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Keep the bee in Ethiopia's wheatbelt

Challenges for apiculture integration in the intensified agricultural landscape of Arsi-Zone

Susanne Dollmann, Erik Burtchen, Diana Diekjürgen, Laura Kübke, Rebecca Younan, Sophia-Marie Zimmermann

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Seminar für Ländliche Entwicklung | Centre for Rural Development

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Preface

The Centre for Rural Development (SLE – Seminar für Ländliche Entwicklung), Humboldt-Universität zu Berlin, has trained young professionals in the field of German and international development cooperation for more than fifty years.

Six-month empirical and applied research projects conducted on behalf of German or international development agencies are an integral part of the one-year postgraduate course. With interdisciplinary teams and the guidance of experienced team leaders, young professionals carry out assignments on innovative future-oriented topics, providing consultant support to the commissioning organizations. Here the involvement of a diverse range of actors in the process is of great importance, i.e., surveys range from household level to decision-makers and experts at national level. The outputs of this applied research contribute directly to solving specific development problems.

The studies are mostly linked to rural development themes and have a socio-economic focus, such as the improvement of agricultural livelihoods or regimes for sustainable management of natural resources. The host countries are mostly developing or transformation countries, but also fragile states. In the latter, topics such as disaster prevention, peace building and relief are also under review. Another study focus lies in the field of method development or of handbooks and guidelines. Evaluation, impact analysis and participatory planning belong likewise in this category.

Throughout the years, SLE has carried out more than two hundred consulting projects in approximately ninety countries and regularly publishes the results in this series. In 2016, SLE teams completed four studies in Ethiopia, Kenya, and Peru.

The present study is "Keep the bee in Ethiopia's wheatbelt. Challenges for apiculture integration in the intensified agricultural landscape of Arsi-Zone."

The study was commissioned by the Green Innovation Centre Ethiopia / GIZ.

The report is also available from the SLE on request and downloadable from the SLE-website.

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Executive summary

The Commissioning Partner Green Innovation Centre (a GIZ programme), based in Addis Ababa, Ethiopia, as part of the "One World-no Hunger Initiative", focuses on activities for food security in accordance with the Ethiopian governmental strategy of the Growth and Transformation Plan (GTP II). This research project of the SLE-study at hand is a systemic approach and integration of apiculture and agriculture and the elaboration of potentials and recommendations for improvement and integration of beekeeping aiming at income generation mainly for women and youth in Arsi-Zone.

Ethiopia with a population of around 100 million people is the second most populous country in Africa (with an estimated annual growth rate of 2.9%), with over 70 ethnic groups. Agriculture accounts for 73% of employment. Regarding growth numbers, Ethiopia has been an economic success over the past 10 years with an average growth rate of 10.5%. However, in 2016 10 million Ethiopians were dependent on food aid. Within the GTP II, small-scale farmers are intended to transform from subsistence agriculture to market production and the government has committed itself to the promotion of women and youth empowerment. In general, the government is aiming for Ethiopia to become a middle-income country by 2025.

The agricultural extension service of Ethiopia is the biggest extension service in Africa, providing credit to cooperatives and supporting the farmers with a Training and Visit (T&V) system, mainly promoting selected model farmers. The extension departments provide services in the fields of crop production, livestock production and natural resource management using a traditional, rather top-down approach. Critical observers comment that the extension services could be used as an instrument for political legitimation and support for the current government.

Ethiopian agricultural inputs and supplies are organized by the cooperative union offices in the zonal capitals acting as wholesalers and distributors of fertilizers for cooperation unions down to *kebele* level. Pesticides are used on 24% of the cultivated area and private actors dominate the sales market. Due to lack of training, the majority of farmers learn indirectly from other farmers about application and effects of fertilizers. Rural and urban land in Ethiopia is under public ownership and peasants only have user rights and no right to sell, exchange or pledge land. The government's concern is to guarantee security for peasants against market forces. Critics underline negative aspects on land use like reduced investments. Leasing of land is to some extent possible. In recent years, the increasing rural population could only be provided with sufficient farming land by decreasing average holding sizes. Additionally, the productivity of land in the highlands is decreasing due to other factors e.g. erosion and other forms of degradation. Especially young people are affected by the lack of land and therefore by lack of employment and income.

The data collection procedure was divided into three phases: preparation in Germany; an in country and field phase including discussions; and an exchange with Ethiopian counterpart students, experts and extension staff. In Arsi-Zone criteria for the choice of the *woredas* were the agro-ecological zone, number of cultivation periods, asphalt road/market access, and extension service availability. Assumptions were formulated for field research, research tools developed for micro-, meso-, and macro level for farmers and beekeepers. Mainly Participatory Rural Appraisal (PRA) methods and additionally secondary data were used from available literature and research. A total of 252 interviewees and participants of group sessions were addressed for the data collection. Data was coded for anonymization. Due to the social and ethnic unrests in the country, the government announced a six-month emergency state in October 2016. This limited the radius of the research team and the mobility of team members during the field phase.

The results of the field study in Arsi-Zone, namely in Lude Hitosa and Arsi-Robe are summarized in the following:

Agriculture and apiculture in Arsi-Zone

Wheat production dominates, exceeding the country's average harvest with mainly small-scale farms and few state farms with the highest level of mechanisation in the country (small-scale 10–15% mechanisation only). In both *woredas*, Lude Hitosa and Arsi-Robe, cereal crops are wheat, tef, barley and maize (80%); cultivated pulses are: faba bean, peas, additional chick peas (Arsi-Robe) and vegetables: onions, cabbage, tomato, garlic, and oilseed rape; additionally, flax and sunflower are grown in Arsi-Robe. Vegetables are mainly cultivated for home consumption but also on a larger scale for sale. The core vegetable varieties in the research areas were tomato, onion, potato, cabbage, coffee, and pepper. The variety of cultivated crops seemed to be less diverse in Lude Hitosa. Livestock in Arsi-Zone are used for field work and transport, as well as for sale or home consumption. Beekeeping is an additional income possibility for the household. Small-scale farmers in Arsi-Zone have about 1.49 hectare of agricultural land per household. According to the 2007 census, 17% of the farmers in Arsi-Zone are female (Etefa and Dibaba, 2011).

The organisational level of small-scale farmers in Arsi-Zone is low in Lude Hitosa where no form of official union exists; whereas in Arsi-Robe the active union cooperative has 29 918 members (2 112 female members). Farm work is also organised with family members working on the field (women, children) and hired labourers.

Use of agro-chemicals has increased significantly over the past decade; simultaneously the occurrence of pests and diseases has augmented, too. Men or children working on the field carrying sprayer pumps on their back without protection cloth were seen in all *kebeles.* Pesticide use is increasing, especially in cash crop cultivation, despite rising prices and although many farmers mentioned health issues attributable to pesticide application in the fields.

There is awareness amongst extensionists of the importance and benefits of crop rotation. Negative effects of monocultures are known, but due to the need for basic income, diversification has not been seen as a realistic solution to date.

Certified organic farming as a specified approach with certified products was not observed in Arsi-Zone. However, the research results reveal the importance of sustainable production systems. Some interviewees explain the avoidance of agro-chemicals in their kitchen gardens with the negative effects they have on health. Techniques used are application of compost, intercropping maize with peppers, coffee or oats, onion with tef, and integration of legumes in crop rotation for improvement of soil fertility.

Farming in Arsi-Zone is constrained by a lack of appropriate agricultural training and a low level of organisational integration. Crop rotation practice as well as availability of farm inputs is limited. The farmers are aware of sustainable production and organic farming methods, but tend to follow the economic pressure keeping up a semi-intensive production for income. Use of pesticides is high and harming bees. Finally market access is limited for less common crops, especially in remote areas. In this context, the limitation of marketing for alternative crops could result in low willingness or capability of farmers to change their current farming system.

Situation analysis of the honey value chain in Arsi-Zone

The Ethiopian honey sector has a long tradition, high national production and an even higher potential, currently producing 10 % of the estimated potential. The production is characterized by traditional methods. The government is putting efforts into developing the apiculture sector but has not prioritized activities of the extension service.

On the input supply side, bee keeping requires bee colonies, bee fodder and hives before production starts.

In Ethiopia at least three honey bee subspecies are confirmed to be present, occupying different agro-ecological zones. The *Apis mellifera scutellata, Apis mellifera monticola,* and *Apis mellifera yemenitica* (Fichtl and Abi 1994). Bee feeding involved supplying with water, sugar and *shiró* (chickpea powder), faba bean, or barley flower. Bee forage planting was reported rarely (e.g. roses). Plants that serve as bee forage are flowers, e.g. Meskel flower (*Bidens prestinaria)*, crops, e.g. faba bean *(Vicia faba*), and trees, e.g. Tasmanian blue gum (*Eucalyptus globulus)* (for a complete list see p. 53/120 resp.). Water scarcity and a deforested landscape lead to a lack of bee forage in Arsi-Zone.

Most of the registered beekeepers in Arsi-Zone use traditional beehives of which they own between 1 and 25, on average 2.6. The costs for traditional hive construction in Arsi-Zone were estimated at no more than ETB 50 for one hive with minimal management and least productivity. Transitional hives are Top-Bar hives with moderate level of managing honey bees to conduct hive inspection and shift frames. Modern hives are made of wood and contain various chambers and a cover. The number of modern hives in Arsi-Zone is decreasing because of a lack of proper processing instruments and proper management skills. Modern beehives generally require advanced management skills and knowledge from the beekeeper in comparison to transitional or traditional hives.

Main activities for beekeepers are catching the bee colony, bee feeding and in rare cases bee forage planting.

Pollinators, like honeybees are highly affected by agro-chemicals. All the beekeepers interviewed related the increasing absconding of bees to the increased application of pesticides over the past three years. Lack of processing instruments led to poor honey quality as well as the death of many bees. Most beekeepers lack access to proper extraction and processing tools, smokers, protection clothes and further beekeeping instruments.

Honey production: Crude honey is mashed combs, including dead bees and the brood. It is the lowest quality and beekeepers in Arsi-Zone get the lowest price for it. Chunk honey consists of whole combs of honey harvested from the beehive; pieces of the comb are put into jars and containers. Semi-refined honey is the honey remaining when the wax has been removed, but the honey still contains particles of wax, bees and brood.

Processing and storage: The two main beekeeping products harvested in Arsi-Zone are honey and beeswax. Processing is done on household level without access to proper processing tools (extractor, smoker etc.). 50% of the honey is used for home consumption. Storage is done in form of raw honey, semi-processed or combed honey in plastic containers, bags or tea kettles. No wax is extracted.

Marketing and consumption: The table honey is marketed at the farm gate and 82% of the wax stays at household level. The honey quality can be classified as "low" due to the lack of know-how, processing materials and proper storage possibilities. Therefore, current honey production does not meet international standards or volumes for the export market.

There are huge challenges for Ethiopia regarding rural unemployment. Land scarcity and land market restriction lead to limited access to agricultural land which is the basis for employment in the rural areas. Thus Opportunities for employment for youth in rural Arsi-Zone are characterized by lack of potential additional agricultural land according to the Arsi-Zone Land Administration Office. The average farmer in Arsi-Zone has 1.4 ha for cultivation, while 39% of the households have 6–9 members[1], limiting the possibility of these families to share land among family members. According to the *woreda* youth experts, young people would only have access to community land if they were organised in cooperatives.

The *woredas* visited had no active youth beekeeping cooperatives. In Arsi-Robe one beekeeping cooperative had been established with the help of an organization of the Ethiopian Orthodox Church. At the time of the visit, the beekeeping cooperative was one year old. Honey had not yet been harvested and most of the modern hives where empty. The young beekeepers showed interest in training courses to improve their skills.

The biggest constraint on the promotion of beekeeping is access to land. Another limitation might be that bees bear a certain danger of sting attacks. Beekeeping in a cooperative can only generate enough to be a side income. Therefore, beekeeping needs to be coupled with further income generating activities.

What is known and practised amongst all Oromo groups is the *gadaa* system – a term used for various concepts but mainly describing "a male-centred egalitarian socio-political organisation". It became clear that women see themselves only

1 The further distribution is 31% (4–5 members),23% (2–3 members), 5% (10 and more) and 2% (one member) (CSA, 2016b: 61)

as supporters, assisting their husbands in beekeeping and honey production. All female informants mentioned the following tasks as their responsibilities: cleaning around the beehives; feeding the bees (in the dry season); smoking during harvesting; protecting the bees and doing other management activities except for catching the colonies. Honey harvesting is only done by male beekeepers. At the same time, women are very interested in becoming more involved and especially in learning more about beekeeping and honey production.

Constraints on women in beekeeping are a lack of specific training, the practical and social barriers related to beekeeping, lack of equipment, lack of financial capacity, and limited market access due to the lack of infrastructure, standardized containers for marketing, etc.

Income effects of beekeeping are moderate and it is mostly practised as a side activity. Gross margins at farm gate per hive are ETB 388/year for traditional hives, ETB 676/year for transitional hives, and ETB 2 010/year for modern hives. The most profitable hive technology is the modern hive, similar to the European hive model, but this also involves the highest investment costs (ETB 4 300). Also management practises are more complex and special construction materials are needed. Further income options through beekeeping are beeswax as a by-product for honey production from traditional and transitional hives (ETB 250 to 350/kg) and colonies (ETB 300 in Lude Hitosa; ETB 1 000 in Tigray). Other products might be propolis (bee glue) or pollen.

Financing schemes or alternative approaches are necessary to allow beekeepers and other actors to take the risk of new practises.

Transitional hives are a good alternative to modern hives for increased production and improved beekeeping management (compared to traditional hives), and as an entry point for women, landless young people or others who start newly with beekeeping. One important conclusion from both situation analyses is that apiculture and agriculture should be thought of as a system rather than regarding both sectors separately. Including apiculture in agricultural management and vice versa might lead to synergy effects with benefits for sustainability, ecological, socio-cultural and economical.

When designing a landscape, plants serving as bee forage could be integrated to supply food for the bees in various ways, e.g. as living fence, additional crop on the field, or trees. Therefore, a diversified landscape with bees is ecologically more resilient towards environmental hazards. Also a sustained agricultural productivity can be established with less pesticide use and soil conservation methods.

An example for social value of an Integrated Multi Purpose Plant (IMPP) is the *meskel* flower (*Bidens macroptera*), which plays a prominent role in an Ethiopian religious celebration. The integration of plants serving as bee forage should primarily have benefits for farmers. Plants or crops could serve as additional sources of food, as livestock fodder, building material, or fuel wood, with an additional benefit for farmers.

Economic advantages could emerge, if farmers integrated beekeeping into their agricultural system as an additional income opportunity. The marketing of wax could also create further income for the rural households. In addition, income could be generated by the diversification of crop rotation. Plants like sunflower, flax or oil-seed rape could be harvested and marketed by the farmers and would simultaneously serve as bee forage. Product diversification might make farmers more resilient and less dependent on cash-crops. A second step could be the establishment of a proper value chain of honey. If the demand for input supplies (processing machines, protection clothes, hives) increases, production might increase as well. Additional jobs could be created (processing manufacturers, carpenters).

The analysis shows: possible synergy effects will arise if a system approach is adapted to agriculture and beekeeping in Arsi-Zone. At this stage, IMPPs (Integrated Multi-Purpose Plants) may serve as bee forage on the one hand and create an additional benefit for small-scale farmers on the other. IMPPs can be integrated in crop rotation, but other applications are possible, like living fences or edge strips.

Recommendations

The following recommendations are elaborated in the full report:

1. Improve stakeholder cooperation (a) in research, policy making and organisations of national scale and (b) in beekeeping cooperatives.
2. Raise awareness of the wider importance of bees as pollinators and bio-indicators to sensitise for better decision making in agriculture.
3. Improve content, structure and organisation of beekeeping training courses and make these accessible especially for women.
4. Beekeeping may be considered as a possible income generating activity for youth groups and must be combined with additional activities.
5. Make affordable tools available for beekeeping and honey harvesting and processing.
6. Advance beekeeping commercialisation by linking beekeepers, processors and wholesalers, strengthening possibilities for additional beekeeping products and improving marketing strategies.

7. Develop a bee-friendly pesticide strategy.
8. Promote the diversification of the farming system and wider landscape.

If the Green Innovation Centre aims to promote beekeeping and good agricultural practises in Arsi-Zone, combining these activities by integration will possibly offer a sustainable approach. A total transformation of the agricultural system in Arsi-Zone into a leading honey producing area is unrealistic. But every single step taken in this direction could contribute to the improvement of the current farming system, environmentally, socially and economically. Prevention of deterioration of the current agricultural production and simultaneously protection of the small-scale farmers' livelihood in the landscape of Arsi-Zone and its biodiversity will be worth the efforts to keep the bee in Arsi-Zone.

Zusammenfassung

Der Auftraggeber der vorliegenden Studie, das Grüne Innovationszentrum (Green Innovation Centre, GIC) der Deutschen Gesellschaft für Internationale Zusammenarbeit (GIZ), hat seinen Sitz in Addis Abeba, Äthiopien, und gehört zur Sonderinitiative „EINEWELT ohne Hunger" (One World-no Hunger) und arbeitet schwerpunktmäßig zur Ernährungssicherung. Diese unterstützt die äthiopische Regierungsstrategie des Wachstums- und Transformationsplans II (Growth and Transformation Plan, GTP II). Das Ziel der vorliegenden SLE-Studie ist ein systematischer Ansatz der Integration von Bienenhaltung und Landwirtschaft mit einer Ausarbeitung der Potentiale und Empfehlungen zur Verbesserung der Integration der Bienenhaltung zur Einkommenserwirtschaftung vor allem für Frauen und Jugendliche in der Arsi-Zone.

Äthiopien steht mit einer Bevölkerung von ca. 100 Millionen Menschen an zweiter Stelle im afrikanischen Kontinent (mit einer geschätzten Wachstumsrate von 2,9%) und ist gleichzeitig ein ethnisch diverses Land mit über 70 Ethnien. Im Agrarsektor sind 73% der Bevölkerung in der Landwirtschaft tätig. Innerhalb der letzten 10 Jahre zählte Äthiopien als wirtschaftliches Erfolgsland mit einer durchschnittlichen Wachstumsrate von 10,5%. Dennoch waren im Jahr 2016 10 Millionen Äthiopier von Lebensmittelhilfe abhängig. Ziel des GTP II ist es, Kleinbauern von der Subsistenz zur Marktproduktion zu überführen. Dabei hat sich die Regierung selbst zur Frauenförderung und zur Unterstützung Jugendlicher verpflichtet. Generell strebt die äthiopische Regierung den Status eines Schwellenlandes für das Jahr 2025 an.

Der landwirtschaftliche Beratungsdienst Äthiopiens ist der größte Beratungsdienst Afrikas und unterstützt Kooperativen mit Krediten und bietet den Bauern ein Trainings- und Besuchssystem (Training and Visit, T&V) an und arbeitet vorwiegend mit ausgesuchten „Modelbauern". Die Beratungsabteilungen bieten Dienstleistungen zu Pflanzenproduktion, Tierhaltung und natürlichem Ressourcenmanagement an, wobei ein traditioneller, „Top-Down" Ansatz angewendet wird.

Die äthiopische Landwirtschaft bezieht Inputs durch die Kooperativenunionbüros (Cooperative Union Offices) in den regionalen Hauptstädten (Zonal Capitals) und betätigt sich als Großhändler und Verteiler von Dünger der Kooperativenunionen (Cooperative Unions) bis zur kleinsten Verwaltungseinheit, der *kebele*. Pestizide werden zu 24% der landwirtschaftlichen Anbaufläche eingesetzt und private Anbieter beherrschen hier den Markt. Aufgrund mangelnden Trainings

erlernt die Mehrheit der Landwirte nur indirekt über Anwendung und Wirkung von Düngemitteln. Landtitel im ländlichen und städtischen Raum Äthiopiens sind in öffentlicher Hand und die ländliche Bevölkerung hat keine Landtitel sondern Nutzungsrechte, daher können sie das Land weder verkaufen, handeln noch verpfänden. Das Anliegen der Regierung ist hierbei die Sicherheit der Bauern gegen Marktkräfte zu gewährleisten. Kritiker betonen die negativen Aspekte der Landnutzungsrechte wie den Rückgang von Investitionen. Landpacht ist in beschränktem Maße möglich. In den vergangenen Jahren konnte die ländliche Bevölkerung nur durch eine sinkende Durchschnittsfläche pro Farm mit landwirtschaftlicher Nutzfläche versorgt werden. Zusätzlich geht die Produktivität im Hochland zurück aufgrund von verschiedenen Faktoren wie Erosion und anderen Formen der Bodendegradation. Besonders Jugendliche sind durch den Mangel an Bodenverfügbarkeit, Beschäftigung sowie Einkommen betroffen.

Die Datensammlung wurde in drei Phasen unterteilt: Vorbereitung in Deutschland, eine Phase vor Ort mit vorbereitenden Diskussionen und Interviews und schließlich die Feldphase incl. Austausch mit äthiopischen Counterpart-Studentinnen, Experten und landwirtschaftlichen Beratern. Für die Auswahl der *woredas* (Distrikte) waren die Kriterien ökologische Zone, Anzahl der Anbauperioden, Straßenanbindung bzw. Marktzugang und Beratungsdienstverfügbarkeit. Für die Feldphase wurden Annahmen formuliert, Forschungsinstrumente entwickelt für Mikro-, Meso- und Makro-Ebene in Bezug auf Bauern und Imker. Vor allem Participatory Rural Appraisal (PRA) Methoden wurden angewendet sowie Sekundärdaten aus Forschung und Literatur. Insgesamt 252 Interviewpartner bzw. Teilnehmer von Gruppensitzungen nahmen an Befragungen teil. Zur Auswertung der Felddaten wurden die Ergebnisse kodiert und die Datensätze anonymisiert. Der sechsmonatige Notstand, der im Oktober 2016 in Äthiopien aufgrund von sozialen und ethnisch-basierten Unruhen verhängt wurde, schränkte den Radius des Forschungsteams und die Mobilität während der Erhebungsphase ein.

Die Ergebnisse der Feldstudie aus Arsi-Zone, den *woredas* Lude Hitosa und Arsi-Robe, sind im Folgenden zusammen gefasst.

Landwirtschaft und Bienenhaltung in der Arsi-Zone

Die Weizenproduktion dominiert und übertrifft den Erntedurchschnitt des Landes mit einer überwiegend kleinbäuerlichen Struktur und wenigen Staatsfarmen und gleichzeitig dem höchsten Mechanisierungsgrad des Landes (Kleinbauern 10–15% Mechanisierung). In beiden *woredas*, Lude Hitosa und Arsi-Robe, werden die Getreidearten Weizen, Tef, Gerste und Mais angebaut (80%); an Hülsenfrüchten: Fababohne, Erbsen und Kichererbsen (Arsi-Robe) und an Gemüse:

Zwiebeln, Kohl, Tomate und Knoblauch als auch die Ölfrucht Raps; zusätzlich wurden in Arsi-Robe Flachs und Sonnenblume angetroffen. Gemüse wird vor allem für den Eigenkonsum, bei größeren Flächen auch für den Verkauf angebaut. Die Hautgemüsearten im Untersuchungsgebiet sind Tomate, Zwiebel, Kartoffel, Kohl, Kaffee und Pfeffer. Die Bandbreite der angebauten Kulturpflanzen erschien in Lude Hitosa weniger divers. Die Tierhaltung wird in Arsi-Zone für die Feldarbeit, Transport, Verkauf oder Eigenkonsum betrieben. Bienenhaltung ist weniger verbreitet als andere Tierhaltung, bietet aber ein zusätzliches Einkommen für den Haushalt. Kleinbauern in der Arsi-Zone verfügen über durchschnittlich 1,49 ha landwirtschaftliche Nutzfläche pro Haushalt, wobei der Anteil der Kleinbäuerinnen 17% beträgt (Etefa und Dibaba, 2011).

Das Organisationsniveau in der Arsi-Zone, wie in Lude Hitosa, ist gering, keine Form offizieller Zusammenschlüsse existiert hier. Die aktive Union-Kooperative in Arsi-Robe dagegen hat 29 918 Mitglieder (2 112 weibliche Mitglieder). Farmarbeit wird sowohl mit Familienmitgliedern organisiert (Frauen, Kindern) als auch mit bezahlten Farmarbeitern.

Die Verwendung von Agrarchemikalien hat im letzten Jahrzehnt signifikant zugenommen; gleichzeitig stieg der Befall mit Pflanzenschädlingen und -krankheiten. Männer und Kinder mit Handspritzgeräten auf dem Rücken und ohne Schutzkleidung wurden in allen *kebeles* angetroffen. Der Pestizideinsatz nimmt stetig zu, besonders im Marktfruchtanbau (cash crops), obwohl die Preise der Chemikalien steigen und viele Bauern Gesundheitsprobleme erwähnten, verbunden mit der Pestizidausbringung in den Feldern.

Die Berater sind sich der Bedeutung und der Prinzipien des Fruchtwechsels bewusst. Die negativen Begleiterscheinungen des Monokulturanbaus sind bekannt, jedoch wird aufgrund des Bedarfs des Basiseinkommens die Diversifizierung nicht als realistische Lösung angesehen.

Der zertifizierte biologische Landbau als definierter Produktionsansatz mit zertifizierten Produkten, wurde nicht in der Arsi-Zone beobachtet, jedoch zeigen die Forschungsergebnisse die Bedeutung eines nachhaltigen Produktionssystems. So vermeiden die befragten Bauern die Ausbringung von Agrochemikalien in ihren Hausgärten, aufgrund der negativen Begleiterscheinungen. Angewandte Techniken waren Kompostausbringung, Mischkulturanbau (intercropping), z.B. Mais mit Pfeffer, Kaffee oder Hafer als auch Zwiebel mit Tef und die Integration von Leguminosen in die Fruchtfolge für die Verbesserung der Bodenfruchtbarkeit.

Die Landwirtschaft in der Arsi-Zone ist gekennzeichnet durch Probleme wie das Fehlen der passendenden landwirtschaftlichen Aus- bzw. Weiterbildung und ein niedriges Niveau des Organisationsgrads. Die Fruchtfolgepraktiken wie auch die Verfügbarkeit von Agrarinputs sind eingeschränkt. Die Bauern kennen Praktiken einer nachhaltigen Landwirtschaft und biologischer Anbaumethoden, folgen jedoch dem ökonomischen Druck und betreiben eine semi-intensive Produktion für die Sicherung ihres Einkommens. Der starke Einsatz von Pestiziden schadet den Bienen. Schließlich ist der Marktzugang limitiert für außergewöhnliche Ackerfrüchte, besonders in entlegenen Gebieten. Dies kann ein Grund für das geringe Interesse bzw. die reduzierte Möglichkeit der Bauern sein, ihr bestehendes Anbausystem zu ändern.

Situationsanalyse der Wertschöpfungskette des Honigs in der Arsi-Zone

Der äthiopische Honigsektor hat eine lange Tradition, eine hohe nationale Produktion und ein noch größeres Potential, wobei derzeit die Produktion dieses nur zu 10% ausschöpft. Die Produktion basiert vor allem auf traditionellen Methoden. Die Regierung bemüht sich, den Imkerei-Sektor weiter zu entwickeln, jedoch ohne eine Priorisierung der Aktivitäten des Beratungsdienstes.

Auf der Input-Seite benötigen die Imkerei und Honigproduktion Bienenkolonien, Bienenfutter und Bienenstöcke.

In Äthiopien gibt es mindestens drei Unterarten der Honigbiene in verschiedenen agro-ökologischen Zonen. Die *Apis mellifera scutellata, Apis mellifera monticola* and *Apis mellifera yemenitica* (Fichtl and Abi 1994). Beobachtete bestehende Praxis der Bienenfütterung war die Versorgung mit Wasser, Zucker und *shiró (*Brei aus Wasser und Kichererbsen-Fababohnen oder Gerstenmehl). Von der Anpflanzung von Bienenfutter wurde selten berichtet (z.B. Rosen). Pflanzen, die ebenfalls als Bienenfutter dienen, sind folgende Blüten, z.B. die *Meskel-Blume* (*Bidens prestinaria),* Feldfrüchte, z.B. die Fababohne *(Vicia faba*), und bestimmte Bäume, z.B. *Tasmanian Blue Gum* (*Eucalyptus globulus)* (für die komplette Auflistung siehe S. 53 bzw. 120). Wasserknappheit und entwaldete Landschaften führten zu einem Mangel an Bienenfutter in der Arsi-Zone.

Die Mehrheit der registrierten Bienenhalter der Arsi-Zone verwendet traditionelle Bienenkörbe, zwischen 1–25 Stück und im Durchschnitt 2,6. Die Kosten der traditionellen Korbkonstruktion wurden auf 50 ETB geschätzt mit minimalem Management und der geringsten Produktivität. Die „Übergangsbienenkästen" (transitional hives) sind Oberträgerbeute-Körbe (Top Bar) mit einem mittleren Managementniveau für die Kasteninspektion und das Auswechseln der Rahmen. Moderne Bienenkästen sind aus Holz hergestellt, enthalten verschiedene Kammern und sind abgedeckt. Die Anzahl der modernen Bienenkästen in der Arsi-Zone nimmt ab, da es an passenden Verarbeitungsinstrumenten und Managementfähigkeiten fehlt. Moderne Bienenkästen verlangen fortgeschrittene Managementfähigkeiten und Know-how der Imker im Vergleich zu den Übergangskästen- oder traditionellen Körben.

Die Hauptaktivitäten der Imker sind das Einfangen der Bienenkolonie, die Fütterung und in seltenen Fällen das Anpflanzen von Bienenfutterpflanzen.

Bestäuber, wie Honigbienen, werden stark durch Agrochemikalien beeinträchtigt. Alle befragten Imker führten den zunehmenden Bienenschwund auf den erhöhten Pestizideinsatz innerhalb der vergangenen drei Jahre zurück. Der Mangel an Verarbeitungsmaterialien führt zum einen zu geringer Honigqualität und zum anderen zum Tod vieler Bienen. Die meisten Imker haben keinen Zugang zu passenden Extraktions- und Verarbeitungszubehör, wie Rauchbläser, Schutzkleidung, etc.

Honigproduktion: Rohhonig (raw honey) besteht aus ausgedrückten Waben, die tote Bienen und auch Brut enthalten. Da es sich um die geringste Qualität handelt, erhalten die Imker aus Arsi-Zone den geringsten Preis. Honig mit Wabenteilen oder Wabenstücke in Honig (chunk honey) wird vom Bienenstock geerntet und in Töpfe oder andere Behälter gefüllt. Halbrafinierter Honig (semi-refined honey) besteht aus Honig, aus dem das Wachs entnommen wurde, enthält aber noch Wachspartikel, Bienen oder Brut.

Verarbeitung und Lagerung: Die beiden Hauptprodukte, die in der Arsi-Zone geerntet werden sind Honig und Bienenwachs. Die Verarbeitung wird auf Haushaltsniveau durchgeführt ohne passende Verarbeitungsgerätschaften wie Extraktor oder Rauchbläser. 50% des Honigs werden für Eigenkonsum verwendet. Die Lagerung erfolgt als Rohhonig, halbrafiniert oder als Scheibenhonig (combed honey) in Plastikbehältern, Tüten oder Teekesseln. Das Wachs wird nicht extrahiert.

Vermarktung und Konsum: Tafelhonig wird direkt vermarktet und 82% des Wachs' verbleiben im Haushalt. Die Honigqualität kann aufgrund des Mangels an Know-How sowie an Verarbeitungsmaterialien und passenden Lagermöglichkeiten als niedrig eingestuft werden.. Daher erreicht die Honigproduktion weder in Bezug auf Qualität noch Quantität internationale Standards für den Export.

Äthiopien steht vor großen Herausforderungen in Bezug auf ländliche Erwerbslosigkeit. Landknappheit und eingeschränkter Handel von Bodentiteln führen zu eingeschränktem Zugang landwirtschaftlicher Nutzflächen, was wiederum die Basis für ländliche Beschäftigung bietet. Die Beschäftigungsmöglichkeiten im ländlichen Raum für Jugendliche sind ebenso durch den Mangel an zusätzlicher landwirtschaftlicher Nutzfläche gekennzeichnet, wie das Arsi-Zone Landverwaltungsamt (Arsi-Zone Land Administration Office) mitteilte. Durchschnittlich hat ein Bauer 1,4 ha Ackerland zur Verfügung, wobei 39% der Haushalte 6–9 Mitglieder[2] haben und die Möglichkeit der Aufteilung unter den Familienmitgliedern daher eingeschränkt ist. Nach den Aussagen der *woreda*-Experten hätte die Jugend nur Zugang zu kommunalem Land durch einen Zusammenschluss in Kooperativen.

In den besuchten *woredas* existierten keine aktiven Jungimker-Kooperativen. In Arsi-Robe existiert eine Imkerkooperative, die mit Unterstützung einer Organisation der Äthiopischen-Orthodoxen Kirche (Ethiopian Orthodox Church) gegründet wurde. Zur Zeit des Besuchs war diese ein Jahr alt, Honig wurde bisher nicht geerntet und die meisten der modernen Bienenkästen waren leer. Die befragten jüngeren Imker zeigten jedoch Interesse an Training, um ihre Kenntnisse zu verbessern.

Das größte Problem für die Förderung der Imkerei ist der Zugang zu Land, ein weiteres die Gefahr von Stechattacken durch die Bienen. Die in einer Kooperative betriebene Imkerei kann nur ein Zusatzeinkommen generieren. Daher ist es notwendig, dieses mit weiteren einkommensschaffenden Aktivitäten zu kombinieren.

Das Sozialsystem der Oromo-Gruppen ist das sogenannte *gaada*-System, eine Bezeichnung der in verschiedenen Zusammenhängen genannt wird, aber hauptsächlich „eine männlich zentrierte, egalitäre sozio-politische Organisation" bezeichnet. Während der Feldphase zeigte sich, dass Frauen sich nur als Hilfskräfte sehen, die ihre Ehemänner bei der Imkerei und Honigproduktion unterstützen. Alle weiblichen Befragten nannten die folgenden Tätigkeiten als ihre Zuständigkeiten: Putzen um den Bienenstock, Füttern der Bienen (während der Trockenzeit), Räuchern während der Erntesaison, Schützen der Bienen und andere Managementtätigkeiten, außer des Einfangens der Kolonien. Die Honigernte wird nur durch männliche Imker durchgeführt. Gleichzeitig besteht unter den Frauen ein großes Interesse an Fortbildung zu Imkerei und Honigproduktion.

Hemmnisse für Frauen in der Bienenhaltung bestehen im Mangel an spezifischem Training für Frauen sowie praktischen und sozialen Barrieren, im Fehlen an Ausrüstung, in eingeschränkter finanzielle Kapazität und im limitierten Marktzugang aufgrund von mangelnder Infrastruktur und Vertriebsmaterial (z.B. standardisierte Behälter).

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2 Die weitere Verteilung beträgt 31% (4–5 Mitglieder), 23% (2–3 Mitglieder), 5% (10 oder mehr) und 2% (ein Mitglied) (CSA,2016b: 61).

Einkommenseffekte in der Bienenhaltung sind moderat, da sie vorwiegend als Nebentätigkeit ausgeübt wird. Die Deckungsbeitragsrechung für Direktvermarktung erreicht pro Bienenstock 388 ETB/Jahr für traditionelle, 676 ETB/Jahr für Übergangs- und 2010 ETB/Jahr für moderne Bienenstöcke. Die profitabelste Bienenstocktechnologie ist die moderne Art, vergleichbar mit europäischen Modellen, jedoch auch mit den höchsten Investitionskosten (4 300 ETB). Auch das Management ist komplexer und es wird spezielles Konstruktionsmaterial benötigt. Weitere Einkommensmöglichkeiten in der Bienenhaltung ist das Bienenwachs als Nebenprodukt der Honigproduktion bei traditionellen und Übergangsbienenstöcken (250 bis 350 ETB/kg) und die Bienenkolonien selbst (300 ETB in Lude Hitosa; 1 000 ETB in Tigrae). Andere mögliche Produkte wären Propolis und Blütenpollen.

Auch Finanzierungsmodelle oder alternative Unterstützungsansätze sind notwendig, um Imkern und anderen Akteuren die Aufnahme neuer Praktiken und damit neu entstehender Risiken zu ermöglichen.

Übergangsbienenkästen sind eine gute Alternative zu modernen Kästen für die Steigerung der Produktion und für ein verbessertes Bienenhaltungsmanagement (im Vergleich zu traditionellen Bienenkörben) und als ein Ansatzpunkt für Frauen, landlose Jugendlichen und Andere, um neu mit der Imkerei zu beginnen. Eine wichtige Schlussfolgerung von beiden Situationsanalysen ist, dass Bienenhaltung und Landwirtschaft als System zusammen gedacht werden sollten, anstatt beide separat zu betrachten. Die gegenseitige Integration von Apikultur und Agrarwirtschaft würde zu synergetischen Effekten mit positiven Wirkungen in allen drei Säulen der Nachhaltigkeit führen.

Bei der Landschaftsgestaltung könnten Pflanzen, die der Biene als Futter dienen, verschiedentlich integriert werden, z.B. als lebende Zäune, als zusätzlich integrierte Feldfrucht oder Bäume. Folglich wäre eine diversifizierte Landschaft mit Bienen ökologisch widerstandsfähiger (resilient) gegen schädliche Umwelteinflüsse. Auch kann die Landwirtschaft nachhaltig produktiv aufgebaut werden mit geringerem Pestizideinsatz und bodenkonservierenden Maßnahmen.

Ein Beispiel für sozialen Wert einer Mehrnutzungspflanze (Integrated Multi Purpose Plant, IMPP) ist die Meskel Flower (*Bidens macroptera),* die eine prominente Rolle bei äthiopischen religiösen Festen spielt. Die Integration der Pflanzen sollte vor allem Nutzen für die Bauern bieten. Die Pflanzen oder Kulturpflanzen könnten als zusätzliche Nahrungsquellen, als Futterpflanzen, Baumaterial oder Feuerholz dienen und damit den Bauern zusätzlichen Nutzen bieten.

Ökonomische Vorteile könnten bei der Integration der Bienenhaltung in das landwirtschaftliche System mit zusätzlicher Einkommenserwirtschaftung entstehen. Die Vermarktung von Wachs könnte für die ländlichen Haushalte weiteres Einkommen generieren. Außerdem würde sich zusätzliches Einkommen durch die Ausweitung des Fruchtwechsels ergeben. Pflanzen wie die Sonnenblume, Flachs oder Raps könnten geerntet und durch die Bauern vermarktet werden und zeitgleich als Bienenfutter für die Bienenkolonien genutzt werden. Die Produktdiversifizierung kann Farmer belastbarer (resilient) und weniger abhängig von Marktfrüchten (cash crops) werden lassen. Ein zweiter Schritt könnte die Etablierung von passenden Wertschöpfungsketten des Honigs sein. Bei steigender Nachfrage nach Inputversorgung (Verarbeitungsmaschinen, Schutzkleidung, Bienenkästen) könnte deren Produktion ebenfalls ansteigen. Zusätzlich Arbeitsplätze könnten kreiert werden (Verarbeitungsmanufakturen, Tischlereien).

Die Analyse zeigt: mögliche Synergieeffekte werden entstehen, wenn Landwirtschaft und Bienenhaltung in der Arsi-Zone in einem Systemansatz integriert werden. Hier können die Mehrnutzungspflanzen (Integrated Multi Purpose Plants) die Voraussetzungen erfüllen, einerseits als Bienenfutter genutzt zu werden und andererseits ein zusätzliches Einkommen für die Kleinbauern zu bieten, wobei andere Möglichkeiten, wie die Verwendung als lebende Zäune oder Randstreifennutzung u.ä., ebenfalls denkbar sind.

Empfehlungen

Die folgenden Empfehlungen sind im Detail im Bericht dargestellt:

1. Verbesserung der Zusammenarbeit der Interessensgruppen (a) in Forschung, Politikgestaltung und nationalen Organisationen und (b) in Imkerkooperativen.
2. Bewusstseinsbildung der weitgreifenden Bedeutung von Bienen als Bestäuber und Bioindikator zur Entscheidungsfindung in der Landwirtschaft.
3. Verbesserung der Inhalte, Struktur und Organisation von Imkertrainingsangeboten und Zugangsverbesserung für Frauen.
4. Imkerei, in Kombination mit anderen Aktivtäten, kann als eine mögliche Einkommensquelle für Jugendgruppen betrachtet werden.
5. Herstellung von und kostengünstiger Zugang zu Geräten für die Imkerei, Honigernte und Honigverarbeitung.
6. Weiterentwicklung kommerzieller Bienenhaltung durch die Verbindung von Imkern mit Großhändlern, bei Stärkung möglicher Imkereiprodukte und verbesserte Vermarktungsstrategien.
7. Entwicklung einer bienenfreundlichen Pestizidstrategie.
8. Förderung der Diversifizierung des Farmsystems und der umliegenden Landschaft.

Wenn das Grüne Innovationszentrum (Green Innovation Centre) sich zum Ziel setzt, die Bienenhaltung und gute landwirtschaftliche Praxis in der Arsi-Zone zu fördern, wird die Kombination und Integration dieser Aktivitäten möglicherweise zu einem nachhaltigen Ansatz führen. Eine totale Transformation des landwirtschaftlichen Systems zu einem führenden Honigproduktionsgebiet in Arsi-Zone zu erreichen, ist unrealistisch. Aber jeder einzelne Schritt in diese Richtung kann zu einer Verbesserung des aktuellen landwirtschaftlichen Systems beitragen, in ökologischer, sozialer und ökonomischer Hinsicht. Die Verhinderung des Verfalls des aktuellen landwirtschaftlichen Systems und der gleichzeitige Schutz der kleinbäuerlichen Existenzgrundlage in der Arsi-Zone wird es wert sein, sich für die Biene einzusetzen und sie im Arsi-Hochland zu bewahren.

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Abbreviations

ADLI	Agriculture Development-Led Industrialisation
AISE	Agricultural Inputs Supply Enterprise
AR	Arsi-Robe
ASPIRE	Apiculture Scaling Up Programme for Income and Rural Employment
ATVET	Agricultural Technical and Vocational Education and Training
BOAM	Support to Business Organizations and their Access to Markets
DA	Development Agent
DAP	Di- Ammonium Phosphate
EAB	Ethiopian Apiculture Board
EPRDF	Ethiopian People's Liberation Front
ESE	Ethiopian Seeds Enterprise
ETB	Ethiopian Birr
FDRE	Ministry of Finance and Economic Cooperation of Ethiopia
FGD	Focus Group Discussion
FTC	Farmer Training Centre
GIZ	Gesellschaft für Internationale Zusammenarbeit
GTP	Growth and Transformation Plan
IMPP	Identified Multi-Purpose Plant
IMX	Small and Micro Entreprises (SMEs) in Oromo language, Interpriyizii Maaykiroo fi Xixiqaa
IP-Consult	Institut für Projektplanung GmbH
ISD	Institute of Sustainable Development
LH	Lude Hitosa
SEWOH	Special Initiative "One World-No Hunger"
SNNPR	Southern Nations, Nationalities, and Peoples' Region
SNV	Stichting Nederlandse vriwilligers (Netherlands Development Organization)
T&V	Training and Visit

Glossary

Apiculture	Science and art of raising honey bees
Apiary site	Colonies, hives, and other equipment assembled in one location for beekeeping operations; also known as a bee yard
Beehive	Receptacle used for housing a colony of bees
Bee veil	Cloth or form of hat usually made of wire netting to protect the beekeeper's head and neck from stings
Belg	Minor rainy season from February to April
Brood	Immature bees that have not yet emerged from their cells. Brood can be in the form of eggs, larvae, or pupae of different ages
Comb	Mass of six-sided cells made by honey bees in which brood is reared and honey and pollen are stored; composed of two layers united at their bases
Comb foundation	Commercially made structure consisting of thin sheets of beeswax with the cell bases of worker cells embossed on both sides in the same manner as they are produced naturally by honey bees
Derg	Name for the former military dictatorship that ruled over Ethiopia from 1975 – 1987, oriented on a socialist political ideology
Extractor	Machine which removes honey from the cells of comb by centrifugal force
Frame	Piece of equipment made of either wood or plastic designed to hold the honey comb
Honey comb	Densely packed group of cells made by honey bees of beeswax and used for honey storage
Honey super	Upper body of beehive that is used to collect honey
Injera	A flatbread usually made from tef – a staple food of Ethiopian cuisine
Innovation	The process by which actors change given routines
Kebele	Municipality, administrative unit below *woreda* level
Meher	Main rainy season from June to August

Nectar	Sweet and often fragrant liquid secreted by the nectaries of plants for attracting animals. Nectar is the raw product of honey
Pollen	Male reproductive cell bodies produced by anthers of flowers. It is collected and used by honey bees as their source of protein
Pollination	The transfer of pollen from the anthers to the stigma of flowers
Propolis	Resinous materials collected from trees or plants by bees and used to strengthen the comb and to seal cracks; also called bee glue
Queen bee	Female bee with a fully developed reproductive system, and she is larger and longer than a worker bee
Shiró	Ethiopian widespread recipe based on chickpea powder
Small-scale farmer	Producer with 0.5–5 acres of land
Smoker	Device in which materials are slowly burned to produce smoke (not flames) which is used to subdue bees. It is important to use a material that produces a cool smoke as not to harm the bees
Top-bar hive	Manmade bee home trapezoid shaped with wooden top bars suspended from the top of cavity where bees draw their combs on
Tej	Traditional honey wine
Tef	Main cereal and endemic in Ethiopia, mainly used for tef production
Woreda	Districts, administrative unit below zonal level
Zone	Administrative unit below regional level

1 Introduction

The international discussion on development and food security in the South focusses on the global post-2015 development agenda, the Sustainable Development Goals (SDGs). SEWOH, "One World – No Hunger" (SEWOH) launched in 2014 by the German Federal Ministry for Economic Cooperation and Development (BMZ), is aiming to support the SDGs. Therefore, Green Innovation Centre/ *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) is interested in the current situation of agricultural practices and integration of apiculture and the potential in the Arsi-Zone in Oromia Region of Ethiopia. Hence the Green Innovation Centre Ethiopia assigned a multi-disciplinary team of junior consultants from the Centre for Rural Development (SLE, Humboldt-University Berlin) for this study. Throughout the study phase the six-strong SLE team collaborated with Ethiopian postgraduate students, two agronomy students from Jimma University and three dryland agroforestry and land rehabilitation students from Mekele University, and a project assistant (Green Innovation Centre/GIZ). The results of this study are thus a product of this joint venture.

The study looks at the possibilities of apiculture integration in agriculture in Arsi-Zone. Chapter 2 introduces the commissioning party and the research team. The aim and approach of the study are outlined. Chapter 3 provides a general framework of the setting in Ethiopia: the political, economic and legal conditions concerning the agricultural sector. Special focus lies on the Ethiopian honey sector. Chapter 4 introduces the research area of Arsi-Zone and outlines how data was gathered and analysed. In Chapter 5, findings on agriculture are detailed and challenges pointed out. Then findings and challenges along the value chain of honey are presented. The Chapter 6 focuses on opportunities for women and young people and the socio-cultural circumstances they face in the context of income generation and employment. Chapter 7 emphasises synergies which if promoted may benefit agriculture, beekeeping and the employment situation simultaneously. The final chapter concludes the findings and outlines recommendations aimed at overcoming the challenges that were identified.

2 Commissioning partner, aim and approach of the study

This chapter introduces the commissioning partner and the wider development agenda in which the work is embedded. It outlines the main study topics and hypotheses guiding the research. In addition, the aim and approach are explained and how the study was designed as a system approach.

2.1 The commissioning partner

In 2014, Germany's Federal Ministry for Economic Cooperation and Development (BMZ) launched the special initiative "One World-No Hunger" (SEWOH). The programme allocates considerable funding to the food and agricultural sectors through rural development efforts. One aim of the initiative is to enable small-scale farmers to increase their production capacities e.g. through innovations in methods, routines, cooperation, processing and marketing.

There are 13 Green Innovation Centres in the SEWOH initiative. These centres in India and across Africa disseminate innovative solutions from within the small-scale farmers' communities to increase productivity, profitability, employment and nutrition. The Green Innovation Centres aim to increase the productivity of 0.5 million small-scale farms through training courses by 2019 (BMZ, 2015: 17).

The Ethiopian Green Innovation Centre has launched "Innovations for Agricultural Productivity" (IFAP) in the Arsi-Zone of the Oromia Region, an area with a high potential for intensified crop production. This project includes the improvement of the value chains of faba bean and wheat. Interventions are focused on good agricultural practice, agricultural inputs, mechanisation and technology, investments and value chain actors' organisation (GIZ, 2016). IFAP's approach is in alignment with the second Ethiopian Growth and Transformation Plan (GTP II) (see section 3.1). The administrative districts (*woredas*) of Arsi-Zone in which the Green Innovation Centre's IFAP is implemented are: Arsi-Robe, Lude Hitosa, Hitosa, Tiyo and Digalu Tijo. They were chosen for their high potential to increase productivity and profitability of wheat and faba bean production. Actions taken included testing and show-casing good farming practice in farmers' field schools and cooperation with farmer training centres. Through an integrated approach, market opportunities and income were envisioned to improve, especially for women and youths.

The Green Innovation Centre, as the commissioning partner of the present study, was interested in assessing the suitability and feasibility of additional and alternative agricultural practises for sustainable and inclusive development. Beekeeping and honey was used as an entry point to the wider agricultural production system. The aim was to identify how this related to the context of the project area (Arsi-Zone).

2.2 Aim of the study

The aim of the study was to identify possibilities and give recommendations concerning the improvement of beekeeping in Arsi-Zone, furthering the integration of honey production and crop farming to enhance sustainability and to identify opportunities for income generation and employment especially for women and youths along the value chain of honey.

In Arsi-Zone, no primary attention is given to beekeeping and honey production. Within a mainly crop producing area, bees and beekeepers face a multitude of challenges. In other parts of Ethiopia, main hindrances were found to be lack of bee forage, the levels of pollutants, and a lack of available beekeeping inputs (Adeday et al., 2012). The integration of crop farming and beekeeping still has to be addressed.

Additionally, small-scale farmers in Arsi-Zone are producing crops below their full capacity within unsustainable production systems. Sustainable ways to transform agriculture systems with low inputs and low outputs to systems with higher outputs are needed. At the same time, the study focused on possibilities for the diversification of production systems.

Arsi-Zone is not particularly known for its honey production. So why focus on beekeepers in an area of predominantly cereal farming? Because beekeeping may serve as an entry point to a multitude of inter-linked topics in a complex agricultural system. The focus on beekeeping and honey production allows:

- A dialogue about farming practices
- A consideration of sustainable farming methods
- A discussion on possibilities for income generation
- A wider consideration of the agro-ecological landscape

All of which can lead to the development of an integrated, multi-dimensional system approach.

2.3 Study approach

The approach contains the three central topics: 1) agriculture, 2) apiculture and 3) income generation and employment opportunities. Each aspect was assessed according to the current situation and the limitations. In agriculture, this referred to production systems and inputs. In beekeeping, the focus was on the value chain of honey and knowledge and practices of local beekeepers. For employment opportunities and income generation, the socio-economic context of women and youths was the focus.

The following questions guided the research. They are considered in the following chapters.

I) If honey is a highly valued commodity in Ethiopia, what is preventing beekeepers in Arsi-Zone from realising its full potential?

II) If bee forage is a major constraint to beekeeping in Arsi-Zone, how can the planting of bee forage be promoted?

III) If bee populations are in decline, how is this related to the agricultural system in Arsi-Zone? And if the agriculture is causing environmental damage, how can sustainability be improved?

IV) If beekeeping could be better integrated into the crop farming system, what effects would this have on the sustainability of the agricultural system?

V) If beekeeping is a lucrative side-activity, how can women and youths get involved to generate income?

System approach

To assess agriculture, apiculture and additional income-generation independently but at the same time relate the three aspects and find comprehensive solutions, the study team developed a system approach: Good agricultural practices, beekeeping and honey production as well as income generation and employment opportunities were analysed in a wider context. Three key dimensions were considered (environmental, economic and socio-cultural). In accordance with the system approach, a special emphasis was put on the relationships between the different aspects (e.g. see Box 1). Ideally a systemic analysis will help find opportunities that can be mutually beneficial and improve the dimensions' various components. These opportunities identified as synergies are elaborated on in Chapter 8. If various system components were to be considered independently, realities might not only be ignored but interventions in one part of the system could be detrimental to others.

For example, from an economic point of view a high demand for honey could be an opportunity to generate income for women and youths who are not yet involved in beekeeping. But it is also necessary to assess social or cultural aspects, such as inhibitions preventing women or youths from partaking in beekeeping. The potential would also need to be viewed in the environmental dimension, considering whether the conditions are favourable to increase the number of bee colonies or improve honey harvest, or how these conditions would need to change. Any changes or adaptations should be as broadly beneficial as possible. Most importantly, changes in one part should not have negative impacts elsewhere. For example, agricultural practices that are more appropriate and less harmful to pollinators are only viable if they do not threaten farmers' livelihoods and are feasible under the given circumstances.

Box 1: Honey bees as pollinators – economic and ecologic importance

Flowering plants and pollinators are closely linked through co-evolution. Pollination as an ecosystem service contributes to ecosystem sustainability, plant reproduction, crop productivity, pest management and many more aspects, both in the wilderness and in agriculture (Buchmann and Nabhan, 1996; Kevan and Wojcik, 2007). The most important economic contribution of the honey bee is neither honey nor an associated hive product but global pollination services. They contribute 10–15 times more to the global economy than honey products (D.I.B. e.V., 2017). In 2015 this contribution to crop production constituted of an estimated US$ 235 to 577 billion of market value (IPBES, 2016). The absolute value of pollination services is not easily determined since the dependency of crops on animal pollination varies and markets are versatile. However, 35% of global crop production depends on animal pollination either for fruit or seed production or for substantial yield increases (Hein, 2009; IPBES, 2016). For example, yield of oilseed rape and sunflower increases by 20% through animal pollination and doubles in fruit trees (Oliva, 2016). Pollination has been found to be the agricultural input that contributes the greatest to yields, beyond other management practices (Manriquez, 2016). If animal pollination collapsed, up to 8% of global crop production volume would be lost entirely, in 40% of crops it would lead to yield reductions. Which is why Kevan and Wojcik (2007) stated: "Conservation of honeybees, other domesticated bees, wild bees, and other pollinators is an important issue in the global context of agricultural and natural sustainable productivity".

Taking the system approach into consideration, the study does not aim to change the agricultural system to accommodate beekeeping, but rather to take measures to enable a step by step integration of beekeeping into the farming system, while highlighting shortcomings and urgent measures. This results in the development of strategies to improve beekeeping and their integration in the farming system, as well as the assessment of necessary steps to enhance income and employment opportunities along the value chain of honey. Possibilities were identified and recommendations for future interventions are formulated.

3 Framework conditions in Ethiopia

This chapter describes the framework conditions for small-scale farmers and honey production in Ethiopia. After some general information about Ethiopia, the current government and the agricultural sector are described, focussing on policies, extension services and the situation of small-scale farmers. In addition, information is given on honey production and its potential in Ethiopia.

3.1 General information on Ethiopia

Ethiopia is the second most populous country in Africa, with close to 100 million people and an estimated annual population growth rate of 2.9%. It is a diverse country with over 70 ethnic groups (CIA, 2016). The geography encompasses highland, lowland and desert, while most of the population is concentrated in the highlands with nearly 80% of the population inhabiting 37% of the landmass (Berhanu and Poulton, 2014: 198). In the highlands, mixed farming (farms with crop production and livestock husbandry) is prevalent, while in the lowlands pastoral production is the main source of income. Two thirds of the agricultural revenues are derived from cereals and legumes and a quarter from cattle rearing (Lefort, 2015: 371). In all of Ethiopia, agriculture accounts for 73% of employment (Zerihun et al., 2016: 3). In the rural areas, agriculture provides 90% of all possible employment opportunities (Bezu and Stein, 2014: 260). Ethiopia, the second most populated country in Africa after Nigeria, is also the least urbanised, with urbanisation at only 19%, significantly below the sub-Saharan average of 37%. The urban population has grown at an average 3.8% per annum since 2005 and is expected to triple from 15.2 million in 2012 to 42.3 million by 2037. (Zerihun et al., 2016: 2).[3] The literacy level among Ethiopians is 49.1 % (CIA, 2016).

Ethiopia has been an economic success for the past 10 years with a declared average annual growth rate of 10.5% (CIA, 2016:24).[4] Growth is mainly generated by public-sector-led development and in the fiscal year 2014/15 was divided into the sectors agriculture (38.8%), services (46.6%) and industries (15.2%) (Zerihun et al., 2016: 2).[5]

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3 The average urbanisation level in Africa is 37% (Zerihun et al., 2016: 3).

4 The growth rates seem very optimistic and cannot be confirmed by IMF or World Bank, who estimate a robust growth of 7–8 % (Lefort, 2015: 358). This also seems to be true for agricultural statistics (Lefort, 2015: 358). The reason might be the importance of numbers to show the success of the government.

5 The GDP is estimated to be around US$ 70 billion (CIA, 2016).

Recently, Ethiopia has mainly received media attention for two events. In 2016, around 10 million people were dependent on food aid due to a drought induced by El Niño (FAO 2016b). Furthermore, civil unrest grew in 2016, with protestors demonstrating against the government. Security forces reacted with mass arrests and killings (HRW, 2016). The government declared a six-month state of emergency on 9 October 2016 after the destruction of government buildings and private property (including foreign investments).

Role of the state and development strategy

After deposing the former socialist *Derg* regime, a party coalition under the name of Ethiopian People's Liberation Front (EPRDF) came to power in 1991. The initial political ideology of the EPRDF was based on Marxism-Leninism, but the economic model has moved from a strongly socialist inspired to a "developmental capitalist" model comparable to that of China (Vaughan, 2011: 620). For the government, development success and broad-based economic growth are a way of sustaining their political legitimacy.

Since 2005, the political space for the opposition has diminished. The EPDRF increased their membership base from 760 000 in 2005 to 7.5 million in 2015, rewarding members for their loyalty with access to land, fertilizers, higher education or civil-service jobs, leading to a fusion of the party and the government (Arriola and Lyons, 2016: 81). In the 2015 election, the EPRDF won all 547 seats in parliament.

The government's aim is to develop the economy rapidly through broad-based growth, including small scale-farmers. Ethiopia is a low-income country with a per capita income of $590 in 2015 (World Bank, 2016b). In the Human Development Index, the country is ranked 174 out of 183 (UNDP, 2016). According to the current governmental five-year development plan, the GTP II, Ethiopia wants to become a low-middle income country by 2025 (FDRE, 2016).

3.2 Agricultural sector

For the Ethiopian government, small-scale farmers are important for economic and political reasons. The governmental extension service reaches into every village and is one of the most important actors in small-scale farmer development. Another way to evolve agricultural production is the promotion of modern technologies, including the use and supply of mineral fertilizer, improved seeds and pesticides. The crucial institutional framework for the access of land for small-scale farmers is the land legislation in Ethiopia, a heritage of the former socialist *Derg* regime, which means that all land belongs to the government.

3.2.1 Agricultural policy

Small-scale farmers are at the centre of agricultural production. Of around 17 million private agricultural households in Ethiopia, over 15 million are smallholder[6]. They produce about 95% of the national agricultural output (CSA, 2016a: 2). The average holding size of an agricultural household is 1 ha, of which on average 0.9 ha is used for crops.[7] The average agricultural household has 5 members (CSA, 2016b: 16). Within the GTP II, small-scale farmers are aimed at transforming from subsistence agriculture to market production. In the ADLI (Agriculture Development-Led Industrialisation) established in 1993, agriculture is identified as the sector with most economic development potential (Lefort, 2015: 363). The idea was to develop the sector with the help of the extension service and at the same time to gain the political support of the peasantry (Lefort, 2015: 363). The state invested 15% of the development budget in agricultural and rural development from 2002/3 to 2011/12 (Fan et al., 2009). Economically, the development of the agricultural sector was not as successful as expected, as the productivity of small-scale farmers did not increase as planned and investment returns were higher in other sectors. According to the GTP II, growth is generated through processed agricultural products, in manufacturing, like textiles, garments and leather goods, as well as infrastructure, including power generation, roads and rails (FDRE, 2016).

Extension service

Based on the ADLI the government devised the agricultural extension service to develop the agricultural sector. The Ethiopian extension service is based on a Training and Visit (T&V) system (Spielman et al., 2011: 25). In 2004, the government established Agricultural Technical and Vocational Education and Training colleges (ATVETs) to train the staff for the extension service and Farmer Training Centres (FTCs). The extension service aims to employ three extension workers called Development Agents (DAs) per *kebele* (smallest administrative unit in Ethiopia), who specialize in crop production, livestock production and natural resource management, with additional agents working across *kebeles* on animal health (under a separate Ministry of Livestock and Fisheries). In this system, beekeeping

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6 According to the Ethiopian Central Statistical Agency, smallholders are private holders with a holding size up to 2h (CSA 2016a, 2016b).

7 This crop land includes temporary crops such as cereals, oil seed and pulses, as well as permanent crops such as fruit trees and trees for beverages such as coffee or tea (CSA, 2016b: 11f)

is part of the livestock production. When fully implemented this will lead to more than 60 000 extension workers in the whole country and is by far the biggest extension service in Africa.[8] It represents one of the lowest farmers to extension worker ratios in the world (Berhanu and Poulton, 2014: 198).

The activities of the extension service include training, advisory service and credit supply (CSA, 2016a: 18). In 2015/16, 7.4 million households participated in crop extension programmes (CSA, 2016a: 18). The extension workers reached 40% of the farmers' households with training and more than 60% with their advisory service (CSA, 2016a: 19). Another role is credit supply, which was accessed by 3.3 million households in 2015/16. As most of the farmers cannot pay cash for inputs, the government established a credit system (Berhanu and Poulton, 2014: 205). The farmers are supposed to be organised in cooperatives or in credit and saving groups under the guidance of extension workers. After receiving inputs on credit, borrowers must repay their debt after the harvest.

The agricultural extension service is an example of the government's top-down approach in politics and the economy. In accordance with the administrative structure, control lies in the hand of the regional governments. Nevertheless, the success of the extension service and the work of DAs respectively are measured in numerical targets and physical input (Spielman et al., 2011: 25). Those numbers refer to the national level. In consequence, this structure does little to encourage local capacity or respond to local demand and DAs see themselves as distributers of credit and inputs, which impairs their role as technical advisors (Spielman et al., 2011: 25).

Apart from economic goals and the aim to develop the agricultural sector by transforming production, farmers represent another interest of the government. Some 17 million households constitute an important political support basis of the government.[9] To reach and influence this target group, the extension service is an important instrument to gain political support. Through the extension service, the state is able to reach into every community and village (Berhanu and Poulton, 2014, Lefort 2015: 385). Moreover, the structures of the extension allow the replacement of societal organisations through state-influenced structures. Additionally, extension officers give preference to farmers who are loyal to the party

8 In 2008, the number of DAs reached almost 47 500 (Spielman et al., 2011: 25).

9 The total number of all private agricultural household members in Ethiopia in 2015/16 is around 88 million (CSA, 2016b: 16).

when distributing seeds, fertilizers, credits, etc. (Berhanu and Poulton, 2014: 206f). This method has also been used to increase party membership since 2005.

An evaluation of the extension service by Spielman et al. (2011) shows mixed results. While the training of extension service workers increased massively, the quality of FTCs are lagging behind. Furthermore, one aim is to adapt training and extension service packages to the diversity of agro-ecologies and communities. The political motive of supporting farmers loyal to the party can be diametrically opposed to the economic motive to support the farmers who perform best (Berhanu and Poulton, 2014; Lefort 2015). For the small-scale farmers, this means that their political opinion can have an influence on the governmental support.

3.2.2 Agricultural input use and supply

According to the government, modern technologies are important for small-scale farmers to increase their production. The developmental capitalist ideology of the government in consequence justifies a strong involvement in and influence on market structures. This mainly concerns the use and supply markets for agricultural inputs like mineral fertilizer and improved seeds. In contrast, private sector actors are more involved in the pesticide market as shown below.

State and markets

The government is generally sceptical about private actors and is strongly involved in strategic markets (Abegaz, 2011). The production of staple food and the access to small-scale farmers is one example of a strategic market. In Ethiopian markets, private actors can be side-lined while public enterprises and actors with close ties to the party can be given an advantage. In the case of the Ethiopian economy this fosters

> *"the separation between two economies, one that is either part of the power structure (public and parastatal companies) or operating within its orbit (the new oligarchs), and one that is independent and pays a price for that. The 'privileged' sector could reach yearly returns on investment as high as 50 per cent or 60 per cent [...]. The disadvantaged sector [...] might give a rate of return on investment of 30 per cent per annum."* (Lefort, 2015: 383)

This circumstance has consequences on the effectivity of markets in general and specifically on prices, competitiveness and supply. The task of input distribution shifted from the extension service to cooperative unions and unions for the extension service to focus more on technical advice (Spielman et al., 2011: 27). In Ethiopia, each *kebele* usually forms one union. The next highest administrative level is the *woreda*. Above the *woreda* is the zone. Cooperative unions are located on the zonal-level. One administrative step higher are the regional branches of the Ministry of Agriculture, and on top the national level. Unions work in this structure as wholesalers and distributers. This will be explained further for the case of mineral fertilizer and improved seeds. As mentioned earlier, unions are also a channel for farmers to gain access to credit to pay for supplies.

Mineral fertilizer

Of all the land cultivated by small-scale farmers in Ethiopia in 2015/16, around 56% was fertilised. For 79% of the fertilised land, mineral fertilizer was used and for 21% organic fertilizer (CSA, 2016a: 10).[10] Around 90% of the fertilizer went into cereal production which is cultivated on about 70% of the agricultural land (CSA, 2016a: 10).

The government liberalised the fertilizer market in the early 1990s and the private sector grew in 1996 to several private actors importing fertilizer: 67 private wholesalers and 2 300 retailers (Spielman et al., 2011: 188). Those firms were gradually replaced by private holding companies with close relations to the government. Since 2007 the parastatal Agricultural Inputs Supply Enterprise (AISE) has been the sole importer of fertilizer, and cooperative unions provide the distribution channels. This has led to "a state monopoly over fertilizer importation but also a cooperative monopoly over fertilizer distribution" (Agbahey et al., 2015: 96).

In short, the fertilizer supply chain works as follows (Agbahey et al., 2015): Import planning begins with the demand assessment by the Das, who estimate the projected demand on *kebele* level. The information is aggregated through *woreda* level up to the Zonal Bureau of Agriculture and collected on national level. AISE calls for tenders on the international market and imports the estimated demand. The cooperative union offices in the zonal capitals are the wholesalers and distribute the fertilizer to unions down to *kebele* level. According to Agbahey et al. (2015), the biggest challenge in this system is the high price of fertilizer which can be two to three times higher than the world market price. Moreover, demand estimates are based on guesses and are too high, which generates high stock leftovers, increases the storage costs and finally the price. Ethiopia as a land locked country also has high transport costs.

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10 The area cultivated by small-scale farmers is around 14.5 million ha (CSA, 2016a: 10). The statistically recorded mineral fertilizer are DAP, urea and NPS (CSA, 2016a: 10).

Improved seeds[11]

The application of improved seeds in Ethiopia is at a relatively low level. Around 11% of the cereal cropped area in 2015/16 was covered by improved seeds, with much lower levels for oil seeds (1.5%) and pulses (1%) (CSA, 2016a: 15). Other farmers use their own indigenous seeds, which are multiplied by the farmers themselves. Most of the improved seeds for cereals are maize (83%), wheat (10%), tef (6%), barley (1%) and sorghum (0.3%).[12]

The Ethiopian improved seed market is dominated by state actors (Spielman et al., 2011). The state-owned Ethiopian Seeds Enterprise (ESE) is responsible for the production and multiplication of improved seeds. It builds on the same system of demand estimation, from DAs on the ground up to the zonal bureau and aggregated on national level. Seeds are distributed through the described regional input supply system based on unions. To produce improved seeds, the ESE uses private subcontractors, state farms, cooperatives and state-owned regional seed enterprises, e.g. the Oromia Seed Enterprise, to produce and to collect the demanded seeds. The formal seed system is constantly falling short of supply. The supply in percentage of official demand in 2008 was 24% wheat, 7% barley, 48% maize and 19% of tef (Spielman et al., 2011: 12). One of the bottlenecks is the supply of pre-basic or basic seeds by research centres or universities to the production sites. These basic seeds are an essential input for the certified seed production, but their supply is already insufficient and does not meet the demand.

Pesticides

In 2015/16 the area of pesticide application was around 3.5 million ha, which was approximately 24% of all cultivated crop land (CSA, 2016a: 17). Most of the pesticides were used for cereals; pesticides were applied on 32% of the cereal land (CSA, 2016a: 17).

The pesticide market is different from the fertilizer and seed market in that it is dominated by private actors (Mengistie et al., 2016).[13] International manufacturers work with local retailers in Ethiopia. There are 41 legally registered pesticide

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11 According to CSA improved seed "is crop variety, which gives a significantly higher yield, and better quality compared to locally produced variety of seeds" (CSA, 2016c: 9).

12 The share of all cereal land for these cereals are: maize (21%), wheat (17%), tef (29%), barley (10%) and sorghum (19%) (CSA, 2016a: 13).

13 Adami Tulu Pesticide Company is the only Ethiopian pesticide formulating company, using imported ingrediencies and produced from the year 2000 to 2012 around 9 000 metric tons which is around one quarter of the available agricultural pesticides in that time frame, while 32 000 metric tons have been imported (Mengistie et al., 2016: 67).

importers in Ethiopia. Pesticides must be registered by the Ethiopian state and are sold in licensed shops. According to Mengistie et al., most of the farmers buy pesticides at a shop (81%) followed by cooperative unions (13%) or on the open unregulated market (6%) (2016: 70).

While the supply of pesticides is not a problem, the main challenge of the pesticide supply chain is a lack of state governance, showing a lack of control.[14] Information and training is essential for an appropriate application of pesticides. The research of Mengistie et al. showed a lack of training and information distribution: only 11% of the farmers they observed received training from the extension officer, while 47% gained information on pesticide use from neighbouring farmers (ibid, 2016: 70).[15]

The situation of fertilizer, seeds and pesticides show that government companies and institutions play a main role in production and supply. The state has influence on how much and to whom it will supply, except for pesticides. The government believes it is able to make better informed decisions to benefit a broad base of farmers. For the farmer this could mean that their political opinion can have influence on their input supply[16] and the supply of certain input can depend on availability and state goals.

3.2.3 Land legislation and access to rural land

The access to land is crucial for farmers. In Ethiopia, all rural and urban land is under public ownership and peasants have only user rights and no right to sale, exchange or pledge land (FDRE, 1995).[17] According to Ambaye (2013: 70ff), the argument by the government for public ownership of land serves two policy objectives: social equity and tenure security. Social equity means that all people shall have equal access to land. Regarding rural land, the constitution grants every rural

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14 There are no ingredients testing facilities, which also means that the analysis of imported pesticides is not possible. Furthermore, there are no unannounced examination of importers because of lack of personal of the Ministry (Mengistie et al., 2016)

15 Other information sources for farmer are extension service (31%), cooperative union (13%) and retailers (9%) (Mengistie et al., 2016: 70).

16 Lefort (2012) shows the example of "model farmers", who are economically successful, promoted through the state as "new entrepreneurs" and at the same time are party members. They serve an economic and a political agenda as a model for other farmers.

17 Article 40 (3) of the Constitution: "The right to ownership of rural and urban land, as well as of all natural resources, is exclusively vested in the State and in the peoples of Ethiopia. Land is a common property of the Nations, Nationalities and Peoples of Ethiopia and shall not be subject to sale or to other means of exchange" (FDRE, 1995).

citizen wanting to engage in farming free access to land.[18] The availability of agricultural land is a natural limiting factor. In recent years, the increasing rural population could only be provided with farm land by decreasing average holding sizes. Moreover, the productive land in the highlands is continually decreasing, e.g. through erosion or degradation (Gebreselassie, 2006: 2f). Currently, especially youths are affected by the lack of additional arable land which pushes them into unemployment, non-farming activities or sharecropping (Gebreselassie, 2006: 2). Though officially operating as a same-rights system, women's access to land is usually determined by their husbands. They are legally able to own land but in reality few land owners (or heads of household) are women.

Regarding land tenure security as the second policy objective, the government argues that state ownership protects peasants against market forces, as they would be forced to sell their land during times of hardship (Ambaye, 2013: 71). Critics say that a lack of ownership will have a negative effect on the security of long-term land use and impede investments to develop this land (Gebreselassie, 2006: 2). The government enacted laws to increase subjective tenure security. These measures included life long tenure security, rights to compensation for land that is taken for public or private investment and minimum plot sizes (Crewett and Korf, 2008: 210). Most importantly, the government initiated a land registration process. This allows federal governments to register land users and issue certificates which give the holder the right to use the land. These certificates can only be transferred through inheritance or gifting to family members, divorce and rent, while commercial mechanised farmers can lease land from the government (USAID, 2011: 8).

The implementation of land rights is organised by the federal states. For this study, the land policy of Oromia is relevant (FDRE, 2007). Land use rights in Oromia not only give tenure security to the farmer, but also oblige the farmers to cultivate the field and to make use of the land for agricultural purposes. When farmers do not cultivate the land (except to restore fertility in fallow periods) user rights can be terminated. If the land has not been cultivated within two years the land user will be deprived of his land use rights (FDRE, 2007: 4). Land can also be leased, but leasing is restricted. Rights holders can lease out up to half of their land for a period not exceeding three years unless the land is cultivated with mechanised production methods (FDRE, 2007: 5). These rules aim to secure that

18 Article 40 (4) of the Constitution: "Ethiopian peasants have right to obtain land without payment and the protection against eviction from their possession" (FDRE, 1994).

the holder of land use rights is a local resident and that they cultivate at least half of the land themselves.

3.3 Honey production and potential in Ethiopia

Honey production and beekeeping (and honey hunting) are a long-standing Ethiopian tradition first mentioned in the hieroglyphs of ancient Egypt (Hartmann, 2004: 2). With a total honey production of 50 800 t in 2015/16, Ethiopia is the biggest honey producer in Africa and is ranked ninth in the world (CSA, 2016d; FAOStat, 2016b). With an export of 900 t in 2013 it is also the biggest exporter of honey in Africa (FAOStat, 2016b). There are an estimated 5.92 million hives in Ethiopia and around 1.4 million households practice beekeeping (CSA, 2016d; MoA and ILRI, 2013: 3).

Several factors favour beekeeping in Ethiopia, including the various agro-ecological zones and plant species; in some areas three honey harvests a year are possible, for example in Jimma, Oromia (E28). The main honey types are white, yellow and dark in colour with white Tigray honey fetching prices of up to ETB 350/kg in a supermarket in Addis Ababa. The overall potential for honey production in Ethiopia is estimated to be 500 000 t/year (MoA and ILRI, 2013: 3).

Of the total honey production of 50 800 t in 2015/16 (see Table 1) around 93% was harvested from traditional hives, 2.5% from transitional hives, and 4% from modern hives (hives types are described in chapter 6). The traditional hive with an average harvest of 8.3 kg/hive/year has the lowest productivity. The transitional hive has an average production of 18.3 kg/hive/year, and the modern hive of about 15.5 kg/hive/year.

Table 1: Honey production in Ethiopia, 2015/16

	Traditional	Transitional	Modern	Total
Number of hives	5 706 959	70 753	138 388	5 916 100
Share (%)	96.46	1.2	2.34	100
Production (tonnes)	47 352.62	1 293.06	2 144.88	50 790.57
Production (%)	93.23	2.55	4.22	100
Production (kg/hive)	8.3	18.3	15.5	8.6
Harvest (per year)	1.61	1.95	1.64	1.73

Source: CSA (2016d)

The relatively low number of modern hives compared to traditional hives, and the low productivity (less than half the estimated harvest potential for modern hives of 40 kg/year) indicates that there are some obstacles to the use of modern hives in Ethiopia. This impression is also supported by the comparison of the number of modern hives from previous years. The number of modern hives in use decreased from 155 376 in 2013 to 138 388 in 2015 (see Table 2) [19]. Reasons for this decrease may be flaws in the technology of modern hives (inaccurate construction of hives with incorrect measurements, use of paint that is toxic to bees), lack of inputs like beeswax or lack of forage resulting in bee swarming and bee colonies leaving the bee hive (E28).

Table 2: Number of bee hives in Ethiopia, 2013–2015

	Traditional	Transitional	Modern	Total
2013	4 996 933	54 991	155 376	5 207 300
2014	5 663 492	71 900	149 871	5 885 263
2015	5 706 959	70 753	138 388	5 916 100

Source: CSA (2014, 2015a, 2016d)

The Regions Amhara (19 900 t), Oromia (16 000 t), Southern Nations, Nationalities, and Peoples' Region (SNNPR) (7 900 t) and Tigray (2 700 t) are the leading producers of honey in Ethiopia (see Annex 1). Oromia is the region with most beehives (50.9%, around 3 million) and is producing 31.4% of the national output. Amhara has the highest productivity with 39.7% of the honey produced from 22.4% of Ethiopia's beehives (around 1.3 million).

Of Ethiopia's total honey production, about 38% is used for household consumption and about 58% is sold (CSA, 2016e: 93). Remaining honey is used for wages in kind (1%) or for other purposes (3.5%). Roughly 70% of honey marketed in Ethiopia goes into the *tej* production (see Box 2), a locally made mead (MoA and ILRI, 2013: 2). The honey used for *tej* production has a very low price due to poor quality, since the honey is not extracted from the wax. The value of wax is unknown to most beekeepers practicing traditional beekeeping, even though they have a high wax yield (Yadeta, 2014: 449). The estimated yearly production of

19 Bee hives are counted where honey has been harvested at least once a year.

beeswax is above 5 000 t. Local prices vary from ETB 250 to 350/kg (Yadeta, 2014: 449f.).

The Ethiopian Ministry of Agriculture and Natural Resources has recognised the potential of honey production and developed a national strategy to promote the honey sector (MoA and ILRI, 2013). The national production of honey is envisioned to quadruple to 200 000 t (+ 12 000 t beeswax) and export to 2 400 t (1 000 t beeswax) until 2025. The number of beekeepers should double to 2.8 million and the annual production should increase to an average of 40 kg per hive. The extension service offers training in beekeeping through the honey and wax development package, which is part of the livestock extension package. In the year 2015/16, 292 000 farm holders were trained within the livestock extension package, while 4.5% of them received the honey and wax development package (53% poultry, 20% dairy, 15% beef/meat/mutton) (CSA, 2016d: 36). Furthermore, in 2009, the government adopted a "Proclamation to Provide for Apiculture Resources Development and Protection" which allows legal sanctions for pesticide application that causes damage to bee colonies (FDRE, 2009). The proclamation has not yet been implemented.

In summary, the honey sector in Ethiopia has a long tradition, high production and an even higher potential, currently producing 10% of the potential estimated. The production is characterised by traditional methods. The government is putting efforts into developing the apiculture sector but it is not a priority in the activities of the extension service. In the past three years, the number of modern hives in use decreased, which indicates constraints on the application and dissemination of modern technology. Furthermore, most of the honey is sold as crude honey and goes into *tej* production. Processing of honey and additional products like wax could increase the income for beekeepers.

Box 2: *Tej* making

Tej, also known as honey beer or honey wine, is a yellow mead with a sweet taste. Because of its yeast content, *tej* contains carbonic acid and is cloudy. It is produced at household level for direct consumption and in *tej*-pubs. An estimate given for the average per capita consumption of *tej* is 7.8 l annually and rising (Bahiru et al., 2001; F17). Approximately 80% of Ethiopian honey is used for *tej* making (Hartmann, 2004). Recipes vary across the country and with the intended flavour and potency. The flavour is also known to vary depending on the area in which the honey was collected, variable both with the area's climate and the bee forage. From Lude-Hitosa it was reported that local honey was unsuitable for *tej* production and especially, that the honey shouldn't be too fresh (T7). *Tej* house owners use honey that has been stored for some weeks or month prior to brewing (T6). The following ingredients make up *tej* recipes:

- 1 part (liquid volume) honey, 2–5 parts (liquid volume) water

Optional ingredients:

- leaves of *Gesho* (*Rhamnus prenoides*), hops, malt, sugar, various types of bark, root or herbs

The mixture is left to ferment for between one to three weeks at room temperature (Bahiru et al., 2001). According to some recipes, the solid matter is strained from the liquid partway through the fermentation process. Some *tej* producers also heat the beverage at some point during fermentation.

***Tej* being filled into kettle**

Photo: Diekjürgen

Traditional *Tej* bottles

Photo: Zimmermann

4 Study region and methodology

The study makes use of qualitative and participative research methods. This allowed an integrative investigation and offered a profound understanding of the research area's landscape. The following chapter introduces the study region, sheds light on how data was collected and analysed and explains for what purpose the methods were chosen.

4.1 Study region: Arsi-Zone

Arsi-Zone was selected as the study region by the commissioning partner due to the Green Innovation Centre's involvement and project activities in that area. As mentioned earlier, the Green Innovation Centre is interested in assessing the potential of beekeeping and honey as an entry point to the wider agricultural production system in the country's wheatbelt region of Arsi-Zone.

The Arsi-Zone is one of 18 zones within the Oromia Region, which is the largest region in Ethiopia. Asela is the capital of Arsi-Zone, which is divided into 26 administrative units, the *woredas*. The *woredas* are again subdivided into a total of 648 *kebeles* (BoFED, 2011).

Arsi-Zone is classified into five agro-ecological zones: warm, moderately warm, moderately cool, cool, and cool/cold zones. The agricultural highlands, comprising of above 70% of the total area, are moderately cool or cold, with average temperatures between 10°C to 20°C (BoFED, 2014). The hottest months are February to May, while October to January are the coldest. Mean annual rainfall in the zone is 1 020 mm. Although differing between areas and altitudes, in general there are two rainy seasons known as *belg* and *meher*. The *meher* rains fall mostly in June, July and August. In some areas, the *belg* season from February to April can also be used for crop production (BoFED, 2011).

In total, the Arsi-Zone comprises of 21 009 square kilometres of which 44% are cultivated land (Oromia Stats, 2008). Arable land is located especially in the highlands, where rain-fed crop cultivation, sedentary livestock rearing and the twelve state farms can be found. Other forms of farming are plantations, horticulture, and pastoral and mixed farming, including both mechanised and traditional practices.

Recent censuses indicate that Arsi-Zone now has a population of 3.1 million people. Of these well above 40%, and in some *woredas* 45% are below the age of 14 years. Including the elderly, this means half of the population is economically dependent on the other half.

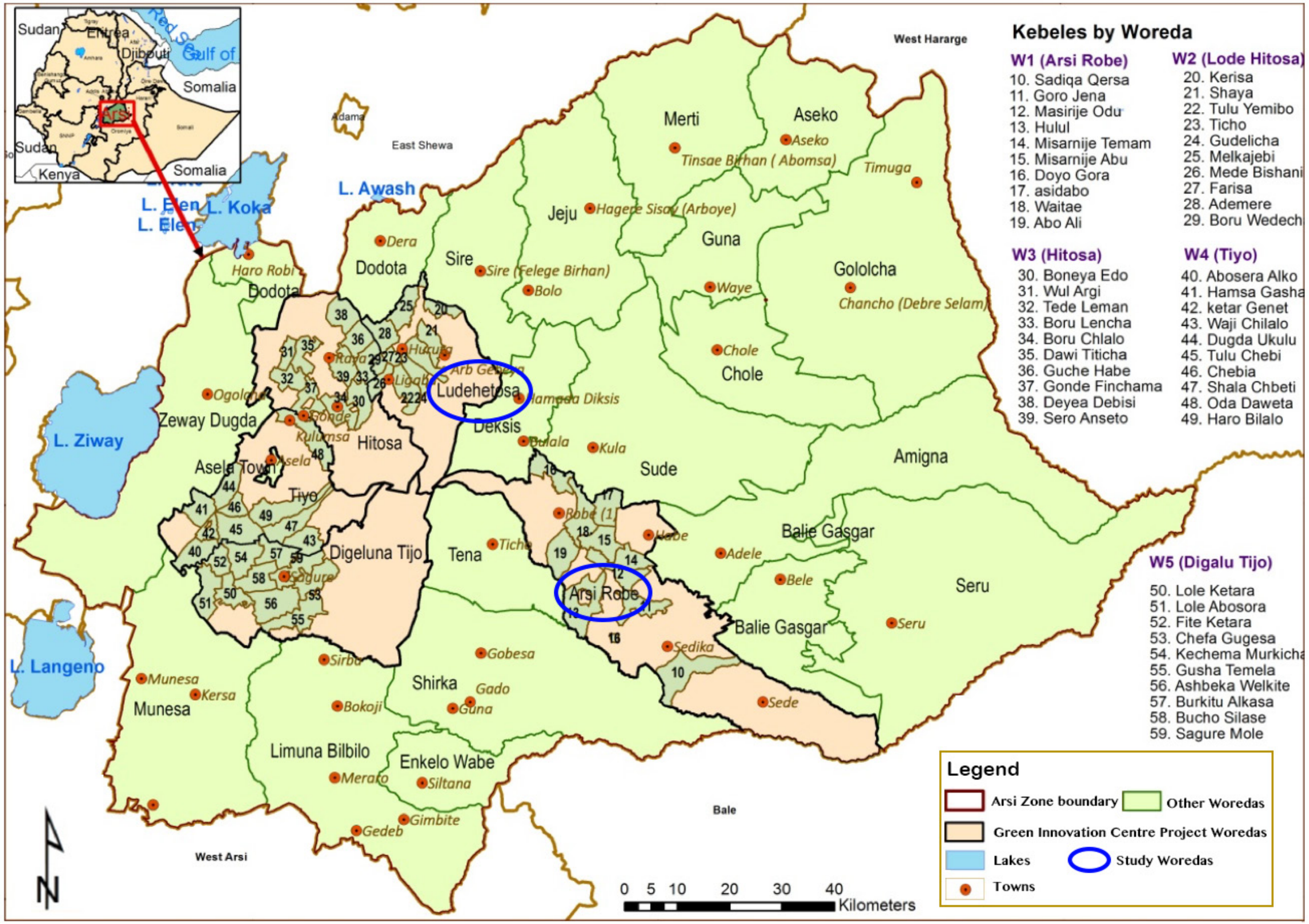

Figure 1: Study region and selected *woredas*

Source: modified from Green Innovation Center (2016, unpublished)

Predominant religions in the zone are Islam and Orthodox Christianity, with a general total majority of almost 60% Muslims. By far the largest ethnic group in Arsi-Zone (above 80%) are the Oromia people, followed by approximately 15% Amharas (BoFED, 2011).

Infrastructure in Arsi-Zone is poor; below 10% of the more than 1 150 km road are asphalted. In 2006, only 38% of the population were supplied with potable water. In the same year, less than half of the urban centres and no rural areas were connected to the power grid (BoFED, 2011). The provision of health centres and hospitals is below WHO standards.[20] The same can be said for schools, where the shortage of teachers was cited as a major constraint to quality education (BoFED, 2011). Even though 84% of children were enrolled in primary schools in 2004, only 22% went on to secondary education (Anderson Schaffner, 2004). At the same time, fewer than 5% of teachers had a university degree (BoFED, 2011).

The study focused on two *woredas*: Arsi-Robe and Lude Hitosa, as representative for the whole of Arsi-Zone.

Table 3: Comparison of the *woredas* in which data collection was conducted

	Lude-Hitosa	Arsi-Robe
Agro-ecological zone	Subtropical (63%) Temperate (37%)	Temperate (80%) Tropical (12%) Subtropical (8%)
Cultivation period	1	2
Asphalt road/ market access	Close to main road	Very remote, only local markets easily accessible
Extension service availability	Less extensive area makes it easier to reach villages and farmers	Vast area, lack of transportation
Religion	Predominantly Christian	Predominantly Muslim

Source: own illustration

Prior to the data collection phase, a workshop was organised with DAs, farmers, beekeeping experts, and other relevant representatives from different organisations to discuss the selection of the *kebeles* within Arsi-Robe and Lude Hitosa. Gardebussa and Medebeshani (Lude Hitosa) differ in terms of honey productivity,

20 The WHO recommends a hospital citizen ratio of one to 50 000, in 2006 in Arsi-Zone the ratio was one to approx. 1.4 million.

agroecological zone and infrastructure from Messeranji Abu and Jena Barbuko (Arsi-Robe) and were therefore considered appropriate for the study's investigation.

Image 1: Discussion on *kebeles* in Arsi-Robe

Photo: Diekjürgen

4.2 Methods of data collection

As mentioned in section 2.3, the study addressed the following questions:

- If honey is a highly valued commodity in Ethiopia, what is preventing bee-keepers from realising its full potential in Arsi-Zone?
- If bee forage is a major constraint on beekeeping in Arsi-Zone, how can the planting of bee forage be promoted?
- If bee populations are in decline in Arsi-Zone, how is this related to the agricultural system? And if the agriculture is causing environmental damage, how can sustainability be improved?
- If beekeeping were better integrated into the crop farming system, what effects would this have on the sustainability of the agricultural system?
- If beekeeping is a lucrative side-activity, how can women and young people get involved to generate income?

Various qualitative and participatory research tools were applied to collect the required data. The range of methods was intended to supplement the information and views gathered from stakeholders at all levels. The study group focused especially on the micro-level as it was a main concern to include farmers and beekeepers who regarding the topic, represent a relevant group of experts. Participatory Rural Appraisal tools were among those most often applied. This included the following methodological approaches:

Several focus group discussions (FGD) were conducted. They were mainly used to investigate the everyday life of women and youths and thus to analyse their occupation, the gender-based labour division, as well as their motivation and availability for additional income generating activities along the value chain of honey.

Image 2: Transect walk

Photo: Younan

Transect walks, market transects and farm visits in the research areas were guided by residents. This method offered an overview of the multidimensional landscape, including socioeconomic, environmental and infrastructural aspects and furthermore gave a necessary overview of the environment and surroundings of the designated areas.

Image 3: Women's focus groupdiscussion

Photo: Kübke

Group expert interviews constituted one of the main data collection methods. They were chosen to bring together expert interview partners and collect concentrated data from small-scale farmers and beekeepers. By bringing these groups together, the assumption on synergies of beekeeping and farming was analysed and discussed from both perspectives and thus ensured not only a profound investigation but also a triangulation and validation of research results.

Semi-structured individual interviews with various experts on all three levels were chosen as one of the major data collection methods as they allowed for a comparable data collection and a flexible course of conversation.

Daily routine schemes and semi-structured interviews were conducted with single participants of the women's focus group discussions. The aim was to get an overview of work peaks throughout the day, week and year as the illustrated describe the various activities. Daily routines and semi-structured interviews were mainly used to triangulate research results.

Table 4: Number of research activities and participants

Level	Semi-structured interviews	FGD women	Daily routine scheme	FGD youth	Group expert interviews with farmers/beekeepers	Tran-sects
Macro-level	15					
Meso-level	10				1	
Micro-level	16	6	2	1	9	16
Subtotal	41	6	2	1	10	16
Subtotal participants	55	51	2	8	120	16
						TOTAL: 252

Source: own illustration

4.3 Data collection procedure

There were various steps within the data collection procedure. Firstly, a review of secondary data was carried out in Germany (June–August) to gather basic information on the research area and the topic itself. During this orientation phase, ideas and knowledge were exchanged with the Ethiopian colleagues who came to Berlin and Feldafing for three weeks; this was very important and fruitful.

The second data collection phase started during the first three weeks in Addis Ababa. Stakeholders were identified and approached. Expert interviews were mainly conducted on a macro-level to verify assumptions and to gain a better overview of the situation on-site. In addition, the two research areas for data collection were chosen, Lude-Hitosa and Arsi-Robe.

This was followed by the third phase, the data collection procedure itself in Arsi-Zone. It started with a kick-off workshop and pre-tests of the planned data collection methods in both research areas. Within the following two weeks the requisite data was collected in Lude Hitosa and Arsi-Robe using refined and modified data collection methods. As some of the villages within the chosen *kebeles* were very remote and the Oromo and Amharic languages presented a barrier to the study group, the cooperation with the DAs was a great help for connecting with the farmers and beekeepers. However, the close consultation with the DAs meant they selected almost all the participants, informants and interviewees.

Towards the end of the study group's stay in Ethiopia, an expert workshop with a final presentation of the main findings was held. Various semi-structured working group discussions amongst the participants served as a form of triangulation and verification of the data. The results of the discussions were used to formulate the final recommendations.

4.4 Data documentation and analysis

The data were documented in various ways. For single interviews, question sheets were filled out and kept. The study group took notes during the group discussion and the interviews with women, youths, farmers and beekeepers. The same applies for the daily routine scheme; an additional time-schema was developed here. Sketches, photos and videos were made explicitly during the transects and market visits. To make the collection of data analysable an Excel®-sheet was created and coded: information was entered and clustered according to the research questions and subtopics and was available to all study group members. In the following chapter, data and information will be quoted according to the coding. For example, the ninth [9] expert interview [E] will be indicated as the source E9; the second [2] transect walk [T] is quoted as T2 and so on. An overview of all codes and additional information can be found in Annex 2.

5 Agriculture and apiculture in Arsi-Zone

Arsi-Zone is characterised by a relatively high level of agricultural productivity in comparison with other regions in Ethiopia due to suitable conditions for cultivation. It is a major grain growing area. As mentioned in Chapter Two, the region has potential for improved crop productivity according to the SEWOH classification. Nevertheless, Arsi-Zone does not appear as a potential area for the nationally expanding honey sector.

Section 5.1 aims to identify obstacles for beekeepers trying to expand their production (e.g. lack of bee forage in the agricultural landscape) as well as outlining aspects and shortcomings of the current agricultural practices. Section 5.2 looks at the current situation and challenges along the honey value chain in Arsi-Zone. It is assumed that potential for improvement of crop production but also for the situation for beekeepers in Arsi-Zone can be detected through detailed observation and analysis of agricultural activities in Arsi-Zone. Referring to the initially formulated research questions in Chapter two, answers to the questions concerning a decline in bee populations and honey production in Arsi-Zone and how this can be related to agricultural activities shall be found. In addition to this, the value chain analysis of honey in Arsi-Zone identifies potentials for farmers to increase their income through beekeeping. Finally, the intention is to determine synergy effects between agricultural production and beekeeping in Arsi-Zone. The bees are also an important bio-indicator, as mentioned in Chapter two. Hence, apiculture and agriculture with its related activities are highly dependent on one another due to the bees' interaction with the flora and fauna.

5.1 Situation analysis of agriculture in Arsi-Zone

This chapter presents the results of the in-depth situation analysis of the chosen *woredas* in Arsi-Zone, analysing constraints hindering increased agricultural productivity and examining constraints on beekeeping. The main question is how sustainability in the agricultural sector of Arsi-Zone can be improved, particularly relating to beekeeping activities in the area.

5.1.1 Farm types and farm structures in Arsi-Zone

Apart from state farms[21] that are breeding and multiplying seeds for the country, small-scale farming is the most prevalent agricultural management system in Arsi-Zone (CSA, 2016b). Both Lude Hitosa and Arsi-Robe are marked by semi-intensive crop production (T1, T2, T9, T10, T14, T15). In Arsi-Zone around 560 000 agricultural households cultivate 600 000 ha of crop land (CSA, 2016f: 48). Of this crop land, 87% is used for cereals. Wheat is grown on 40% of the cereal land and is the predominant crop in Arsi-Zone (CSA, 2016f: 48).[22] The yields of wheat exceed the country's average by about 3–4 t/ha/a in Arsi-Zone (GIZ, 2016: 3). This illustrates the region's potential for ensuring the supply of seeds and food. Within Ethiopia, Arsi-Zone has the highest level of mechanisation such as tractors and combined harvesters. The conditions for mechanised agriculture are good because the area is relatively flat and soils are fertile. However, the level of mechanisation amongst small-scale farmers in Arsi-Robe is only 10–15% overall (E3).

Lude Hitosa and Arsi-Robe were presented in detail in Chapter four. Apart from the many similarities, distinct differences of agricultural practices related to the *woredas*' agro-ecological zones, infrastructure and socio-economic structure could be identified (see Table 3). A major difference between the two districts is the shift in cultivation periods due to different rainy seasons and elevations[23], allowing two harvests per year in Arsi-Robe and only one in Lude Hitosa. Huruta, the district capital of Lude Hitosa, is situated 40 km north-east of Asela, the regional capital. From the asphalt road, another 2.5 h must be covered on gravel road to reach Robe town, the district capital of Arsi-Robe, which is located 100 km from Asela. There are weekly markets in both *woredas* where farmers from the region sell their fruits and vegetables, field crops, or livestock.

Extension service in the research area

As in all of Ethiopia, the extension service is present also in Arsi-Zone. In theory, farmers should be receiving training on various topics e.g. making compost, pest management, crop rotation and improved agricultural production systems (E19, E23, F17, I12). But interviews with DAs who are responsible for training in the two *woredas* revealed a different story (E19, E23). In Robe, farmers are hard to reach and the agricultural office does not have the means of transport to drive to

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21 Like Oromia Seed Enterprise and agricultural research centre in Kulumsa.

22 Of the cereal land in Arsi-Zone, with around 18.5% tef is the second and with around 18% barley is the third most cultivated cereal (CSA, 2016f: 48).

23 Lude-Hitosa: 1 000–3 000 m; Arsi-Robe: 1 200–4 000 m (Etefa and Dibaba, 2011)

the very remote farmers (E19). Additionally, DAs reported that most theoretical approaches for improved crop production have not been implemented in practice (E19, E23). There are various causes for this discrepancy. Mostly farmers mentioned their lack of land but also the dependency on cash crops (E19, F17).

The extent to which extension service in Arsi-Zone needs more capacity building is illustrated by another example: DAs suggest application of fertilizers without knowing the soil quality. There is no testing of soils (due to lack of material and laboratories) so the demand for nutrients remains unclear and the likelihood that the recommended amount of fertilizer fits to the soil's demand is low.

Crops

Table 5 lists the main species, which were observed or mentioned by interviewees in the two *woredas*:

Table 5: List of crops observed in research region

Major crops found in Lude Hitosa	**Major crops found in Arsi-Robe**
Cereal crops wheat, tef, barley, maize	**Cereal crops** wheat, tef (white and red), barley, maize
Pulses faba bean, peas	**Pulses** faba bean, peas, chickpeas
Vegetables onions, cabbage, tomato, potato, garlic	**Vegetables** onions, cabbage, tomato, potato, garlic
Oil crops rape	**Oil crops** flax, rape, sunflower

Source: own data

The main crops in Arsi-Robe are cereals, followed by pulses and vegetables (E19). Oil crops are rising in their importance as sources of additional income for the farmers (Etefa and Dibaba, 2011: 340). In Arsi-Robe, many fields of flax (*Linum usitatissimum*) were found and patches of oil-seed rape (*Brassica napus*) and sunflower (*Helianthus*). For cereals, wheat (*Triticum sp.*) is predominantly cultivated followed by tef (*Eragrostis tef*), barley (*Hordeum vulgare*), and maize (*Zea mays*). Within the *meher* season, wheat, tef and barley account for more than 80% of the crops (Etefa and Dibaba, 2011: 340). Vegetables are cultivated for home consumption but also on larger scale for sale. The main species found in the research areas were tomato (*Solanum lycopersicum*), onion (*Allium sp.*), potato (*Solanum tu-*

berosum), cabbage (*Brassica oleracea*), coffee (*Coffea sp.*), and pepper (*Piper sp.*). It was observed that in Lude Hitosa the variety of cultivated crops is less diverse than in Arsi-Robe; cereals and cash crops (e.g. onions, tomatoes, potatoes) dominated the crop rotation.

Livestock

Most farmers in Arsi-Zone keep livestock in addition to their grain and vegetable production. This ensures additional income but most importantly allows for more diverse goods for home consumption. The livestock husbandry serves various purposes: horses, donkeys and oxen are kept for transport and field work, whereas cattle, sheep, goats and chicken are kept for sale and home consumption of milk, meat, and eggs (I7, I15, T1, T10). As mentioned before, beekeeping is less common than other livestock but offers an additional income possibility for the household.

Image 4: Living fences found in the research area

Photos: Younan

Livestock are mostly fed on communal pastures or by cut and carry systems. After harvest, most farmers allow free-grazing leading to animals eating crop residues from other fields (Etefa and Dibaba, 2011: 21). For field and crop protection during the cultivation period, (living) fences are used (T2, T15). The fences are designed along the paths serving as protection against livestock, weathering influences or theft. Furthermore, these fences can serve as a breeding place and refuge for birds or other small animals and thereby increase biodiversity.

5.1.2 Small-scale farmers' activities

According to the Oromia Finance and Economic Development Bureau, around 89% of Arsi-Zone's population live in rural areas and thus are indirectly or directly involved in agricultural production. The census (2007) states that 17% of the farmers in Arsi-Zone are female (Etefa and Dibaba, 2011: 15). This number might be misleading, because many women working mainly in households take on responsibilities in the families' farming activities but are not classed as female farmers because their husband is head of the household and holds the certificate for the land (see section 3.2.3) (E19).

The high percentage of people living in rural areas indicates that agricultural activities account for most people's income. Most small-scale farms in the research areas were family-owned, multipurpose farms.[24] The average household in Arsi-Zone consists of five household members. The average size of agricultural land is about 1.49 hectare per household (CSA, 2016b: 31). Apart from home consumption, farmers are trying to produce a surplus of crops and livestock to sell. In both *woredas*, many farmers explained that apart from the land for which they hold land-use certificates, they also cultivate rented land (F4, I7, I12, I13, I15). In Lude-Hitosa land was distributed to the farmers according to the size of their household (T5).

Employment of day-workers for weeding is a regular procedure in Lude Hitosa. The daily rate for workers is up to ETB 120/day (I6). Apart from hired daily workers, family members help on the fields as well. During transects it was observed that children work on fields applying pesticides without any kind of protective clothing etc. (T4, T14, T15). Talking to women about their daily routine, it emerged that after women finish their work in the house they support their husbands on the fields (I11, I16).

24 Crop production and livestock rearing

Degree of organisation of small-scale farmers in Arsi-Zone

In both *woredas*, stakeholders reported forms of mainly informal but also formal cooperation amongst farmers. Nevertheless, in Lude Hitosa some farmers stated that there is no form of official unionisation (I7, I12). One model-farmer[25] explained that he works in a farmers' cooperative but during the harvest season he prefers to hire day workers to help him because all farmers are busy and cannot support each other (I5). In Arsi-Robe, the book-keeper of a farmers' association explained that in the *woreda* there were 69 cooperative unions with 29 918 members (2 112 of them were female). The estimate is that 75% of farmers in Robe are formally unionised (E21). Farmers pay ETB 500 registration fee to become a member and are provided with seeds, chemicals and other inputs.

Farm management

In view of the differences in farm management between the two *woredas*[26], the following section is firstly structured according to the different results of Arsi-Robe and Lude Hitosa:

Arsi-Robe: Ploughing for the preparation of sowing in Arsi-Robe starts in March (I5). Most farmers plough with oxen three to four times to reach the required depth of 20–30cm (E23). Between each ploughing operation, farmers wait 10–15 days for weeds to shoot, which are ploughed in the soil in the following sessions (E19). Depending on the crops, the time of sowing differs. Summer crops are sown in April. Sowing is mainly done by casting (I7). 30–40 days later the first application of pesticides occurs (E19, I5). Weeding is done by hand but the use of herbicides during the growth period is increasing continuously (I6, T10). The first harvest season in Arsi-Robe is in August followed by another cultivation period. The second harvest of most cash-crops takes place in November (see Annex 3).

Lude Hitosa: In contrast to Arsi-Robe there is only one harvest season per year in Lude Hitosa. Seed preparation and sowing in Lude Hitosa is as described for Arsi-Robe (see above). Weed management and fertilisation is comparable, too. Harvest begins in late October and continues into November, depending on the end of the rainy season (E6, I5). After harvest the dry season begins. Due to lack of irrigation systems or access to water farmers are not able to cultivate their fields during this time (E6, I5, T5). Therefore, the fields lie fallow from late November until March when farmers start to plough again.

25 Model farmers are specially supported by extension service because of their willingness to improve production. Serving as role models they may be an incentive for other farmers to catch up.

26 Because of the different agro-ecological zones and the consequential differences in cultivation

Box 3: Renting oxen in the ploughing season

Ploughing with oxen is widespread in Ethiopia. In contrast to a modern plough pulled by tractors, farmers with oxen must plough the field 4–5 times. Oxen can be rented from neighbours. In contrast to renting machinery it is for free but there is a defined ranking: the farmer who has most oxen may plough first (I12).

Ox ploughing, Arsi-Robe

Photo: Diekjürgen

Crop rotation

There is awareness amongst DAs of the importance and benefits of crop rotation. This is propagated to the farmers (see image below). The DAs interviewed knew about interrupting circulation of diseases through breaks within the rotation and the benefits of the integration of legumes. These breaks stop pathogens in the soil from spreading. Plants from other families, which do not provide basic food resource for pests can therefore diversify the crop rotation and stabilize soil fertility.

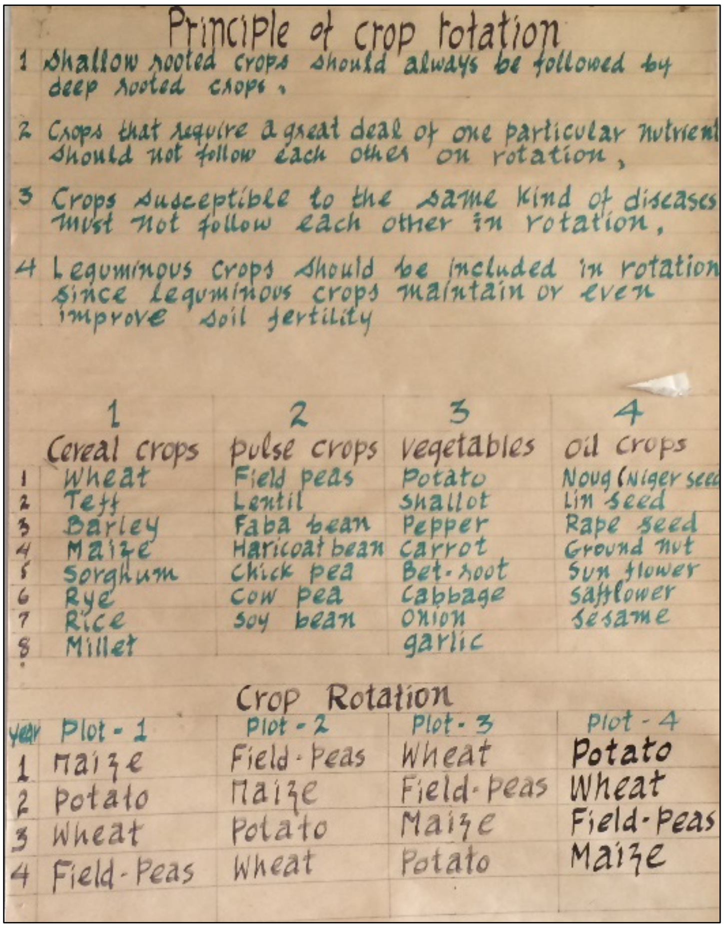


Image 5: Poster explaining crop production in the agricultural office in Arsi-Robe

Photo: Kübke

Forms of crop rotation described by the farmers are listed in Table 6. Many of them are very limited, meaning less diverse and not following the rule of appropriate breaks in cultivating related species one after another leading to negative effects as mentioned above. Apart from the dominating crops in rotations mentioned haricot beans (*Phaseolus vulgaris*) and lentils (*Lens culinaris*), maize (*Zea mays*), potatoes (*Solanum tuberosum*) and tomatoes (*Solanum lycopersicum*) were also found on small patches (T12, T16). Cultivation of perennial crops, trees or shrubs was rare. For various reasons, such as availability of agricultural land or seeds, crop rotations are cash crop dominated (I12, T1, T9). Also, farmers focus on planting crops which they mainly use for home consumption (E23). A study carried out by Mengesha (2011) revealed a similar picture of cereal dominated crop rotations in the highlands of Arsi-Zone. Many farmers were not aware of the benefits of diversified crop rotation. They knew about negative effects of monocultures (planting the same crops for more than five years) but due to the pressure to harvest crops for food and income every year, diversification was not seen as a realistic solution (E23).

Table 6: Examples of crop rotation-systems in Lude Hitosa and Arsi-Robe

Crop rotation
Wheat – faba bean – wheat/tef – faba bean
Wheat – barley – faba bean
Onion – tef – onion – wheat
Onion – wheat – barley

Source: own data

In interviews and focus group discussions, sowing and harvesting dates were enquired about to identify cultivation gaps for possible integration of bee forage plants (see IMPPs, chapter 7).

Farm inputs and seed management

Assuring a sufficient harvest at the end of the cultivation period was the overriding aim of farmers. Apart from factors which cannot be influenced directly[27], farmers used inputs to manipulate the intended yields. These were either derived from the farm itself (internal inputs) or came from outside (external inputs). Table 7 lists identified internal and external inputs of relevance for small-scale farmers in the research area.

Table 7: Identified inputs for farming systems in the research area

Internal inputs	External inputs
Compost	Synthetic fertilizers
Manure	Chemical pesticides
Biogas residues	Chemical fungicides
Seeds (self-produced)	Chemical herbicides
	Improved seeds

Source: own data

27 E.g. climatic factors (El-Niño effect), drought, heavy rain fall

Agro-chemicals in Arsi-Zone

According to most farmers and experts interviewed in the two *woredas*, the use of agro-chemicals has increased significantly over the past decade (E17, E19, F12, F16, I8, I14). Simultaneously, the incidence of pests and diseases has also increased (F16). Several farmers reported that some years ago, agro-chemicals were not commonly used in the region (F9). Today, the situation is very different: throughout many transects use and application of chemicals could be observed. Men or children working on the field carrying sprayer pumps on their back without protection clothes were seen in all *kebeles* (T14, T15). Many farmers stated that without the application of pesticides their yield would decrease. Even complete losses of harvests were feared (F9). Therefore, pesticide use is increasing constantly although the prices for those chemicals are increasing, too. Additionally, farmers mentioned health issues which they linked to their use of pesticides (F12, F16).

Fertilizer use

Natural fertilizers such as compost, manure and biogas residues were rarely applied on fields. However, compost was found in farmers' kitchen gardens. During a focus group discussion in Shankura in Arsi-Robe, one farmer stated "natural compost [is] very good for home consumption products" (F13).

Other farmers confirmed the awareness of negative effects of pesticides, as mentioned earlier (F8, F13). Yet the use of external inputs was dominant within the observed farming system (E23, F12). DAs in Arsi-Robe were trying to promote a better management of internal farm inputs but due to several constraints (e.g. lack of water, labour intensive collection of manure from free-ranging livestock) agro-chemicals are still preferred by the farmers. When asking farmers about their yields, responses were very diverse. Reasons for different yields included availability and quality of land, use and availability of seeds and other inputs (see Chapter three) as well as farmers' management skills.

Seeds

Another serious limitation is the availability and quality of the seed. The example of Arsi-Robe underlines this: In Robe-Town, the crop production expert stated that sowing in 2015 was ensured through seed donations provided by the regional office and NGOs but for the coming years seed origin was yet undetermined (E23). Farmers and other stakeholders confirmed this shortage of seed (E19, I15). Many farmers save seed from previous harvests[28] but the current storage systems cannot prevent infestation with insects or vermin, often forcing farmers to buy seed from cooperatives or the agricultural office (T14).

Organic farming methods in the research area

Organic farming methods are known to be sustainable compared to current practices. Therefore, they were chosen by the commissioning partner and the study group as a possible solution for a better integration of apiculture into the farming systems in Arsi-Zone. A brief observation on their existence and the farmers' awareness of sustainable farming practices was included in the topics of research.

Certified organic farming with certified products was not to be found in Arsi-Zone. However, interviews and focus group discussions amongst farmers revealed the need for sustainable production systems (E19, F8, F17, I15). Farmers stated they would not apply agro-chemicals in their kitchen gardens due to negative effects on health (F8, F17).

Three organic farming methods were observed: 1) Use of compost and manure, 2) Inter-cropping and 3) Integration of legumes.

1) Application of organic fertilizers (compost, manure)

Training on producing compost was offered by the agricultural offices in the *woredas*. Compost was used as organic fertilizer but also as fuel in the household (F8, I5). Generally, the use of compost was rarely seen during data collection. Water scarcity made it nearly impossible to prepare compost during the dry season (I5).

28 Up to 12 kg for wheat (T14)

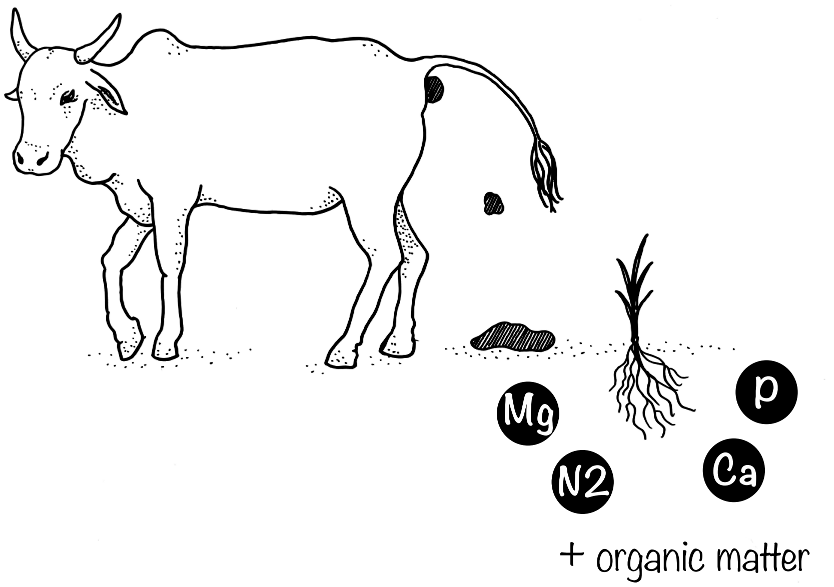


Figure 2: Organic farming methods

Source: Blair (2016, exclusively designed for SLE)

Image 6: Storage of manure on farm

Photo: Kübke

2) Inter-cropping (maize with peppers, coffee or oat; onion with tef)

Several practices of inter-cropping were described and showcased by farmers in Arsi-Zone. The selection of crops for the combined cultivation on one field can achieve many agronomic benefits.[29] In addition, yields can be increased due to use of field resources like nutrients in the soil and water by more than one crop. The integration of agro-forestry systems (inter-cropping with shrubs or trees) can stabilise the nutrient contents in the soil and improve the soil water holding capacity.

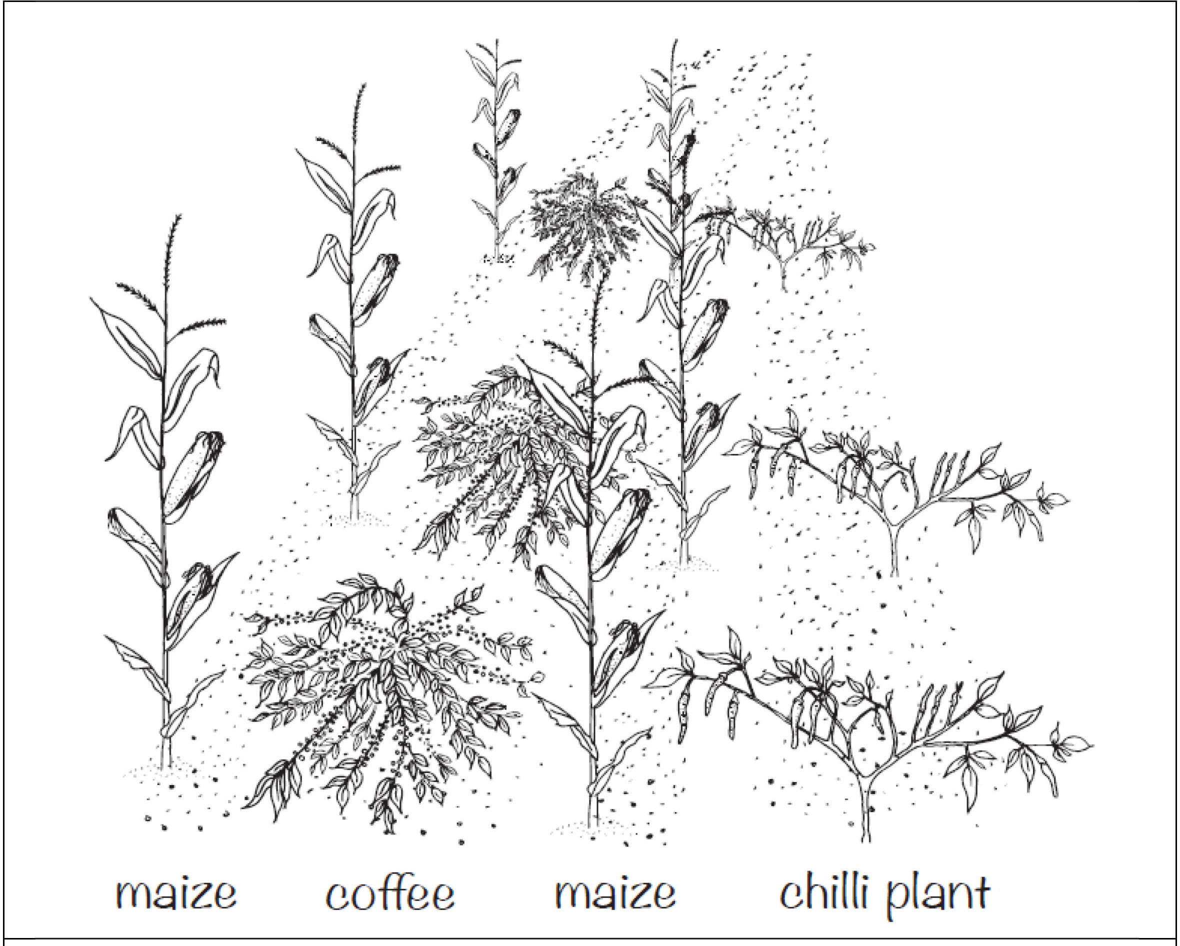


Figure 3: Maize inter-cropped with coffee and pepper

Source: Blair (2016, exclusively designed for SLE)

29 E.g. planting plants together with crops that give structural support; planting deep rooting plants with shallow rooting ones; combining crops that prevent weeds or supply their companion with nutrients

Image 7: Maize inter-cropped with coffee and pepper

Photo: Younan

3) Integration of legumes in crop rotation for improvement of soil fertility

The integration of nitrogen-fixing plants may improve soil fertility significantly. As faba bean is being promoted by the Green Innovation Centre, a possibility to propagate its integration into the crop rotation may arise, enhancing the amount of nitrogen in the soil and reducing the need for additional artificial fertilizer. Plants would benefit from this nitrogen which could lead to stable yields due to sufficient nutrition supply.

Image 8: Faba bean integrated in crop rotation to fix nitrogen

Photos: Kübke

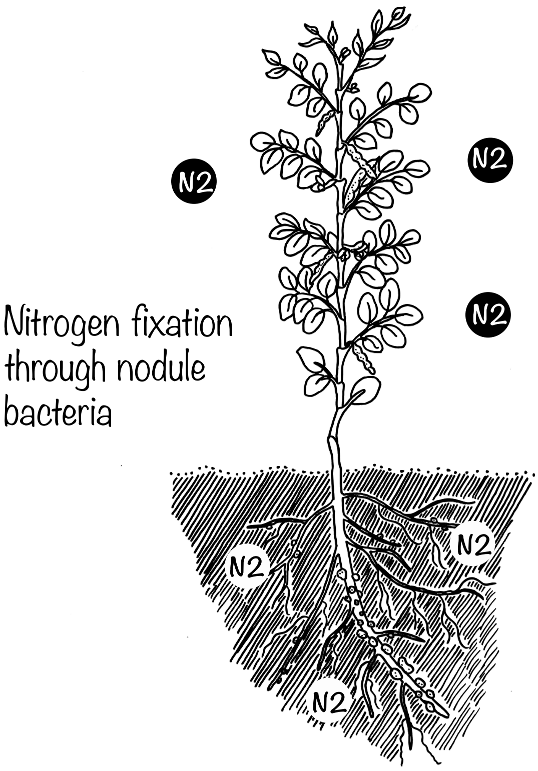


Figure 4: Legume integration in the crop rotation

Source: Blair (2016, exclusively designed for SLE)

Asked about changes in agricultural production within the past decade most farmers responded that pests and diseases began to increase three years ago, especially rust in crop production (F9). The farmers assumed that there were two reasons for the increase in pest pressure on wheat and faba beans: first, climate change with its rising temperatures and increase of moisture in the soil (F9), and secondly the increased use of agro-chemicals. According to their observations, crop diseases arose in combination with the implementation of agro-chemicals (F12).

Awareness for sustainable production was noticed throughout interviews and focus group discussions with farmers, however, many of their activities on the field contradicted this (F12). Although DAs said that they offered training on the use of agro-chemicals and would caution against malpractice, and although farmers reported that they got sick after working with pesticides, application did not comply with the recommendations of the extensions service. Especially on those fields with cash crop cultivation, the use of agro-chemicals was very high.[30]

Often, the observed farming methods did not reflect this awareness of organic farming. The need to ensure a successful harvest season reinforces the trend towards high-input agriculture in Arsi-Zone. Applying chemicals on the fields is less labour intensive for the farmers and the results are immediately visible (F12, I7). Therefore, manure and compost could not compete with agro-chemicals because they were perceived to be more labour intensive, but also because of the lack of knowledge and a shortage of inputs to produce compost. Other reasons for intensification and high input production were policy guidelines (see section 3.2.1), limitations concerning land ownership [31], and a lack of training for farmers on good practices in applying agro-chemicals (E19, E23).

Marketing agricultural products

Having produced a surplus of their crops, fruits and vegetables, farmers sell them on a local weekly market. In both *woredas*, there were fixed market days during the week. These are an important event for the people of the area, either for provision with basic supplies or for selling their products to generate income. Normally, the market started around noon, giving farmers from more remote areas time to reach the market in time (T12, T16). Farmers reported that walking to

30 The farmers' fear is a total loss of harvest. Therefore, they keep on applying more and more chemicals to ensure a sufficient harvest and thus ensure a sufficient income.

31 One farmer stated that on his rented land he would not apply compost to increase its longer term fertility because he feared that the land would be taken away from him (I7).

the market takes up to two hours (F11, I11). Transport to the market may differ depending on farmers' financial resources. Products were usually carried by beasts of burden (T2, T12, T14, T15, T16). Apart from harvested crops, processed products were found in small amounts (e.g. oils, traditional butter, spice mixtures).

Image 9: Vegetables on sale at a weekly market in Robe Town

Photo: Kübke

Constraints on improved farming systems

As stated in the beginning of this chapter, Arsi-Zone is marked for improved crop production within Ethiopia. However, its production is still below the potential. The analysis and description of agricultural activities in the research area revealed a situation with potentials and limitations for the future. Table 8 summarises constraints for sustainable agricultural production. Particularly, constraints were identified on the integration of apiculture into current farming activities. These are listed in Table 8.

Table 8: Identified constraints for sustainable agricultural production in the research area

Aspect	Identified constraints
Extension service	– lack of transport – **lack of training on sustainable agriculture**
Degree of organisation of small-scale farmers	– difficulties to support each other during work peaks
Crop rotation	– **spatial problem for diversification of crop rotation** – lack of seed – cash-crop dependency
Farm inputs	– limited availability of seed – **perceived dependency of pesticides** – inefficient use of agro-chemicals – difficulties to produce compost – **danger caused by use of pesticides**
Farmers awareness of sustainable production and organic farming methods	– **limited willingness to change farming system due to economic pressure** – pressure to keep up production to ensure income – lack of resources for application
Marketing of agricultural products	– **lack of marketing opportunities for crops which would widen the crop rotation** – limited market access for remote farmers – lack of transport of goods to the market

Source: own data

Due to a lack of training, farmers did not receive information about the benefits of proper beekeeping, not only for their direct income through the selling of honey or other products but also through pollination.

The limited crop rotation dominated by cereals was identified as major constraint on beekeeping because it resulted in a lack of bee forage since natural forests and fauna were rare in the research area. Another observed constraint can be linked to this: the increased use of pesticides. Spraying during the flowering season has a significant impact on bee populations.

Another constraint was the limited possibility for small-scale farmers to introduce crops with which they have had no previous experience. This could result in an overall reluctance to change their current farming system. The latter constraint could be a result of the interlinkages of the other constraints that were found. To what extent the data collection on beekeeping proves these assumptions, will be considered in the next section.

5.2 Situation analysis of the honey value chain in Arsi-Zone

If honey is a highly valued commodity in Ethiopia, what is preventing beekeepers from realising its full potential in Arsi-Zone? This section analyses challenges as well as potentials for beekeeping in Arsi-Zone.

Honey production has a huge potential in Ethiopia (see section 3.3). Beekeeping skills and know-how in Ethiopia have been passed from generation to generation since ancient times. In Arsi-Zone most interviewees stated they had been beekeeping for two to 38 years, and that they had been taught the necessary skills by their parents and relatives (F1, F9, F13, F14, F17, I6, I10).

Overview of the honey value chain in Arsi-Zone

The value chain of honey in Arsi-Zone is relatively short. The main actors in a honey value chain are input suppliers, beekeepers, traders, processors and consumers, and most of the actors in Arsi-Zone can be categorised as micro-players at production and trading levels. According to primary and secondary data, honey producers in Arsi-Zone produce at below their potential (compare to Ethiopia in general, section 3.3) and they use rudimentary and traditional processing methods. These methods are inefficient and result in inferior honey quality. Further stakeholders from Ethiopia's honey sector that can be relevant for upgrading the value chain in Arsi-Zone are listed in the following stakeholder graph:

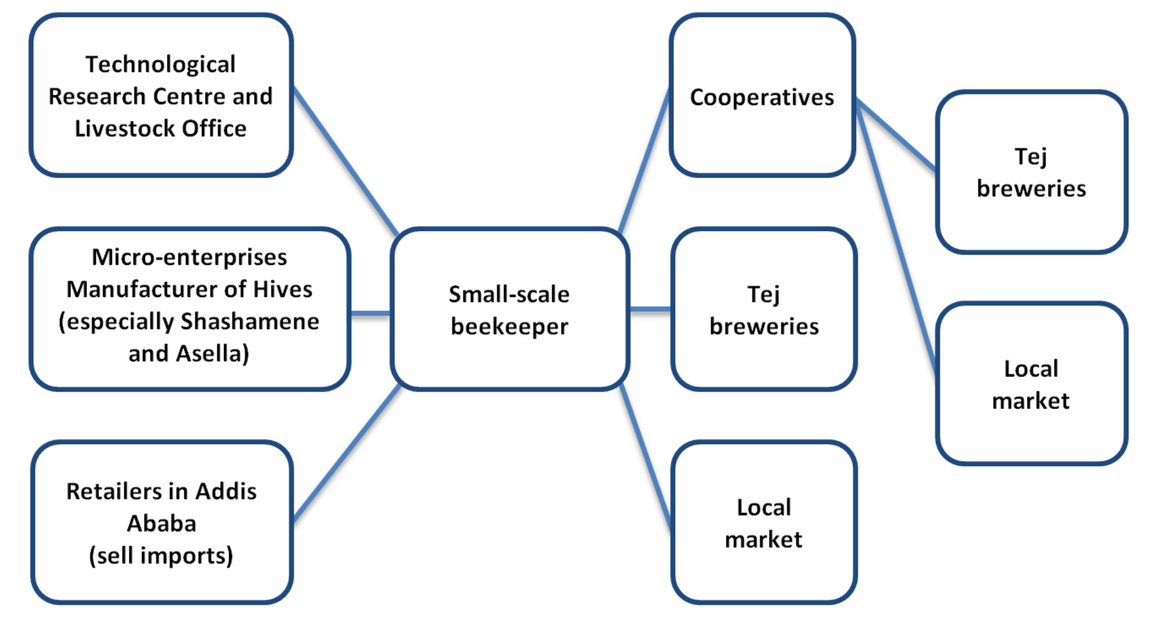


Figure 5: Stakeholders in the honey value chain (regional); retailers in Addis Ababa sell imported beekeeping equipment and tools

Source: Grimm-Pampe (2016)

Analysis of the honey VC in Arsi Zone

The value chain of honey is presented along the following segments, describing their stakeholders and functions:

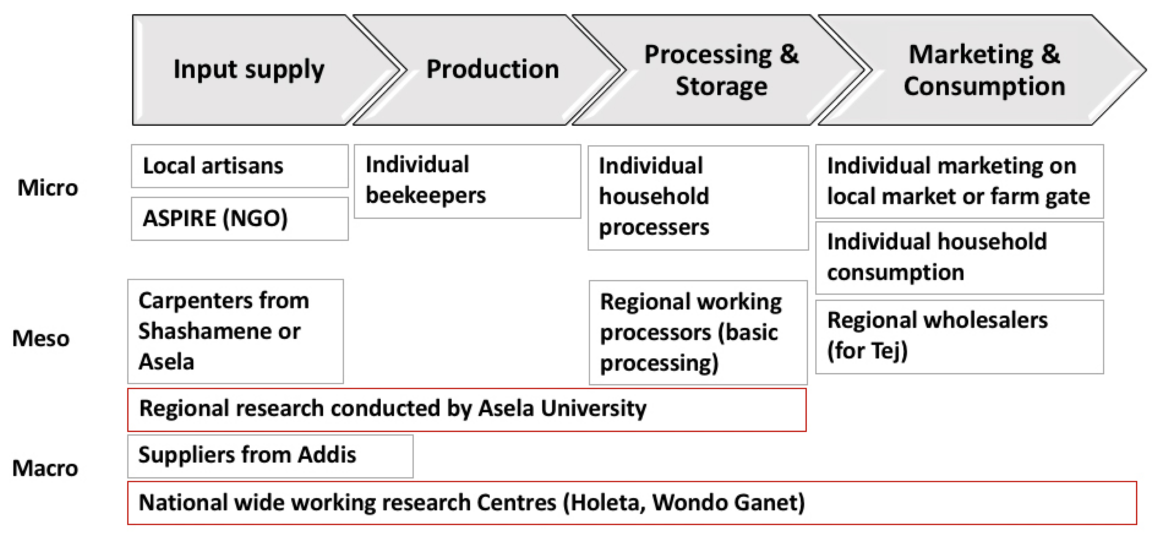


Figure 6: Overview of stakeholders in the honey value chain (Arsi-Zone)

Source: own illustration

Input supply

Regarding input supplies for beekeeping activities, most of the value chain key players in this segment were the beekeepers themselves and their families. Most of the modern hives were supplied by wholesalers from Shashamene.[32] No external bee colonies or queens were traded from other regions into Arsi-Zone.

To start honey production, inputs like honey producing bees, bee forage and hives are needed as described below.

Predominant bee families in Ethiopia and the study area

Image 10: *Apis mellifera* on *Sensal* flowers

Photo: Younan

In Ethiopia, at least three honey bee subspecies are confirmed to be present occupying different agro-ecological zones; the *Apis mellifera scutellata, Apis mellifera monticola* and *Apis mellifera yemenitica* (Fichtl and Abi, 1994). The *Apis m. scutellata* is described as occurring in altitudes between 500 and 2 400 m above sea-level. The *Apis m. monticola* is less defensive and occurs between altitudes of 2 400 up to 3 400 m above sea-level. The third, *Apis m. yemenitica*, is known to be drought resistant and is found in lowland areas, for example in south-eastern Ethiopia (Fichtl and Abi, 1994).

32 Shashamene is a town and *woreda* located 150 km south of Addis Ababa, in the West Arsi Zone of Oromia Region.

Box 4: *Tazma*

Besides the honeybee (*Apis mellifera*), the stingless bee (*Trigona spp.)* is commonly found in medium altitudes in Ethiopia up to 2 300 m above sea-level. The stingless bee produces a special honey which is called *Tazma* in Ethiopia. It is a small bee, about 10 mm long, building its nest about 1 m deep in the ground which makes handling and honey extraction difficult. The stingless bee colony produces 110 kg of honey a year which is a relatively low yield compared to 30–45 kg for the average honey bee. Although *Tazma* can fetch high prices, the extraction difficulties hinder its commercialised exploitation. *Tazma* honey is runny with a strong acidity. Wax is not extracted during the honey hunting process. Interviewees mentioned several times that *Tazma* is collected around Adama (Nazareth) and is perceived as a special medicine especially for women after giving birth. Therefore the demand is very high (E25).

All Ethiopian honeybee races have many enemies, including various species of bee-eater birds (*Merops spp.),* the honey badger (*Mellivora capensis*), wasps, and ants. Due to these predators, they have developed a very strong defensive behaviour and this affects bee colony management and handling, especially the feeding during the dry season and harvesting of honey (Fichtl and Abi, 1994). When the bee colony feels attacked, hundreds of bees leave the nest to drive the predator off. If the bees fail to drive the danger away they will leave the nest and look for a safer place to settle. During times of bee forage scarcity (in the dry season), the whole bee colony may abscond.

Important bee forage plants in Arsi-Zone

Ethiopia's flora has between six and seven thousand species of flowering plants (Fichtl and Abi, 1994). Bees use the pollen exclusively as a source of protein and it is therefore crucial for their nutrition as well as for bee colony's health. In addition, the available vegetation affects the viscosity, flavour and colour of honey.

While several bee forage calendars and numerous bee forage articles and books have been published in Ethiopia over recent decades (e.g. Edwards et al. 2000; Fichtl and Abi, 1994; Edwards, 1976), Arsi-Zone has been under-represented. This following list demonstrates examples of common bee forage plants identified in Arsi-Zone. A full list of all bee forage plants in Arsi-Zone in general is to be found in Annex 4.

Table 9: Bee forage list

Amharic (Amh.)/ Oromifa (Or.)	**English**	**Scientific Name**	**Family**	**Apicultural value (Fichtl and Abi, 1994)**
Flower				
Adey ababa/ Yemeskel-Abeba (Amh.)	Meskel flower	*Bidens prestinaria*	*Asteraceae*	Flowering: Sept. – Oct. Pollen and nectar from the flowers is collected frequently. Important honey source.
Nug (Amh.)	Niger-seed	*Guizotia abyssinica*	*Asteraceae*	Flowering: Sept. – Oct. Pollen and nectar is collected. One of the most important honey source of Ethiopia.
Suf (Amh)	Sun-flower	*Helianthus annuus*	*Asteraceae*	Pollen and nectar from flower is collected as well as extrafloral nectar. Green dried stems and leaves good for smoker fuel.
Crops				
Baqiela (Amh.)/ *Baqela* (Or)	Faba-bean	*Vicia faba*	*Fabaceae*	Flowering: mainly Sept.- Oct. Pollen and nectar is collected as well as extra-floral nectar during vegetative period of the plant. Little nectar with low sugar concentration.
Kariya (Amh.)	Pepper	*Capsicum annuum*	*Solanaceae*	Pollen and nectar is collected occasionally.
Telba (Amh.)	Linseed	*Linum usitatissimum*	*Linaceae*	Flowering: almost all year round but augmented from Oct.- Nov.
Trees				
Bahr-zaf (Amh.)	Tasmanian blue gum	*Eucalyptus globulus*	*Myrtaceae*	High source of eucalyptus honey; abundant pollen and nectar production every year, peak every 4 to 5 years.
Barzafi-Dima (Om.)	River red gum	*Eucalyptus camaldulsensis*	*Myrtaceae*	Of all eucalyptus heaviest nectar yield. High value and abundant pollen.
Grawa (Amh)/ *Ebicha* (Om.)	Bitter leaf	*Vernonia amygdalina*	*Asteraceae*	Flowering: Dez.-May, main Jan.-Feb., pollen and nectar is collected. High value for honey production.
Wanza (Amh.)		*Cordia africana*	*Boraginaceae*	High value for honey production; abundant pollen and nectar. Crushed seeds dissolved in water can be used to feed bees during dry season.

Source: after Fichtl and Abi (1994)

Water scarcity in the dry season (November to March) is the main limiting factor for agriculture and apiculture. During this time, the availability of bee forage is severely limited, as is the availability of drinking water for bees. Some of the farmers feed the bees or provide drinking water for their bee colonies. Other beekeepers reported absconding swarms during the dry season (I5, I12, I15).

When observing the deforested landscape of Arsi-Zone, the absence of perennial plants with potential for bee forage becomes obvious. Interviewed farmers stated that the decrease of forest cover, the absence of flowering species including weeds and herbs affect the availability of bee forage. Through the need for food production, the pressure on land is high (F16, I10). Further, the intensified application of agro-chemicals, especially herbicides has decreased the available bee forage drastically (F3, F10, F16, I7).

Farmers were reportedly aware of the bees' dependency on forage. However, the pollination services were rarely acknowledged or if they were mentioned then only in association with papayas and other fruit trees (F4, I6).

Image 11: Sunflower (Helianthus annuus) and opuntia (*Opuntia ficus-indica*) (left); Wanza (*Cordia africana*) (right)

Photos: Diekjürgen and Younan

Available hive technology

As mentioned in section 3.3, three hive types are in use in Ethiopia: traditional, transitional and modern beehives. When the Ethiopian government realised the potential of the apiculture subsector, various beekeeping technologies were introduced. For example, different beekeeping demonstration sites like Holeta, Nekemte and Jimma were established to disseminate beekeeping technologies[33] (Gebiso, 2015). As Table 10 illustrates, 98% of the Ethiopian beehives in use are traditional ones. The different hive types vary a lot in productivity and therefore in their shares of the regional and national production. Advantages, disadvantages as well a detailed description about the differences will be explained later.

Table 10: Comparison of hive types in Oromia – costs, production and percentages

Hive type	Number of beehives	% of regional number	Production [kg]	% of regional production	% of national production	Average honey-harvest per hive per year [kg]
Total	2 864 320	-	19 063 088	-	39.13	6.7
Traditional beehives	2 809 143	98.07	18 276 825	95.88	37.52	6.5
Origin	Ethiopia, local					
Acquisition costs	LH: ETB 50–60 AR: ETB 0–60					
Transitional beehives	37 572	1.31	426 367	2.24	0.88	11.3
Origin	Ethiopia, local					
Acquisition costs	LH: ETB 300–500 AR: ETB 50–150					
Modern beehives	17 605	0.61	359 896	1.89	0.74	20.4
Origin	Ethiopia, regional					
Acquisition costs[34]	LH ETB 1 300, or ETB 600 if produced by beekeeping expert AR: ETB 3 200					

LH = Lude-Hitosa AR= Arsi-Robe

Source: CSA (2015a), own data

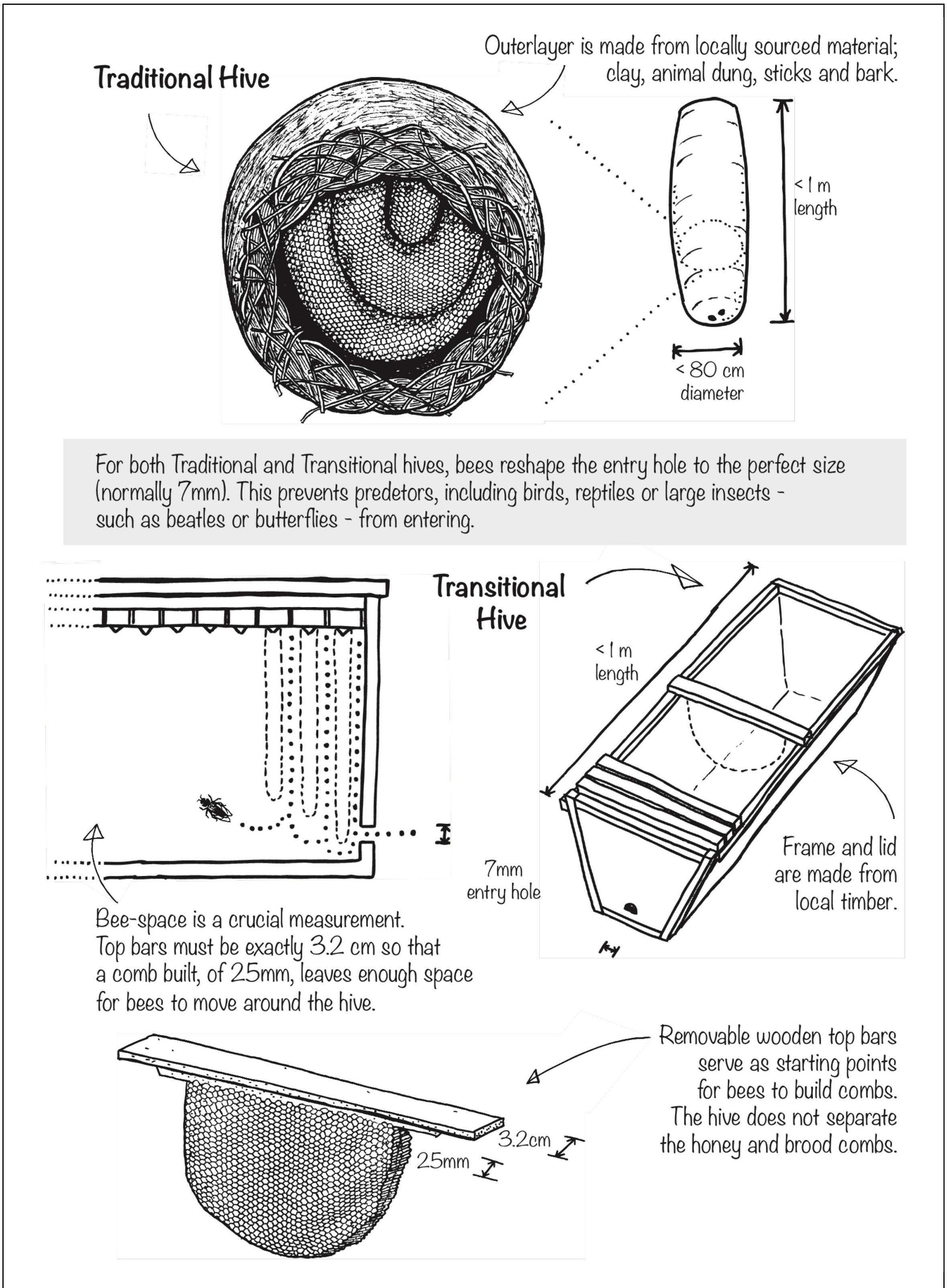
Most of the registered beekeepers in Arsi-Zone use traditional beehives. The total number of beehives per beekeeper ranges in the selected *woredas* from

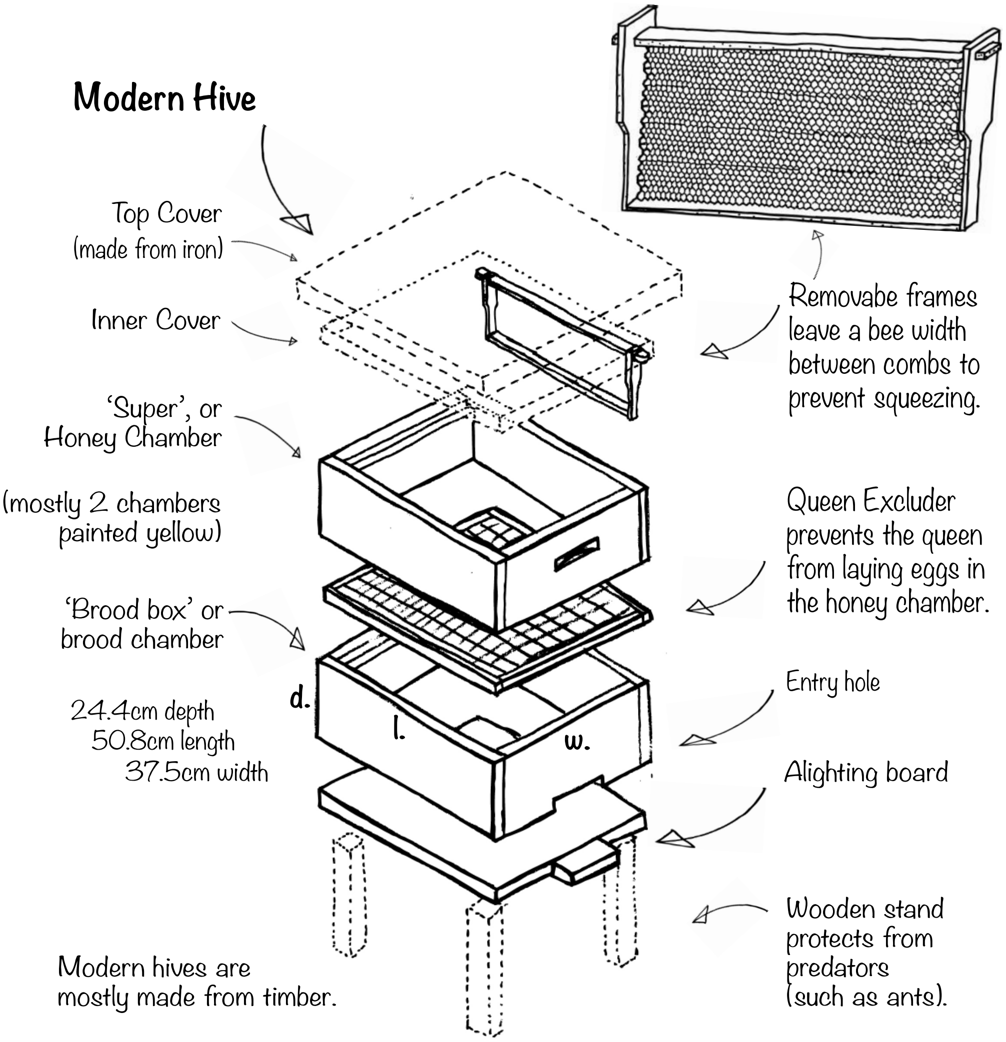
33 Box hives, casting moulds, honey extractor, honey presser, smoker, water sprayer, veil, gloves etc.

34 Information based on interviews E10 and E22.

one to 25 hives per beekeeper. On average the interviewees had 2.6 hives (Teklemedhin, 2016).

The differences between the three hive types, their dimensions, materials and set up in are shown in Figure 7.






Traditional Hive


Transitional Hive


Modern Hive

Figure 7: Hive types

Source: Blair (2016, exclusively designed for SLE); Photos: Diekjürgen

Traditional hive

Traditional beehives are cylindrical, slightly over one metre in length and 20–40 cm in diameter. They are built from readily available natural materials like wood, bamboo, tree branches and barks, manure and clay (E10; Fichtl and Abi 1994). The costs for traditional hive construction in Arsi-Zone were estimated at no more than ETB 50 for one hive. They were said to be preferable to the transitional hives in Arsi-Robe, which were too spacious and cold, leading to absconding of colonies (E22).

The method of traditional beekeeping is based on minimal management. Once the hive is produced it is fixed in a tree. In Arsi-Zone, traditional hives are made of wood and clay plastered with manure. Due to their weight and size they are mostly stored next to the farmers' home, when not in use, lying on the ground without rain protection covered in straw, clothes and grass matts (see image 13). Some farmers used the traditional hive for swarm catching only, while others kept the bee colony in this kind of hive throughout the season (F5, F9).

Image 12: Catching bee swarms traditionally around Langano Lake (Asela Mountains)

Photo: Diekjürgen

Image 13: Traditional beehive in Arsi-Robe

Photo: Diekjürgen

Although traditional beehives have the least productivity (E11, F5) they are the most commonly used. This is attributed to their low cost, availability of local material for construction and the simple harvesting. The traditional hive is cut open or destroyed when the harvest period comes (F12, Fichtl and Abi 1994). Due to the minimal management requirements of traditional beehives, most beekeepers said they felt more confident working with traditional hives than with modern hives (E9, F13,). However, most interviewees said they would prefer to have modern hives although they lacked processing material and know-how (F5).

Transitional hive

The transitional hive is also called Top-Bar hive because the frames of the hive only have a top bar, no sides nor a bottom bar (see Figure 7). Transitional hives were familiar to beekeepers in both *woredas* but not widely used (F9). Made from locally available timber and plastered with clay, the transitional hive normally holds between 27 and 33 top bars.

Image 14: Transitional hive in Lude-Hitosa without shelter

Photo: Diekjürgen

In top-bar hives, bees build the combs starting from the top bar so the combs hang down. Therefore, honey produced in transitional hives cannot be extracted by centrifugation. The beeswax is harvested by crushing honeycombs, and bees must rebuild combs after every harvest. This leads to higher beeswax production and less honey production. For the continuance of the bee colony it is most important that transitional hive products can be collected without killing or losing the bee colony (E10, E22).

In general, transitional hives are moderately effective for managing honey bees, conducting hive inspection, and shifting frames. The combination and division of colonies or moving the brood inside the hive was feasible for the beekeeper (E22).

Modern hive

The modern hive is made from wood and contains various chambers and a composite cover with galvanised sheet metal (see Figure 7). The hive bodies or supers all have the same size and contain the same number of frames. While the bottom hive body is mainly used for reproduction (brood) and the queen, the upper ones are used for honey storage. The modern hives are based on Lorenzo Lorraine Langstroth's[35] assumption that bees always leave the same space between the combs when building their hives. Depending on the availability of bee forage and the size of the bee colony, further boxes can be mounted on top of each other. For inspection or harvest purposes the frames can be taken out individually without disturbing other combs or squashing bees (E22).

Most of the interviewees who have or have had modern hives were either given them by non-governmental organisations or purchased them from the *woreda* offices or beekeeping supply companies in Addis or Shashamane (E10, E22, F9). While the quality of modern hives and the honey was perceived as superior to that from traditional or transitional beehive, interviewees said that the number of modern hives in Arsi-Zone was decreasing because of a lack of proper processing instruments and proper management skills (E22, F13). Due to lack of transport, the *woreda* office in Arsi-Robe proposed bulk buying of modern beehives (E22). Although most of the modern beehives were not produced in Arsi-Zone, innovations by beekeeping experts have been tested recently and locally produced modern beehives have been sold to farmers and governmental employees in the urban areas of Huruta (E10, E22). Still, major challenges remained, including lack of re-

35 Lorenzo Lorraine Langstroth (1810–1895): Apiarist and creator of the modern Langstroth hive

sources such as timber and the right carpentry equipment, since modern hives need to be very precise so as not to harm the bees during inspection and harvest. For example, frame spacing needs to be accurate (see Figure 7). Modern beehives generally require advanced management skills and knowledge from the beekeeper in comparison with transitional or traditional hives (E10, E22, F5, I9). Further input material like wax foundation require the harvesting and processing of bees' wax.

The following table illustrates the number of bee colonies per hive type in the five *woredas* in which the Green Innovation Centre works. In general, the table illustrates remarkable differences in the hive numbers comparing Arsi-Robe and Lude-Hitosa. This may be due to Lude-Hitosa's closeness to Asela and other main markets of the region.

Table 11: Colonies and beekeepers by hive type and region

Woreda	**No. of colonies by technology category**			**No. of beekeepers by technology category**		
	Traditional	**Transitional**	**Modern**	**Traditional**	**Transitional**	**Modern**
Arsi-Robe[36]	5 650	250	452	1 883	84	226
Lude-Hitosa	13 963	3 042	481	6 982	760	121
Hitosa	2 453	235	123	490	73	41
Sagure	5 440	1 825	520	2 125	608	265
Tijo	2 820	1 135	368	564	425	245
Total	30 326	6 487	1 944	12 044	1 950	898

Source: Teklehmedin (2016)

To sum up hive type differences, Table 12 again highlights all advantages and disadvantages identified for the research area. This information is relevant for later identification of input and training needs.

36 In comparison, in Lude-Hitosa: 862 females beekeepers and 4 971 males and in Arsi-Robe: 662 females and 1 457 males.

Table 12: Summarised advantages and disadvantages of hive types

	Advantages	**Disadvantages**
Traditional	– Affordable due to use of local material – Farmers can produce hives themselves – Minimal management skills are required to manage the hive and extract the honey	– Disintegrates over time – Susceptible to predators – Difficult to detect diseases and pests – Bees take longer to build the combs than if frames or foundation sheets are provided – Combs are cut out of the hive and cannot be reused – Difficulty especially for women during hanging and harvesting (if put in trees) – Hive is cut open and often destroyed after harvest
Transitional	– Honey yield is slightly higher than from traditional hive (5–7 kg) – Wax production is high – Management, including pest control, can be done more easily due to frames that can be taken out individually	– Hive surface made from clay, susceptible to predators – Combs tend to break – Roof lid of corrugated metal without an insulation layer, causing excessive warming, which forces bees to abscond
Modern	– If managed properly, honey yield is higher than in traditional and transitional hives – Withstands rainy weather conditions – Roof and boxes are detachable, making inspection, management and disease detection easier – Possibility of using a queen excluder to separate brood from honey boxes to enhance honey quality and pureness – Bees use frames to build combs making harvest more efficient – Frames can be taken out individually for inspection and harvesting – Combs do not break during harvesting	– Costs of hive production and processing materials are high (see table 10) – Foundation wax needed, often lacking – Advanced skills, know-how and tools for harvesting, extracting and processing of honey required

Source: own data

Management practices in Arsi-Robe and Lude-Hitosa

Due to the different requirements of materials for the hives they vary in production costs (see Table 10). Therefore, the choice of hive also depends on the beekeeper's economic situation. Additional beekeeping material, like queen excluders and spare boxes were needed to ensure a promising yield from modern hives. Although most of the observed modern beehives in Arsi-Zone had one or two layers (brood box and one honey chamber) a beekeeping expert stated that whenever a beekeeper used modern beehives a third layer would be in store. Due to the lack of bee forage, the third layer was not made use of for hosting bees or honey production (E22).

Concerning colony reproduction practices, most of the beekeepers in Arsi-Zone caught wild swarms or absconded colonies and did not actively breed their own swarms (E22). Therefore, they were dependent on the natural occurrence of swarms rather than being able to buy a bee colony.

Some smokers were available in the selected *woredas* which were bought by farmers or beekeeping experts from Addis Ababa for ETB 250 each (E10). During some farm visits, self-made equipment like face veils or smokers could be found (I8) (see Image 15).

Image 15: Self-made beekeeping protection hat and veil in Arsi-Zone

Photos: Diekjürgen

Major beekeeping activities

Beekeeping involves hive preparation or construction, swarm catching and transferal, hive inspection, cleaning of the surrounding area, feeding of bees, honey harvesting, extraction of wax, and storing and marketing of honey.

Beekeeping practices in Arsi-Zone were found to represent a mixture of traditional beekeeping knowledge based on the long Ethiopian beekeeping tradition combined with "modern" beekeeping procedures promoted by governmental agencies and development programmes (E10, E22). Two outstanding examples will be described briefly:

a. Catching the bee colony and swarming

Most interviewed beekeepers said they knew how to catch a swarm. The minority of women interviewed could catch a swarm. Many of them were afraid of the bees' general aggressiveness and therefore mainly supported their men in preparing the traditional hive for catching. The hive was smoked with special leaves to attract bee swarms (E10, F6).

b. Bee feeding and bee forage planting

Most of the beekeepers fed their honey bees during the dry season due to difficulties for worker bees to find nectar, pollen or even water. The feeding included provision of sugar in dissolved water, *shiró* (chickpea powder), faba bean or barley flower (F12). Only a few of the interviewees stated that they plant bee forage like roses (*Rosa abyssinica*), *sensal* (*Adhatoda schimperiana*) or *nug* (*Guizotia abyssinica*) to provide sustenance during the dry season, but it was also mentioned that there was a lack knowledge when it came to additional bee forage planting (F6). Feeding and provision of water for the bees was perceived as a woman's task (F9, I11). Further smoking and supporting during the harvest were tasks mainly conducted by women (F9).

Production of honey in Arsi-Zone

Along the value chain of honey, the beekeepers were the main stakeholders on production level. Further the beekeeping experts from the agricultural offices were stakeholders conducting training, collecting statistical data and supporting the beekeepers by lending protection clothes and beekeeping instruments.

Apiary sites

The lack of available land was related to the high rate of deforestation in Arsi-Zone where beekeeping could not be performed in the trees using the traditional hive. Furthermore, interviewees stated that an apiary site should be close to the house due to possible theft but at the same time at a safe distance from livestock and the family's daily life (F9, F10).

Due to deforestation in Arsi-Zone, most of the hives are now kept close to the house on the ground (T15). While most of the traditional hives were found on the ground, transitional hives and modern beehives were raised on bricks, stones or small racks. Some farmers built a lean-to as shelters for the beehives to protect them from rain or too much sunlight (F5). Mostly women and children were responsible for clearing the apiary site from abundant vegetation (F9).

Some farmers mentioned the application of agro-chemicals like herbicides around the hives to control weeds and possibly to destroy nests of predators (F1). This practice was confirmed by extension officers (E22). Although the importance of shelters for protecting the beehives from sun and rain exposure was little known, more professional beekeepers provided a roof, an elevation and forms of protected area for their beehives (F5).

Productivity and seasonality of beekeeping

There were generally two honey harvesting seasons in Arsi-Zone: the main one lasting from October to November and a second minor one lasting from April to June (E10, E22). Interviewees stated that if bees could be prevented from swarming by feeding between June and August, a good harvest could be expected (F6). Although the existence of minor harvesting periods in Arsi-Zone was not mentioned by the farmers, these are theoretically possible (E10, E22). Harvest depended on rainfall and the availability of flowering plants throughout the year. The productivity of hives varied and was reliant on the hive technology used (see Table 13 and Figure 6), the availability of bee forage, and the management practices. Some farmers mentioned harvesting twice a year in the past but only harvesting once a year now (F14).

Due to the weight of traditional hives' and because they are specifically built to hang in trees, management and harvest can be difficult for female beekeepers. Because of the construction of the hives, inspection for diseases, cleaning or regular checks on the brood and honey comb is impossible. This contributes to the low productivity of traditional hives. During harvesting, the bee colony is killed or absconds and no wax is extracted (see Table 12).

All interviewed beekeepers stated that pests, diseases and predators challenged the health of their bee colonies and in consequence the honey production and outcome. Predators and diseases were a big challenge for beekeepers and farmers, and were reported in each of the selected *woredas* and *kebeles*. Ants, the green bee-eater birds, lizards, spiders, and honey badgers were reported in Arsi-Zone.

Influences of agro-chemicals on beekeeping

Pollinators like honeybees are highly affected by insecticides and other agro-chemicals. All interviewed beekeepers related the increasing absconding of bees to the increased application of pesticides during the past three years, as mentioned in Chapter 5.1.2 (E23, F6, F9, F11, I7). During some focus group discussions farmers emphasised that they had lost bee colonies over recent years (i.e. from 7 to 4 bee colonies, F6).

Box 5: Bio-indication

Bio-indicators are indicators of ecosystem's health; they can be plants, animals or other organisms. Their abundance or absence indicates ongoing events in the ecosystem, which often are negative imbalances (Kevan and Wojcik, 2007). In Europe, honey bees have reduced by 25% over 20 years (Greenpeace, 2014). The protection of bee pollinators, e.g. honey bees in the U.S. (…) has grown increasingly important because declines in their populations have the potential to impact food security due to loss of pollination services (USDA, 2017).

Table 13: Honey yields per hive

Description	Traditional		Transitional		Modern	
Average honey yield in kg/year; 2 harvests (Arsi-Zone)	LH 7	AR 11–12	LH 15	AR 15.5	LH 25	AR 21.5
Average yield in kg/year (national)	6.5		11.3		20.4	

Source: E10,22 and CSA (2016b)

Processing and storage

Processing and storage of honey and other apicultural products was done in individual households. Therefore, no external wholesalers or processors were found in the selected *woredas* (compare stakeholder graph, Figure 5). Main extracted products besides honey were tej and beeswax.

All interviewed beekeepers carried out primary processing such as honey extraction from the combs. Due to a lack of processing instruments, most of the beekeepers extracted the honey using a spoon or knife, leading to poor honey quality as well as the death of many bees (F12, F17, I9).

All interviewed farmers only one beekeeper had a honey extractor. Few farmers mentioned owning further processing material like wax presses for foundation sheets. In general, most beekeepers did not have access to proper extraction and processing tools, smokers, protection clothes, or further beekeeping instruments.

In both *woredas* it was stated that the extractor was broken, spare parts were missing and repairs could only be done in Addis (E10). Further, it was mentioned that only one set of protective clothing was available in each of the two *woredas*. Both interviewed beekeeping experts mentioned that the protective clothes are borrowed by farmers mostly during harvesting time (E10, E22). However, experts noted that sharing protective clothes amongst beekeepers and moving equipment between sites may spread diseases (F18).

In Arsi-Zone, bee products were mostly stored in the form of raw honey, semi-processed and combed honey. Especially the lack of the extraction of wax was severe. Further bee products like royal jelly, pollen or propolis have so far never been harvested or processed (E10).

Image 16: Honey centrifuge to extract honey manually at Asela University; used for training purposes

Photo: Younan

Image 17: Extractor owned by model farmer in Arsi-Zone

Photo: Diekjürgen

Honey qualities

In farmers group discussions, it was mentioned that honey is extracted, processed, stored and finally sold in different grades (see Table 14), but experts stated that only crude honey was available in Asela (F8, F9, E11).

Table 14: Honey grades

Type 1	Type 2	Type 3
Crude honey is mashed combs, including dead bees and the brood. Crude honey is the lowest quality and beekeepers in Arsi-Zone get the lowest price for it.	Chunk honey consists of whole combs of honey. It can be harvested whole from the beehive and pieces of the comb are put into jars and containers.	Semi-refined honey is the honey remaining when the wax has been taken away; it still contains particles of wax, bees and brood.

Source: own data, Trust (2012)

Most of the interviewed beekeepers packaged their honey in plastic containers, tea kettles or plastic bags and sold it to consumers or stored it for home consumption (F5).

Image 18: Crude honey stored in 50 litre plastic containers in Arsi-Zone

Photo: Diekjürgen

Image 19: Tea kettle for storing up to 5 kg

Photo: Zimmermann

Only one woman stated knowing how to use honey in order to make medicine, cosmetics like lip balm, and a special drink which is given to women during pregnancy (I11).

Marketing and consumption of beekeeping products in Arsi-Zone

The two main beekeeping products that were harvested in Arsi-Zone are honey and wax.

Table 15: Honey product utilization % in Arsi-Zone, 2015

	Household use	Sale	Wages in kind	Other
Honey	54.18	41.39	0.13	4.3
Beeswax	81.82	-	-	18.18

Source: CSA (2016e)

Honey

The main consumption purpose of honey in Arsi-Zone is table honey (54.18% in 2015). Although a main product from honey is *tej*, we found that local *tej* houses in Arsi-Zone (Huruta and Arsi-Robe) buy honey from other regions, for example from Jimma or even Addis Ababa or from middlemen (T6, T7). This may be due to small yields in Arsi-Zone leading to a lack of honey on the market and inadequate honey storage capacity or due to an unsuitable quality of the honey (see Box 2: *Tej* making) (F3, F9).

A lot of the honey trade took place at farm-gates, with some farmers selling honey directly to the final consumer. Around 50% of the honey produced in Arsi-Zone was used for household consumption or even given away as a gift to family members and neighbours. Most farmers failed to meet the demand for honey due to their low yields.

The honey price in both selected *woredas* was similar, despite the slight quality differences already mentioned. Although the quality of the honey influenced the price, honey availability seemed to be more important for price fluctuations. During harvesting time, the farmers earned up to ETB 120/kg while during scarcity the honey price increased up to ETB 200/kg. In general, interviewees stated that the honey price was increasing because the availability was decreasing (F12). Most of the honey produced in the selected *woredas* was not traded to surrounding towns like Ithaya or Asela or Addis Ababa. Despite this, some interviewees rated the market access as generally good (E17).

Beeswax

As explained before, beeswax was not extracted in Arsi-Zone and 82% of the beeswax produced remains at the household level (CSA, 2016b). Due to the predominant use of traditional beehives, no beeswax was extracted and was therefore not available for further beekeeping management i.e. for the foundation of modern frames. During one interview, it was mentioned that beeswax traders collect the wax from *tej* makers (E7.)

Challenges for beekeeping in Arsi-Zone

Summarising the situation analysis of the value chain of honey in Arsi-Zone, beekeeping and honey production faced challenges at all levels of the value chain. These ranged from low honey production, low technical extraction and processing methods to the absence of packaging materials and marketing channels. Middlemen played a minor role in the marketing of honey and few beekeepers had connections to processors and retailers.

Table 16: Identified constraints for an improved value chain of honey in the research area

Aspect	Identified constraints
Apiary sites	– Lack of land for possible apiary sites
Hive technology	– Lack of adequate material and carpenters – Produced and utilised types – Dependency on external suppliers (high costs) – Unsuitable size of the hives – Low productivity
Beekeeping management	– Lack of proper hive management – Lack of inspection – Predators – Pests and diseases of the honeybee
Bee forage	– Shortage of bee forage especially during dry season – Decrease of wild bee forage due to deforestation, application of agro-chemicals and monotonous crop rotation
Harvest and processing	– Lack of financial capital – Limited or no access to honey extraction and processing tools – Lack of proper storage containers or further packaging
Marketing	– No professionalism in the marketing of honey – Bee products are sold or given away locally in the farmers' vicinity
Importance of beekeeping and knowledge	– Lack of awareness – Little knowledge about importance of the honeybee and the bees' eco-systems services (i.e. pollination) – Lack of knowledge (application of agro-chemicals, extraction and processing practices, business skills)

Source: own data

Farmers did not see beekeeping as a promising source of income (E22, F9, F12). Beekeeping in Arsi-Zone was clearly seen as a side-activity and farmers did not invest much time or effort in the management of the apiary.

The biggest challenge was to address the need to raise awareness and increase knowledge about the importance of the bees for pollination as well as about the improvement of honey qualities. Although most of the farmers interviewed showed interest in training on beekeeping, offers of training by the *woreda* offices were rare (once a year) (E22). The environmental, economic and social recognition of the importance of bees was assessed as weak in Arsi-Zone. Topics such as pollination value of the honey bee, generation of additional income through the extraction and marketing of beeswax were not to be found in the selected *woredas*. Experts stated that to exercise good beekeeping management practise one should have a good understanding of the bee biology, the bees' needs and behaviour (E10, E22). Although beekeeping experts were highly motivated to give more training on these topics, the lack of priority given to the apicultural sector is a challenge.

Overall, the honey value chain in Arsi-Zone is restricted to the area, while the honey quality can be classed as low due to the lack of know-how, processing materials and proper storage possibilities. Therefore, current honey production does not meet international standards or volumes for the export market. Nevertheless, farmers in Arsi-Zone are aware of the importance of honey as a food source and medicine. Further the majority of the farmers connect the decline in bee populations with the loss of biodiversity in the agricultural landscape caused by deforestation and the application of agro-chemicals. The awareness of the importance of honey as a food source as well as an additional income for the farmers' households presents a window of opportunities for upgrading beekeeping and additionally for taking measurement to protect the honey bee in Arsi-Zone from extinction.

6 Income generation and employment opportunities women and youth

If beekeeping is a lucrative side-activity, how can youth and women get more involved? This question is addressed by looking at the employment situation in Ethiopia and by analysing the social and economic dimension for youths and women in Arsi-Zone. The conditions for young people and women to participate in beekeeping as a possible source of income or an employment opportunity are analysed. The second part of this chapter looks at the possible income effects of beekeeping.

Primarily it is important to differentiate between the terms "income generation" and "employment". Both terms are used widely in science and research; a variety of meanings and interpretations can be found. The following are basic definitions for this study:

Employment is defined as "any service performed for payment or compensation. This definition applies to any hiring contract, whether written, oral or implied. The three essential elements to the definition of employment are service[37], wages[38], and direction and control[39]." (TWC, 2015). In the context of the study, employment opportunities in the honey sector should especially be identified for young people because a relatively large proportion are seeking work due to a lack of agricultural land.

Income generating activities on the other hand are understood as activities that permit "an improvement in the families' economic situation through an increase in the household's purchasing power" (ACF, 2009: 13) without necessarily being employed or working with/for someone. In the context of the study these improvement opportunities refer especially to women: It is presumed that women being not formally employed are yet occupied with household activities and field work throughout the day. Therefore, it would be highly unrealistic for them to take up further job activities. Nevertheless, there can be a chance for women to generate further income along the value chain of honey.

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37 "The agreement under which a person agrees to perform a service is known as a contract of hire. Employment begins when service starts and continues until it is discontinued by discharge, death, resignation or an alteration in the terms of the employment agreement." (TWC, 2015)

38 "A person who receives wages or non-cash compensation for services is said to be employed. An example of non-cash compensation is room and board for live-in domestic help." (TWC, 2015)

39 "If the employer controls the manner and means by which the work is performed or has the right to do so, the person performing the work is employed." (TWC, 2015)

6.1 Employment for women and youths in rural Ethiopia

Young people and women are special target groups for the Ethiopian government and receive special attention in the GTP II, as they are most affected by unemployment (FDRE, 2016). There are huge challenges for Ethiopia regarding rural unemployment. Land scarcity and land market restriction lead to limited access to agricultural land (Bezu and Stein, 2014).[40] Around 80% of the population live in rural areas, and urban population is growing by 4.9% annually (CIA, 2016). The population structure in Ethiopia is characterised by the young, with the median age at 17.8 years and 40 percent of the population below the age of 15 (CIA, 2016). Every year up to 2.5 million young Ethiopians enter the labour market and not all of them can be employed in traditional agriculture (Lefort, 2015: 373). This leads to an increased unemployment rate and pressure on the government to develop the economic sectors of industries and services.

Official statistics for 2015/16 show that urban unemployment is at 17%; rate is lower for men at 9.4%, than for women at 24.7% (CSA, 2016g: xiv).[41] This means that especially young women are affected by unemployment. Unofficially, around 50% of young people in the urban population are unemployed (Lefort, 2015: 373). The rate of urban unemployment might be the consequence of a lack of income opportunities in rural Ethiopia and resulting rural-urban migration (Bezu and Stein, 2014). The greatest asset for rural young people regarding employment becomes education to work in sectors outside of agriculture (Bezu and Stein, 2014). Education and training for youths to work in other sectors is one strategy of the government for youth employment.

In the GTP II the government committed itself to promote women and youth empowerment, other activities to promoting education and training are enabling access to credit and productive assets, gender equality in education and access to land for women (FDRE, 2016). Specific attention is given to small and medium enterprises to promote private entrepreneurship to create jobs in non-farming activities (Lefort, 2015:373).

40 90% of economic activities in the rural areas is related to agriculture (Bezu and Stein, 2014: 260).

41 The Central Statistical Agency (CSA) measures only urban unemployment. According to them, the urban population is at 17.6 million, with more than 67% (8.9 million) being economically active (CSA, 2016g).

6.1.1 Situation analysis and opportunities on employment for youth in rural Arsi-Zone

What is the potential for the employment of young people in apiculture and the honey value chain in Arsi-Zone? Landless youth do not own land use certificates or have access to land through their family (see section 3.2.3). For this group, employment in rural areas is more difficult to find and especially youths newly entering the labour market are affected.

Youth beekeeping cooperatives might offer an opportunity for landless youths in Arsi-Zone. To test this assumption, the following topics will be considered: First the possibilities for youth to gain access to land and current employment opportunities. This sheds light on the employment situation for youth and what kind of land could be used as an apiary site as well as governmental support for youth employment. Then beekeeping will be analysed as means for employment for young people. Lastly, some constraints on beekeeping will be considered. The focus for employment opportunities will be on the production side of the honey value chain as this is where some potential may be found.

Access to land and employment opportunities for youth in rural Arsi-Zone

The Proclamation of Oromia Rural Land Use and Administration states that "[a]ny resident of the region, aged eighteen years and above, whose livelihood depends on agriculture and/or wants to live on, have the right to get land free of charge" (FDRE, 2007: 3). According to the Arsi-Zone Land Administration Office currently all potential agricultural land is already in use and no more additional agricultural land is available in Arsi-Zone (E18).

Young people can gain access to land through the land ownership of the family, renting (or sharing), or community land (E15, E18). If the family has available land it can be given to a youth to farm on. But the average farmer in Arsi-Zone only has 1.4 ha to cultivate, while 39% of the households have 6–9 members[42], which limits the possibility to share land among family members (CSA, 2016b: 61ff). The available rented land is usually already rented out and divided among farmers (E18). Community land (e.g. grazing land, area enclosures or land belonging to schools or churches) is in the hand of the community. User rights for additional income generating activities on community land (e.g. cutting livestock fodder or wood) must be approved by the community but there is usually a high com-

42 The further distribution is 31% (4–5 members),23% (2–3 members), 5% (10 and more) and 2% (one member) (CSA, 2016b: 61)

petition for this land. According to the *woreda* youth experts, youth would only have access to community land if they were organised in cooperatives (E15, E16). This is one way the government promotes youth cooperatives. Owning land is even more difficult for youth. To own land use certificates, young people must inherit them from their parents (E18).

When the access to land is restricted, agriculture as an employment opportunity for youths is also restricted. In consequence, education becomes more important in Arsi-Zone. This was confirmed by some of the farmers and youth experts in Arsi-Zone. Farmers mentioned that they send their children into cities for secondary or higher education as their future employment should be outside of agriculture (I14, I15). Another incentive for education was the hope that the salary and the living standard would be higher (I13). In consequence, youth in Arsi-Zone have strong incentives to move from rural areas into the cities due to education, but also due to job opportunities (E15, E16).

Nevertheless, there are potentials for employment and the government puts efforts in the employment creation for youth in rural areas. Arsi-Zone is an agricultural high potential area. At harvest time, Arsi-Zone is even a destination of rural migration with around 20 000 people coming to work as day labourers (E16). To provide regular employment the government supports small and medium sized enterprises for young people through easier access to credit to support rural entrepreneurship (E16). Furthermore, there are employment opportunities in rural areas outside of agriculture, but mostly as a day labourer. As a result, young people work in different jobs to make a living. Typical activities for landless youth are loading and unloading trucks or carts, laying paving, sand extraction and transport, irrigation, cutting of livestock feed, wood cutting, road construction, or food vending (e.g. *injera*, chai or samosa) (E15, E16). The government supports these activities, for example by giving training in road construction or paving (E16). Furthermore, youth cooperatives are promoted by the state through support in training and granting of better credit conditions (E16).

In other communities in Ethiopia, beekeeping was perceived as an opportunity for landless peasants to create employment. Advantages of beekeeping are that little space is required and that hives can be made from local materials. This means beekeeping can be practised with small land holdings and small capital (Berhe et al., 2016: 5).

Situation analysis and potential opportunities in beekeeping for landless youth

As stated earlier, the main employment potential for beekeeping is on the production side. If young people in Arsi-Zone are unable to access land through their family or by renting, they can form cooperatives to get access to community land (E15, E16). The advantage of beekeeping is that land can even be used without cultivation if it offers sufficient bee forage. This qualifies marginal forest areas, area enclosures, watersheds or hillsides as a potential apiary sites.

There were no active youth beekeeping cooperatives in the *woredas* we visited (E16). In Lude Hitosa there used to be one with four members using community land as an apiary site but conflicts with livestock owners who used the land for grazing led to legal actions. In Arsi-Robe, one beekeeping cooperative was established with the help of an organisation of the Ethiopian Orthodox Church (F15). They started with an irrigation system on a hillside. Now the village has water throughout the year. As a next step, trees were planted (e.g. apple, avocado, mango, neem, and *grawa*). The NGO distributed 36 modern hives for 38 members (16 hives on common land and 20 hives on private land). At the time of our visit, the beekeeping cooperative was one year old. Honey had not yet been harvested and most of the modern hives were empty.

Image 20: Bee hive shed on a hillside (left) and bee hives in the shed (right)

Photos: Burtchen

Image 21: Members of the beekeeping cooperative in Arsi-Robe (left) and planted trees on the hillside (right)

Photos: Burtchen

Young beekeepers in Arsi-Zone were interested in improving their skills (F10). This could be another target group to benefit from the development of honey production in Arsi-Zone. The young beekeepers were children of farmers who had learned the skills from their parents, who gave them a piece of land to install their hives. They confirmed that beekeeping is a good way to earn income compared with other farming activities in relation to the work done and financial revenue gained (F10). According to them beekeeping is a potentially good income opportunity but training is needed to teach the necessary skills and a suitable apiary site has to be found (F10).

Limitations and possible strategies to promote beekeeping

The situation described above shows that there were certain limitations for youth cooperatives to practise beekeeping. The biggest constraint was gaining access to land and the use of this land. One strategy was to form cooperatives to access community land. Furthermore, there were only few forest areas in which beekeeping is allowed (E16). Another limitation might a certain danger through bees. One farmer mentioned that it was difficult for him to put the beehives outside his own land because if people or livestock got stung he would be held accountable (I10).

Another limitation was that beekeeping in a cooperative can only generate a side income (Gebretinsae, 2015).[43] Therefore, beekeeping cooperatives should try to combine other activities with beekeeping, like agroforestry or horticulture. In this sense, the beekeeping cooperative in Arsi-Robe was a good example because they practised beekeeping on a hillside which is unused; except for cutting wood and livestock feed. Furthermore, they combined different activities as they built an irrigation system, planted (fruit) trees, and used beekeeping as an additional income generating activity. In this way, beekeeping could be part of a combination of different employment activities for youth. For youths to start beekeeping or to improve their beekeeping skills, training is needed. This would support the activities of the government to create youth employment and the extension service in increasing the farmers' production and income.

6.1.2 Situation analysis and income generation opportunities for women

This chapter introduces the occupational situation of women in the research areas of Arsi-Zone and then focuses on income generating activities. Looking at the cultural and social role of women seemed essential as it was part of the methodological PRA-approach.[44] Possible income generating activities along the value chain of honey had not yet been identified in Lude Hitosa and Arsi-Robe. The study group therefore understood the commission as a first stage and the results offer a base for further research.[45]

According to principles of FAO and others, a bottom up approach was necessary for the identification of suitable income generating activities as they should "correspond to the needs of women. [...] For the benefit for women, IGAs [Income generating activities] to be supported should be those traditionally undertaken by women, and located in or near the home. Potential IGAs should concern activities where women can use skills they already possess." (ibid)

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43 In his calculation, a fully equipped beekeeping cooperative with 10 members and 40 modern beehives in Tigray has an annual profit of around ETB 22 000, which is not enough to sustain the livelihood of the members (Gebretinsae, 2015). According to Gebretinsae, the work could be done by 2 people.

44 All female informants were married or lived with their family. Female-headed households were therefore not the subject of investigation and their specific characteristics or social status are not reflected in the data.

45 This corresponds to what the FAO describes as the first step "identification": "The participants should ask themselves how they can obtain income from an activity, and identify the factors contributing to the success of IGAs. At the same time, they should ask themselves if they are already involved in the activity. They need to be aware of these factors and to gauge them own skills when they consider embarking on an activity." Step one will be followed by 2) technical feasibility, 3) economic and financial profitability, 4) planning, 5) plans for marketing, 6) ways of financing (FAO, 1996).

As stated in the introduction, beekeeping and other activities along the value chain of honey have the potential to generate additional income (cf. section 3.1). But why do women not benefit from this even though the government's declared aim is to better integrate them into the economy and Ethiopia's business system? To find answers, it was necessary first to take a closer look at the cultural background and aspects of gender-based labour division in Arsi-Zone, before analysing the situation, constraints and opportunities for women.[46]

Cultural background and gender-based labour division

What is known and practised amongst all Oromo groups is the *gadaa* system – a term used for various concepts but mainly describing "a male-centred egalitarian socio-political organisation" (Terefe, 2012: 67) in which women do not play any political or powerful role. Leadership and socio-economic positions are based on *gadaa* which categorises and classifies the society according to age and gender and provides different groups with different tasks and positions.

The Arsi are one of the largest group among the Oromo; they are mainly organised in the lowest kin group called *mana* which basically describes the house, the nuclear family. "This elementary family lives by itself under the control of the husband. Since Arsi societies are potentially polygynous, if a man can be married to more than one woman, he will have more than one *mana*." (Terefe, 2012: 82).[47]

Gender roles are socially constructed and the base for predefined activities depending on one's gender identity. Terefe (2012) describes four major aspects that are considered sacred for females in Arsi-Zone: (1) Women are connectors of the family, (2) they are (due to the bride-wealth) a source of wealth, (3) they are responsible for reproduction and the continuity of the family's lineage and (4) they maintain the culture by passing it on to the children. These responsibilities are also reflected in the allocation of working activities. There are specific Oromo terms for the description of gender-based labour division: The husband, or head of the family, is responsible for all *karaa gadi* activities, everything that is done outdoors. The wife on the other hand takes care of everything in and around the house – *karaa olli*. It should be noted that gender roles among the Arsi are distinct and divided into "male and female working members" (Gemetchu, 1994).

46 The security situation in Oromia Region during our stay hindered data collection; this included missing interviews with experts from the Women & Children's Affairs Office of Arsi-Zone.

47 Ethiopia's cultures vary greatly. As context-specific and profound secondary literature about gender relations in Arsi-Zone can hardly be found, Terefe (2012) will be quoted as the main source. The quoted statements comply with own observations and are thus triangulated data.

The above definition of the gender-based work categories matches statements collected in this research. Women saw themselves as “only assisting” their husbands and being their supporters (F11, I11). Men reduced the work activities of women to the household activities as “it is a cultural thing” (I13). Some male informants specified that women are not supposed to get engaged in any economic activities and even if they did, they must give all the money earned to their husbands as women cannot have their own income (F13). Not all informants agreed on the strict gender-based division. Some argued that there are families working together and that all work activities are done equally and are accessible to men and women without any cultural restrictions (E14, F13, I6). But it can be noted that the overall and predominant impression was that of a woman in her allotted gender role and aware of her work responsibilities.

This impression was verified through triangulation: The daily routine schemes conducted with women revealed that they were occupied with household chores during the day, including cooking and preparing coffee, cleaning, taking care of the children and the house, cleaning the beehives around the house and feeding the livestock (E25, I11, I16, F14). In addition, most of the female interviewees also went to the fields and helped their husbands with weeding, sowing or ploughing (I6, I11, I16, E14).

Occupation of women and their role in apiculture

Aspects of gender relations and gender based labour division in apiculture and along the value chain of honey can only be understood in the interrelationships of social, religious and cultural traditions of the Arsi-Oromo as outlined above.

Women in the research areas of Lude Hitosa and Arsi-Robe were mainly occupied with domestic work activities and with assisting their husbands in the fields. Daily routine schemes were drawn up with female informants to investigate their concrete activities and their work peaks during the day, week and year. This information can be considered for the development of recommendations on further income generating activities for women. The women were asked to list their daily activities and routines according to duration and day times and the results were consistent with the respondents and with secondary data[48]:

48 E.g. CRS (2013). See Annex 5.

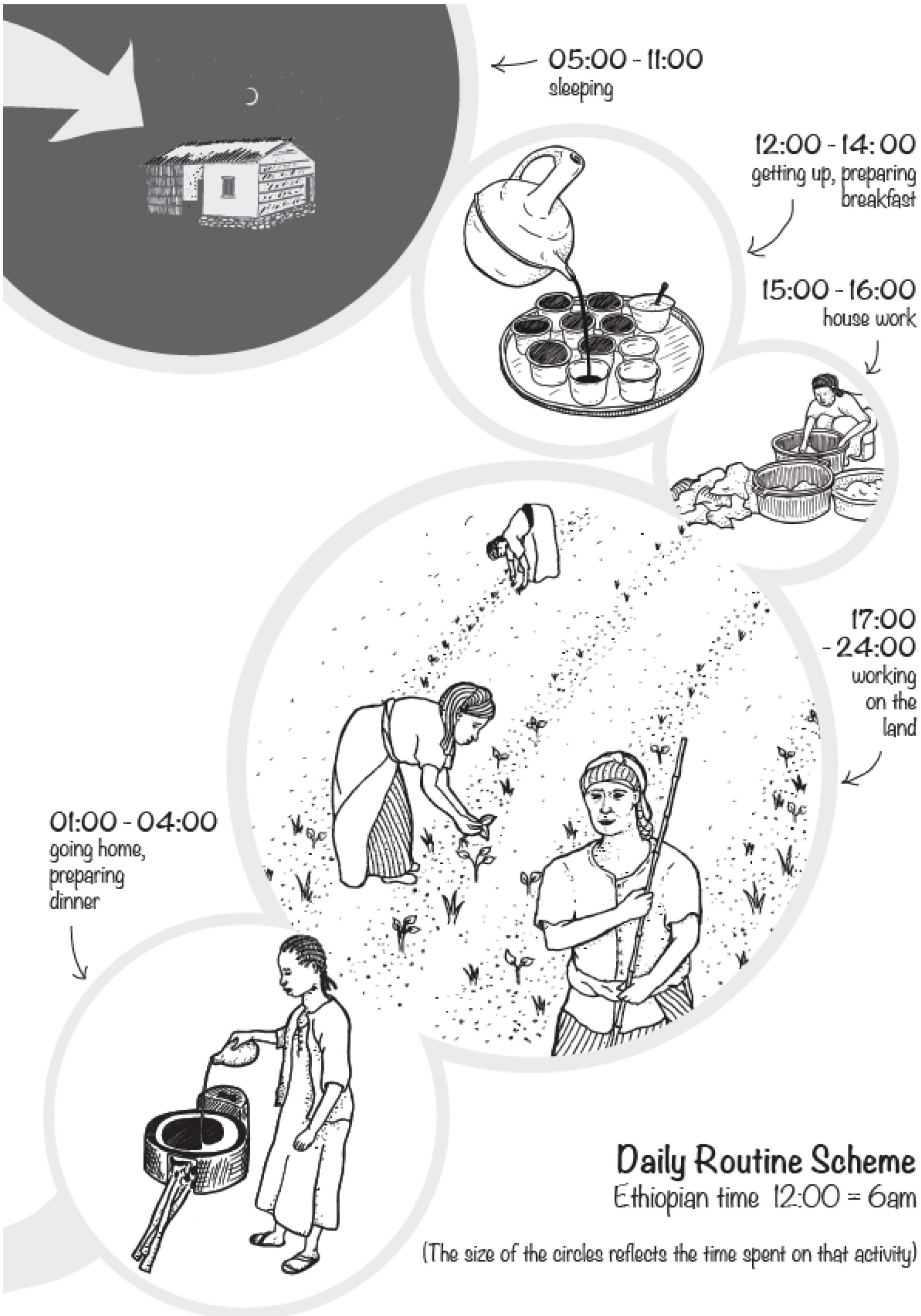

Figure 8: Daily routine scheme

Source: Blair (2016, exclusively designed for SLE)

Figure 8 visualises the different time slots that could be identified after the analysis of the collected data. Women in the research area worked long hours, on an average 16–17 hours per day (I11, I16). Even though most of them were not formally employed, they were occupied throughout the day with little free time left to spend. The interviewees began at 6:00 am with cooking and preparing breakfast and coffee. They took care of the children and were occupied with housework, feeding the livestock and cleaning around the beehives throughout the morning. After preparing lunch they worked on the fields in the afternoon and helped their husbands with weeding, drilling and sowing. On returning from the fields at dusk, they prepared dinner for the family and went to sleep (I11, I16). Depending on the area, the weekly market day was a fixed date. In the villages visited in Lude Hitosa, most women were busy selling and buying goods on the market on Wednesdays. The same applied for Arsi-Robe on Thursdays. Work peaks during the year were identified for the months from September till January (I11).

To further identify potentials for additional income generation along the value chain of honey, women were asked about their work activities in the beekeeping and honey sector. The description and work tasks mentioned were similar in both research areas of Lude Hitosa and Arsi-Robe. It became clear that women do see themselves only as supporters, assisting their husbands in beekeeping and honey production (F11, I11). All female informants mentioned the following tasks as their responsibilities: cleaning around the beehives, feeding the bees (during the dry season), smoking hives during harvesting (F3, F5, F9, F11), protecting the bees, and other management activities except for catching the colonies (F3, F5, F13). The honey was only harvested by male beekeepers; women were not involved in this for cultural reasons and because of fear of the aggressiveness of bees (F11, F14, I11). At the same time, women were very interested in becoming more involved and learning more about beekeeping and honey production (E16, E17, F11, I11).

As described earlier, the value chain of honey was very short in the research areas. Potential income activities could therefore only be identified on the production and local marketing level. Simultaneously, almost every female interviewee stated that she would like to participate in beekeeping training if it was offered for women. They showed great interest in gaining profound knowledge about the different management steps of honey production as they seemed sure about the additional income effect: "Beekeeping can create a lot of money." "Honey is good for income." (F5) Bringing together these two results of potential activities on the production side and the interest and ability[49] of women in becoming involved in beekeeping defines a clear potential. Through overcoming limiting social or cultural constraints and better integration and support for women in beekeeping (i.e. access to training, equipment, credit), honey production and sales, the potential for generating additional income is high. This is also because beekeeping can be done as a side-activity (as described earlier) and therefore does not require much time from the very busy women (see routine scheme). The following constraints were identified as reasons currently preventing the realisation of potentials:

- Training is mainly or even exclusively offered for male beekeepers.
- Cultural or social norms keep women from taking over all the necessary management steps of beekeeping (e.g. harvesting). The practice of traditional hives in the trees further presents a practical barrier.
- The lack of equipment (e.g. proper protective clothes) and financial capacity does not allow women to start or become further engaged in beekeeping and honey production.
- The access to markets is limited through lacking infrastructure and sales equipment (e.g. standardised containers).

6.2 Income effects of beekeeping

This section considers the income effect of beekeeping, the income beekeeping can generate and the income effects of different hive types. Furthermore, examples are given of how to develop a honey value chain on a larger scale. To do this, beekeeping should be approached as a professional activity rather than a side activity. For this, beekeepers should produce the right quality to ensure the marketability of their product and to establish better market links.

6.2.1 Gross margin and investment cost

Table 17 illustrates the annual gross margin of honey sales at the farm gate. It is the lowest for the traditional hive, gross margin with ETB389/year. Followed by the transitional hive with ETB676/year and the modern hive generating the highest profit with ETB1 810/year. The modern hive is the most profitable because of the high yield (20.4 kg) and because the honey can be sold at a higher price (ETB

49 During the focus group discussions and the single interviews, it became clear that many women already had a broad knowledge on apiculture on which they could therefore easily build if additional training was offered.

100 instead of ETB 63) due to a higher quality of the product, as the honey is extracted from wax and combs and therefore purified. In contrast to the traditional and transitional hive, the modern hive has additional costs for beeswax (ETB 200) as input for production.

Table 17: Gross-margin (farm gate) calculation by hive type per year in Arsi-Zone

Indicator	Unit	Traditional	Transitional	Modern
Productivity	Kg/hive/year	6.7	11.3	20.4
Farm gate price	ETB/kg honey	62.50	62.50	100
Turnover	ETB	418.75	706.25	2 040
Feed cost	ETB	30	30	30
Wax cost	ETB	-	-	200
Total cost	ETB	30	30	230
Gross margin[50]	ETB	388. 75	676.20	1 810
	Euro	16	27.9	74.8

Source: CSA (2015b), Gebretinsae (2015), own data

As shown in Table 18, the investment costs vary greatly. The highest investment of ETB 4 300 is for the modern hive, which should be built by specialised carpenters. This means that more capital is needed to start production with the modern hive and therefore it is financially riskier. As one of the beekeeping experts explained, there is also a problem with of the poor quality of modern hives constructed in Ethiopia (E28). When they are not properly constructed, for example if the frame dimensions are not right, they can be useless for beekeeping as bees are unable to fit their combs into the frames. Moreover, the management practice for modern hives is more challenging.

50 Based on total of farm gate price reduced by variable production costs feed and wax only.

Table 18: Investment cost calculation to start beekeeping by hive type

Cost	Unit	Traditional	Transitional	Modern
Hive cost	ETB	50	400	3 200[51]
Smoker	ETB	250	250	250
Bee suit veil	ETB	500	500	500
Gloves	ETB	50	50	50
Bee colony	ETB	300	300	300
Total investment cost per hive	ETB Euro	1 150 45.5	1 500 62	4 300 177.7

Source: Gebretinsae (2015), own data

The investment is lower for traditional and transitional hives (ETB 1 150 and ETB 1 500, respectively) because they can be made from local materials and produced by the beekeepers themselves. Investment costs can be reduced further if beekeepers catch colonies or produce materials like smoker and protection clothes by themselves. If the investments for material like smoker, bee suit, veil and gloves (subtotal ETB 800) are not taken into account, the investment cost per hive is reduced; traditional hive (ETB 350), transitional hive (ETB 700) and modern hive (ETB 3 500).

Beekeepers in Arsi-Zone usually have more than one hive and they always had traditional hives, since they are especially helpful for catching bee colonies. To give an overview of the different possible income effects of the hives, Table 19 illustrates four different scenarios with a differently developed beekeeping practice. Scenario 1 is based on three traditional hives and Scenario 2 on one traditional and three transitional hives. Scenario 3 includes one traditional and one modern hive. Scenario 4 is the most elaborate beekeeping scenario with two traditional, three transitional and two modern hives. The investment costs for materials (smoker, bee suit veil and gloves) were only included once per scenario.

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51 The price of ETB 3 200 is the most expensive, that we heard of. Other material that is necessary for the modern bee hive is a honey extractor. A small one costs around ETB 5 000 and a big one ETB 10 000. Most of the beekeepers that had a modern hive did not own a honey extractor and told us that they borrow one, for example from the extension service.

Table 19: Investment and income calculation for different beekeeping scenarios

	Unit	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Traditional hive					
Amount	No.	3	1	1	2
Investment	ETB	1 850	1 150	1 150	1 500
Income	ETB/year	1 166.25	388.75	388.75	777.5
Transitional hive					
Amount	No.	-	3	-	3
Investment	ETB	-	2 100	-	2 100
Income	ETB/year	-	2 028.6	-	2 028.6
Modern hive		-	-		
Amount	No.	-	-	1	2
Investment	ETB	-	-	3 500	7 000
Income/year	ETB	-	-	1 810	3 620
Total investment	ETB	1 850	3 250	4 650	10 600
	Euro	76.4	134.3	192.1	438
Total income	ETB/year	1 166.20	2 417.35	2 198.75	6 426.1
	Euro	48.2	99.9	90.9	265.5
Time to pay off investment		1 year 214 days	1 year 126 days	2 years 44 days	1 year 237 days

Source: own data

Scenario 1, with only traditional bee hives has the lowest investment cost (€76.4) and the lowest annual income (€48.2). Scenario 4 has the highest investment (€438) and the highest yearly income (€265.5). Looking at the time for investment pay off, scenario 2 has the lowest period (1 year, 126 days) compared to the highest with scenario 3 (2 years, 44 days). Scenario 2 generates €9 more income annually.

Looking at the gross margin of Table 17 for transitional hives (€27.9) and modern hives (€74.8), the gross margin of one modern hive equals the gross margin of 2.7 transitional hives. Comparing investment costs excluding beekeeping materials for one transitional (ETB 700= €28.9) and one modern hive (ETB 3 500= €144.6) and multiplying the investment for one transitional hive with 2.7, the investment is around €78. The investment for 2.7 transitional hives is 54% of one modern hive with €144.6 while generating the same gross margin of around €75 per year.

In addition to honey there are other income opportunities for beekeepers. Beeswax is a by-product for honey production from traditional and transitional hives and can generate up to ETB 350/kg (Yadete, 2014). Another income opportunity is colonies, that cost ETB 300 (I9) in Lude Hitosa and ETB 1 000 in Tigray-Region (Gebretinsae, 2015). Other products include propolis and pollen.

6.2.2 Value chain approaches and good examples

In Ethiopia, there are already various projects working on the improvement of honey value chains. This section looks at some examples and how a honey value chain could support the work of the Green Innovation Centre. Currently the Green Innovation Centre works in Arsi-Zone on the value chains of wheat and faba bean. The goal is to increase the annual income by 25%. The average net annual income of agricultural households, according to a baseline study, is €677 for the value chain of wheat and €348 for faba bean (BMZ, 2016: 28). Therefore, the aim for the Green Innovation Centre is to increase the yearly income of small-scale farmers by €169.28 with wheat and by €87.00 for faba bean.

In Ethiopia, the biggest honey value chain project is currently ASPIRE (Apiculture Scaling-up Programme for Income and Rural Employment), implemented by the Netherlands Development Organisation (SNV) with a project phase from January 2013 to November 2017. ASPIRE is the follow-up project of Ethiopia's "Support to Business Organizations and their Access to Markets" (BOAM) in which the honey value chain was included.[52] The value chain approach of BOAM addressed the middle of the value chain and included processors, traders, and exporters and in some cases farmer organizations (Visser et al., 2012). Starting from there, the quality of honey processing and the honey production was improved through agreements and capacity development from the middle of the value chain to the beekeepers. The original goal of BOAM's value chain approach was to improve the livelihoods of the beekeepers. Through working with the honey processors of the value chain, as a first step, the idea is to secure the beekeepers' access to a market to sell honey. By developing the middle of the value chain and creating linkages between processors and beekeepers, the sale of an increased honey production is secured, as well as the right quality of honey. One of the biggest successes was the third country listing for the European market for seven processors now selling honey to Norway, Germany, Italy and France (Shiferaw and Regassa, 2012). As a result of the project activities, around 8 000 beekeeper households increased their

52 The other value chains were on dairy, oil seeds and fruits.

honey production on average from 104 kg/year to 128 kg/year and the income on average from €82.6/year to €151/year (Shiferaw and Regassa, 2012). Furthermore, the export value of Ethiopia's honey production increased from around €12 500 in 2003/04 to €830 000 in 2009/10 (Shiferaw and Regassa, 2012). The current project phase of ASPIRE is developing the honey value chain further. The project is aiming to increase average income of 30 000 beekeepers from €40 to €360 per annum (SNV).

Table 20 shows the example for the involvement of a private entrepreneur with the goal of developing the honey value chain and creating youth employment. It is the business plan of a honey processor from Adama in a neighboring region of Arsi-Zone, which is 80 km from Asela. The processor[53] is promoting youth employment in beekeeping with transitional hives. The beekeepers provide him with honey at ETB 50 per kg as contract farmers. He in return provides them with a secure marketing channel, support and technology. The income of the business man is generated by processing, refining, packaging and selling table honey.

Table 20: The business plan of a processor and income of contract beekeepers

Indicator	Unit	Amount
Number of transitional beehives per beekeeper	No.	10
Yield per hive (minimum)	Kg	15
Total yield per season	Kg	150
Production season	No./year	2
Total yield per year	Kg/year	300
Selling price	ETB/kg	50
Annual revenue	ETB/year	15 000
Total cost of production per year	ETB/year	500
Income	ETB/year	14 500
Monthly income of beekeepers	ETB/month	1 208

Source: E29

53 Jony Girma

He also encourages beekeepers to plant ten trees per transitional hive to secure sufficient bee forage. In his calculation, the yield per transitional hive/year is 30 kg, due to two harvesting seasons and favorable conditions in a forest area near Adama. With ten transitional hives, a monthly income of ETB 1 208 can be generated which is around EUR 50.

The calculations show that beekeeping can be a lucrative side activity supplementing other farming or income generating activities. Beekeeping can support the goal of the Green Innovation Centre to increase the income of small-scale farmers and could generate increased income, comparable to that aimed for in the value chain of wheat and faba bean. SNV and other actors have already gained experience that can be built on in Ethiopia in the value chain development of honey.

The examples of BOAM and ASPIRE from SNV in Ethiopia show that the improvement of beekeeping practices requires investments. Not only beekeepers but also processors or other value chain actors might play a role in ensuring the market links for the products of the beekeepers. Therefore, financing schemes or alternative approaches are necessary to allow beekeepers and other actors to take the risk of new practices. The example of the processor from Adama is one of a businessman promoting youth employment and integrating beekeeping with the planting of trees.

7 Synergies between apiculture and agriculture

The current situation of the agricultural production and especially the sector of beekeeping in Arsi-Zone were presented in Chapter 5. Major constraints could be identified regarding sustainable production which would allow for the maintenance of eco-system services while generating additional income for small-scale farmers and beekeepers.

Both situation analyses confirmed the need to see apiculture and agriculture as a single system rather than regarding both sectors separately. Including apiculture in agricultural management and vice versa might lead to synergy effects with benefits for sustainability.

As mentioned before, bees are an indicator for resilient and healthy landscapes. Keeping the bees in Arsi-Zone with the help of adjusted agricultural activities and with a supply of bee forage throughout the year could have effects such as less application of harmful agro-chemicals and could ideally lead to sustainable income generation in the region. Within this structure these synergy effects will be discussed according to environmental, social and economic aspects. Appropriate farming methods fulfil the requirements for integrating apiculture into agriculture.

This idea was elaborated on by the concept of growing Identified Multi-Purpose Plants (IMPPs). IMPPs are plants that serve as bee forage and provide additional benefits in at least one additional sustainability category. They may be a living fence, edge strips, intercropped plants, or trees. They were identified as existent or capable of being integrated within the current system and worth promoting. Sustainable introduction or promotion of certain plants is only achievable if the incentives and benefits exceed the required efforts. The strongest incentive would be an IMPP's market value, however further possibilities were identified. The IMPPs and their benefits are listed in Table 21. Successful integration and promotion of IMPPs would require further research into the feasibility and necessary requirements (see recommendations, section 8.2).

Ecological dimension

As presented in Box 1 in 2.3 (p. 6), bees have an important role within the ecosystem pollinating flowers. Once bees disappear this ecosystem service is missing, leading to significant changes and loss of biodiversity. Conversely, bees need a flowering landscape to have enough bee forage over the year. When designing a sustainable landscape, plants serving as bee forage could be integrated to supply food for the bees in various ways e.g. as living fences, additional crops on the field or trees. Examples include chickpeas (*Cicer arietinum*), lentils (*Lens culinaris*) and acacia trees. They all fix nitrogen, increasing soil fertility and reducing the need for fertilisers.

Social dimension

The integration of plants serving as bee forage should have benefits for farmers. Plants or crops could serve as additional source of food, contributing to food security and healthy nutrition. Other direct benefits for farmers include e.g. prickly pear (*Opuntia cylindrica*) serving as livestock fodder or trees providing building material or fuel wood. Consequently, some IMPPs could reduce farmers' expenses assuming they were provided with the necessary seeds or saplings.

An IMPP with special cultural value is the *meskel* flower (*Bidens macroptera*) which play a prominent role in an Ethiopian religious celebration. Enabling beekeeping through the provision of bee forage sustains the traditional and cultural practices connected to honey. Honey and other apicultural products are used as traditional medicine (e.g. a mixture of wheat and honey is given to women after birth to strengthen their circulation). IMPPs such as *sensel* (*Justitia schimperana*), also have medicinal values. Reconciliation of apiculture and agriculture would serve to provide small-scale farmers with a socially inclusive source of income. Under the right circumstances and if transitional hives were used, beekeeping could be practised by men and women, young and old, requiring neither much space nor high investment costs.

Economic dimension

If farmers integrate beekeeping into their agricultural system, an additional income opportunity will emerge. Interviews and transects made it clear that the demand for honey in Arsi-Zone is high and so is the price. Beekeeping and honey production could generate employment opportunities (especially for young people) and could serve as additional income activities (especially for women). This was emphasised in the gross margin calculation (see section 6.2). In addition, income could be generated through the diversification of crop rotation. Demand for oil crops is rising. Plants like sunflower, flax or oil-seed rape could be harvested and marketed by the farmers and would simultaneously serve as bee forage. Product diversification might make farmers more resilient and less dependent on cash-crops.

Concerning the synergies of beekeeping and employment, a necessary step could be the establishment of a proper value chain for honey. As mentioned in the situation analysis of the honey value chain, there is a lack of input supplies for beekeepers, such as processing machines or protective clothing. If the demand for those products increases, supply of them might increase as well. Processing manufactures as well carpenters could create jobs.

To conclude, the analysis show possible synergy effects and multi-dimensional benefits when agriculture and beekeeping in Arsi-Zone are thought of in a system approach. Improved sustainability in the farming system could contribute to halting the decline of bee colonies (question III). In return, environmental hazards and threats to human health through crop production could be reduced (question IV). To give a practical example of this integration, IMPPs fulfil the requirement of serving as bee forage on the one hand but also create an additional benefit for small-scale farmers and on their farms. These benefits should sustainably promote the planting of bee forage (question II). The following IMPPs were identified throughout this research and were re-evaluated during the stakeholder workshop:

Table 21: Identified Multi-Purpose Plants (IMPPs)

IMPP	Bees' benefits	Farm benefits	Farmers' benefits
Crops			
Flax (*Linum usitatissimum*)		Less pesticide demanding Diversification of crop rotation	Additional income: 31.58 ETB/kg Home consumption
Rape (*Brassica napus*)	Flowering from September to November Honeybees are most important pollinators to increase yield Honeybees collect nectar and pollen	Livestock fodder Diversification of crop rotation	Additional income: 28.00 ETB/kg Home consumption
Cabbage (*Brassica oleracea*)		Diversification of crop rotation	Additional income. 5.15 ETB/kg Home consumption
Chickpea (*Cicer arietinum*)		Nitrogen fixator Diversification of crop production	Additional income: 20.00 ETB/kg unmilled
Sunflower		Diversification of crop rotation Livestock fodder	Additional income: 26.00 ETB/kg Home consumption

Table 21: Identified Multi-Purpose Plants (IMPPs) (cont.)

IMPP	Bees' benefits	Farm benefits	Farmers' benefits
Lentils (*Lens culinaris*)		Nitrogen fixator Diversification of crop rotation	Additional income: 40.00 ETB/kg un-milled
Faba bean (*Vicia faba*)	Flowering from June to March Honeybees forage for both pollen and nectar	Nitrogen fixator Livestock fodder	Home consumption Additional income: 17.00 ETB/kg un-milled
Shrubs/edge strips			
Prickly pear (*Opuntia cylindrica*)	Flowering throughout the year Frequently visited by honeybees for pollen and nectar	Living fence -> helps structure farmland and protect crops Serves as livestock fodder	Additional income
Coffee (*Coffea arabica*)	Bees are found foraging all day Bees can play role in increasing yields	Agroforest system	Additional income: 83.20 ETB/kg beans
Sensel (*Justitia schimperana*)	Honeybees collect pollen and nectar from the flowers Flowering throughout the year	Living fence -> helps structuring farmland	Medical use Crushed leaves used to brew *tela* (traditional beverage)
Trees			
Acacia	Honeybees are foraging abundant nectar and pollen	Nitrogen fixator Shade tree for livestock	Fuel wood Building material
Wanza (*Cordia africana*)	Supplies abundant pollen and copious nectar	Shade tree for coffee plants	Additional income: 1 500.00ETB/chair out of *Wanza* Medical use
Natural flora			
Meskel flower (*Bidens macroptera*)	Flowering from September to December Honeybees collect pollen and nectar from the flowers		Cultural value Additional income through selling flowers during *Meskel* (religious holiday)

All prices from Asela

Source: own data, Fichtl and Abi (1994)

8 Conclusions and recommendations

Following the description of the current situation and system constraints this chapter gives recommendations on possible interventions to overcome identified constraints. The major recommendations developed are presented for different intervention areas and levels.

8.1 Conclusions

Beekeeping plays a marginalised role in the specific project region. However, a systemic approach addressing challenges in crop farming as well as beekeeping can provide first steps towards viable solutions.

Main challenges faced in crop farming include land shortages, low levels of mechanisation, high dependency on cash crops and hazards through pests and crop diseases. Arsi-Zone's farming systems were found to be unsustainable. Although the area of Arsi-Zone offers good conditions for an intensification of agricultural production to produce surpluses and meet the national demand for cereals and legumes, yields are below expectations. And on top of that, long-term sustainable concepts are lacking at all levels of production. This was especially clear with regard to agro-chemicals; farmers are making high investments in chemicals in an attempt to stop ever increasing crop diseases. At the same time these agro-chemicals are applied with little or no consideration being paid to the effects on human and environmental health.

In beekeeping, the effects of high pesticide and herbicide use and unfavourable environmental conditions were identified as the main reasons for the decrease in bee populations. Despite the high demand for honey across Ethiopia there was a general trend away from beekeeping in Arsi-Zone and honey production was found to be very low. The value chain was rudimentary with little national and no international market access and no formalised business relations. Intrinsic reasons hindering good beekeeping practices were gaps in management knowledge through a lack of appropriate training and the unavailability of necessary inputs.

Limited employment for women and youths were found along the honey value chain. These were predominantly on the production level due to the current lack of processing or marketing. However, opportunities were identified for income generation and how to improve this side income.

8.2 Recommendations

The recommendations of this study are starting points to improve the situation of small-scale farmers in Arsi-Zone. The aim of the system approach is not only to promote beekeeping; it is an attempt to integrate beekeeping better into current agricultural practices to make agriculture sustainable and improve beekeeping practices to keep the bee in Arsi-Zone. A primary target group should therefore be small-scale farmers currently practising beekeeping, in order to improve their productivity and income. But in the light of a system approach, non-beekeeping farmers must also be addressed to positively influence agricultural practices in favour of beekeeping and to promote this further.

The formulated recommendations are set at varying intervention levels; from the micro- or farm level to the extension service and activities on regional (meso-) level and finally, on macro-level addressing the government stakeholders and national programmes. Additionally, recommendations address interventions of varying time scales. Some suggestions of immediate actions and steps to be taken are closely defined and could lead to short-term results. Other aspects would require further research and planning but would only unfold their effects in the long run. Recommendations include both immediate plans of action as well as more conceptual and strategic approaches. Strategies include activities aimed to complement one another.

The following list shows some possible or necessary interventions addressing the most pressing issues in relation to Arsi-Zone that were found during this research period. They were further revised with relevant stakeholders and experts during the final presentation of the results in Addis Ababa (F18) under consideration of their suitability to overcome constraints.

Concerning the recipients of the recommendations, plans of action and strategies could primarily be realised by the Green Innovation Centre. But it is not achievable without the cooperation with various stakeholders. How this could be realised is detailed in the first recommendation:

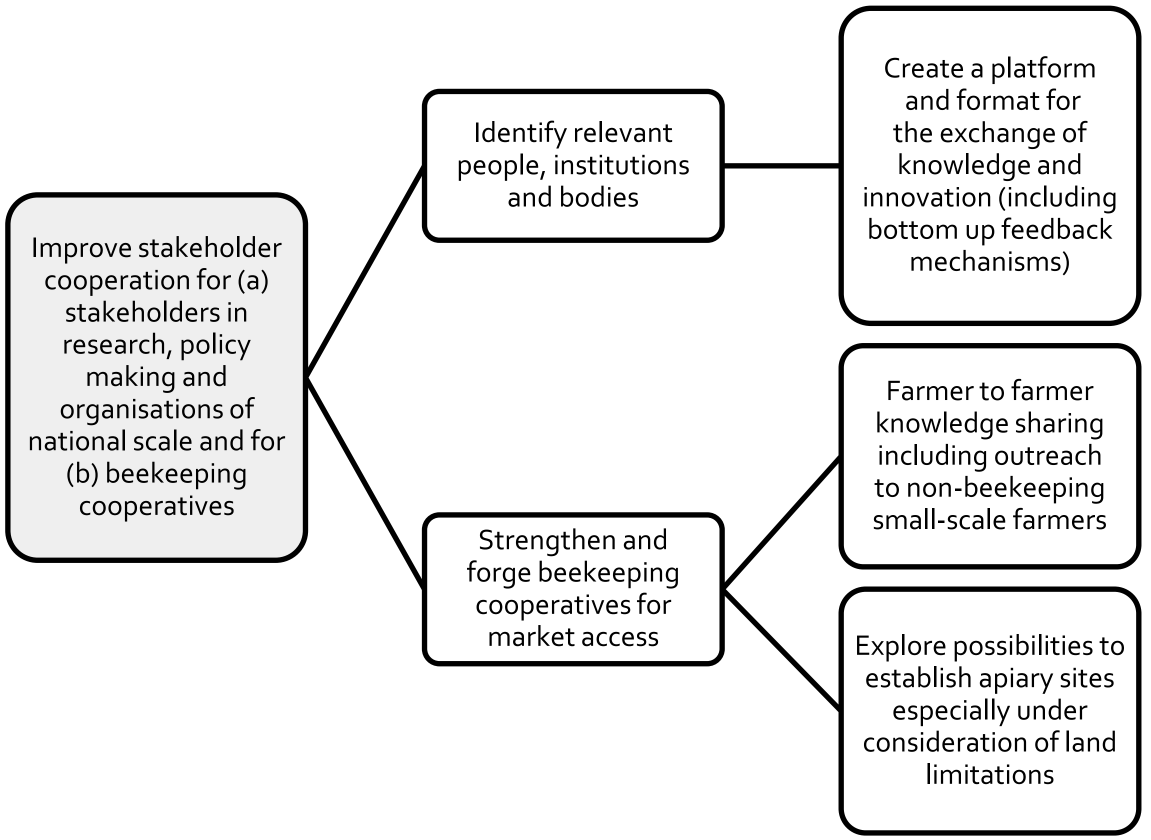

Figure 9: Recommendation (1)[54]

Source: own illustration

After connecting stakeholders and establishing knowledge-sharing systems, the content of knowledge exchanged may be improved. Amongst farmers and other stakeholders in Arsi-Zone, there is a considerable lack of awareness of the relevance of the bee as a pollinator. Economic benefits of beekeeping are a good starting point, but for future planning both policy makers and small-scale farmers should understand how dependent agricultural production is on pollination. In a top-down system such as Ethiopia, the national level must be included in order for knowledge to be disseminated through the given structures. Additionally, the role of the bee as an indicator for ecosystem health and subsequently human health should be brought to people's attention.

54 The inter-connectedness through cooperatives is relevant as a starting point for interventions as well as for the development of markets for beekeeping (relate to recommendation concerning markets). Farmer to farmer knowledge sharing is promoted through cooperatives and enables improved bee-keeping training approaches (relate to recommendation concerning training).

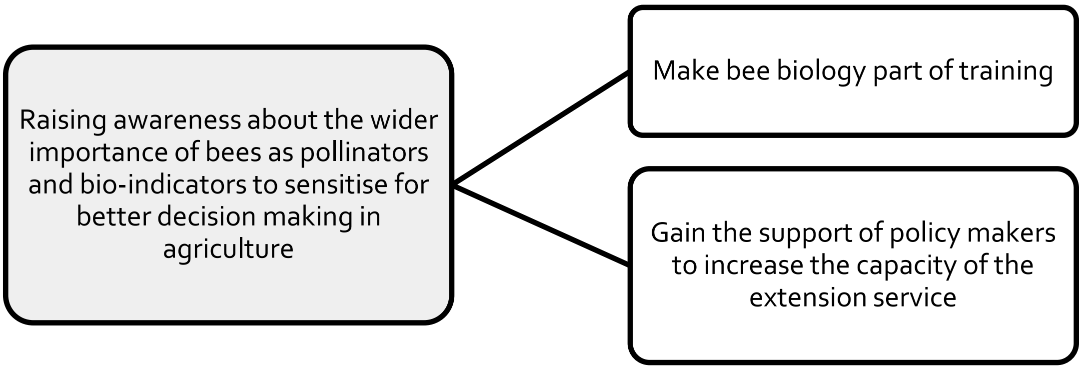

Figure 10: Recommendation (2)[55]

Source: own illustration

Beekeepers in Arsi-Zone were found in need of assistance to enable them to realise the full potential of their business activities. The three main deficits currently hindering enablement in Arsi-Zone are in training, inputs and markets. Provision of training would need to be closely coordinated with the extension service. While working within the given structures it is important to consider that certain groups such as model farmers may receive favourable treatment in comparison to others.

Beekeepers voiced their need for more suitable training in beekeeping practices. Especially women showed considerable interest but felt excluded from training. The following improvements are recommended:

55 Awareness raising must be part of the improved training modules (relate to recommendation 3 concerning training).

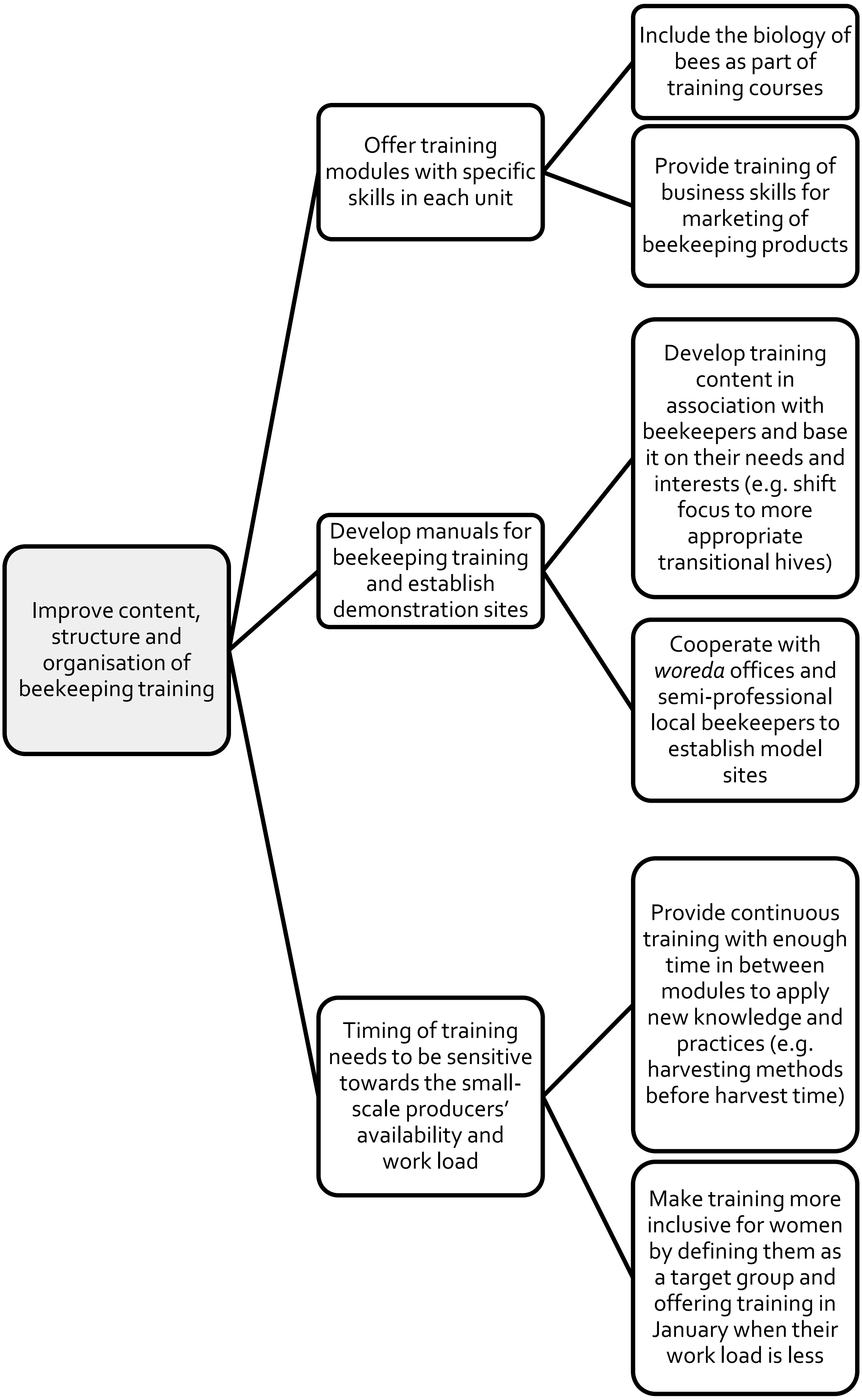

Figure 11: Recommendation (3)

Source: own illustration

It is easier to work with people already involved in beekeeping. However, if this approach is to be extended to young people (especially landless youths), the following steps should be taken:

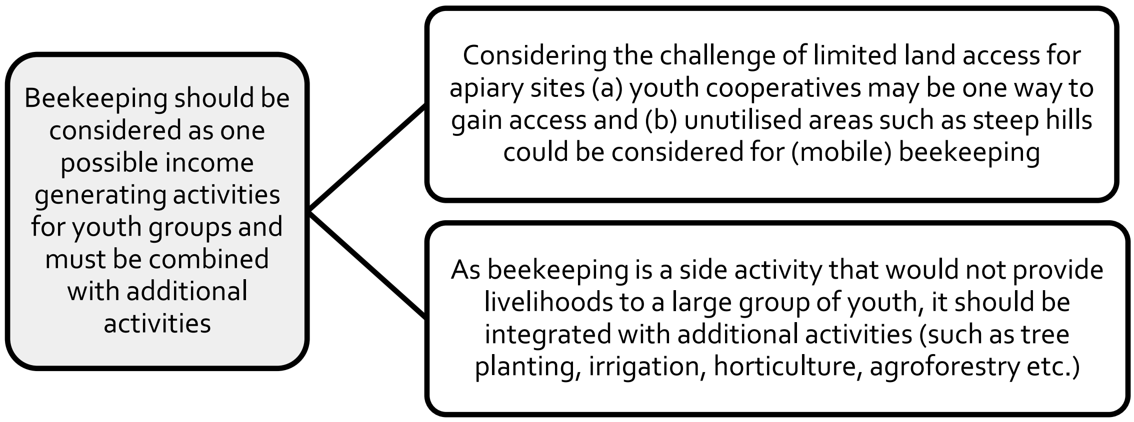

Figure 12: Recommendation (4)[56]

Source: own illustration

The second component to enablement is the availability of beekeeping inputs which are tools for management, harvesting and processing. Recommendations may be implemented individually or in combination.

56 Youth must also receive appropriate training.

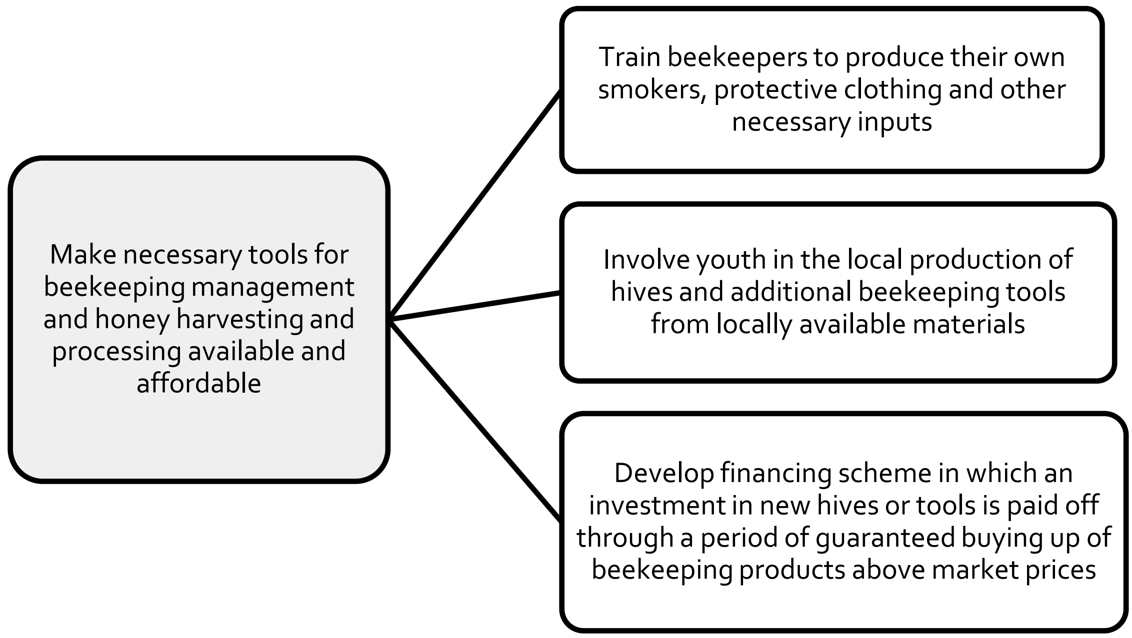

Figure 13: Recommendation (5)[57]

Source: own illustration

For beekeeping to improve on the long run, producers need to be incentivised through the income it can generate. Prices for honey in Ethiopia have been rising during recent years and there is growing demand. At the same time production must become steadier and more predictable for better commercialisation structures to develop and maintain themselves.

57 Relate to recommendation 3 on training.

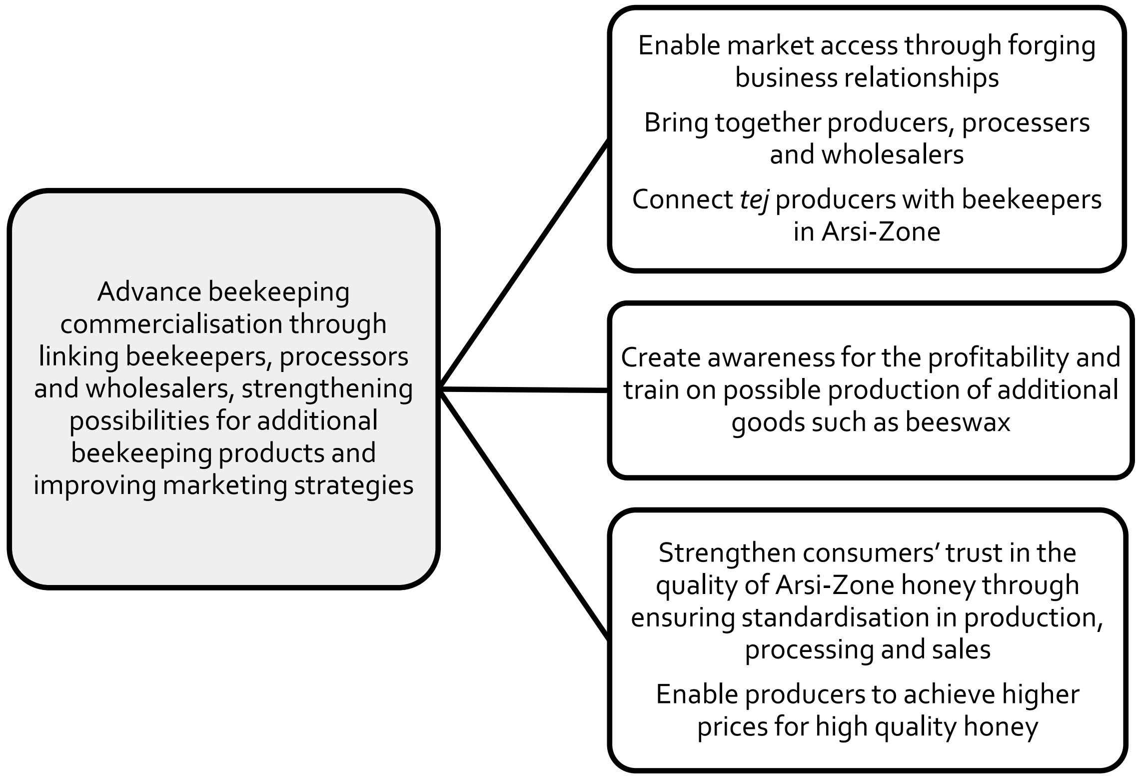

Figure 14: Recommendation (6)

Source: own illustration

The first recommendations aimed at awareness and knowledge raising concerning the bee, as well as direct interventions for and with beekeepers. However, considering the aim to improve agricultural sustainability, interventions beyond beekeeping must influence the wider farming system. Current farming methods are indeed threatening bee colonies. A farming system more suitable to beekeeping is a farming system with lower environmental hazards. Corresponding legislation in Ethiopia would have to be passed at a national level. However, producing the necessary scientific evidence and piloting alternative good practices can be done within Arsi-Zone.

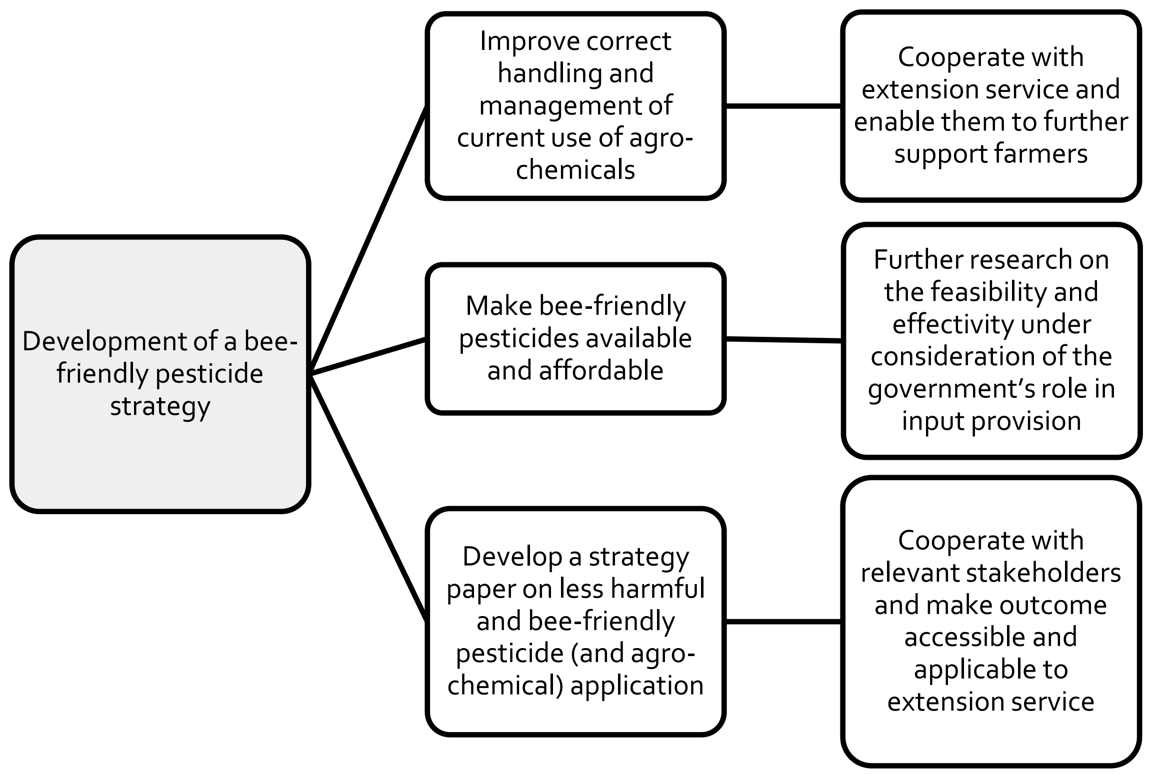

Figure 15: Recommendation (7)[58]

Source: own illustration

Positive change within farming methods is only one necessary component suggested. Further interventions on a landscape level may improve the ecosystem both in favour of the bee as well as for the farmers themselves. It is important to ensure minimal financial risk to farmers, otherwise they may not be prepared to make any changes on or around their farms.

Diversifying the plant life increases the availability of bee forage for honey production. But only plants with direct benefits to the small-scale producers (see IMPPs, Chapter 7) will provide enough incentives to spread independently and sustain their use sustainably. Additional plants must not compete for space with relevant cash crops. They should be capable of being integrated in the current systems where space is available, so that bee forage availability can be improved for the long term.

58 The extension service as a knowledge dissemination structure can reach most small-scale producers but requires support to do so effectively.

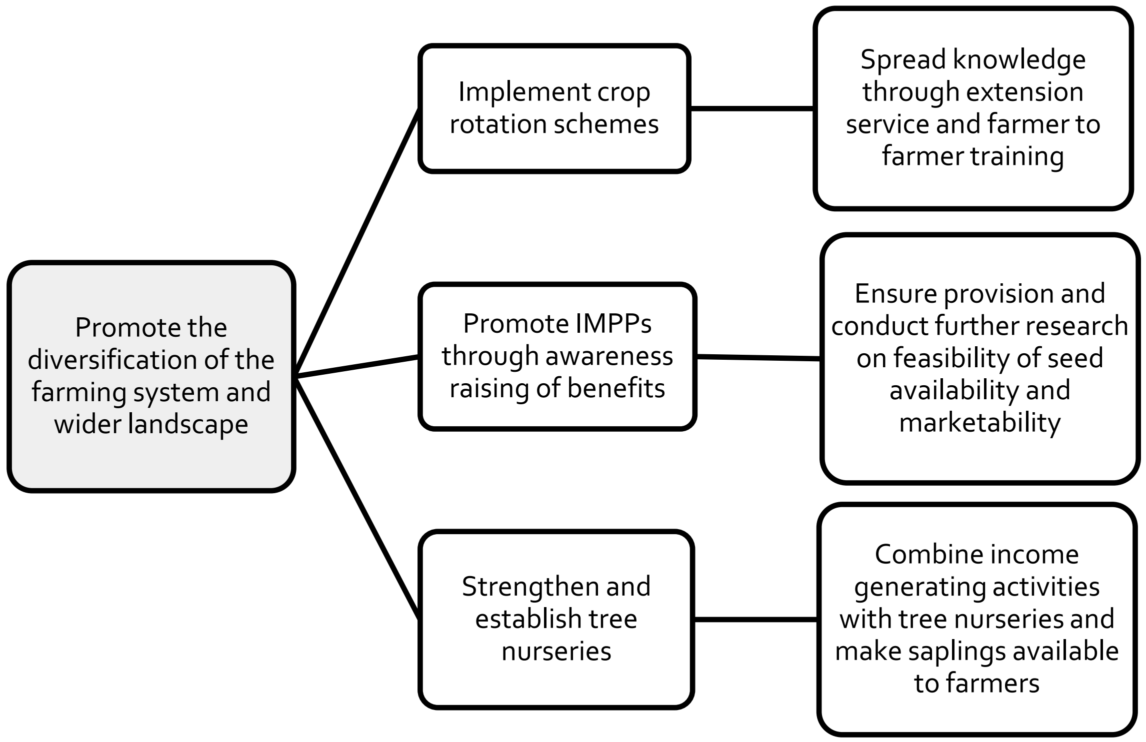

Figure 16: Recommendation (8)[59]

Source: own illustration

Based on the system approach, the recommendations aim at all three dimensions (ecological, social, economic). Ideal outcomes could result in beneficial synergies as presented in Chapter 7.

If the Green Innovation Centre aims to promote beekeeping and good agricultural practices in Arsi-Zone, combining these activities through integration may be a sustainable approach. It is unrealistic to want to rapidly transform Arsi-Zone into a leading honey-producing area. Too many constraints would have to be overcome, from perception to logistics and more. But every single step taken into this direction would already contribute to improving the current farming system environmentally, socially and economically. Ignoring current issues, following development strategies as they are being implemented now and not acknowledging signs and warnings will lead to a deterioration of current agricultural production and the small-scale farmers' situation.

Therefore, all efforts should be made to keep the bee in Arsi-Zone.

59 IMPPs are found in Chapter 7.

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10 Annexes

10.1 Production of and prices for honey by region

Production of honey and number of beehives by region, 2015/16

Region	Oromia	Amhara	SNNPR	Tigray
Production (kg)	15 954 736	19 890 422	7 866 567	2 681 598
% of national production	31.4%	39.7%	15.5%	5.3%
Production (kg)				
Traditional	15 095 368	18 604 757	7 381 954	1 895 455
Transitional	300 919	673 701	251 607	59 341
Modern	558 449	611 963	-	726 802
No. beehives	3 009 745	1 328 235	992 633	263 961
% of national hives	50.9%	22.4%	16.8%	4.5%
Number				
Traditional	2 944 415	1 273 885	962 862	207 173
Transitional	25 749	14 224	20 440	-
Modern	39 582	40 127	9 331	47 637
Harvest per hive (kg)				
Traditional	5.1	14.6	7.7	9.1
Transitional	11.7	47.4	12.3	-
Modern	14.1	15.3	-	15.3
Area (km²)	284 538	154 709	105 887	41 409
% of national area	25.8%	14%	9.6%	3.7%

Source: CSA (2016a)

Retail prices honey ETB/kg December 2015 by region			
	Average	Highest (place)	Lowest (place)
Addis Ababa	120	147 (Merkato)	103 (Shola)
Oromia *Asela*	92 120	155 (Diksise)	60 (Bedele)
Amhara	102	155 (Kobo)	57 (Gondar)
SNNPR	75	120 (Yiregachefie)	45 (Shewa Bench)
Tigray	147	253 (Mekelle)	106 (Endabaguna)
Source: CSA (2015b)			

Retail price of honey ETB/kg June 2016 by region			
	Average	Highest (place)	Lowest (place)
Addis Ababa	136	153 (Addisu Gebeya)	106 (Shola)
Oromia *Asela*	105 140	240 (Asebe Teferi)	60 (Dembidolo)
Amhara	112	200 (Debre Birhan)	53 (Gondar)
SNNPR	81	120 (Butajira, Doyugena, Yiregachefie)	40 (Shewa Bench)
Tigray	161	320 (Mekelle)	101 (Endabaguna)
Source: CSA (2016h)			

10.2 List of codes

Codes and list of expert interviews				
Code	**Date**	**Place (*Woreda*)[60]**	**Institution**	**Number of experts**
E1	04.08.2016	Addis Ababa	Director of ISD	1
E2	04.08.2016	Addis Ababa	Programme director GIZ SLM	1
E3	08.08.2016	Addis Ababa	Component manager of Agricultural Training Centre Kulumsa	1
E4	08.08.2016	Addis Ababa	Professor of Humbodt University, via Skype	1
E5	10.08.2016	Addis Ababa	Honey value chain expert from EAB	1
E6	10.08.2016	Addis Ababa	CIM integrated expert at ATC Kulumsa	1
E7	17.08.2016	Addis Ababa	Expert meeting with Oromia Regional Livestock Bureau beekeeping experts	2
E8	18.08.2016	Addis Ababa	Menschen für Menschen	2
E9	25.08.2016	Addis Ababa	Expert meeting with EAB	5
E10	03.09.2016	Huruta (LH)	Beekeeping expert in Lude Hitosa	1
E11	06.09.2016	Asela (LH)	Arsi University beekeeping specialist	1
E12	07.09.2016	Huruta (LH)	*Woreda* women office finance specialist	1
E13	07.09.2016	Huruta (LH)	IMX *Woreda* office	1
E14	07.09.2016	Huruta (LH)	vice of *Woreda* womens' office	1
E15	07.09.2016	Huruta (LH)	*Woreda* youth and sport office	2
E16	08.09.2016	Huruta (LH)	*Woreda* head of youth and sport	4
E17	23.08.2016	Asela	Arsi University beekeeping trainer for women	1
E18	07.09.2016	Asela	Zonal land administration of Arsi	2
E19	20.09.2016	Robe (AR)	Crop protection expert (female)	1
E20	20.09.2016	Hoda (AR)	Expert group discussion with young beekeepers	3
E21	20.09.2016	Robe (AR)	Accountant from Didea-Union	1
E22	20.09.2016	Hoda (AR)	Beekeeping expert	1
E23	21.09.2016	Robe (AR)	Crop expert	1
E24	21.09.2016	Robe (AR)	Extensions and livelihood expert	1
E25	22.09.2016	Robe (AR)	Women and children office	2
E26	31.08.2016	Robe (AR)	IP Consult, Delegation	4
E27	21.08.2016	Bekoji	Zonal office Beekeeping Sector	5
E28	14.10.2016	Addis Ababa	SNV, Experts from ASPIRE Programme	2
E29	29.10.2016	Addis Ababa	Private honey processor	1

60 LH = Lude Hitosa, AR = Arsi-Robe

Codes and list of focus group discussions				
Code	**Date**	**Village**	**Type**	**Number of participants**
F1	01.09.2016	Arendima (LH)	female farmers/ beekeepers	5 farmers women, 2 beekeeping
F2	01.09.2016	Arendima (LH)	farmers/ beekeepers	19 farmers (of which 6 are bee-keepers)
F3	01.09.2016	Kitebe (LH)	female farmers/ beekeepers	6 farmers (of which most are bee-keepers)
F4	01.09.2016	Kitebe (LH)	farmers/ beekeepers	12 farmers (of which 4 are bee-keepers)
F5	03.09.2016	Huruta-Gardebussa (LH)	female farmers/ beekeepers	11 (of which 3 are beekeepers)
F6	03.09.2016	Huruta-Gardebussa (LH)	farmers/ beekeepers	14 farmers (number of bee-keepers unknown)
F7	06.09.2016	Lode-Gardebussa (LH)	female farmers/ beekeepers	14 women (of which 2 are bee-keepers)
F8	06.09.2016	Lode-Gardebussa (LH)	farmers/ beekeepers	14 farmers (of which 2 are bee-keepers), beekeeping expert, DA
F9	20.09.2016	Hoda (AR)	farmers/ beekeepers	6 farmers (all beekeepers), 2 DAs and agronomist
F10	20.09.2016	Hoda (AR)	young farmers/ beekeepers	8 (of which 3 are beekeepers)
F11	20.09.2016	Hoda (AR)	female farmers/ beekeepers	10 women (of which 3 are bee-keepers)
F12	21.09.2016	Hoda (AR)	farmers/ beekeepers	13 farmers (number of bee-keepers unknown), 1 DA
F13	22.09.2016	Shankura (AR)	farmers/ beekeepers	18 farmers and beekeepers (mixed), 1 DA
F14	22.09.2016	Shankura (AR)	female farmers/ beekeepers	5 farmers women (of which 2 are beekeepers)
F15	22.09.2016	Sindeka (AR)	beekeeping cooperative	8 from cooperative
F16	23.09.2016	Lode (AR)	farmers/ beekeepers	16 farmers and beekeepers (mixed)
F17	23.09.2016	Lode (AR)	farmers/ beekeepers	8 farmers women (of which 3 are beekeepers), 1 DA, 1 agronomist
F18	27.10.2016	Addis Ababa	Stakeholder workshop	30 experts from beekeeping sector, SLE-team

Codes and list of interviews				
Code	**Date**	**Village**	**Tool**	**Number of participants**
I1	05.08-23.09.2016	Addis Ababa	Interview with commissioning partner	1
I2	05.08-23.09.2016	Addis Ababa	Interview with Green Innovation Centre interns	2
I3	08.08.2016	Addis Ababa	Interview with deputy of Green Innovation Centre	1
I4	09.08-23.09.2016	Addis Ababa	Interview with Green Innovation Centre specialist	1
I5	30.08.2016	Kitebe (LH)	Interview with model farmer/beekeeper	1
I6	30.08.2016	Kitebe (LH)	Interview with female model farmer/beekeeper	1
I7	30.08.2016	Arendima (LH)	Interview with model farmer/beekeeper	1
I8	30.08.2016	Arendima (LH)	Interview with model farmer/beekeeper, wheat mill	1
I9	30.08.2015	Arendima (LH)	Interview with farmer/ beekeeper	1
I10	03.09.2016	Lode-Gardebussa (LH)	Interview with farmer/ beekeeper	1
I11	07.09.2016	Lode-Gardebussa (LH)	Interview with female farmer/beekeeper	1
I12	07.09.2016	Lode-Gardebussa (LH)	Interview with farmer/ beekeeper	1
I13	21.09.2016	Hoda (AR)	Interview with farmer/ beekeeper	1
I14	21.09.2016	Hoda (AR)	Interview with farmer	1
I15	22.09.2016	Shankura (AR)	Interview with farmer	1
I16	22.09.2016	Shankura (AR)	Interview with female farmer/beekeeper	1

Codes and list of transect walks				
Code	**Date**	**Village**	**Tool**	**Number of participants**
T1	30.08.2016	Kitebe (LH)	Transect to river and back with extensionist	1
T2	30.08.2016	Kitebe (LH)	Transect to water pump and back with extensionist	1 DA
T3	30.08.2015	Arendima (LH)	On farm observation	
T4	03.09.2016	Lode-Gardebussa (LH)	Transect to end of village and back	1 local person
T5	06.09.2016	Lode-Gardebussa (LH)	Transect to end of village and back	
T6	07.09.2016	Huruta (LH)	Market transect and tej bar visit	1 owner of tej bar
T7	07.09.2016	Huruta (LH)	Market transect and tej bar visit	1 owner of tej bar
T8	20.09.2016	Hoda (AR)	Farm visit at beekeeping experts house including interview with old traditional beekeeper	1 beekeeper
T9	20.09.2016	Hoda (AR)	Transect through village	1 farmer
T10	21.09.2016	Hoda (AR)	Transect through village	
T11	21.09.2016	Robe (AR)	Market visit	
T12	21.09.2016	Robe (AR)	Market visit	
T13	21.09.2016	Robe (AR)	Market visit	
T14	22.09.2016	Shankura (AR)	Transect through village	
T15	23.09.2016	Lode (AR)	Transect through village	
T16	23.09.2016	Robe(AR)	Market visit	

10.3 Sowing and harvesting date for Lude Hitosa and Arsi Robe

Sowing and harvesting dates for Lude-Hitosa (LH) and Arsi-Robe (AR)				
Name	**Date of sowing**		**Date of harvest**	
	LH	**AR**	**LH**	**AR**
Wheat	July 13	June 28	November 17	December 13
Faba bean	June 09	June 23	November 10	November 27
Tef	July 28	July 9	November 27	January 12
Maize	June 08	April 18	October 22	December 02
Flax	June 28	May 23	December 02	November 27
Peas	June 18	June 23	November 02	November 27
Sunflowers	May 28	N/A	October 22	N/A
Onion	July 06	July 23	October 22	October 27
Barley	July 18	June 28	October 27	December 13
Potato	May 28	N/A	October 22	N/A
Lentil	June 18	N/A	October 22	N/A
Tomato	June 28	N/A	October 13	N/A
Chickpea	September 22	N/A	January 18	N/A
Source: own data				

This table states dates when the majority of farmers accomplish planting and harvesting their crops in the two *woreda*s.

Agro-chemicals found in research region		
Name of agro-chemical [1)]	**Purpose**	**Prices (LH, AR)**
Lamdex [1)]	For the control of maize stalk borer (Busseola fusca Fuller) on maize and aphids, thrips, leafhoppers, caterpillars and leaf miners on flowers	LH: N/A AR: ETB 550/l
Roundup [1)]	For the control of complex weeds in coffee	LH: N/A AR: ETB 230/l
Diazinon [1)]	For the control of army worm and other pests on cereals	LH: N/A AR: ETB 440 /l
Zura [1)]	For the control of broad leaf weeds on maize	LH: N/A AR: ETB 110/l
Natura [1)]	For the control of yellow rust disease on wheat	LH: N/A AR: ETB 350/0.5l
Mancozeb [1)]	For the control of late blight on tomato	LH: N/A AR: ETB 100/0.5kg
Celphos [1)]	For the control of maize weevil (*sitophil-lus spp*) and flour beetle (*Tribolium spp*) on stored maize	LH: N/A AR: ETB 65/30
Mancolaxyl [1)]	For the control of late blight on tomato	LH: N/A AR: ETB 420/kg
Tilt [1)]	For the control of fungus spp. on tef wheat and barley	LH: N/A AR: ETB 650/l
2.4-D amine [1)]	For the control of broadleaf weeds in wheat, barley, tef, maize and sorghum	LH: ETB 85 AR: ETB 110/l
Topik [1)]	For the control of grass weeds in wheat	LH: N/A AR: ETB 650/l
Pallas [1)]	For the control of grass weeds (wild oat, downy brome /*Bromus Spp.*/ and annual broad leaf weeds on wheat and tef	LH: ETB 2000/l AR: ETB 450 /0.2l
Top Harvest [1)]	For the control of grass weeds in wheat	LH: N/A AR: ETB 330–350/0.5l
Ridomil [1)]	For the control of fungus spp. on pepper, tomato, orange and apples	LH: ETB 350/kg AR: ETB 200–230 /0.25 kg
Karate [1)]	For the control of cotton pests on large scale farms	LH: ETB 300 AR: ETB 180–200 /0.25l
Selecron 720 EC[1)]	For the control of maize stalk borer on maize	LH: ETB 700/l AR: N/A

Name of agro-chemical [1)]	Purpose	Prices (LH, AR)
Agro-Lambacin Super 315 EC[1)]	For the control of African bollworm (*Helicoverpa armigera*) cotton	LH: ETB 380/l AR: N/A
Trogrid	N/A	LH: ETB 580/l AR: N/A
Rider	It provides an effective and prolong protection against sucking pest like Jassid, aphids, and white fly	LH: ETB 380/l AR: N/A
Moden	N/A	LH: ETB 380/l AR: N/A
Felerite	N/A	LH: ETB 500/l AR: N/A
Granstar[1)]	For the control of broadleaf weeds in wheat	LH: ETB 6.00/mg AR: N/A
Mancozeb[1)]	For the control of Downey mildew, Botrytes, Black spot and rust on 27 flowers	LH: ETB 180/kg AR: ETB 90–100/0.5 kg
Rexduo[1)]	For the control of yellow/stripe rust on wheat	LH: ETB 450/l AR: N/A
Jerget	N/A	LH: ETB 500/l AR: N/A

1) agro-chemical listed by the Ministry of Agriculture and Natural Resources (2014)

Source: own data

10.4 Bee forage plants

Bee forage list by common English, local, and scientific name and plant family			
English	**Amh./Or.**	***Scientific name***	**Family**
Vegetable/crops/herbs			
Cauliflower	Abeba gomen (Amh.)	*Brassica oleracea*	Brassicaceae
Fenugreek	Abishi (Amh.)	*Trigonella foenum-graecum*	Fabaceae
Meskel flower	Adey ababa/Yemeskel-Abeba (Amh.)	*Bidens prestinaria*	Asteraceae
Alfalfa	Alfalfa (Amh.)	*Medicago sativa*	Fabaceae
Pea	Ater (Amh)	*Pisum sativum*	Fabaceae
Salvia	Basobila (Amh)	*Salvia nilotica Juss. Ex Jacq.*	Lamiaceae
Maize	Bakolo (Or)	*Zea mays*	Poaceae
Faba bean	Baqela (Or)/Baqiela (Amh.)	*Vicia faba*	Fabaceae
Leek	Baro (Amh.)	*Allium porrum L.*	Alliaceae
Haricot bean	Boloke (Amh.)	*Phaseolus vulgaris*	Fabaceae
Carot	Carrot	*Daucus carota*	Parsley (Apiaceae)
Castor bean	Gulo (Amh.)	*Ricinus communis*	Euphorbiaceae
Potato	Dinich (Amh.)	*Solanum tuberosum*	Solanaceae
Pumpkin	Duba (Amh.)	*Cucurbita pepo*	Cucurbitaceae
Strawberry	Enjory (Amh)	*Fragaria × ananassa*	Rosaceae
False banana	Enset (Amh.)	*Ensete ventricosum*	Musaceae
Barley	Gebis (Amh.)	*Hordeum vulgareL.*	poaceae
Cabbage	Gomen (Amh	*Beta vulgaris*	Amaranthaceae
	Hada (Om.)	*Guizotia scabra*	Asteraceae
Pepper	Kariya (Amh.)	*Capsicum annuum*	Solanaceae
Beetroot	Keysir (Amh.)	*Beta vulgaris*	Amaranthaceae
Niger-seed	Nug (Amh.)	*Guizotia abyssinica*	Asteraceae
Nettle	Sama (Amh.)	*Urtica simensis*	Urticaceae
Rosemary	Sega metibesha (Amh.)	*Rosmarinus officinalis*	Lamiaceae
Lettuce	Seleta (Amh.)	*Lactuca sativa*	Asteraceae
Wheat	Sinde (Amh.)	*Triticum spp.*	Poaceae
Sunflower	Suf (Amh)	*Helianthus annuus*	Asteraceae

English	Amh./Or.	*Scientific name*	Family
Rue	Tena-adam (Amh)	*Ruta chalepensis*	Rutaceae
Linseed	Telba (Amh.)	*Linum usitatissimum*	Linaceae
African eggplant	Ye'āfirīka weyinit'eji k'elemi (Amh.)	*Solanum macrocarpon L.*	Soloanaceae
Thyme	Tosign (Amh.)	*Satureja punctata*	Lamiaceae
Rose	Ts'gie-reda (Amh.)	*Rosa x richardii*	Rosaceae
Abyssinian rose	Qega/Kega (Amh.+Om.)	*Rosa abyssinica*	Rosaceae
Blue sweet pea	Guaya/Gwaya (Amh)	*Latyrus sativus*	Fabaceae
Trees and shrubs			
Bayberry	Abay (Amh.)	*Myrica salicifolia*	Myricaceae
	Adado (Om.)	*Barbeya oleoides*	Barbeyaceae
	Aleltu (Om.)	*Salix subserrata*	Salicaceae
	Anono		
Tasmanian bluegum	Bahr-zaf (Amh.)	*Eucalyptus globulus*	Myrtaceae
River red gum	Barzafi-Dima (Om.)	*Eucalyptus camaldul-sensis*	Myrtaceae
	Besole		
	Bilike		
	Caura hare (Om)		
	Ejerssa (Om.)	*Olea africana*	
African soapberry	Endod (Amh.)	*Phytolacca dode-candra*	Phytolaccaceae
Pine	Gatira (Om.)/tid (Amh.)	*Juniperus procera*	Plantae
	Gebisa (Om)		
	Garamba (Om.)	*Hypericum revolutum*	Hypericaceae
	Geremon		
Buckthorn	Gesho (Amh.)	*Rhamnus prunoides*	Rhamnaceae
	Grawa (Amh)	*Vernonia amygdalina*	Asteraceae
	Gura-hare (Om)		
	Keteba (tree) (Om)		
	Koshim (Amh.)	*Dovyalis abyssinica*	Flacourtiaceae
	Kusaye (Om.)		
	Mech (damakase)		

English	Amh./Or.	*Scientific name*	Family
Beckera polystachia	Muja (Amh.)	*Snowdenia poly-stachya*	Poaceae
	Reji guracha (Om.)		
	Sedisa (Om.)		
Malabur nut	Sensel (Amh)	*Adhatoda schimperia-na*	Acanthaceae
Egyptian pea	Sesbaniya	*Sesbania sesban*	Fabaceae (alt. Le-guminosae)
Cape fig	Shola (Amh.)	*Ficus sur*	*Moraceae*
	Sokorij (Om.)		
Ana tree, balanzan tree	Sola	*Faidherbia albida*	Fabaceae
	Sunene (Om.)		
Tree Lucerne	Tree Lucerne	*Chamaecytisus palmensis*	Fabaceae
	Wanza (Amh.)	*Cordia africana*	Boraginaceae
Exotic pine	Ye ferenji tid (Amh.)	*Cupresus lustanica*	Cupressaceae

Source: Teklemedhin, T. (2016, unpublished), own data

10.5 Sample gender analysis

Women's and men's typical daily activities

Time	Activity*	
	Women	**Men**
4:00 a.m.–9:00 a.m.	• Prepare food and coffee and serve breakfast • Prepare children for school • Clean house • Fetch water • Milk cows • Take care of livestock	• Pray • Eat breakfast and drink coffee • Work in the fields
9:00 a.m.–12:00 p.m.	• Work in the fields • Take care of livestock • Fetch water and firewood • Prepare food for community labor or bring tea to husband	Work in the fields
1:00 p.m.–3:00 p.m.	• Prepare and serve lunch (often bringing it to the field) • Work in the fields	• Eat lunch and rest • PSNP public works • Work in the fields • Collect feed for animals
3:00 p.m.–5:00 p.m.	• Feed animals • Collect fuel and participate in other income-generating activities • Wash clothes and clean house	Work in the fields
5:00 p.m.–9:00 p.m.	• Collect and feed livestock • Fetch water • Prepare and serve dinner	• Collect and feed livestock • Chew chat and rest • Eat dinner
9:00 p.m.–12:00 a.m.	• Prepare bed for children • Prepare and drink coffee while discussing with husband • Clean house • Prepare dough for the next day	• Drink coffee and discuss with wife • Go to bed (by 9:00–10:00 pm)
11:00 p.m.–12:00 a.m.	Go to bed	
Activity summary	**Arsi Zone**	**EH Zone and Dire Dawa Administrative Council**
	• Women work 15–18 hours per day (longest hours from July to January). No hours of rest mentioned. • Men work 9–13 hours per day (longest hours from October to January). Rest for an average of 7 hours.	• Women work 15–19 hours per day. Two to three hours of rest mentioned only for Goro Gutu, Meta and Melka Bello. • Men work 5–12 hours per day. Chew chat for 3–4 hours. Rest for 8 hours total.

Source: Data compiled from men's and women's focus groups in EH Zone, Arsi Zone, and Dire Dawa Administrative Council.

*Daily activities vary by season and by district. Certain activities for women are more time-consuming such as collecting water, going to the grinding mill for flour, and petty trading, so they may do one of these activities one day and another the next day.

Source: CRS (2013: 28)

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