization of collaborative work.

Special attention has to be given to the power distance factor as UCD requires many team processes that benefit from low hierarchy levels.

It will be very important to include all influential stakeholders in the countries and to rely on the experience of the country partners how to approach them and how to maintain their interest and support.

3.2.5.2 Gender Aspects

In both countries, beekeeping is almost exclusively performed by men. Interviewed experts and beekeepers explain this with the fact that traditional beekeeping is very hard physical work, which includes climbing trees in order to harvest traditional hives.

In Indonesia, wives and daughters of beekeepers are the ones helping with beekeeping. There is an assumption that women could be rather involved in processing of honey and wax than being beekeepers themselves.

A small percentage of women attends beekeeping training in Sukabumi, one of the SAMS partner regions. There is intention to raise this numbers and encourage women to be beekeepers.

In Ethiopia, there is a very small percentage of female beekeepers. Some women cooperatives working with modern hives exist. There is a wish to give more women access to beekeeping and find female beekeepers who can be role models for others.

3.2.5.3 Educational Aspects

Both countries face the challenge of language diversity. In West-Java, some beekeepers speak Sundanese much better than Indonesian. Ethiopia has approximately 90 different languages. For SAMS Amharic and Oromiffa are the most relevant ones, later maybe also Tigrinya.

Literacy level and language diversity are closely connected. Especially in Ethiopia, grammar school lessons are conducted in local languages and Amharic is only second language, which can result in lower literacy in Amharic. Products and applications have to be provided in at least two or three languages or have to be designed in a way that users with low literacy skills can still operate them. Due to the long process of developing the DSS and ASS based on

findings and different interpretations, SAMS will face the challenge of being able to fulfil this aspect and to provide the different systems in different languages until the project ends.

The level of education among the beekeeper user groups in both countries will be very diverse. Beekeepers in urban areas are more likely to have higher education.

3.2.5.4 Training Requirements

Cultural dimensions as well as educational aspects do have an impact on training requirements. Based on the findings each region needs a different training approach to overcome culture specific aspects.

Based on the literacy level it is also expected to use different tools for training such as videos and work together with local training academies to overcome challenges. This is especially important for maintenance and repairing aspects, which will occur at one point while using the systems. Conclusively training requirements can only be planned after further investigation of target communities and their beekeeping practices as well as first tryouts of SAMS systems with beekeepers. First site visits and first data of the ongoing user research phase two indicates that beekeeping practice, especially of small-hold beekeepers, is strongly affected by traditional customs that are significantly different from modern beehive management requirements.

It is expected that pure knowledge transfer about modern beekeeping will not be enough to enable beekeepers to benefit from SAMS technology. Beyond that, it will be necessary to convince beekeepers to change their life long habits of beehive treatment.

Along with the UCD process, specific training requirements will be identified and integrated with other user requirements for SAMS products.

3.2.5.5 Information Channels

West-Java in Indonesia has full internet coverage; city population seems to practice intense usage of internet and social media. Smart phones are very common. To what extend this is also true for the beekeeper user group has to be investigated. Mostly the currently active beekeepers are the first generation on beekeeping activity, their average age is above 40 years. Smartphone users among them are rare.

In Ethiopia, internet connection outside of towns is not reliable. Mobile phone services have often only slow connections. Therefore, radio and TV services have more importance.

3.2.5.6 Data Protection

Data protection strategies are described in D1.9 – Initial Data Management Plan. In general, the awareness for data protection is lower in the partner countries Ethiopia and Indonesia as we do experience it in Europe.

3.2.5.7 Business Modelling along the Honey Value Chain

Both countries express the need of a further development of business opportunities along the honey value chain. Stakeholders and possible partners have therefore been integrated in the user research process. In Indonesia, the activities are presently focused on the development of honey products and quality insurance of honey.

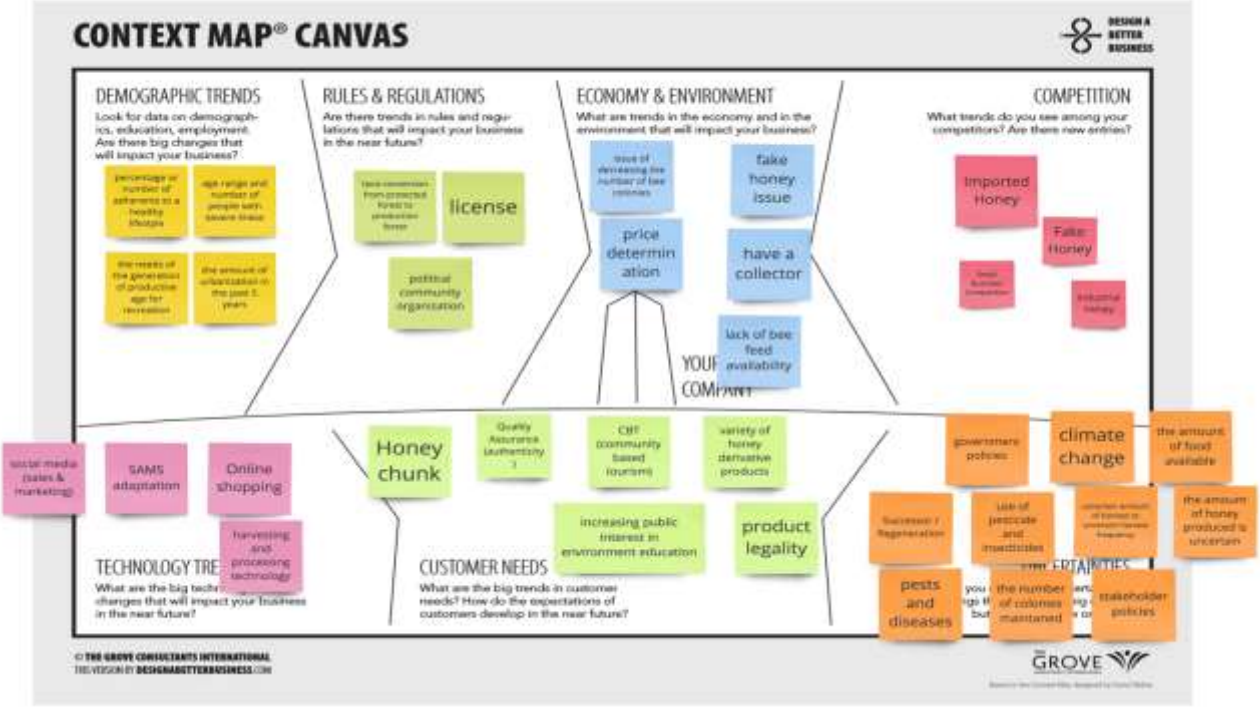


Figure 18: Context Map Canvas for Bee Product Business in Indonesia (UNPAD)

Quality of honey is also one focus in Ethiopia to enable producers to reach proven export quality for EU countries.

3.3 Predicted User Groups

The SAMS application defines the following **target groups** for the complete SAMS project scope:

- **Existing and potential beekeepers** (farmers, households, cooperatives)
- **Apiculture input supplier**
- **Bee related experts (**research institutes, bee health associations, NGOs, apiculture networks)
- **Facilitator** (government agencies, training centers, rural extension services)
- **Agripreneurs**
- **SAMS data beneficiaries** (external research institutions, climate experts, agriculture institutions)
- **Market participants** (trader, distributer, retail, consumer)

The User Centered Design process requires to identify user groups with similar personal characteristics who have a context of use related to the future interactive systems. These user groups are a subset of the target group. Both country teams formulated user groups who will be relevant for future interactive SAMS products.

There are also different user groups within the EU, but they can resort to existing solutions. Therefore, the EU stakeholder will focus on the DSS / collected data / comparisons and doing research.

Especially in Indonesia, there is the idea to inspire youth to become new beekeepers or new bee product entrepreneurs. The assumption is that it takes more effort to teach the existing beekeepers, who have an age above 40 years, how to operate a SAMS beehive than to teach the younger generation in beekeeping with IoT support.

Figure 19: Predicted User Groups for DSS and ASS in Ethiopia

Figure 20: Predicted User Groups for DSS and ASS in Indonesia

There are significant differences between the two countries. Both for example have a user group “beekeeper” but differ according to the categorization of this group. The extension worker, who is a locally working expert in Ethiopia and is only a phenomenon there, helps to transfer new knowledge to farmers.

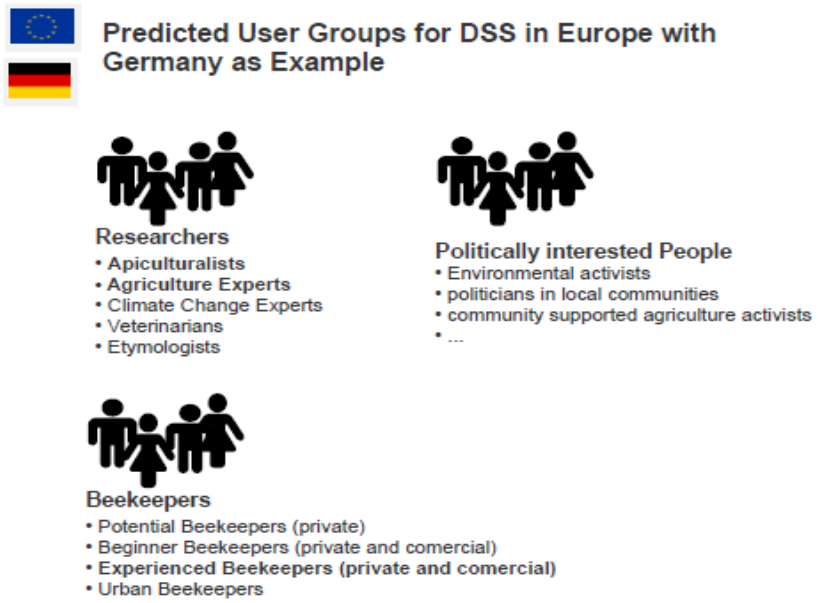


Figure 21: Predicted User Groups for DSS in EU

There are also differences between the two countries and the EU. Both for example have a user group “beekeeper” but differ according to the categorization of this group. In the EU, beekeepers are mostly organized in professional associations or non-profit associations.

These and further differences will be more profoundly investigated in user research phase two. According to the findings, the user group identification will be specialized for the actual products.

4 Country User Research Workshops

The country user research workshops were held to establish co-working among the UCD teams, to go some steps of user research together and to give the European partners fom the Universities of Kassel (Germany), Graz (Austria) and Jelgava (Latvia) more insight and understanding of the local context.

Each workshop consisted of three core actions: involvement of stakeholders and experts through group discussions, site visits and teambuilding activities.

All results of the workshops will be added to the user research documentation in form of persona descriptions, context of use descriptions, as-is scenarios etc. after being translated into English and evaluated. Therefore, the following sections give solely a brief overview of the activities.

4.1 Expert Discussions

In order to collect expert knowledge and at the same time initiate exchange between the local experts, each workshop included a group discussion day.

4.1.1 World Cafe in Indonesia

In Indonesia, a World Cafe facilitated by CV.Primary was performed and brought together a large and quite diverse group.

Small round tables were set up with 4-6 chairs. After a short warm up and explanations from the moderator three thirty-minutes discussion rounds were performed. After each round, the tables were remixed.

The following questions have been discussed during the World Cafe:

- What knowledge do you have about beekeeping in Indonesia & what do you consider as important about bee keeping in Indonesia?
- From the previous discussion, what kind of problems could you see/ identify?
- If there is a solution, which can solve any problem of beekeeping, what do you think is the most important thing to do?

Results were recorded on task cards, later grouped into topic clusters and documented.

Figure 22: Result Documentation of Group Discussion

The discussion has been carried out in Indonesian language to not lose any important facts or information, through translating into English. As mentioned, everything has been documented and translated by our local partners.

4.1.2 Focus Group Discussions in Ethiopia

In Ethiopia, the setting of the group discussion took place in a different way with two topic related focus groups – one with local honey business representatives and experts and the second group consisted of scientists from Holeta Oromia Agricultural Research Institute. Representatives and experts of the local honey business discussed the possible challenges and benefits of SAMS system for the honey market in Ethiopia while the second group discussed potential scientific benefits of SAMS as well as risks and challenges of introducing such systems to the local beekeepers.

The discussion has been carried out in Amharic and English language.

4.2 Site Visits

Due to language barriers, the site visits' main purpose was to get hands on impressions on living circumstances of regional beekeepers and how beekeeping is practiced. The results now help the team in Kassel to develop appropriate hardware prototypes. They also laid a foundation for user research phase two actions presently in progress.

4.2.1 Indonesia

Summary Indonesia by Sascha Fiedler, University of Kassel:

Essential aspects of beekeeping with *Apis cerana* in Indonesia

The statements are based on interviews with four beekeepers on Java in Indonesia from July 2018. They are not based on a scientific investigation and are merely intended to convey an impression and show a tendency.

Problems and strategies

In some regions, there are reports of weight loss, which can lead to crop failure or decline of bee colonies. Pesticide use, disturbances through predators like fox and wasp, as well as unnoticed swarming of bee colonies, are often seen as a cause of colonial decline. Robbery by other bee colonies at low season, when little pollen and nectar is found in nature, is reported as another cause. In addition, the market and its often low quality standards represent a hurdle. There is great competition with sweetened and very cheap honey. In general, the productivity of the species *Apis cerana* is considered to be low. Major problems with diseases are not reported. Solution strategies are seen in the reduction of chemicals in agriculture as well as in cooperation and agreement with farmers. The choice of location is a priority. Moving with the bee colonies to time-limited blooming locations is not common with *Apis cerana*. A fundamental optimization of management and practice is obviously rated as positive and desirable.

Human knowledge and access to useful tools for beekeeping, harvesting and marketing are seen as one of the main optimization factors. Information and communication technology to increase the efficiency and monitoring of bee colonies is considered desirable. However, practical relevance will depend very much on price and handling. Bee breeding as a strategy to increase productivity is rarely mentioned but is already done in a few places with remote mating sites in mountainous areas. However, the majority of bee breeding in Indonesia is confined to *Apis mellifera*.

Swarm control

To prevent the swarming of bee colonies beehives are regularly, usually weekly, controlled. For this, all honeycombs are tested for new queen cells and these cells are broken if necessary. Another possibility is the artificial division of bee colonies to prevent the natural swarming. For unrecognized swarms are empty beehives in trees and on the ground. With the process of swarming, the beekeeper increases the number of bee colonies and thus secures the long-term yield and rejuvenation of bee colonies.

Honey harvest

Honey is harvested regularly on a weekly inspection when honeycombs are filled. These filled honeycombs are cut from the honey frames. Larvae-filled areas are preserved for reproduction. The separation of breeding area and honey space by separating grids is not a common practice and is practiced only by some beekeepers in the main attic. This prevents the queen from gaining access to the honey chamber, thus preventing eggs from being laid in honeycombs. This facilitates the honey harvest. Subsequently, the harvested honeycombs are pressed and filtered to separate honey from wax. Another variant of the separation is done in buckets, which are exposed to solar radiation and uses a melting process of the honeycomb wax. This is to reduce the water content of the honey and simplify the honey harvest. The water content should be below 20% in order to preserve the honey.

Sascha Fiedler – UNIKAS – Bandung, July 2, 2018

4.2.2 Ethiopia

In Ethiopia, bees behave more aggressive. Therefore, the observation of beekeeping actions is difficult. Two site visits were made, one to Wondo Genet to visit small beekeepers as well as extension workers. The other one to Holeta Oromia Agricultural Research Institute to see the beekeeping test sites and scientific facilities.

Beehives

Traditional hives

Many beekeepers still work with traditional hives. The material, bamboo sticks is available almost everywhere. According to an extension worker in Wondo Genet 95% are traditional hives. The main reasons are: it is less time consuming and inexpensive, no investments are needed.

A management of traditional hives is really hard – 30% are not managed. The colony size is smaller than in transitional or modern hives and feeding of bees is not possible.

During the harvest the larva cannot be protected and will be destroyed.

Traditional hives are often used for catching bee colonies which are then resettled in transitional or modern hives.

According to experts 92% of wax production comes from traditional hives, 8% from transitional hives and almost none from modern beehives.

Transitional hives

Transitional hives are based on traditional hives in shape but are built to allow more efficient management. They have a flat base and a lid to open the hive.

They are used for honey production and wax production.

Transitional hives combine the advantages of low management effort with the comfort of modern hives in terms of accessibility.

Modern hives

Modern hives are made of wood (frames & box). They are expensive and hard to get for small farmers. In Wondo Genet, small beekeepers had modern hives only through participation in funded projects.

The most important advantage of modern hives is a higher honey yield of 45 kg per year, seldom reached by small beekeepers we visited. One reason is that management guidelines are not known by most of the beekeepers and running costs are too high.

Because the traditional beekeeping does not require much management, beekeepers have no management routines.

Beekeepers gain almost none wax from modern hives but wax is expensive and therefore an important source of income – that is one of the reasons why a change from traditional or transitional is not fulfilled.

As consequence of bad management, bee colonies in modern hives escape and beekeepers lose them.

Test sites in Holeta

Holeta runs test sites, where modern hive constructions are tested and beekeepers can receive management training.

4.3 Establish Co-Working for UCD

UCD requires a lot of communication and co-working processes. Therefore, one day of each country workshop was dedicated to review and planning of the ongoing user research activities. It was a very important step for the teams in Indonesia, Ethiopia and the EU to learn about approaches and operation methods. One result has been a team mapping which visualizes connections and responsibilities.

4.3.1 User Research Phase One – Result, Review and Methodological Discussion

The country teams gave an overview of interview and discussion results from previous activities. The methodological approach was then discussed.

One result was that there are very different challenges in each country.

In Indonesia, the Partners UNPAD and CV.Primary have very different approaches of research. UNPAD follows a more scientific, systematic tactic, using very sophisticated questionnaires. CV.Primary is very experienced in social research methodologies, and rather works with contextual methods like long-term observations and in-depth interviews. One significant factor in Indonesia is also, that they have large teams and can therefore benefit from the different expertise and large work force. A flip side of this fact is, that it is hard to recognize sometimes from Europe who is the best person to address.

In Ethiopia the ICEADDIS team work closely together with Holeta in all UCD processes. The UCD team is much smaller and interview activity as well as site exploration and selection have to be done more focused. The experience of the Holeta team and their already considerable knowledge of beekeepers and regions in Ethiopia enables the UCD team to select interview partners very efficiently.

The results were used to plan the user research phase two.

4.3.2 SAMS Team Mapping - knowing each other

It became very obvious during the first part of discussion that an overview about the team structure of SAMS will help to identify who has which expertise and professional interests and how every person is involved in the project.

The team mapping is currently under review of all SAMS partners.

5 User Research Phase Two

User research phase two is motivated by the conclusion from the user research workshops because a more in-depth understanding of users and their context is required. Both country teams will conduct more contextual interviews and observations. For this, they will focuse on the sites where SAMS systems will be implemented first.

5.1 Interview Strategies

5.1.1 Indonesia

The two Indonesian partners have different approaches for interviews and documentation. UNPAD has a very systematic questionnaire approach that ensures all information is collected.

BEEKEEPERS QUESTIONER

									Notes:
	Isian								
Enterpreneuer Data	Name	:							
	Gender	:							
	Age	:							
	HP No.	:	Male			Female			
	Education	:	Dropouts	Basic School	Junior High School	High School	Barchelor	Master	Ph.D/Doctoral
	Address	:							
			Street name						
			District						
	Number of employee			ORANG					
	Employee education level	:	Putus Sekolah	SD	SMP	SMA	Barchelor	Master	Ph.D/Doctoral
	Facebook	:							
	Instagram	:							
	Twitter	:							
	Email	:							
	Telephon number	:	House/office			HP number			
	Brand's name	:							
	Main job	:							
	Side job	:							
	Monthly income	:							
Enterprise Data	Name	:							
	Address	:							
	Business form	:							
	Legal aspect	:							
	Permit Year	:							
	Establish Year	:							
	Number of labor	:							
	Member of Association	:							
	Duration	:							
	Business partners	:							
	Annual income	:							
	Enterprise assets	:	Micro	Small	Medium	Big	Range of Asset (fill here)		
			RP. 50 Mio	RP. 50-500 Mio	RP. 500-10 Bio	>RP. 10 Bio			
	Capital Sources	:	Micro	Small	Medium	Big	Exact amount of profit (fill here)		

Figure 23: UNPAD Beekeeper Questionnaire Indonesia

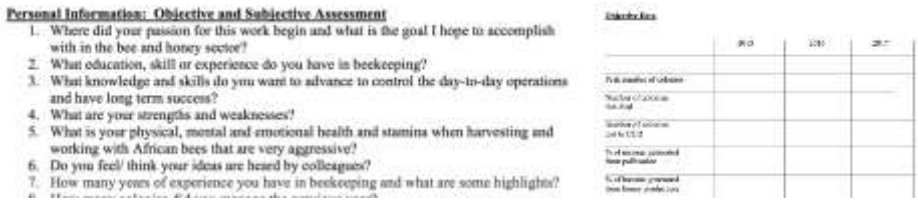
CV.Primary favors a more unstructured interview approach, using aspects of contextual and/ or social inquiry as well as empathy interviews. The goal is to gain a deeper understanding about their real motivations, relations and goals. This type of interview requires some time and includes in-depth contextual inquiries over more than one day.

To generate synergies of the two approaches the Indonesian team decided to analyze results of the UNPAD survey in order to find interview partners that are especially interesting for a more thorough in-depth inquiry.

These interviews are currently in progress.

5.1.2 Ethiopia

In Ethiopia, the first SAMS systems will be set up at research sites of the Oromia Agricultural Research Institute. Therefore, the first users will be employees of the institute, who are experienced beehive managers. To investigate their background, ICEADDIS decided to conduct interviews with this group. For this purpose, they selected a semi-structured approach, which is on the one hand suitable to understand the personal background and on the other hand to investigate the current beehive management practices.



Personal Information: Objective and Subjective Assessment

1. Where did your passion for this work begin and what is the goal I hope to accomplish with in the bee and honey sector?
2. What education, skill or experience do you have in beekeeping?
3. What knowledge and skills do you want to advance to control the day-to-day operations and have long term success?
4. What are your strengths and weaknesses?
5. What is your physical, mental and emotional health and stamina when harvesting and working with African bees that are very aggressive?
6. Do you feel/ think your ideas are heard by colleagues?
7. How many years of experience you have in beekeeping and what are some highlights?

Figure 24: Interview Structure Ethiopia

These interviews are currently in progress.

5.2 Result Documentation

All interviews will be conducted and documented in local languages. Teams in Indonesia and Ethiopia will transcribe and summarize all results in the original language first. After this, the following documents will be generated and then translated into English:

- Persona Descriptions
- As-is Scenarios for Beehive Management
- Context of use descriptions
- Task analysis and Identification of user needs for future products

6 Specify User Requirements

While user research phase two is still in progress, the specification of user requirements has already started. The requirement documents will be product-specific.

6.1 Agile Product Development Approach

SAMS product development has to be flexible and will closely cooperate with stakeholders and UCD activities. Therefore, the SAMS team plans to follow an agile approach and agreed to use the Scrum framework, which uses small teams and fast time boxed development sprints.

The requirements for Scrum are documented in a product backlog and are formulated in user stories.

6.2 Formulation of User Stories

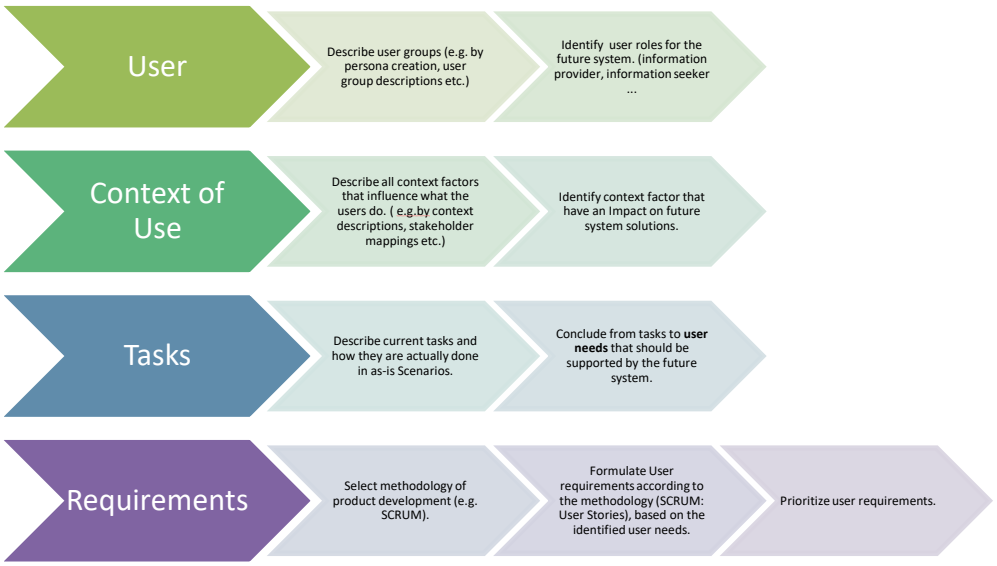


Figure 25: Steps to User Requirement

It is essential for the UCD process to be able to trace back all user requirements to the according user research results. In case of iterations, this helps to retrace the origin and to identify which additional action is needed. The figure 24 Steps to User Requirements shows how user research results will be transformed into SAMS system requirements. The following table gives an example:

Table 3: Contextual Derivation of User Needs for Future Systems

User Group	Context of Use	Task Describing present situation without the future system	User Need for the future system
Beekeeper	In order to know if there is enough honey to have a profitable harvest, the beekeeper needs to open the hive regularly. Every time he opens the hive, the bees are disturbed. The beekeeper is in danger to get stings.	001 Open the hive to see if there is enough honey enough honey in the hive to harvest.	(UN005) The beekeeper needs information about the best time of harvest.

In Scrum, user requirements or user stories are formulated in a given way:

As a < type of user >, **I want** < some goal > **so that** < some reason >.

The user story with its origin is:

As a beekeeper **I want** to see the recommended date of my next honey harvest **so that** I can avoid disturbing the bees unnecessarily. (Origin: UN005)

7 Survey with Scientists to identify User Requirements for DSS

The optimization of the DSS (in compliance with the UCD principles for different regional settings) will be one main task. The system can recognize different states of the colony: death of the bee colony, start of intensive brood rearing process, pre-swarming state etc.

It is an assumption of the SAMS team, that the DSS data will be attractive for scientists of several research fields (e.g. environment, climate, etc.).

In order to collect more knowledge on how the beehive data could be used in different scientific contexts, a survey will be developed based on the data the first test installations in Ethiopia and Indonesia will actually deliver. As mentioned beforehand the involved project regions focus on different priorities by implementing the project.

The focus of SAMS for Europe lays mainly on scientific aspects such as:

- Gaining comparable data from other regions in the world to improve the knowledge about the decline of pollinators as well as on causes and consequences even so they have to deal e.g. with the same climate change aspects, use of pesticides etc. but do not experience a decrease of pollinators like Europe (or if they are solely not aware of this fact)
- Fighting the causes of the decline of pollinators
- Enhancing interoperability and standards for the digital single markets
- Raising awareness, involving society and promoting cooperation between researchers, policy-makers, businesses and the public

This contributes the EU Pollinators Initiative[27], which also focuses on the following three priorities:

1. Improving knowledge of pollinator decline, its causes and consequences
2. Tackling the causes of pollinator decline
3. Raising awareness, engaging society-at-large and promoting collaboration

The focus of SAMS for Ethiopia and Indonesia lays mainly on:

- Supporting small-hold beekeepers in managing and monitoring the bee colonies
- Strengthening the agriculture sector, increasing food quality, volume and production
- Research aspects on bee health, behavior and management
- Enabling businesses along the honey production value-chain to establish sustainable business models (in cooperation with beekeepers)

[27] European Commission (2018): EU Pollinators Initiative. The EU approach to tackle pollinator decline. URL: http://ec.europa.eu/environment/nature/conservation/species/pollinators/index_en.htm (access: 28.3.2019)

Due to this fact, the survey will first be sent to selected scientists in EU countries to meet two purposes: first to verify that the data are of interest and second to make first encounters how the data would be analyzed in different scientific contexts.

Of special interest is for example, if changing parameters of bee behavior, measured with SAMS sensors, can be connected to local climate factors or other changing conditions in the ecosystem.

The survey will be refined after a first round in Europe and then rolled out to scientists in Indonesia and Ethiopia to learn about the local research focus.

After the discussion of the questionnaire for the survey in March, the survey will be sent out in April.

8 References

Bees in EuropE and the Decline Of honey bee Colonies: BEE DOC. URL: http://www.bee-doc.eu/index.php (access: 1.2.2019)

Bees in EuropE and Sustainable HOney Production: BEE SHOP. URL: http://www2.biologie.uni-halle.de/zool/mol_ecol/bee-shop/index.html (access: 1.2.2019)

Coloss honey bee research association (2018): Coloss. URL: https://coloss.org/ (access: 1.2.2019)

Cordis (2012-2015): Swarmonitor. URL: http://cordis.europa.eu/projects/rcn/105847_en.html (access: 1.2.2019)

Cost European Cooperation in Science and Technology: SUPER-B. Sustainable Pollination in Europe. URL: http://superb-project.eu/show/about_11124/ (access: 1.2.2019)

EFSA (2018): Bienengesundheit: URL: https://www.efsa.europa.eu/de/topics/topic/bee-health (access: 31.1.2019)

EFSA (2018): Terms of reference for an EU Bee Partnership. URL: https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2018.EN-1423 (access: 31.1.2019)

EPILOBEE (2016): A pan-European epidemiological study on honeybee colony losses 2012-2014. URL: https://ec.europa.eu/food/sites/food/files/animals/docs/la_bees_epilobee-report_2012-2014.pdf (access: 31.1.2019)

European Commission (2018): EU Pollinators Initiative. The EU approach to tackle pollinator decline. URL: http://ec.europa.eu/environment/nature/conservation/species/pollinators/index_en.htm (access: 28.3.2019)

European Commission: National Apiculture Programmes. URL: https://ec.europa.eu/agriculture/honey/programmes_en (access: 19.9.2018)

European Commission: Research Projects. URL: https://ec.europa.eu/food/animals/live_animals/bees/research_en (access: 31.1.2019)

European Commission: Trade and Import. URL: https://ec.europa.eu/food/animals/live_animals/bees/trade_en (access: 21.9.2018)

European Parliament (2017): At a glance. The EU's beekeeping sector. URL: http://www.europarl.europa.eu/RegData/etudes/ATAG/2017/608786/EPRS_ATA%282017%29608786_EN.pdf (access: 19.9.2018)

European Parliament (2018): Key facts about European's honey market (infographic). URL: http://www.europarl.europa.eu/news/en/headlines/economy/20180222STO98435/key-facts-about-europe-s-honey-market-infographic (access: 19.9.2018)

Department of Community Ecology: Assessing LArge scale Risks for biodiversity with tested Methods. URL: http://www.alarmproject.net/contact.php (access: 1.2.2019)

Geis, T., Polkehn, K., Molich, R., & Kluge, O. (7. June 2016). *UXQB - International Usability and UX Qualification Board.* Abgerufen am 24. August 2018 von CPUX-UR Curriculum Certified Professional for Usability and User Experience – User Requirements Engineering: uxqb.org

Hofstede, P. G. (29. August 2018). *Hofstede Insights*. Von https://www.hofstede-insights.com/country-comparison/ethiopia,germany,indonesia/ abgerufen

ITApic (2019): Application of Information Technologies in Precision Apiculture. URL: http://www.itapic.eu/index.php (access: 31.1.2019)

Klas (2016): Innovation Factory – Part 1. A closer look at the buzz around bees in Ethiopia

Madu Pina Apiari (2018): Development of Beekeeping in Indonesia. URL: http://madubinaapiari.co.id/development-of-beekeeping-in-indonesia/ (access: 21.9.2018)

Ministry of Agriculture (2013): Apiculture value chain vision and strategy for Ethiopia , International Livestock Research Institute, Addis Ababa, ISBN: 92–9146–410–4

Quality Services International GmbH (2010): Vietnam Symposium. URL: https://www.apimondia.com/symposia/2010/vietnam/Honey%20quality%20requirements%20of%20the%20European%20market%20-%20Klaus%20Beckmann%20-%20Hanoi%202010.pdf (access: 19.9.2018)

Shiferaw A., Jaleta M., Gebremedhin B., Hoekstra D. (2010): Increasing economic benefit from Apiculture through value chain development approach: The case of Alaba special district, Southern Ethiopia. Project "Improving Productivity and Market Success of Ethiopian farmers (IPMS)", Canadian International Development Agency & International Livestock Research Institute Ethiopia, March 2010

STEP (2019): Status and Trends for European Pollinators. URL: http://www.step-project.net/ (access: 1.2.2019)

Annexes

Project website: www.sams-project.eu

Project Coordinator contact:

Angela Zur,
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
An der Alster 62,
20999 Hamburg, Germany
Angela.Zur@giz.de

DISCLAIMER