5-2023

Profitable, Alternative Income Generation and Improved Quality of Life Among Global Beekeepers

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A dissertation

presented to

the faculty of the Department of Health Services Management

East Tennessee State University

In partial fulfillment

of the requirements for the degree

DrPH in Public Health, Health Services Management and Policy

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by

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May 2023

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Keywords: beekeeping, business ecosystem, sustainable apiculture, agricultural sustainability, livelihoods, value chains, pollination, farmer profits, sustainable development, sustainability indicators, constraints, rural, apiculture, international development, income generating activities, community development, sustainable livelihoods, alternative income, alternative livelihoods, rural development, honey, non-timber forest products, livelihood diversification, economics, honey yield, forest management, organizational assessment.

ABSTRACT

Profitable, Alternative Income Generation and Improved Quality of Life

Among Global Beekeepers

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Interventions that promote alternative income generation (AIG) to address social determinants of health are associated with increased household income and improved health outcomes. Organizations have used beekeeping to address poverty and other development goals with mixed outcomes. Beekeeping presents a viable option to promote AIG. Organizations increase their risk of failing to achieve positive outcomes when beekeeping interventions are inadequate. This project aims to develop an organizational assessment tool that measures organizational position in relation to evidence-based factors for income generation and improved quality of life among global beekeepers. The assessment is organized into seven domains that correspond with PRECEDE-PROCEED and may be a useful iterative diagnosis, evaluation, and monitoring tool. The instrument was developed through a literature review and adapted to PRECEDE-PROCEED to include organizational, ecological, and evaluation factors. The instrument was pretested among content experts and revised before being administered to BEECause Gambia (BCG). BEECause's mission is to reduce poverty and promote pollinator and honeybee populations. The assessment results were analyzed to propose recommendations to BCG to consider in future strategic planning processes.

The pretest included a survey and cognitive interviews to identify and revise problematic statements. Pretest survey statements were evaluated using a five-point Likert scale. Scores ≤ 3

directly informed the cognitive interview protocol, which allowed respondents to explicate their feedback and concerns. Interview results were analyzed for trends between respondents and corroborated against evidence-based factors. Statements were revised to consider optimal domain alignment, content validity, and meaningfulness. The revised survey included seven domains, 49 statements and one open-ended response. BEECause's overall assessment score was 4.1. By domain their scores were 4.1 in design, 4.1 in implementation, 4.2 in predisposing factors, 3.1 in enabling factors, 3.8 in reinforcing factors, 4.2 in impact, and 5.0 in outcomes. Domain and statement scores underwent SWOT analysis. Scores ≥ 4 were considered strengths. Scores < 4 were considered weaknesses, opportunities, and threats. The assessment resulted in three recommendations to BCG including 1) build financial security, 2) build stakeholder confidence, and 3) address enabling and reinforcing factors. This project may serve as a model for public health efforts in AIG.

DEDICATION

My experience living and working with Gambian men, women, and youth taught me of the realities and needs of farmers and small-holder producers and the role organizations can play in bringing about real change. Reflecting on those days, I see that, “This is where I learned to use my hands and hear my heart” (Mallett, 1990). This dissertation is dedicated to small-holder producers and the organizations that support them.

ACKNOWLEDGEMENTS

Thanks be to God for all I have learned and experienced. And for those who have helped, encouraged, inspired, and challenged me along the way.

Thank you, mom, dad, and Phillip, for your support and encouragement.

Thank you, Dr. Hale for agreeing to take a new project and for helping to identify and maintain a clear focus.

Thank you, Dr. Stoots, for supporting me to learn the practical side of beekeeping at Valleybrook.

Thank you, Dr. Beatty, for being a part of this project and for your help with the methodologies.

Thank you, Dean Wykoff, for your time and support throughout the DrPH experience.

Thank you, content experts, for your insights and your serious approach to the task.

Thank you, BEECause Gambia, for your willingness to participate in this project and for your enthusiasm and commitment to support beekeepers in Gambia. Your lives and work are exemplary.

Thank you, Phoebe, Jake, and Shahin for making this DrPH experience enjoyable.

Thank you, Mark, for your friendship.

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Chapter 1. Introduction

Rationale for Prioritizing the Public Health Issue

Socioeconomic status is a social determinant of health (Catalano et al., 2011; Schnake-Mahl et al., 2018), and alternative income generating activities have demonstrated effectiveness at improving health outcomes and quality of life (Goto et al., 2019) in areas with high rates of poverty. This project seeks to provide an evidence-based resource for organizations to design, implement, and evaluate effective income generating interventions through apiculture (beekeeping). Awareness of the importance of honeybees and pollinators has grown over recent years. In addition to sustaining a healthy, vibrant food system, pollinators represent economic opportunities that could improve the quality of life of beekeepers. Bees have been identified for their potential contribution to fifteen of the seventeen United Nation's Sustainable Development Goals (SDGs) (Patel et al., 2020) associated with forestry, poverty (Amulen et al., 2017; Lowore et al., 2018; Meaton et al., 2021), health outcomes (Goto et al., 2019), and women's empowerment (Pocol & McDonough, 2015) among others.

This project is focused on the development, piloting, and administration of an organizational assessment tool, referred to as the Beekeeping for Alternative Income Generation Assessment (BAIG-A) that assesses organizational performance around evidence-based beekeeping practices and can be used to identify areas for future improvement. The instrument will be administered among BEECause Gambia's leadership team. Gambia has a long history of honey and wax trade, predating European contact (Wright, 2004) and BEECause Gambia has been implementing beekeeping training to address poverty and pollinator population decline since 2009. Its parent organization, Africa BEECause (ABC), is a charity based in the United Kingdom. Africa BEECause formulated strategic plans, made operational decisions, and

provided leadership to the organization. During that time, they developed BEECause Gambia's (BCG) capacity to implement effective trainings and to manage their operations with the intent of transitioning BCG into an independent organization. Since 2009, BEECause Gambia has trained over one thousand beekeepers in beginning and advanced beekeeping. The organization is trusted by beekeepers for reliable training and responsive interventions. However, there are significant challenges for Gambian beekeepers and for supporting agencies operating in less favored areas (LFAs) (AbouAssi, 2013; Kuyvenhoven, 2004). In January 2018, BCG became operationally independent from Africa BEECause and assumed responsibility for training beekeepers, supporting the beekeeping industry, organizational planning, operations, and funding its programs and activities through grant-writing and other means (BEECause, 2020, 2021).

The SARS-CoV-2, Coronavirus Disease 2019 (COVID-19), pandemic hastened BCG's transition as borders closed and travel between Gambia and the United Kingdom was restricted. Africa BEECause remains involved to a reduced degree and BCG is effectively independent. This is a crucial point in the BCG's history. This project will provide an evidence matrix of factors that impact beekeepers' success; develop an organizational assessment tool; and assess BCG's current position in relation to the evidence matrix. The project will culminate in recommendations for BCG to consider in its future strategic planning activities.

Epidemiological Data/trends to Support Prioritization of the Issue

According to the United Nations Development Program's Human Development Report 2020, Gambia ranks 172 out of 189 countries and 49% of its population live in extreme poverty (UNDP, 2020). The youth unemployment rate is 40% (Camara & Hunt, 2018) and every year, significant percentages of rural village populations decline due to migrations across the Sahara to Europe, the Middle East, and Asia. Subsistence agriculture is a major activity across the country

and the annual per capita gross domestic product is $773 (WBG, 2022b), estimated at $2.12 per person per day. Access to capital is an impediment to some small farmers' ability to grow successful enterprises, especially for villages who rely on agriculture or animal husbandry for subsistence. The connection between poverty and health outcomes is well documented (Catalano et al., 2011; Schnake-Mahl et al., 2018) and can be observed in the prevalence of stunting in Gambian children five years of age or younger, 16.1% (WBG, 2022a), and the fact that just over half of the population uses basic sanitation services (WBG, 2022a).

Beekeeping as Economic Development Tool

Beekeeping is an effective intervention to address multiple goals including economic, community, and social development as well as environmental objectives towards sustainability, biodiversity, and conservation (Lowore et al., 2018). At the national level, beekeeping contributes significantly to the economies of several countries including Turkey and Ethiopia. Turkey increased its volume of honey production from 4 tons in 1984 (Lee, 2014) to 61,000 tons in 2001 with 4.1 million colonies (Saner et al., 2004). In 2010, Turkey became the world's second largest producer of honey (Saner et al., 2004).

In many regions of the world, beekeeping traditions date back thousands of years (Elzaki & Tian, 2020; Meaton et al., 2021). Evidence of beekeeping in Ethiopia dates back as early as 5,000 years ago, when Abyssinia was a source of honey for Egypt (Sahle et al., 2018). Tej, a honey-wine drink commonly produced in Ethiopia, is a primary income generator for beekeepers in the region (Meaton et al., 2021). Today, Ethiopia is the number one producer of honey in Africa and ranks tenth in the world (Sahle et al., 2018).

Apiculture has the potential to provide a diversified and alternative source of income security that promotes shock resilience among the poor (Ahmad et al., 2017; Amulen et al.,

2017; Goshme & Ayele, 2020). Value-added products allow for diversified income generation, such as bee pollen, royal jelly, and local medicines (Amulen et al., 2017). Honey contributes significantly to village and household income in several countries throughout Africa including Zambia, where 40,000 people depend on 1,000 tons (Lowore et al., 2018) annually. In Pakistan, a beekeeping intervention increased household income by 51.5 percent and nearly one third of participants increased their ability to pay for school fees by 25 percent (Ahmad et al., 2017).

Beekeeping makes a significant and important contribution to the environment and to our pollinator-dependent food system (Amulen et al., 2017; Elzaki & Tian, 2020). Beekeeping promotes biodiversity, conservation, and pollinator habitat, which is foundational for agriculture (Elzaki & Tian, 2020). Pollinator-dependent crops provide essential micronutrients to the human diet and nutrition (Potts et al., 2016). Economically, pollinators increase crop yields, which translates into revenue (Garibaldi et al., 2016). Community forests are often sustained through the economic interest derived from forest honey and other non-timber forest products. In southwest Ethiopia, 97% of beekeepers engage in some form of forest conservation and 34% of beekeepers have been involved in lobbying efforts to reduce bush fires (Lowore et al., 2018).

Potential ROI Projected by Addressing the Health Concern

Organizations play a vital role in funding, designing, and implementing beekeeping projects. Unfortunately, many efforts have been ineffective for a variety of reasons. This project will culminate in an organizational assessment instrument that informs organizations of foundational elements for successful, profitable income generation. The instrument will be useful at any stage of an organization's life cycle to diagnose issues, and identify strengths, weaknesses, and opportunities. Based on the results of the assessment, organizations can develop strategic priorities to better serve beekeepers.

Impacts may be seen within the organization as well as among beekeepers. For instance, BEECause may decide to promote a goal, profit-oriented approach to beekeeping to help beekeepers benefit from sustainable, long-term income potential. Increased revenue may contribute to the families of beekeepers through improved economic resilience to shock and food security. Over time, increased revenue may contribute to household healthcare, education, financial security, and quality of life.

Extent to Which the Problem is Amenable to Change

Organizational Buy-In

BEECause Gambia's leadership team seeks to be a successful, sustainable, independent organization. The board has expressed an interest in participating in the ILE project and hopes to utilize the results for future strategic planning activities. The deliverables will be designed to inform the organization of evidence-based factors associated with successful income generation through apiculture; a summary of the organization's strengths, weaknesses, and opportunities; as well as recommendations that will help build the capacity and intervention design to promote a profitable, sustainable, enabling environment; achieve their desired impacts and outcomes; and promote the organization's viability. The board members and BCG's director have agreed to participate in the project. A formal letter of support is included in the Appendix.

Discussion of How Addressing the Problem Will Lead to a Population Health Impact

Beekeeping can be an effective economic development tool (Amulen et al., 2017) in generating alternative income streams and reducing the impact of economic shocks on people living in low-income countries, especially those who depend on subsistence agriculture (Goto et al., 2019). Small-scale beekeeping is less time-consuming than other activities, can be conducted in the evenings, after other work is completed, and does not require daily attention. Beekeeping

is challenging work, but if participants enjoy the work, are not afraid of bees, and commit to growing a profitable enterprise, it can contribute as an alternative income source. A single harvest of one hive can result in at least 20 liters of honey and can bring 2,000 Gambian Dalasis to the beekeeper. A single 20-liter harvest can buy one month's food supply of rice and contribute to oil, protein, and vegetables. Two thousand dalasi can also contribute towards household needs, school fees, medications, or be reinvested into other income-earning activities.

Gambian roads are unpaved. Villages lack water, electricity, and sanitation (CIA, 2021). Transportation is expensive and time-consuming. Most Gambians do not have personal vehicles to access school, services, markets, or mentors. Amid high poverty rates, poor infrastructure, and the challenges of beekeeping, services that help Gambians overcome obstacles to managing their apiaries, accessing information, and accessing markets increases their chances for success (Meaton et al., 2021; Schouten, 2020). Considering the many challenges that people face, it is important that beekeeping interventions include evidence-based best practices.

Best practices include the provision of long-term support; development of the value-chain; market access; access to knowledge, information, technology, local materials, and hive-types. It also includes long-term social support systems, such as mentors, and a focus on profitability (Lee, 2014; Schouten, 2020; Schouten & Lloyd, 2019). In the United States, auxiliary services for beekeepers include bee clubs and associations; extension services from land grant universities; regulations and accessible brick-and-motor or online markets to support local producers; and a value chain of producers of various goods and services including apiary management technology, equipment, and an entrepreneurial culture. Gambian beekeepers need similar supports to be successful.

By assessing BEECause Gambia and providing relevant, evidence-based recommendations, this project will contribute to the long-term sustainability of BEECause and to the success of beekeepers in the Gambia. Any resulting improvement to programs, organizational capacity, and the enabling environment have the potential to increase income among beekeepers, which may contribute to improved quality of life and further build an enabling environment for small-holder producers. This project provides a model with applications for other small-holder development programs that strive to generate profitable income for those living in poverty or low-resource, low-income settings.

Project Aims

This project has three aims: 1) Develop an organizational assessment instrument reflecting best practices for implementing beekeeping initiatives in under-resourced countries. 2) Pilot the instrument among content experts. 3) Provide BEECause Gambia with a summary of the assessment's results and propose recommendations for the organization to consider in its strategic planning process.

Identification of DrPH Competencies

The project will meet the following foundational and concentration competencies required by the Doctor of Public Health (DrPH) Integrated Learning Experience (ILE) and Health Services Management and Policy (HSMP) Department at East Tennessee State University's (ETSU's) College of Public Health (COPH).

Foundational Competencies

Data and Analysis.

- (2) Design a qualitative, quantitative, mixed methods policy or evaluation project to address a public health issue.

Leadership, Management, and Governance.

- (6) Integrate knowledge, approaches, methods, values and potential contributions from multiple professions and systems in addressing public health problems.
- (12) Propose human, fiscal, and other resources to achieve a strategic goal.

Concentration Competencies

Health Services Management and Policy.

- (1) Evaluate different organizational behaviors, cultures and structures across sectors and levels of governance to improve organizational effectiveness.
- (3) Assess the effectiveness of public health and healthcare services aimed at improving population health using applied research and evaluation methods.
- (5) Integrate the principles of organizational theory, behavior, and culture to effectively foster shared values for evidence-based decision making and leadership within health service organizations.

Stakeholder Engagement Plan

There are two groups of stakeholders associated with this ILE project. One group, the key informants for the pilot test to achieve the second aim will be identified based on their level of expertise or experience with beekeeping. They will be contacted via email and asked to voluntarily take the organizational assessment and to provide their feedback during a cognitive interview. The other group, BEECause Gambia has confirmed their support for the project. They have received a summary of the project aims and have expressed an interest in using the project to inform their future strategic planning activities. The board provided a formal letter of support for the project on September 15, 2022. Once the instrument is pretested, revised, and ready for administration, it was sent to the leadership team for voluntary administration. The instrument

included a summary of the project aims, a brief explanation of the instrument and the organizational, predisposing, reinforcing, and enabling factors that promote alternative income generation among beekeepers. The leadership team was asked to complete the survey within one month. The organization will receive a summary of the results and recommendations.

Chapter 2. Literature Review

Purpose

The literature review focused on the identification of evidence-based factors associated with positive outcomes when beekeeping is utilized as an intervention to promote alternative income generation in low- and middle-income settings, and other less favored areas (LFAs). The literature search utilized PubMed and ABI/Inform Collection, a business research database. Bibliographies from relevant articles were used to expand the search and some articles were accessed through Sherrod Library's One Search or Google Scholar. The timeframe was limited to the past 22 years, from 2000 to the present.

The search included key words and phrases such as "apiculture for economic development," "best practices for beekeeping projects," and "beekeeping for economic development." This is a comprehensive list of key words that emerged through the process; beekeeping, business ecosystem, sustainable apiculture, agricultural sustainability, livelihoods, value chains, pollination, farmer profits, sustainable development, sustainability indicators, constraints, women, rural, apiculture, international development, gender, income generating activities, community development, sustainable livelihoods, alternative income, alternative livelihoods, rural development, honey, non-timber forest products, livelihood diversification, farming practices, ecosystem services, economics, honey yield, forest management, organizational assessment.

The literature review is organized to 1) provide a holistic perspective of the contributions of apiculture on physical and environmental health, 2) survey global beekeeping interventions to understand impacts, opportunities, and constraints common to achieving successful outcomes, and 3) identify evidence-based factors necessary for supporting local beekeeping efforts in

developing countries. The evidence-based factors will directly inform the organizational assessment instrument and will be organized to align with the PRECEDE-PROCEDE conceptual framework. Accordingly, the evidence-based factors will be organized into program design, implementation, predisposing, reinforcing, enabling, impact and outcome domains.

Contributions of Apiculture to Physical and Environmental Health

Apiculture, also known as beekeeping, is the management of honeybees for honey or other bee product production. Beekeeping provides unique opportunities for people to produce healthy foods for personal use or market consumption at varying levels of profit from endeavors at all scales of operation. Honey is linked with the confection industry and has remained relatively constant over the past ten years despite changes in consumers' attitudes towards sugar. The U.S. market relies on international imports to meet demand, and there is room for new entrants. Honey makes up 50.2% of the honey industry revenue; pollination services make up 9.0%; and other products make up 40.8% (Madigan, 2021). The U.S. honey industry has experienced a reduction in bee colonies since the 1990s due to pests and viruses. In the 1990s, there were an estimated 3.0 million hives, but that number dropped to 2.3 million in 2008 and rose slightly, but remained low at 2.7 million in 2020 (Madigan, 2021).

Beekeeping is not an easy trade or hobby, and many beginners decide after a few failed attempts that beekeeping is not for them. For those that stick it out, enjoy it, or earn their living from it, beekeeping can be profitable for hobbyists, sideliners, and commercial beekeepers. Apiculture holds economic development potential for bee products, such as honey; hive products, such as propolis and pollen; and value-added products, such as infused honey, soaps, cremes and lotions. Apitherapy is a value-added product that has emerged as an alternative medicinal field that has an increasing market presence tied to the vitamin and supplement

industry and to healthy eating indexes (Madigan, 2020). Apitherapy presents an economic opportunity for beekeepers to differentiate their honey, but this is not the only niche market within the beekeeping world. Apitherapy products include infused honey products with local herbs and plant products, pollen, propolis, and royal jelly among others.

At the local level, an entrepreneur may differentiate themselves through niche activities such as in queen rearing, hive building, toolmaking, pollination services to orchards and farms, or other creative activities. Depending on the scale of the beekeeping operation, a hobbyist or sideliner may be able to diversify their products to increase revenue. This would depend on the individual's time and capacity, but as the market demand is much greater than current local supply in the United States, even with international imports labeled as U.S. honey, there is significant opportunity for beekeepers of all levels to profit, earn supplemental or full-time income as beekeepers.

Health Benefits of Honey and Bee Products

Bee and hive products offer physical and economic benefits. This section summarizes the health benefits of honey, propolis, and pollen. There are other bee and hive products, which may be appropriate for beekeepers to consider. This review does not include an exhaustive description of those products. Instead, it focuses on the value of honey, which is the most accessible and well-known product associated with honeybees. Propolis and pollen may be less well-known but have benefits that can be leveraged for income generation.

Honey

Honey is largely made up of carbohydrates (75-80%), water (18-22%), and minerals, vitamins, proteins, enzymes, organic acids, polyphenols, aroma compounds, proteins, and amino acids (1-3%) (Ilia et al., 2021; Pasupuleti et al., 2017). Honey, propolis, pollen, and royal jelly

have anti-inflammatory, antibacterial, antifungal, and antioxidant properties (Ilia et al., 2021; Pasupuleti et al., 2017). Research supports the use of honey among athletes as an energy source, to reduce fatigue, and to aid in recovery. Medically, honey has been used to treat burns and injured tissue and has demonstrated a relationship with improved immune function (Ilia et al., 2021). Apitherapy including honey, bee bread, bee venom, bee pollen, propolis, and royal jelly (Pasupuleti et al., 2017) covers a range of therapeutic and medicinal and antibiotic properties from treating eye infections to healing wounds. Beeswax has a high long-chain ester content, which may be used in biodiesel production (Ilia et al., 2021).

Honey has been used in wound management, skin care, gastrointestinal health, oral health, pharyngitis and coughs; gastroesophageal reflux disease, dyspepsia, gastritis, and peptic ulcers; gastroenteritis, constipation, diarrhea, liver and pancreatic diseases; metabolic and cardiovascular health; as well as cancers of the breast, liver, and colorectum (Pasupuleti et al., 2017). In moderation, honey can reduce systolic blood pressure, low-density lipoproteins (LDL), total cholesterol, and increase high-density lipoprotein (HDL), which is seen as good cholesterol (Ilia et al., 2021). Used in small amounts, honey consumption has been associated with bodyweight reduction. Consuming 20g, roughly 3 teaspoons, of honey diluted in 300mL, or just over one cup, of water per day (Ilia et al., 2021), in combination with physical activity, has been associated with improved immune function and physical performance. While honey allergies are rare, consumers should be aware of the risk of anaphylactic shock that may occur with honey consumption.

Propolis

Propolis is a plant product that results from the collection and processing of plant secretions from all parts of the plant including lipophilic compounds on leaves, buds, gums,

resins and latices (Bankova, 2005). Traditionally thought to have a uniform composition, recent studies have revealed a wide variation in the chemical make-up of propolis. Globally, the primary source of bee glue, propolis, is the black poplar, *Populus nigra*. Poplars are a temperate species that do not survive the tropical or subtropical environments. In non-temperate zones or where poplar trees are not common, bees utilize the diversity of plants to produce the same product with similar beneficial results globally. Among bees, propolis promotes bee health against viruses, bacteria, and fungal attacks. It has also benefited human health and is used to treat wounds, burns, sore throats, and ulcers (Bankova, 2005). Among humans, propolis has been used to treat gastrointestinal disorder, promote gynecological care, oral health, oncological treatment, and dermatological care (Pasupuleti et al., 2017); has consistent anti-microbial properties and has been shown to have hepatoprotective activity against *Helicobacter pylori*, anti-HIV compounds, cytoxic activity against tumor cells, and scavenging activity against free radicals (Bankova, 2005). Antioxidant activity has been associated with antioxidative compounds such as kaempferol, caffeic acid, and phenethyl caffeate (Bankova, 2005). Cytoxic effects associated with apoptosis of human melanoma cells have been associated with antiradical properties of propolins, a flavanone found in propolis (Bankova, 2005). The strength of these properties varies by plant source, but the antibacterial, antifungal, and antiviral properties of propolis are consistent throughout plant sources. Knowledge of the plant sources of propolis may help beekeepers promote colony health through diverse plant promotion in or around apiaries and in the integration of agroforestry principles into apiary management systems (Bankova, 2005).

Bee Pollen

The chemical composition of bee pollen, like propolis and honey, depends on a variety of plant sources defined by geography, climate, soil, bee species and behavior. Two-hundred fifty compounds make up pollen including a range of amino acids, lipids, vitamins, macro- and micronutrients, and flavonoids (Komosinska-Vassev et al., 2015). Bees collect pollen from single sources or multiple sources depending on the crop and the activity of the colony. Poppy, corn, lupin are plants from which bees only collect pollen, but they collect nectar and pollen from other melliferous plants utilized by bees to produce honey. Bee pollen is made into bee bread by salivary secretions or nectar mixed into the plant pollen before being placed in corbiculae (baskets) located on the bee's hind-legs (Komosinska-Vassev et al., 2015).

Bee pollen, like honey and propolis, has anti-inflammatory, anti-microbial, antiviral, antifungal properties, is an immunostimulant, and has analgesic properties (Komosinska-Vassev et al., 2015). Pollen is made up of approximately 22.7% protein, of which 10.4% includes essential amino acids (methionine, lysine, threonine, histidine, leucine, isoleucine, valine, phenylalanine, and tryptophan) necessary for life sustaining processes. Carbohydrates make up roughly 30.8% of pollen, including approximately 25.7% fructose and glucose. Other compounds in pollen include phenolic compounds (flavonoids, leukotrienes, catechins, and phenolic acids), 1.6%, fat-soluble vitamins (A, E, and D), 0.1%, water-soluble vitamins (B1, B2, B6, C; pantothenic, nicotinic, folic, biotin, rutin, and inositol acids), 0.6%, macronutrients (calcium, phosphorous, magnesium, sodium, and potassium), 1.6%, and micronutrients (iron, copper, zinc, manganese, silicon, and selenium) (Komosinska-Vassev et al., 2015).

Pollen has shown pharmacological effects on rabbits and mice to reduce plasma total lipids and triacylglycerols (Komosinska-Vassev et al., 2015). Pollen has been shown to be

effective in wound treatment and it inhibits atherosclerotic changes to the blood vessels and increases blood circulation to the brain and has successfully been used to protect individuals from heart disease and stroke (Komosinska-Vassev et al., 2015). Polyphenols within pollen detoxify and pollen has been used to reduce harm from liver damage from toxic substances and occupational exposures including occupational diseases, heavy metal contamination, industrial gases and dusts, and drugs (antirheumatics, anti-inflammatory drugs, and antibiotics) (Komosinska-Vassev et al., 2015). Pollen has antiallergic properties, reduces pain associated with inflamed prostate conditions, has been effective when administered with antidepressants to reduce pharmacological doses and improve overall condition. This aspect has led to its use in recovery and addiction treatments. Pollen has also been associated with improved blood flow associated with the nervous system and increased mental capacity, and has been used to treat fatigue, apathy, and work-related stress (Komosinska-Vassev et al., 2015).

Pollen can be taken orally before eating, 3 times per day. The recommended daily dose is 20-40g of pollen per day, approximately 3-5 teaspoons per dose for adults and 1-2 teaspoons for children (Komosinska-Vassev et al., 2015). As a treatment, pollen can be taken daily for 1-3 months, which can be repeated 2-4 times as needed, typically taken during seasonal transitions between summer and autumn and, or between winter and spring (Komosinska-Vassev et al., 2015). Honey, propolis, and pollen represent three potential valuable commodities for income generation. Despite the economic potential, interventions often fail to achieve their aims. A review of beekeeping interventions will help organizations design interventions that promote long-term success and enabling environments for income generation.

Impacts of Beekeeping Interventions

Globally, beekeeping has been utilized as an intervention tool to varying degrees of success. Successful interventions have positive impacts on the financial, physical, environmental, and social well-being of participants. Financially, well-designed beekeeping interventions are associated with increased household income (Ahmad et al., 2017; Amulen et al., 2017; Goshme & Ayele, 2020; Lowore et al., 2018) compared to poorly designed interventions that did not provide training or equipment and resulted in no financial improvement (Amulen et al., 2017). Beekeeping is seen as reliable, feasible, and easily transmittable across generations. Beekeeping interventions are associated with increased number of hives, hive and honey products, income and use of honey instead of sugar (Pocol & McDonough, 2015). In Pakistan, one intervention resulted in increased household incomes by 51.5 percent (Ahmad et al., 2017). This intervention enabled 33 percent (Ahmad et al., 2017) of beneficiaries to invest in better schooling, household health, doctor visits, medicines, and transportation to health centers. Beekeeping interventions are also associated with increased savings (Goto et al., 2019) and more money to buy larger quantities and healthier foods, directly contributing to improved nutrition, food security (Garibaldi et al., 2016). Alternative income generating activities are also associated with reduced childhood stunting, and reduced anemia and chronic energy deficiency among mothers (Goto et al., 2019).

Eighty-three percent of the world's population is agrarian and dependent on small-scale agriculture (Garibaldi et al., 2016). Agriculturally, beekeeping has potential to contribute towards economic development (Novelli et al., 2021) through increased production and yield from pollination services (Elzaki & Tian, 2020; Garibaldi et al., 2016; Geslin et al., 2017; Potts et al., 2016). Ninety percent (Potts et al., 2016) of the world's leading crops are pollinator-

dependent and often, these crops fetch a higher price at global markets (Potts et al., 2016). Among apple and pear producers, quality pollinators were associated with increased yield by 15%, weight by 20%, and profit by 70% (Geslin et al., 2017).

In terms of health benefits, beyond those described in detail earlier, pollinators are associated with the global diversity of food sources and micronutrients including vitamins A and C, calcium, fluoride, and folic acid (Potts et al., 2016). Nutritional outcomes and preventable chronic disease have been associated with geographical spread and density of wild and managed pollinators (Potts et al., 2016). Increasing pollinator density could close global agricultural productivity gaps by 24 percent (Potts et al., 2016) and improve population health.

Environmentally, beekeeping is associated with sustainable forest management and conservation practices, biodiversity, (Lowore et al., 2018) and awareness of the role of honeybees in the food and eco-system (Elisante et al., 2019). Pollinator trainings for farmers in Kenya resulted in improved post-test honeybee identification to 99 percent from 77 percent during the pre-test surveys. Awareness of crop value of pollinators improved to 95 percent compared to pre-intervention scores of 52 percent (Elisante et al., 2019). There was also an increase in the awareness of biopesticide impacts on pollinators (Elisante et al., 2019).

Socially and culturally, beekeeping interventions are associated with improved socioeconomic status, involvement in decision-making, and empowerment for women (Johnson et al., 2016; Pocol & McDonough, 2015). Another intervention was associated with increased employment opportunities for youth interested in providing pollinator services (Singh et al., 2016). Personal impacts have included feelings of independence, community, pride, and well-being. Conversely, among women, group empowerment has been less documented than personal gains for women (Pocol & McDonough, 2015).

Apiculture has the potential to contribute to the entire food system's well-being at the global and local level. Globally, beekeeping interventions have been used to address multiple aims, which highlights the versatility and adaptability of beekeeping as a development tool. A brief review of global trends elucidates the lack of standardization among development agencies. While prescriptive approaches may have a higher risk of failure due to low adoption rates in relation to traditional methods or local constraints, such as access to Langstroth hives, hive tools, and capital, a review of global interventions helps to identify common trends that represent issues that beekeepers share in most settings. Understanding trends can also help organizations avoid pitfalls and increase their chances of successfully achieving their objectives and optimizing their return on investment.

Global Trends in Beekeeping Interventions

Development agencies and organizations have taken several approaches to intervention designs that utilize beekeeping. Some of these approaches result in successful outcomes where the beneficiaries and participants attain the intended outcome. Others have been unsuccessful. Beekeeping is often thought to be a cost-effective intervention and organizations may naively provide basic kit without considering the holistic and long-term needs of beekeepers. Here, several interventions are discussed to demonstrate varying levels of input and potential positive and negative impacts associated with different intervention designs.

In Uganda, an intervention targeting people living in extreme poverty did not realize an economic benefit from beekeeping (Amulen et al., 2017). Most of the participants were chosen by aid or government agencies because of their level of poverty, but the interventions did not provide training, hive and safety equipment, market access, ongoing support, or savings programs (Amulen et al., 2017), and was considered a failure. Despite its inability to increase

household incomes among people living in extreme poverty, farmers in the region, who owned land and were not included in the intervention because of their material assets still perceived beekeeping as profitable (Amulen et al., 2017). A long-term, holistic design may have been more effective at generating income for the intended audience.

In Romania, Heifer International promoted a beekeeping intervention to empower women and address food insecurity, hunger, and poverty. During the training, participants were taught how to build a hive, to keep bees, and to market their products. Additionally, the Heifer International model includes a "pass on the gift" component where recipients agree pass on what they received to others (Pocol & McDonough, 2015). Pocol and McDonough (2015) evaluated the intervention several years later to measure the long-term impact and found that beekeeping had contributed to increases in well-being and nutrition; personal empowerment, independence, and pride; social interaction, community involvement, revenue, and awareness of pollinators. The intervention also resulted in greater individual and shared-decision-making among women who kept bees with their husbands (Pocol & McDonough, 2015). While the beekeepers may not have had formal long-term support, by passing on the gift beneficiaries may have contributed to the long-term success through participant-led knowledge sharing, access to equipment, and mentorship.

In Pakistan, a beekeeping intervention aimed at increasing household income included education on conservation and pollinators, as well as capacity development of beekeepers in hive management, harvesting, and honey processing. The intervention provided equipment, organizational capacity, and knowledge. The results of the intervention were positive. Average income from beekeeping increased 51.5 percent (Ahmad et al., 2017) and beneficiaries were able

to contribute to better schooling for their children, doctor visits, medicines, and transportation to health centers. Many were able to reinvest in their beekeeping enterprise (Ahmad et al., 2017).

Bees for Development, a UK-based charity, promotes beekeeping in multiple countries including East Africa. Interventions include introducing modern hives, market-based beekeeping, value chain promotion, and promoting local leadership. Bees for development values include: 1) Promoting use of local resources. 2) Using indigenous bees to promote optimal bee health and immunity against indigenous parasites, viruses, and disease. 3) Building capacity through knowledge sharing. 4) Promoting appropriate, local, and affordable hives. 5) Teaching beekeepers to analyze their own markets (Lee, 2014). This approach requires access to knowledge and capacity development, which Bees for Development provides to its participants.

A value chain approach was utilized in Ethiopia and Zambia (Meaton et al., 2021) to identify key obstacles and inform intervention design. They then proposed interventions to improve upstream and downstream conditions for beekeepers. Upstream interventions focused on honey production and included supplying food-grade buckets to beekeepers to capture honey; community based participatory management of natural resources; providing modern hives; and processing or product diversification (Meaton et al., 2021). Food-grade buckets increased the value of raw honey for the beekeepers by ensuring honey arrives at processing centers in a clean container. Community based participatory management of natural resources increased honey trading and helped to build an enabling environment for beekeepers. Providing modern hives is controversial (Meaton et al., 2021). Introducing or prioritizing modern hives can have a negative impact and may threaten the role of traditional beekeeping methods and result in reduced trust from the community. Processing or post-harvest interventions are not always economically advantageous to beekeepers. Instead, processing investments should be targeted at processors or

value-added producers. "Beekeepers should be left to continue what they have always done, with only a few minor interventions that are supported by beekeepers because they offer the best returns for effort" (p. 167).

Downstream interventions target the activities related to getting products to consumers and might include creating new market routes and promoting participatory forest management (PFM) (Meaton et al., 2021). An example of market creation can be seen in “benign monopolies” (166), such as Forest Fruits of Zambia, which passed the cost of supporting its beekeepers (i.e., training, support, infrastructure, and logistics) on to consumers through higher market prices. Participatory forest management and community based participatory management can have a multiplier effect that promotes an enabling environment (Meaton et al., 2021).

Understanding trends in intervention design and approach is only a portion of the puzzle in understanding the needs of beekeepers. Organizations and program designers need to understand the local characteristics of the region or place in which an intervention will be implemented. Community needs assessments or environmental scans, such as SWOT (strengths, weaknesses, opportunities, and threats) analyses designed for beekeepers will help identify opportunities and constraints. A well designed theoretically based intervention may fail if the organization or program does not consider local opportunities or barriers. Local opportunities may exist which may be leveraged to offer beekeepers a competitive advantage or unique opportunities for income generation. For instance, larger commercial centers may provide opportunities to earn a higher rate for quality honey or traditional hive making practices may provide opportunities to support the value chain. At the same time, local barriers and constraints may undermine the intervention and prevent it from reaching its aim of improving quality of life for the participants. These might include pandemics that close borders and reduce the volume of

tourists and revenue in a season, or areas with extreme poverty where beekeepers may have to prioritize the use of honey revenue towards subsistence over reinvestment and growth of their enterprise.

Understanding such realities can help organizations build lasting partnerships and trust with local beekeepers to create solutions that address barriers or leverage opportunities so that beekeepers can succeed in alternative income generation. The next two sections survey global opportunities and barriers experienced by beekeepers. While they differ by cultural and regional context, they share similarities. These sections highlight the need for regular assessments of local conditions to inform intervention design, implementation, and evaluation.

Opportunities for Beekeepers

Beekeeping presents opportunities for economic resilience (Amulen et al., 2017), income and employment (Garibaldi et al., 2016; Geslin et al., 2017; Goshme & Ayele, 2020; Novelli et al., 2021; Potts et al., 2016; Sahle et al., 2018; Saner et al., 2004; Wagner et al., 2019); and economic development (Novelli et al., 2021) through a diverse array of value-added goods and services (Novelli et al., 2021; Sahle et al., 2018). Understanding opportunities and drivers allows support organizations to align producers with market demand and capture value. While beekeepers share similar opportunities and drivers across regions of the world, local opportunities and gaps exist. Filling these gaps contributes to economic resilience for smallholder producers (Amulen et al., 2017). Apiculture's value chain includes goods and services related to logging, milling, woodworking, crafting hives, and providing pollinator services. It includes vendors, tailors, metallurgists, processors, and bottlers. Additionally, the market provides opportunities for producers of value-added products such as soaps, body butters, lotions, balms, bee pollen, royal jelly, propolis, infusions, meads, and other culinary goods.

Service opportunities exist for trainers, extension agents, and technology developers that aid in hive and pest management, queen rearing.

A major driver and opportunity for beekeepers exists in unmet demand for honey and pollination. Untapped potential for pollination and honey exists in many countries. Increased pollination could increase food production by 24 percent (Potts et al., 2016). In terms of honey sales, the United States (Madigan, 2020), Ethiopia (Berhe et al., 2016), Sudan (Elzaki & Tian, 2020), Zambia and Cameroon (Lowore et al., 2018) have yet to meet demand. Turkey, the second largest producer of honey in 2010 (Lee, 2014) reported that producers had not saturated the market. In 2017, Kenya only produced 14.6 percent of its total potential, and Uganda harvested only 1 percent (Amulen et al., 2017). The demand for honey is not being met in most markets (Berhe et al., 2016). The gap in global markets provides an economic opportunity for beekeepers to gain financially and contributes to enabling conditions (Potts et al., 2016) for long-term success and viability. Organizations, such as social enterprises, can help prepare individuals and communities to pursue these economic opportunities and contribute to alternative income generation.

Constraints

Despite the existence of diverse economic opportunities for beekeepers, there are numerous constraints to profitable beekeeping globally. Understanding regional and global constraints can help organizations problem-solve and design appropriate, effective interventions that benefit smallholder producers. In terms of production, constraints include pests, disease, predators (Goshme & Ayele, 2020; Novelli et al., 2021), weather (Goshme & Ayele, 2020), bee forage, pollinator habitat (Elzaki & Tian, 2020; Goshme & Ayele, 2020; Sahle et al., 2018), and agricultural activities (Elzaki & Tian, 2020; Goshme & Ayele, 2020; Novelli et al., 2021; Sahle

et al., 2018). Hive health and absconding or robbing behaviors among colonies can reduce honey yield (Goshme & Ayele, 2020). Management practices are associated with pests and productivity (Goshme & Ayele, 2020; Sahle et al., 2018; Wagner et al., 2019). Training and knowledge are associated with self-efficacy (Amulen et al., 2017; Goshme & Ayele, 2020; Sahle et al., 2018; Wagner et al., 2019). Equipment and technology serve as barriers to entry and productivity (Amulen et al., 2017; Berhe et al., 2016; Goshme & Ayele, 2020; Sahle et al., 2018).

Research and extension services are associated with success rates and sustainability (Amulen et al., 2017; Berhe et al., 2016; Goshme & Ayele, 2020; Sahle et al., 2018). Beekeepers are also constrained by profitability (Berhe et al., 2016; Wagner et al., 2019), household characteristics (Amulen et al., 2017), land ownership (Wagner et al., 2019), capital (Elzaki & Tian, 2020; Sahle et al., 2018; Wagner et al., 2019), understanding costs and costs themselves (Amulen et al., 2017; Elzaki & Tian, 2020; Sahle et al., 2018). Trained labor shortages limit productivity (Goshme & Ayele, 2020; Sahle et al., 2018), as does hive theft (Wagner et al., 2019).

Market constraints include poor business literacy or general understanding of costs, inputs, revenues (Elzaki & Tian, 2020; Goshme & Ayele, 2020; Meaton et al., 2021), and a lack of market information (Goshme & Ayele, 2020). Poorly developed market linkages, value chains, market centers, and infrastructure (Goshme & Ayele, 2020; Meaton et al., 2021; Sahle et al., 2018) serve as barriers to entry that limit economic growth and hamper long-term sustainability. Household constraints (Amulen et al., 2017) and price fluctuations discourage participation, and post-harvest handling (i.e., storage, processing, packaging, and distribution), and a general lack of business concepts impacts quality and reduces potential earnings (Elzaki & Tian, 2020; Goshme & Ayele, 2020). Any given honey industry is further impacted by national

and international policies that support producers or enable trade through levies and trade standards (Elzaki & Tian, 2020; Saner et al., 2004).

Evidence-Based Factors for Success

Studies of beekeeping interventions around the world indicate that beekeepers need to consider the local environmental conditions and floral resources; capacity development in terms of beekeeping and business or goal-setting training, ongoing education, extension, mentorship; access to capital, equipment, and markets; and program management and design (Amulen et al., 2017; Meaton et al., 2021; Schouten & Lloyd, 2019). Understanding these factors can help an organization determine their position to support beekeepers and to design sustainable, effective interventions.

PRECEDE-PROCEDE provides a relevant model to organize the evidence-based factors, which will inform the instrument design and format. Evidence-based factors at the organizational level include program design and implementation. Predisposing factors include knowledge and efficacy. Enabling factors include availability of resources, access to services, policies and regulations, and issue-related skills. Reinforcing factors include personal and community-wide attitudes. These evidence-based factors have been selected for their association with desirable impacts, such as yield, and outcomes, such as income, profit, and improved quality of life.

Organizational Factors

Beekeepers have unique opportunities and constraints associated with their region, country, culture, and local environment. A beekeeper's ability to succeed depends on their ability to take advantage of opportunities and overcome constraints. A key component to success is the presence of an enabling environment where producers can access modes of production, markets, and earn competitive and profitable income. Organizations, such as non-profits, government

agencies, social enterprises, food hubs, and cooperatives have resources that can foster an enabling environment in ways that are not efficient or profitable for individual beekeepers. Beekeepers are more profitable when they focus on their craft and organizations are more helpful when they build long-term relationships with producers, invest in the value chain, link beekeepers to markets, and provide training and other inputs that build self-efficacy and profitability. Interventions should be simple and designed to address key needs without overly distracting beekeepers from focusing on their primary economic activities (Meaton et al., 2021).

Program Design, Management, and Evaluation

Careful program design and implementation is a key factor for success and long-term sustainability of beekeeping enterprises (Schouten & Lloyd, 2019). Components of program design include mission alignment, development of specific, measurable, achievable, relevant, and time-bound (SMART) goals and objectives (Issel et al., 2022). Needs assessments (Berhe et al., 2016), internal and external environmental scans (Novelli et al., 2021), and stakeholder engagement provide the evidence-basis to design effective interventions and build trusting relationships that contribute to income generation. Beekeeping-specific designs consider a long-term approach that prioritizes the income generation of beekeepers through an enabling environment. Training, education, and access to materials, capital, and markets are among important considerations.

Implementation involves a range of activities based in logic models and adherence to business plans that include stakeholder engagement, adaptation to local context, relationship development, financial strategies, and organizational support for staff, partners, and volunteers. Program monitoring for adherence to program design and budgets and evaluation processes help keep an intervention on track and on budget while also providing information to assess and

improve program design. Logic models may be useful to identify the necessary inputs and their expected impacts and outputs (Issel et al., 2022). Other considerations in program design and implementation include purchasing practices and loan scheme designs which do not become inadvertent poverty traps (Schouten & Lloyd, 2019); quality standards and fair trade (Meaton et al., 2021). Participant selection, such as a sifting process, which selects members over time based on resilience, adherence, and motivation towards profits (Lee, 2014; Schouten & Lloyd, 2019) can help identify serious, persistent beekeepers. It is also useful to identify locally relevant measures and indicators to demonstrate impact (Amulen et al., 2017; Schouten, 2020) and evaluate progress.

Schouten (2020) offers several indicators associated with income generation, productivity, and welfare that may be useful in demonstrating and measuring impact. These factors, in addition to the other evidence-based factors that follow may be useful to consider for intervention design, implementation, and evaluation. Schouten's indicators include hive type; number of hives; household size; frequency of requeening; access to a grant scheme; credit access; capital re-investment; on-farm income; supplementary feeding; age; labor; years' experience; education; number of beekeeping training days; and a contract sales scheme (Schouten, 2020). Ideal intervention designs develop individualized business plans for beekeepers; strive for profitability; consider cost-benefit analysis; build resilience, and help beekeepers increase yields and profit margins (Schouten, 2020). These indicators are not prescriptive and local measures, specific to a region, culture, or intervention could be developed with local beekeepers to ensure relevance and accuracy.

Big-picture concepts, such as sustainable food systems and value chains, are also helpful in program design. While food system and value-chain analysis are beyond the scope of this ILE,

their concepts relate to beekeeping as an intervention that aims to promote quality of life. The sustainable food system perspective challenges organizations to find a balance between its own survival and prioritizing the well-being of beekeepers or other small-holder producers. Additionally, by including the value chain in the program design, organizations contribute to a sustainable enabling environment.

Sustainable Food Systems

Food systems shape planetary and human health (Marshall et al., 2021). Food systems are complex feedback loops that include supply chains (production and inputs; harvesting; storage and distribution; processing and packaging; and retail and marketing); food environments (availability, affordability, product and vendor properties, and food messaging); individual factors (economic, cognitive, aspirational, and situational);
consumer behavior (acquisition, preparation, practices, and storage); and diets. External influences include climate change, globalization and trade, income growth and distribution, urbanization, population growth and migration, politics and leadership, and socio-cultural context. Food systems relate to nutrition, health outcomes, as well as social, political, economic, and environmental impacts (Marshall et al., 2021; Rutten et al., 2011).

Effective food systems sustainably provide food security and nutrition for all people. Promoting an effective food system is essential to the resilience and well-being of people (Berkum & Ruben, 2021). Sustainable food systems promote healthy nutrition for everyone in a manner that does not compromise the food security or nutrition for future generations. To achieve this, they must consider economic, social, and environmental factors such as value chains (FAO, 2018). By these parameters, considering endemic global poverty, food insecurity,

and poor nutrition, our current global food system must not be considered effective or sustainable.

Food systems need to become healthy and nutritious, inclusive, environmentally sustainable, and resilient (Ruben et al., 2021). Ruben et al. (2021) identify five paradigm shifts that need to occur to transform the food system: 1) Raise ambitions from food security to food system resilience. 2) Harmonize goals for production, livelihoods, and environmental sustainability that includes affordable, inclusive, and sustainable diets. 3) Improve connectivity from exchange to midstream interlinkages. 4) Strengthen responsiveness from linear value chains to food systems that demonstrate circular use of material resources. 5) Anchor governance and move from targeted incentives to comprehensive, inclusive, and participatory food system governance. An example may be found in symbiotic food systems, which are alternative food systems that already exists where collaboration is prioritized over competition; able to deliver at scale; and which responds to the needs of those living in poverty (Wegerif & Hebinck, 2016). By seeking to promote both the profitability of beekeepers and the profitability of supporting organizations such as BEECause, this project promotes a healthier, more effective, and sustainable food system.

Value Chain Analysis

Poverty reduction is often the goal of global market integration. However, few interventions document actual impacts on poverty reduction (Bolwig et al., 2010). Value chain development provides an opportunity to support sustainable trade (Meaton et al., 2021) and can consider environmental and social outcomes (Fearne et al., 2012). Value chain thinking is associated with competitive advantage (Barney, 1991; Dung et al., 2020; Dyer & Singh, 1998; Fearne et al., 2012; Hopkins, 2009) and is relevant for agricultural development interventions

because it facilitates improvement of position, performance, and participation of actors throughout the value chain (Muflikh et al., 2021). Four key aspects of value chain analysis include 1) structures of the value chain; 2) governance (power and relationship between actors in the value chain); 3) leverage points across the value chain; and 4) strategies or interventions for upgrading (Muflikh et al., 2021). Leverage points might be physical (i.e., constraints, parameters, rates; size of stock); informational (i.e., length of delays; structure of information flows); social (i.e., policies; power to add change); or conscious (i.e., mindset and mental models) (Muflikh et al., 2021).

Value chain management involves shared vision, aligned strategies, trust, open communication, continuous improvement, understanding of the customer, and value creation throughout the value chain (Bonney et al., 2007; Fearne et al., 2012). Value chain thinking: 1) adds value and focuses on profitability for all segments and actors in the value chain, 2) understands that distribution is determined by demand rather than capacity utilization, 3) shares information as a form of competitive advantage, and 4) builds collaborative relationships. Foundational to this thinking is a collective focus on resilience and the sharing of resources, risks, and benefits (Fearne et al., 2012).

Value chain analysis is limited in that it does not capture dynamic or complex interactions and linkages between actors and cannot measure the impact of interactions on performance of individuals. These limitations can lead to inconsistencies in the identification of problems, causes, and strategies (Muflikh et al., 2021). Systems dynamics have been proposed to manage the limitations of value chain analysis. Systems thinking is thought to provide a systematic approach by 1) understanding the patterns of the problems over time; 2) understanding the system structure that produces the problems; and 3) evaluating effective

strategies to improve the system structure (Muflikh et al., 2021). This underlying limitation can be fortified with a food systems perspective. By combining a food system perspective with value chain analysis, vertical (e.g., governance, upgrading, and standards) and horizonal (e.g., terms of participation, poverty, vulnerability, risk, and inequality) aspects of value chain can be integrated. Actors include chain actors, external actors, expelled actors, and non-participants and or excluded actors. Types of change might include inclusion of new participants; continued participation following initiatives for change; expulsion of participants; and non-participation (Bolwg et al., 2010).

Meaton et al. (2021) utilized value chain analysis to understand and address barriers to productivity and profitability among Kenyan and Ethiopian beekeepers. This study identified seven potential problem areas among beekeepers: 1) rights, 2) technological development, 3) gender issues, 4) product quality, 5) trade development, 6) product processing, and 7) value added, such as fair-trade certification (Meaton et al., 2021). Based on this information, Meaton et al. (2021) developed upstream and downstream interventions to improve productivity and efficiency. The interventions sought to improve efficiency and access to markets so that beekeepers could do what they do best and focus their time and energy to maximize profits (Meaton et al., 2021). Upstream interventions included government policy to increase forest access, and receptacles for honey collection and storage. Downstream interventions include benign monopolies that provide training and support, infrastructure, organization, quality standards, coordinate meeting demand, sales, and provide income. Farmer-owned enterprises can increase income, power, and agency of beekeepers. Participatory forest management can increase forest access, create market linkages, and may have a multiplier effect (Meaton et al., 2021).

Meaton et al. (2021) note several important things for organizations to consider as they design interventions: 1) Introducing modern hives may not be sustainable. 2) Changes to traditional value-chains may undermine cultural and traditional players, connections, and trust within communities. And 3) no comparative advantage is seen for beekeeping in processing, but they do have an advantage in providing pure, raw honey (Meaton et al., 2021). Other points to consider include the choice between traditional and modern hives. It is important to recognize, respect, and integrate traditional methods, which may be more appropriate and are also capable of generating revenue. Beekeepers can decide which hives they prefer based on financial returns and preference. It may be more important to focus on quality goals such as ensuring that honey is not too smokey; has a low water content, and is fully capped (Meaton et al., 2021). Buyers may consider purchasing honey from the comb instead of asking beekeepers to process it. Payment could be based on price per kilogram and the purchase price could include wax and honey for a fair-trade purchase (Meaton et al., 2021). Organizations might consider incremental changes among risk-averse, resource poor, smallholder agricultural producers to increase adoption among beekeepers. One effective method is to introduce beekeepers with successful entrepreneurs who share similar backgrounds (Dung et al., 2020). Overall, there is a positive relationship between entrepreneurial orientation and strategic alliances which can lead to goal achievement, market position, and performance satisfaction (Dung et al., 2020; Li et al., 2017). The next section describes strategic plans and business models, which can help inform an interventions design. Organizations need to align their interventions with their strategic plans to prevent mission drift and increase buy-in among stakeholders and the organization's leadership.

Strategic Plans and Business Models

A business model is a "statement, a description, a representation, architecture, a conceptual tool or model, a structural template, a method, a framework, a pattern, relation function, and a set of activities that define how profits are made" (Tutuba et al., 2019). Simply, a business plan describes how a firm creates and captures value and does business (Chesbrough, 2007, 2010; Tutuba et al., 2019).

Good business models create value for customers and capture value for participants in the ecosystem. Additionally, an inclusive business model is one which does not leave small-scale farmers behind (Vorley et al., 2009). It is important to understand that partner networks (i.e., the supply chain) contribute to competitive advantage. However, this may be complicated by the urge and tendency of small-scale producers to seek the highest price available rather than accept lower prices from long-term partners. Reciprocal responsibility between suppliers and buyers promotes sustainable relationships that can lead to future stronger negotiating strength. It is tempting in the short term to seek the highest price, but this undercuts producers. To promote inclusive business models, skill development might include market linkages for goods and services, social capital, and management capacity (Vorley et al., 2009). A beekeeping business model needs to consider two factors: quality and volume. The main challenge of beekeeping is including potential partners in a way that improves productivity and reduces costs (Tutuba et al., 2019).

One model delineates how partner networks and core capabilities influence value configuration in cost structure and the value proposition. The value proposition leads to revenue, which is influenced by customer relationships, distribution channels, and customer segments. In this model, cost structure and revenue streams lead to success or failure (Vorley et al., 2009). An

evidence-based business plan includes four steps involving an initial assessment and or SWOT analysis, a literature review, development of a strategic plan, and implementation and monitoring (Brandt et al., 2009).

Predisposing Factors

Predisposing factors are associated with the likelihood that an individual will adopt an activity or behavior. They are intellectual and emotional attributes that include knowledge, attitudes, beliefs, values, and confidence, or self-efficacy (CTB, 2022). Predisposing attributes relate to education that builds capacity and shapes attitudes, values, and beliefs, as well as experience that builds confidence. The literature review revealed several areas that relate to predisposing factors that include capacity building, education, and training.

Capacity Building

Capacity building should be aimed at helping beekeepers build resilience, empowerment, and confidence to solve problems on their own (Lee, 2014). Each region has its own set of specific, diverse, and complex constraints, barriers, and gaps (Schouten, 2020). A SWOT analysis (Novelli et al., 2021) or a needs assessment (Berhe et al., 2016) can provide key insights to understand the local situation. Training should be conducted by experienced, enthusiastic beekeepers; focused on practical applications that align with a region's seasonal beekeeping calendar of activities; address local pest and hive management; and focus on beekeeping as a business (Goshme & Ayele, 2020; Schouten & Lloyd, 2019) – especially if the aim is to generate alternative income.

Education and Training

Education is essential to beekeepers' success (Amulen et al., 2017) and to achieving sustainable agricultural intensification (Elisante et al., 2019). Many training models are inadequate and do not result in increased yields for beekeepers, which prevents beekeepers from achieving the intended purpose of adopting beekeeping for alternative income generation (Wagner et al., 2019). A lack of training has been identified with intervention failure (Amulen et al., 2017) and negatively associated with the likeliness to adopt modern technologies that can improve efficiency and yield (Berhe et al., 2016). For example, Kenyan Top Bar (KTB) and Langstroth hives were provided by an NGO to beekeepers selected from extremely poor backgrounds. Among a few beekeepers, honey revenue contributed seven percent (Amulen et al., 2017) of additional household income. However, overall, it did not contribute to improved well-being for all participants. Two primary barriers to success were identified including training and safety equipment, which were absent from the intervention. Training curricula often include Langstroth hive management, apiary management, and pollination. Some training courses cover bee biology and floral resources to promote bee health. An integrated approach helps beekeepers to understand the needs of bees so that they can promote bee health and productivity in a sustainable manner.

Pollination, Biodiversity, and Pollinator Health. Training that focuses on the relationship between pollination, agricultural yields, and agricultural chemical use has demonstrated effectiveness through pre- and post-training assessments on knowledge, attitudes, and values (Elisante et al., 2019). Biodiversity includes teaching beekeepers to identify and cultivate forage species (Goshme & Ayele, 2020; Singh et al., 2016), promoting indigenous pollinators (Lee, 2014) and bee health. Having pollen and nectar sources available is considered

vital for bee health and annual honey production. Beekeepers need to know local nectar flow periods to be able to provide supplemental feeding sources, such as sugar water. Beekeepers also need to understand pest management to maintain healthy colonies (Berhe et al., 2016; Goshme & Ayele, 2020; Schouten, 2020; Singh et al., 2016).

Training for Different Types of Hive. Many organizations provide Langstroth hives because they are considered by Western audiences to be modern. While Langstroth hives are associated with increased productivity (Schouten, 2020), they require specialized training in hive management to increase adoption and adherence rates (Amulen et al., 2017). Langstroth hives also require local skilled carpenters who can match the specifications of the hive's frames, dimensions, and many parts. Traditional hives are often already understood and accepted by local beekeepers and if encouraged, can be utilized to generate income. Beekeepers may be more accustomed to local hive designs than modern types at first but can choose to transition towards more modern hives if they determine it will help improve efficiency or productivity. Langstroth and KTB hives require training in hive management to maximize their utility. In the absence of training on how to use donated Langstroth hives, one study noted a decline in their adoption and a return to traditional hives in Central Ethiopia (Berhe et al., 2016). Being able to source, replace, and maintain equipment is necessary and should be sourced locally.

Hive, Apiary, and Pest Management. Hive, apiary, and pest management are vital to increasing efficiency, productivity, volume of honey, and income. It is important to remember that "if it does not earn money, it will fail," (Schouten & Lloyd, 2019). Hive and pest management competencies include introductory bee biology, hive-type appropriate management skills, the division of labor among bees, differentiating brood (bee larvae) from honey; knowing when and how to harvest for quality honey and wax; necessary equipment and safety gear;

processing and hygienic storage. Pest identification, prevention, and management are key to addressing problems early to increase the chances of a healthy colony and increased volume of clean, pure honey. Competencies should be practical and appropriate for local conditions, like hive splitting (Schouten & Lloyd, 2019), or swarm catching.

Business Approach and Capacity. One component to beekeeping is often missing from the curriculum: the business of beekeeping. Business skills help beekeepers increase income by adopting a business approach to apiary management that focuses on profitability, efficiency, and allows beekeepers to engage in other income generating activities when beekeeping is not the sole revenue source. Business training is important for income generation (Schouten, 2020; Schouten & Lloyd, 2019). To develop value chains and enabling environments, beekeepers need a business approach to beekeeping and if an organization has the capacity, business trainings could be offered to beekeepers and actors within the value chain (i.e., carpenters, processors, value-added producers) (Meaton et al., 2021). If not concerned with creating small, independent enterprises, organizations that promote beekeeping for income generation can promote a business model or goal-oriented approach (Schouten, 2020) for themselves and for the beekeepers. Some useful variables to track and monitor include diminishing return, number of active hives or colonies, frequency of requeening, capital reinvestment, on-farm income, costs, revenue, contract sales schemes, credit, or grant access, profitability, opportunity costs, goal achievement, and efficiency (Ahmad et al., 2017; Goshme & Ayele, 2020; Goto et al., 2019; Hoshide et al., 2018; Lee, 2014; Meaton et al., 2021; Schouten, 2020; Schouten & Lloyd, 2019; Singh et al., 2016).

Setting individualized goals with each beekeeper, tracking those goals, and providing services and training to help beekeepers reach their goals, solve problems on their own, and build confidence increases self-efficacy, adherence, and profitability (Schouten, 2020). Organizations

should be wary of over reliance on number of hives as an indicator of success. Colonies may not be equally healthy or strong in each hive. Some colonies may abscond, and other factors complicate simply counting the number of hives. Instead, volume of honey and profitability are better indicators of success and benchmarks for goal setting (Schouten & Lloyd, 2019).

Enabling Factors

Enabling factors are internal and external elements that promote individual adoption and adherence. Key variables associated with enabling factors include availability of resources, access of services, regulations and policies, and issue-related skills (CTB, 2022). Availability of resources includes floral resources and access to equipment, capital, and training. Services identified in the literature review include extension, mentorship, and ongoing education.

Environmental Conditions and Floral Resources

Knowledge of local floral resources is a foundational concern to beekeepers (Potts et al., 2016; Rahimi et al., 2020; Sahle et al., 2018; Schouten, 2020; Schouten & Lloyd, 2019; Singh et al., 2016). Knowledge of bee nutrition is tied to knowledge of local flower sources and strategies to overcome periods of little or no nectar flow (i.e., the dearth periods) (Schouten & Lloyd, 2019). Themes related to floral resources include regional, seasonal bloom calendars and plant species (Schouten & Lloyd, 2019), a map or general description of where to find certain flowering species.

Access

Access has been described as a barrier to entry and success, and refers to equipment (Amulen et al., 2017; Goto et al., 2019), technology (Schouten & Lloyd, 2019), capital (Amulen et al., 2017; Goshme & Ayele, 2020; Singh et al., 2016), and markets. Access is directly related

to adoption and adherence. Identifying ways to increase access can help reduce the impacts of barriers and constraints and promote productivity for income generation.

Equipment and Technology. Equipment includes suits, gloves, and smokers (Amulen et al., 2017) as well as hives and hive tools. When considering equipment, such as hives, it is important to remember that improvements may not lead to intended outcomes (Schouten & Lloyd, 2019). In several studies, people were given modern hives, but training demands for modern hives and future sources of maintenance or replacement materials were not considered. In the absence of training, beekeepers abandoned Langstroth hives and returned to traditional practices (Berhe et al., 2016). This example demonstrates the importance of understanding the barriers and constraints to accessing materials before an organization promotes the use of equipment and technologies. Similarly, providing incomplete materials can slow adoption and reduce adherence. In another case, an organization supplied recipients with hives without protective equipment. This factor was identified as a primary reason for failure (Amulen et al., 2017). Protective equipment provides safety and security measures that reduce stress, risk of stings, and increase confidence.

Langstroth hives are specific in their design and require more materials than a KTB or other local hive design. The cost to build a Langstroth hive could be greater due to its greater complexity. Unless local carpenters are trained to build Langstroth hives, beekeepers may not be able to afford, source, maintain, or replace additional hives after the initial disbursement. Traditional and local hives can be promoted, but beekeepers should be encouraged to focus on management and harvesting practices that optimize quality for a greater financial return (Meaton et al., 2021).

Capital. Bees can be kept in a diverse array of hive-types (Berhe et al., 2016), which helps make beekeeping accessible. However, access to capital can be a barrier to entry (Schouten, 2020) and is a potential obstacle for beekeepers in low- and middle-income countries. One method to overcome access barriers has been to offer credit. However, organizations seeking to alleviate poverty should be aware of the potential for credit programs to exacerbate poverty. Loan and payment plans should not be onerous, and participants should be engaged in determining the parameters and feasibility of any agreements (Schouten, 2020). As an alternative to credit, Heifer International promotes a "pass on the gift" (Pocol & McDonough, 2015) concept where recipients of hives agree to help others obtain start-up materials once they profit from the program.

Market Access and Development. Access to markets is a common constraint for beekeepers (Goto et al., 2019; Schouten & Lloyd, 2019; Singh et al., 2016). Organizations can develop the market and the enabling environment through quality-focused product development, branding, processing, and packaging (Ahmad et al., 2017). There are also opportunities within the value chain to promote local and sustainable income generation. These include tailors, carpenters, and metallurgists to sew suits, build hives, and forge hive tools (Meaton et al., 2021). For many regions of the world, it is not necessary to import materials and the use of local tradespeople can promote income generation and build up the value chain.

Local hive designs can also promote income generation and productivity. To promote adherence and ownership, beekeepers should choose the system that works best for them (Meaton et al., 2021). Organizations may hold biases for hive-types which need to be overcome to increase adoption and adherence (Meaton et al., 2021; Schouten, 2020). Langstroth hives are often considered superior as modern hives, but can be risk-prone, less preferred, and less

profitable (Schouten, 2020). That is not to say that Langstroth hives are not worth the investment, but it is important to recognize profit earning potential from traditional and local hives, such as the KTB, grass, or log hives. Organizations should promote productivity, engage beekeepers in the decision-making process, and utilize locally available resources. As beekeepers become more profitable, they can make the decision themselves to change hive-type (Meaton et al., 2021).

Ongoing Education, Extension, and Mentorship

In addition to initial education and training, access to sustained and ongoing education helps to promote self-efficacy among beekeepers. Ongoing supports increase beekeepers' chances of persevering through disappointments, new and uncomfortable sensations, such as the hurried buzz of bees around one's head and ears for the first time or an infestation of wax moths. Setbacks are common and ongoing education, site visits, extension, and mentor programs can be effective if targeted at addressing immediate and long-term needs of the beekeepers (Amulen et al., 2017; Berhe et al., 2016; Elisante et al., 2019; Goshme & Ayele, 2020; Lee, 2014; Pocol & McDonough, 2015; Schouten, 2020; Schouten & Lloyd, 2019; Singh et al., 2016). The coordination between research, extension, and farmers is also important. Organizations may have more resources to stay current on best practices and research local trends. If not, partnerships with extension agents or other organizations can help disseminate current knowledge to beekeepers, promote indigenous knowledge, conduct research, and promote product diversification (Goshme & Ayele, 2020).

One study revealed that extension services demonstrated no effect on income and there is no significant relationship between the number of training days or the number of visits by extension agents and household income (Schouten, 2020). This may be due to a lack of focused

technical knowledge and teaching on the part of extension agents. Education and training need to be practical; appropriate to the needs of the beekeepers; local, reliable; involve strong working relationships; develop confidence; and employ reliable sources of information (Schouten, 2020). In contrast to extension agents, mentors can provide direct, field-based support to people in a common region or community, and have demonstrated their effectiveness in building adherence and confidence (Lee, 2014; Schouten & Lloyd, 2019).

Reinforcing Factors

Reinforcing factors include policies, regulations, as well as personal and community-wide attitudes (CTB, 2022). These factors might include taking a value-chain approach to intervention design, implementation, and evaluation. Strategic plans and organizational policies that prioritize profitability to beekeepers in addition to the financial viability of the organization reinforce the enabling environment. Community needs assessments and a focus on long-term relationships builds trust, adherence, and mutual commitments. These factors are all discussed in some fashion in the previous sections. The instrument also includes impacts and outcomes, which also relate to the design phase and indicators to measure impacts and outcomes will need to be developed at the local level in partnership with beekeepers. The instrument will include general impact and outcome measures that relate to income generation and profitability from the literature review.

Conclusion

The literature review provides a scoping review of the benefits of beekeeping to human populations, and a survey of intervention impacts, trends, and global opportunities and constraints. The review culminates in the identification of evidence-based factors that relate to positive beekeeping outcomes based on a review of global beekeeping interventions, studies,

assessments, and reviews. The evidence-based factors are organized to correspond to the resulting instrument, which adapts a PRECEDE-PROCEDE framework to assess an organization's position in relation to the evidence-based factors from the literature review. As one navigates the instrument, the literature review may be a helpful resource for program designers, implementers, and evaluators to increase their awareness of the needs of beekeepers as well as a practical reference to better understand elements of the corresponding organizational assessment tool.

Chapter 3. Methodology

Introduction

The ILE included three aims: 1) Develop an organizational assessment instrument reflecting evidence-based factors for beekeepers to succeed in under-resourced settings. 2) Pretest the instrument among content experts to determine relevance, reliability, and validity. 3) Provide BEECause Gambia (BCG) with a summary of the assessments' results and propose recommendations for the organization to consider in its strategic planning processes.

The instrument was organized to follow the PRECEDE-PROCEED conceptual framework so that it included statements relevant to factors of design, implementation, ecology, impacts, and outcomes. The instrument may be used to measure the initial organizational and environmental conditions; guide intervention design, measure impact, and evaluate processes and outcomes. The instrument was piloted by two subject matter experts to ensure content validity and meaningfulness. After piloting and revising the instrument, the BAIG-A was disseminated to BEECause Gambia, and a report of the results and recommendations, found in the appendices, will be provided to BEECause Gambia for future planning processes.

Aim 1) Develop an organizational assessment instrument reflecting best practices for implementing beekeeping initiatives in under-resourced countries.

To achieve the first aim, a conceptual framework was identified to guide the design and assessment process. A literature review was conducted, and relevant material was summarized into an evidence matrix. A review of organizational assessment instruments was conducted, and evidence-based factors were determined and aligned with the conceptual framework. Statements were drafted and aligned within the framework to represent measurable factors. The organizational assessment methodology was determined. The completion of the first aim was

contingent on the results of the second aim, which pretested the survey statements by content experts.

Purpose

The BAIG-A instrument has multiple purposes. One purpose is to raise awareness among organizations about what it takes to promote beekeeping for income generation. Another purpose is to assess organizational elements such as program design, implementation, ecology, and evaluation in relation to evidence-based factors for beekeepers to succeed in profitable income generation. Still another purpose is to use BAIG-A to develop strategic priorities, goals, and objectives.

The ideal context for the BAIG-A is in less-favored areas where beekeeping represents a viable alternative income generating activity. However, the BAIG-A may be useful in other contexts, as the factors may be applied broadly and are representative of an enabling environment for economic development for small-holder producers. The holistic nature of the instrument provides results that could be useful at any organizational life stage to make program improvements. As a program matures and grows in complexity, capacity, and resources, the baseline assessment will be useful in ongoing monitoring and evaluation processes.

The design of the instrument was guided by PRECEDE-PROCEED, a literature review, and an evidence matrix of factors relevant to income generation, apiculture, program design, implementation, predisposing, enabling, reinforcing, impact, and outcome factors. Rather than a grading tool, the instrument may be used as a diagnostic instrument to inform, design, improve, and evaluate interventions. Among new initiatives, the instrument may inform intervention design. For existing or established projects, it may provide baseline information to determine a project's position in relation to evidence-based factors.

PRECEDE-PROCEED: Conceptual Framework

For reliability, the project utilized the PRECEDE-PROCEDE framework. While beekeeping is not a health behavior, when used as an intervention to promote health outcomes or address social determinants of health, a comprehensive approach to understanding organizational and beekeeper dynamics can elucidate an organization's strengths, weaknesses, and opportunities. To this end, the PRECEDE-PROCEDE frame is relevant for its diverse applications. PRECEDE-PROCEDE is used to diagnose, evaluate, or understand relationships between components (Brownson et al., 2018); assess an organization, plan an intervention; determine feasibility, fit, or availability of resources; or identify necessary changes for improvement (Issel et al., 2022). In terms of understanding relationships, PRECEDE-PROCEDE clarifies behavioral, social, and contextual influences on an intervention (Brownson et al., 2017).

PRECEDE-PROCEDE consists of two parts broken into eight phases, or activities that inform the model. The first part, PROCEDE, focuses on the design of the intervention and includes four phases that assess 1) social, 2) epidemiological, 3) educational and ecological, and 4) administrative and policy factors. The second component, PROCEED includes four phases which focus on 5) implementation, and evaluation of 6) processes, 7) impacts, and 8) outcomes. Social and epidemiological factors were translated into design and implementation factors that maintained needs assessments and determinants. Administrative and policy factors were blended throughout the instrument. Evaluation factors focused on impact and outcomes and process factors were generalized to allow for a broader application, inclusive of diverse intervention approaches. The instrument is not intended to be prescriptive, but assessed against any intervention aimed at supporting beekeepers to gauge whether it includes evidence-based considerations rather than strict process measures. The PRECEDE-PROCEED framework was

used throughout the aims to build an instrument that reflected the relational context of the holistic factors which were considered pertinent to promoting beekeeping for effective alternative income generation.

Literature Review and Evidence Matrix

The literature review included peer-reviewed journal articles and publications from development agencies working in similar fields. ABI/Inform, a business management database, was the primary source for articles in this field. The search prioritized articles from the year 2000 onwards, and prioritized beekeeping and smallholder, small-producer-focused interventions aimed at economic development, income generation, poverty alleviation, or other related areas. The literature findings were summarized into an evidence matrix and factor variables emerged through a sifting process. The sifting process involved listing individual variables and corroborating them against the broader evidence-matrix to promote relevance and to reduce contradictory variables.

Organizational Assessment Instruments

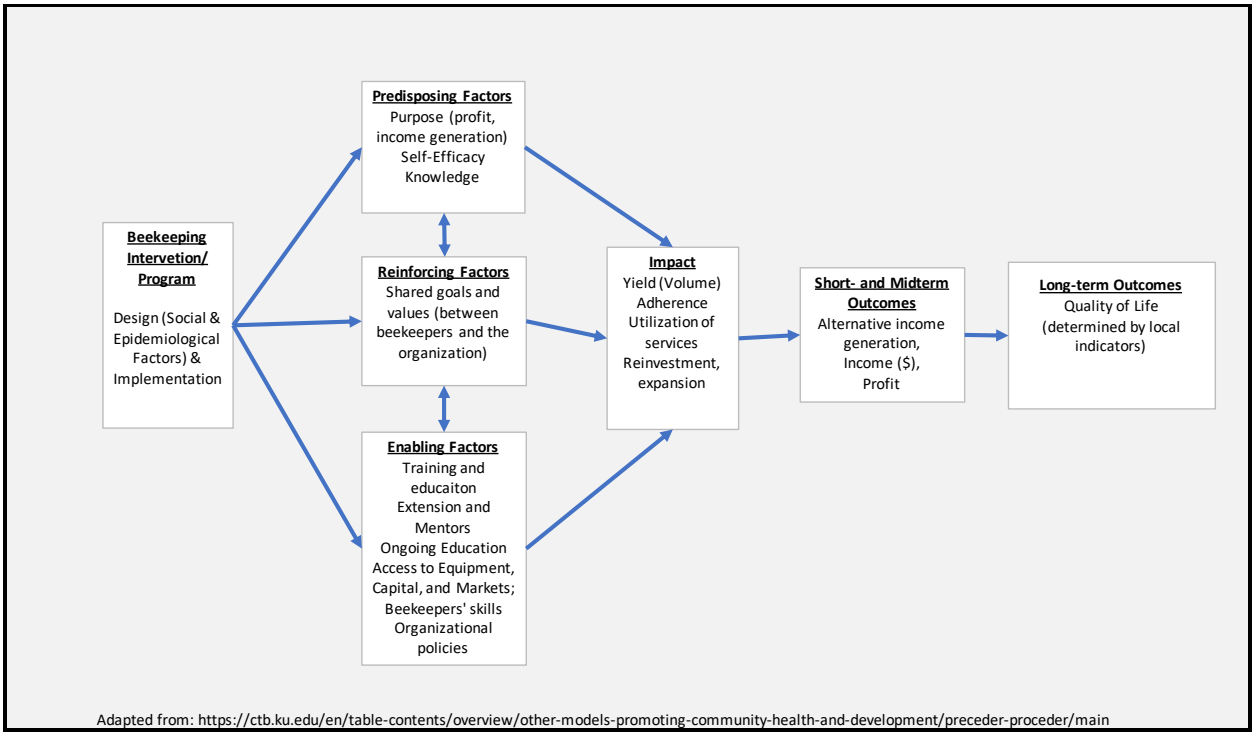
Among organizational assessment instruments, the Organizational Readiness for Change for Directors (TCU ORC-D) (IBR, 2003) instrument, developed by Texas Christian University is one of few organizational assessment instruments considered valid and reliable (Gagnon et al., 2014; Lehman et al., 2002; Simpson, 2002). Its validity and reliability are based on its inclusion of evidence-based factors that relate to readiness. Likewise, the BAIG-A was developed to measure evidence-based factors relevant to income generation among global beekeepers. The TCU-ORC-D has other features that were adapted for the purposes of the ILE such as its five-point Likert scale and its simple format.

Instrument Design and Methodology

The instrument was designed to correspond with PRECEDE-PROCEED and included seven domains: 1) design factors, 2) implementation factors, 3) predisposing factors, 4) enabling factors, 5) reinforcing factors, 6) impact factors, and 7) outcome factors. Figure 1 outlines the relationships between relevant variables that influence income generation and quality of life. A copy of the final survey is available in the appendices.

Figure 1

Guiding Framework: PRECEDE-PROCEED Adapted to Evidence-Based Factors



The instrument development process included all three aims of the ILE. After drafting the instrument, it was pretested among content experts, which is described under the second aim's methodology. The pretest instrument included 47 statements across seven domains and a pre-test specific question to the content experts. After the revision process, the final version included 49

statements and one open-ended response question across seven domains. Participants were asked to reflect on each statement and determine their level of agreement with how well the statements describe their organization, intervention, and beekeepers. They were asked to rank each statement using a five-point Likert scale where 1 = disagree strongly, 2 = disagree, 3 = uncertain, 4 = agree, and 5 = agree strongly. Each statement represented a factor within the conceptual framework and the resulting Likert score for each statement represented the factor score during analysis. The factor scores within each domain were summed and averaged to determine the domain composite score. A SWOT analysis was conducted to determine strengths, weaknesses, opportunities, and threats. Factor and domain composite scores below four (4) represented potential weaknesses, opportunities, and threats. Factor and domain composite scores equal to or greater than 4 represented potential strengths. The SWOT results were listed and analyzed for relationships across the PRECEDE-PROCEED framework to develop recommendations.

To ensure the research project was conducted in an ethical manner, the instrument was submitted with a Form 129 to East Tennessee State University's Institutional Review Board (IRB). On September 21, 2022, the IRB determined that the ILE was not human subjects research and did not fall under the purview of the ETSU IRB. In lieu of a consent form, a letter of support and agreement to participate was provided by BEECause Gambia on September 15, 2022. The survey was voluntarily administered to BEECause Gambia on November 4, 2022, through a PDF file. The organization selected one or more participants to take the survey by hand and the survey statements were submitted for analysis on November 16, 2022, through WhatsApp. The open-ended statement was submitted through an email on November 18, 2022.

The methods demonstrate competence in several areas to address a public health issue as outlined in the DrPH Handbook. Developing the evidence matrix demonstrates competence in

integrating knowledge, approaches, methods, values, and potential contributions from multiple professions and systems (Leadership, Management, & Governance: 6). Development of the BAIG-A will demonstrate competence in designing a quantitative policy and evaluation project (Data & Analysis: 2) that integrates knowledge of cultural values and practices (Policy & Programs: 15), scientific information, ethical frameworks, and potential interests of BEECause's stakeholders (Policy & Programs: 16).

Aim 2) Pretest the instrument among content experts to determine relevance, reliability, and validity of the statements.

To ensure content validity and that survey questions were meaningful, the BAIG-A included a two-part respondent-driven pretest with an initial survey followed by a cognitive interview with two content experts. The content experts were chosen for their depth and breadth of knowledge (Boateng et al., 2018) and expertise in agricultural extension, apicultural entrepreneurship, and beekeeping at hobby and commercial levels. The goal of the survey was to identify problem areas related to definitions and terms, ambiguity, relevance of content, appropriateness or fit (Boateng et al., 2018). The results of the survey were used to develop a cognitive interview protocol designed to further examine how well the statements reflected the content domains being assessed (Boateng et al., 2018). The pretest survey was offered in three formats including: a link on REDCap, an email with a PDF version, or a paper, hard copy. All respondents utilized the REDCap survey. The pretest survey included instructions that described the purpose of the project and how the data would be used. It also included content descriptions and definitions for respondents who were not familiar with PRECEDE-PROCEDE or its terminology.

The survey asked respondents to read and rank each statement in the instrument on a five-point Likert scale from 1, very weakly represents the construct, to 5, very strongly represents the construct. Survey data was coded from 1 to 5 using Excel where 1 corresponded with 'very weakly represents the construct;' 5, 'very strongly represents the construct.' Each statement that scored between 1, very weakly represents the construct' and 3, 'unsure,' (SAGE, 2016) was analyzed for trends between respondents and a protocol was developed that addressed respondent-specific scores.

Cognitive interviews that allowed respondents to verbalize their mental process and provide more detailed feedback (Boateng et al., 2018) were scheduled within one week of completing the survey. The timing of the cognitive interviews allowed respondents to reflect on their responses and on the survey and the cognitive interview included a question protocol of targeted and open-ended questions asking the participant to comment whether the wording accurately reflected the content area and what was missing from the statement or survey (SAGE, 2016). Respondents were invited during the cognitive interview to offer recommendations to clarify or improve the effectiveness of statements. Data from the cognitive interview was analyzed through data reduction (Miller et al., 2014) through which, responses were summarized through detailed summaries in an Excel file; compared across respondents to identify thematic schema; and further analyzed for conclusions (Miller et al., 2014). As the sample size was small, all feedback was taken into consideration and considered against the evidence-matrix and literature review findings. The revision process involved direct edits to survey statement wording, inclusion of new statements, and the elimination of weak, redundant, or otherwise irrelevant statements. Pretesting and revising the BAIG-A demonstrated competence in integrating knowledge, approaches, methods, values, and potential contributions from multiple

professions and systems (Leadership, Management, & Governance: 6); as well as designing a quantitative policy and evaluation project (Data & Analysis: 2).

Aim 3) Provide BEECause Gambia with a Summary of the Assessment's Results and Propose Recommendations for the Organization to Consider in its Strategic Planning Process.

The BAIG-A was voluntarily administered among members of BEECause Gambia's leadership team on November 4, 2022. BEECause's leadership team includes English-speaking members who have a working knowledge of the organization, its mission, resources, activities, and impacts. The organization's board consented to participate in the ILE and stated an interest in considering the results in their future strategic planning activities.

The organizational assessment included a brief introduction of the Integrated Learning Experience's aims, objectives, and key terminology. The organization was informed of the voluntary nature of the assessment, and that the BAIG-A did not collect identifying information that could negatively affect participants. Given the non-human research designation by the IRB on September 21, 2022, BEECause Gambia's letter of support submitted on September 15, 2022, serves in lieu of a consent form. The assessment was available in three formats including REDCap; a PDF version; or a mailed hard copy. BEECause was unable to access REDCap. A PDF version was emailed to the organization on November 4, 2022. The organization submitted the survey responses through WhatsApp on November 16, 2022, and the open-ended response was submitted as an email on November 18, 2022. All data was input into REDCap.

The survey was analyzed using a five-point Likert score for each statement. This scoring method was be adapted from the TCU ORC-D (IBR, 2003), which was rated one of few valid organizational assessment instruments (Gagnon et al., 2014) for its inclusion of evidence-based

factors. Survey domain scores were determined by averaging statement scores within the domain. These scores as well as the individual statement scores of 4.0 or above were considered optimal and used to identify strengths. All scores below 4.0 indicated potential weaknesses, opportunities, and threats.

The assessment results were used to develop recommendations for BCG to consider in the future. The assessment report to the organization summarizes strengths, weaknesses, and opportunities. Strengths were based on composite and overall scores between 4.0 – 5.0. Weaknesses and opportunities were based on scores below 4.0. Recommendations were based on the evidence-based practices discussed in the literature review and framed using PRECEDE-PROCEED.

This survey presented two main challenges. The first challenge was that the leadership team spoke English as a second language and may have required translation services. To mitigate this risk, the survey was limited to 50 statements that were concise and general while addressing specific evidence-based factors. No issues arose that required translation. The second challenge was accessing the survey if internet services were down or interrupted. Surveys were made available in three formats to mitigate this risk including a direct link to REDCap, a PDF version, and mailed hard copy. The PDF version was utilized along with WhatsApp and email due to limited internet access in the Gambia.

Developing recommendations for strategic priorities based on the assessment results demonstrated competence in creating organizational change strategies (Leadership, Management, & Governance: 9) and proposing human, fiscal, and other resources to achieve a strategic goal (Leadership, Management, & Governance: 12). The recommendations, because of their direct relationship with the organizational assessment, represent integrated principles of organizational

theory, behavior, and culture that aim to foster the future use of evidence-based practices, decision-making, and leadership by the organization (HSMP: 5). Finally, the resulting recommendations were based on evidence-based practices identified from a review of global beekeeping interventions and designed to improve organizational effectiveness and resource use (HSMP: 6). Table 2 summarizes the aims, objectives, activities, and competencies for all ILE aims included in the project.

Table 1

ILE Aims, Objectives, Activities, and Competencies

Aim	Objective(s)	Activity	Competency
1	Develop organizational assessment instrument.	1) Literature review 2) Develop evidence matrix. 3) Develop BAIG-A.	• Leadership, Management, & Governance: 6 • Data & Analysis: 2
2	Pretest the instrument and make revisions.	1) Disseminate instrument and collect results. 2) Develop interview protocol and conduct cognitive interviews. 3) Analyze feedback. 4) Revise instrument.	• Data & Analysis: 2
3	Provide a summary of results and recommendations.	1) Disseminate survey to BCG leadership team following IRB protocol. 2) Analyze data and conduct SWOT analysis of survey results. 3) Develop recommendation to BCG.	• Leadership, Management, & Governance: 9, 12 • HSMP: 1,3, 5, 6

Chapter 4. Results

The activities of the integrated learning experience resulted in two products that informed the development of the organizational assessment tool, the Beekeeping for Alternative Income Generation Assessment (BAIG-A). These products included the organizational assessment tool and a report of the findings and recommendations to the organization. The aims of the ILE provided the methodology for survey development based on a literature review and the creation of an evidence matrix which aided in the identification of design, implementation, predisposing, enabling, reinforcing, impact, and outcome factors. Pretesting the survey identified problems with the survey and led to final adjustments before the instrument was administered to BEECause Gambia. Finally, the results of the survey were analyzed through the lens of a SWOT analysis to provide actionable recommendations for the organization to consider in its strategic planning processes.

Aim 1) Develop an organizational assessment instrument reflecting best practices for implementing beekeeping initiatives in under-resourced countries.

The development of the BAIG-A organizational assessment tool included two phases. In the initial phase, a draft of the instrument was developed based on the literature review distilled into an evidence matrix coupled with PRECEDE-PROCEED as the conceptual framework for the project. PRECEDE-PROCEED was chosen for its inclusion of organizational, environmental, impact, and outcome factors. The findings of the literature review are discussed in detail in Chapter 2. Briefly, the initial draft was organized into social and epidemiological, ecological, impact, and outcome domains. The social and ecological domain covered design and implementation factors. Social factors were defined as those variables related to social problems and needs of the population and the goals and priorities which the organization sets to address

those factors. Epidemiological factors incorporated relevant health determinants associated with the social problem and the organization's priorities and goals through an intervention (RHIHUB, 2022). Design variables included needs assessment, identification of local constraints, designs that understand and target predisposing, enabling, and reinforcing factors, business training, and sourcing local materials. Implementation variables included planning, monitoring, budgeting, human resources, financial resources, partnerships, and the capacity to collect data. The ecological assessment domain included predisposing, enabling, and reinforcing factors relevant to beekeepers. These assumed that the organization has a working knowledge of its beekeepers based on needs assessments or regular contact with their beneficiaries. Predisposing variables included perceived motivation of beekeepers, access to training, goal-setting behaviors, and efficacy to manage hives. Enabling variables included nectar and floral resources, strategies to survive dearth periods, skills to maintain equipment, and access to equipment, capital, markets, extension services, mentors, and ongoing education. Reinforcing variables included organizational attitudes such as value-chain approach to design and implementation, long-term commitment to the success of the beekeepers, selection criterion, and adaptation to local context. Impact variables included profiting from beekeeping, quality products, meeting seasonal goals, adherence beyond the first year, utilization of organizational services, market participation, competitive price structures, and adoption of entrepreneurship. Outcome variables included evident improvements to beekeeper's quality of life.

The second phase of the instrument's development was achieved through the second aim of the ILE. Pretesting among content experts resulted in the identification of problems to the survey. Confusing wording was a primary issue which was resolved, and the content experts identified practical nuances that improved the survey. The results of the pretest are described in

detail in the next section. The final, revised version is included in the appendices. Briefly, the final version maintained the original domains but clearly demarcated social and epidemiological factors into intervention design and implementation factors. The variables from the initial draft remained for all sections, but the following additions were made. To intervention variables, organizational expertise on beekeeping was added. To the ecological assessment, instead of capacity for equipment maintenance, beekeeper willingness to use available resources and management techniques was added. Enabling factors were reworded to be more concise and some were combined to avoid redundancy. Reinforcing factors remained largely unchanged except selection criterion was clarified to include likeliness for adherence, resilience, and motivation to avoid ineffective criterion development. Impact variables remained intact with a minor change to the wording on goal attainment. Instead of meeting seasonal goals, making progress towards goals was recommended as more appropriate to beekeepers who experience several constraints beyond their control. Finally, the outcome variable was expanded to include an open-ended question for the organization to describe how the quality of life has been improved to allow for diverse, culturally, and regionally appropriate indicators to emerge relevant to the organization's context. According to the content experts, the final version is lengthy, but appropriate given the multiple factors associated with successful outcomes for beekeepers in low-income and low-resource settings.

Aim 2) Pretest the instrument among content experts to determine relevance, reliability, and validity of the statements.

Pretesting included a survey and cognitive interviews of two content experts. The content experts were experienced beekeepers or knowledgeable on the subject; worked in a professional capacity in agricultural extension; and were Master Beekeepers in The Commonwealth of Virginia.

Survey Results

The survey responses indicated that overall, the variables represented a holistic set of components relevant to beekeeping, organizational design, and implementation factors, as well as environmental factors, impact, and outcome variables. The composite score for design factors was 4.6; implementation factors, 4.8; predisposing factors, 4.4; enabling factors, 4.6; reinforcing factors, 4.1; impact factors, 4.4; and outcome factors, 4.0. Table 3 provides the respondents' scores of each statement among the design factors.

Table 2

Pretest Survey Results: Design Factors

Design Factors	**ID 4 Value**	**ID 6 Value**
The organization conducts regular needs assessments of the beekeepers.	5.0	5.0
The organization has identified constraints among local beekeepers that it wants to address through an intervention.	5.0	3.0
Interventions are designed to support the predisposing, reinforcing, and enabling factors that relate to successful outcomes for beekeepers.	5.0	4.0
Interventions include business and or goal-setting training in addition to beekeeping training.	5.0	4.0

The organization can source all or most of the materials to implement the intervention in the host country or region.	5.0	5.0
Composite Score	5.0	4.2
Average Composite Score	**4.6**	

Respondent ID 4 agreed strongly with all design factor statements reflected in scores of 5 for each statement and a composite score of 5. Respondent ID 6 was uncertain with the statement, "the organization has identified constraints among local beekeepers that it wants to address through an intervention." Overall, they agreed with the other statements and the composite score was a 4.2. The average composite score for this section was 4.6. Table 4 provides the respondents' scores of each statement among the implementation factors.

Table 3

Pretest Survey Results: Implementation Factors

Implementation Factors	**ID 4 Value**	**ID 6 Value**
The organization plans an intervention before implementation.	5.0	5.0
Interventions are monitored throughout implementation.	5.0	5.0
Budgets are developed to estimate the cost of an intervention before implementation.	5.0	5.0
Budgets are monitored throughout the implementation process.	5.0	5.0
The organization has access to available human resources to implement the desired intervention.	5.0	5.0

The organization has the financial resources to implement the intervention.	5.0	5.0
The organization has strategies to secure financial funds for interventions.	5.0	4.0
The organization utilizes partnerships, when feasible, to fill gaps that the organization cannot meet.	5.0	3.0
The organization collects data about its interventions.	5.0	4.0
The organization has the capacity (human and or financial) to collect data about its interventions.	5.0	5.0
Composite Score	5.0	4.6
Average Composite Score	**4.8**	

Again, respondent ID 4 agreed strongly with all implementation factor statements reflected in scores of 5 for each statement and a composite score of 5. Respondent ID 6 was uncertain with the statement, "the organization utilizes partnerships, when feasible, to fill gaps that the organization cannot meet." Overall, they agreed with the other statements and the composite score was a 4.6. The average composite score for this section was 4.8. Table 5 provides the respondents' scores of each statement among the predisposing factors.

Table 4

Pretest Survey Results: Predisposing Factors

Predisposing Factors	**ID 4 Value**	**ID 6 Value**
Most of the beekeepers the organization serves are motivated to earn a profit from beekeeping.	5.0	5.0
Beekeepers have access to training opportunities to help them get started.	5.0	5.0

Beekeepers are able to problem-solve and address issues that arise in their apiaries.	3.0	5.0
Beekeepers set regular production goals each season.	4.0	4.0
Beekeepers can efficiently manage their hives and apiaries to increase honey production (including pest management).	3.0	5.0
Composite Score	4.0	4.8
Average Composite Score	**4.4**	

Overall, respondent ID 4 agreed with the predisposing factor statements, but expressed uncertainty in two statements: "beekeepers are able to problem-solve and address issues that arise in their apiaries," and "beekeepers can efficiently manage their hives to increase honey production (including pest management)." This resulted in a composite score of 4.0. Respondent ID 6 agreed or agreed strongly with most of the statements in this section and the composite score was a 4.8. The average composite score for this section was 4.4. Table 6 provides the respondents' scores of each statement among enabling factors.

Table 5

Pretest Survey Results: Enabling Factors

Enabling Factors	**ID 4 Value**	**ID 6 Value**
There are sufficient nectar and floral resources to meet the needs of honeybees in the region.	5.0	5.0
Beekeepers have strategies to overcome dearth periods when nectar flows are low or non-existent.	5.0	5.0
Beekeepers have access to equipment they need to meet their beekeeping goals (i.e., hives, tools, safety equipment, smokers, etc.).	5.0	5.0

Beekeepers can maintain their equipment after the initial intervention.	5.0	5.0
Beekeepers have access to capital through savings, micro-finance, pay-it-forward commitments, or other arrangements.	5.0	4.0
Credit schemes for beekeepers are not burdensome.	5.0	3.0
Credit schemes have been effective in helping beekeepers reach their project or financial goals.	5.0	3.0
Beekeepers have access to markets for their honey, wax, and other bee or hive products.	5.0	5.0
Extension services are available to beekeepers.	5.0	3.0
Extension agents are knowledgeable about beekeeping.	5.0	3.0
Extension agents are reliable, dependable.	5.0	3.0
Beekeepers utilize mentors.	5.0	5.0
Beekeepers have access to ongoing educational opportunities after the initial intervention covering relevant topics.	5.0	5.0
The organization has the resources or can leverage partnerships to provide ongoing educational opportunities for beekeepers.	5.0	5.0
Composite Score	5.0	4.2
Average Composite Score	**4.6**	

Respondent ID 4 agreed strongly with all enabling factor statements reflected in scores of 5 for each statement and a composite score of 5. Respondent ID 6 was uncertain about five of the statements in this section: 1) “Credit schemes for beekeepers are not burdensome.” 2) “Credit schemes have been effective in helping beekeepers reach their project or financial goals.” 3) “Extension services are available to beekeepers.” 4) “Extension agents are knowledgeable about

beekeeping." And 5) "Extension agents are reliable and dependent." Overall, they agreed with the relevance of the statements to the content of this section and the composite score was a 4.2. The average composite score for this section was 4.6. Table 7 provides the respondents' scores of each statement among the reinforcing factors.

Table 6

Pretest Survey Results: Reinforcing Factors

Reinforcing Factors	**ID 4 Value**	**ID 6 Value**
The organization actively involves other players (also known as actors or members) from the value chain in its programming to promote an enabling environment.	5.0	3.0
The organization is committed to the long-term success of local beekeepers through its own resources or by leveraging partnerships, local resources, or by other means.	5.0	4.0
The organization uses a selection criterion.	5.0	3.0
Interventions are adapted to the local context.	5.0	3.0
Composite Score	5.0	3.3
Average Composite Score	**4.1**	

Respondent ID 4 agreed strongly with all reinforcing factor statements reflected in the composite score, 5. Respondent ID 6 was uncertain about three statements: 1) "The organization actively involves other players (also known as actors or members) from the value chain it its programming to promote an enabling environment." 2) "The organization uses a selection criterion." And 3) "Interventions are adapted to the local context." Overall, respondent ID 6 was uncertain about the content within this section reflected by a composite score of 3.3. The average

composite score for this section was 4.1. Table 8 provides the respondents' scores of each statement among the impact factors.

Table 7

Pretest Survey Results: Impact Factors

Impact Factors	**ID 4 Value**	**ID 6 Value**
Beekeepers profit from beekeeping.	5.0	5.0
Beekeepers produce high quality products for sell.	3.0	5.0
Beekeepers meet their seasonal (production or financial) goals.	5.0	3.0
Beekeepers continue to keep bees longer than 1-year after the intervention.	5.0	5.0
Beekeepers utilize the organization's services longer than 1-year after the intervention.	5.0	3.0
Most of the organization's trained beekeepers sell their goods (for example: honey, wax, and or value-added products).	1.0	5.0
The organization offers a competitive price to its trained beekeepers for their products.	5.0	5.0
Most of the organization's beekeepers take a business approach to beekeeping.	5.0	5.0
Composite Score	4.3	4.5
Average Composite Score	**4.4**	

Overall, respondent ID 4 agreed with the impact statements reflected in a composite score of 4.3. They were uncertain about the statement "Beekeepers produce high-quality products for sell," and strongly disagreed that, "Most of the organization's trained beekeepers sell their goods

(for example: honey, wax, or value-added products)" represents the construct. Respondent ID 6 was uncertain about, "Beekeepers meet their (production or financial) seasonal goals," and "Beekeepers utilize the organization's services longer than 1-year after the intervention." Overall, respondent ID 6 agreed with the other statements and the composite score was a 4.5. The average composite score for this section was 4.4. Table 9 provides the respondents' scores of each statement among the outcome factors.

Table 8

Pretest Survey Results: Outcome Factors

Outcome Factors	**ID 4 Value**	**ID 6 Value**
It is evident that beekeepers have been able to improve their quality of life through beekeeping.	3.0	5.0
Composite Score	3.0	5.0
Average Composite Score	**4.0**	

Respondent ID 4 was uncertain about the outcome statement, "It is evident that beekeepers have been able to improve their quality of life through beekeeping." Overall, given that there was only one (1) variable in this section, respondent ID 4's composite score was 3. Respondent ID 6 strongly agreed with the statement resulting in composite score of 5. The average composite score for the section was 4. Table 10 includes respondent ID 4's reactions to the survey.

Table 9

Pretest Survey Results: Reaction

What are your initial thoughts or reactions to this survey?
The only concern I had was whether the organization was aware enough to know what they didn't know. They might consider themselves knowledgeable when they were in fact deficient.

Respondent ID 4 was the only respondent to answer the open-ended question. The concern expressed in their response reflected uncertainty of whether the organization truly knew their weaknesses and deficiencies without being blinded by false confidence.

Cognitive Interview Protocol

The survey results informed the development of the cognitive interview protocol. The protocol included standard elements for both respondents as well as specific questions based on the unique responses provided by each respondent. Table 11 includes the protocol questions. The complete protocol is included in the appendices.

Table 10

Interview Protocol Questions

Respondent-specific questions (for all survey statements with a score of 3 or below):
-You responded that you are unsure about this statement. What are you unsure about regarding this statement? -A4You responded this statement A4very weakly represents the construct. Please explain why this statement very weakly represents the construct.
General Questions

At beginning of cognitive interview:
-Do you have any questions before we begin?

After respondent-specific questions:
-Was there anything unclear about the instructions? Please specify what you found unclear and what information would have been helpful for you to better understand the purpose and intent of the survey or how to take the survey.
-Please describe the intended audience and use of the survey instrument?
-Were there any terms that you found unclear or confusing?
-Were there any statements that you thought were out of place or not in the section that fit best with their content?
-Please comment on the survey's length.

Please comment on the content of the survey:
-Is there anything that you would remove from the survey?
-Is there anything missing from the survey?
-Do you have any other comments or suggestions about the survey to improve it before we administer it to the study organization?

Cognitive Interview Results

The cognitive interviews varied in length based on the number of respondent-specific questions listed in the protocol. Respondent ID 4's interview lasted 45 minutes; ID 6 lasted 90 minutes. The interviews were conducted without external distraction at the office of Respondent ID 4 and at the home of Respondent ID 6. The following narratives detail the revision process from the cognitive interviews including the initial statement, feedback, action(s) taken, and the resulting revised version of statements.

Design Factors. Respondent ID 6 was uncertain about what was meant by constraints in the second statement. After listening to ID 6's feedback and recommendation, the word feasible was added to the statement to further clarify the statement and focus on constraints within the organization's control.

Statement 2. Initial Statement: The organization has identified constraints among local beekeepers that it wants to address through an intervention.

ID 6 Feedback: "Constraints." Didn't know what constraints referred to. Examples, disease or amount of food or environmental conditions may be out of the control of the beekeeper. Identifying constraints is one thing and addressing them is another. I'm not sure how you could address natural issues. Recommendation: Focus on the factors within the organization's control (marketing, education, checklists, transportation, linking beekeepers with mentors). It would be situational. Organizations and beekeepers have little control over the natural environment.

Action Taken: Added the word feasible.

Revised Version: The organization has identified feasible constraints among local beekeepers that it wants to address through an intervention.

Implementation Factors. Among the implementation factors, respondent ID 6 expressed confusion around the term organization. Based on this feedback a definition of organization was added to the instructions for clarification.

Statement 13. Initial statement: The organization utilizes partnerships, when feasible, to fill gaps that the organization cannot meet.

ID 6 feedback: [I was asked to explain the intent behind the statement. Once explained, the respondent agreed that the statement makes sense and had no change to recommend.] "The organization" was confusing. [May include a definition about the organization in the instructions].

Action taken: Defined "the organization" in the instructions.

Revised version: For the purposes of the survey, "the organization" refers to any organization, NGO, extension office, or other agency seeking to provide services to beekeepers

that promote an enabling environment and builds long-term relationships with small-holder producers.

Predisposing Factors. Respondent ID 4's comments on predisposing factors focused on the efficacy of approaches to problem-solving within an apiary and the potential influence of other variables that may affect apiary management and production. Both recommendations emphasized the willingness on behalf of the beekeepers to try new technologies and apiary management methods.

Statement 18. Initial wording: Beekeepers can problem-solve and address issues that arise in their apiaries.

ID 4 feedback: People often try to solve problems without efficacy. The problem with the question is that while it demonstrates proactive behavior, it does not mean their actions are effective. This may not be a sufficient indicator. Are they trying to be adaptive or are they simply trying the same methods? Recommendation: Add: Are beekeepers open to new methods or tactics? Are beekeepers willing to problem solve to address problems with available tools, information, and resources.

Action taken: Deleted the previous statement and revised to reflect the recommendation.

Revised version: Beekeepers are willing to use available tools, information, and resources to effectively problem solve issues that arise in their apiaries and projects.

Statement 20. Initial statement: Beekeepers can efficiently manage their hives and apiaries to increase honey production (including pest management).

ID 4 feedback: This statement makes a declarative judgement that they already focus on honey production. There are a lot of variables and assumptions in this statement.

Recommendation: Consider adding a question about the willingness. Are they open to changing management if it results in higher yields, profits, etc.? Are they willing to try?

Action taken: Revised to reflect the recommendation.

Revised version: Beekeepers are willing to try new management techniques if it results in higher yields or profits.

Enabling Factors. Respondent ID 6 was uncertain about five statements aimed at measuring enabling factors. Statements 27 and 28 focus on aspects of credit and the respondent's uncertainty focused on their perspectives on the nature of credit and doubts on its efficacy. They expressed confusion on non-burdensome debt, and that all debt could be considered a burden. During the conversation, terms such as micro-finance or micro-loans resonated more with the respondent and the respondent suggested that these terms be emphasized in the statement for clarity as these tend to be more nuanced and designed for people living in poverty or lower-income settings. The respondent commented that mentors can help beekeepers identify more cost-effective methods and tools in apiary management based on experience.

Statements 29 – 31 focus on extension, its availability, and its reliability. Respondent ID 6 commented that here, mentors are usually more important than extension agents for beekeepers. However, they agreed that extension agents could be impactful if they were knowledgeable, available, and reliable, and recommended that these three (3) statements be combined into one (1) statement.

Statement 26. Initial statement: Credit schemes for beekeepers are not burdensome.

ID 6 feedback: "How can credit not be burdensome?" Add "microfinance and, or microloan" to the statement for clarification. [At this point, the respondent spoke on the importance of mentors to help reduce cost and expenses to help beekeepers understand cost-

effective ways and effective management techniques. ID6 also mentioned other factors that may affect success for beekeepers such as government policies or practices such as spraying DDT to kill mosquitos, which could inadvertently kill bees].

Action taken: Added "microfinance or microloans."

Revised version: Credit schemes, including microfinance or microloans, for beekeepers are not burdensome.

Statement 27. Respondent ID 6 was uncertain about five statements aimed at measuring enabling factors. Statements 27 and 28 focus on aspects of credit and the respondent's uncertainty focused on their perspectives on the nature of credit and doubts on its efficacy. They expressed confusion on non-burdensome debt, and that all debt could be considered a burden. During the conversation, terms such as micro-finance or micro-loans resonated more with the respondent and the respondent suggested that these terms be emphasized in the statement for clarity as these tend to be more nuanced and designed for people living in poverty or lower-income settings. The respondent commented that mentors can help beekeepers identify more cost-effective methods and tools in apiary management based on experience.

Statements 29 – 31 focus on extension, its availability, and its reliability. Respondent ID 6 commented that here, mentors are usually more important than extension agents for beekeepers. However, they agreed that extension agents could be impactful if they were knowledgeable, available, and reliable, and recommended that these three (3) statements be combined into one (1) statement.

Initial statement: Credit schemes have been effective in helping beekeepers reach their project or financial goals.

ID 6 feedback: Same as 26. Not sure that credit schemes are effective. Recommendation: May consider rewording to: "the use of credit has helped…" instead. This helps to determine if the current credit scheme has been effective.

Action taken: Changed wording to reflect the recommendation.

Revised version: The use of credit schemes, such as microfinance or microloans, have helped beekeepers reach their project or financial goals.

Statements 29, 30, and 31. Initial statement 29: Extension services are available to beekeepers.

Initial statement 30: Extension agents are knowledgeable about beekeeping.

Initial statement 31: Extension agents are reliable, dependable.

ID 6 feedback: [The respondent paused and reflected on this and again mentioned that mentors are more important than extension agents]. If extension agents are involved in training and pest management, then yes extension can be useful. Recommendation: Combine 29, 30, and 31 to: "Knowledgeable and reliable extension agents are available to beekeepers."

Action taken: Combined 29, 30, and 31, and changed the wording to reflect the recommendation.

Revised version: Knowledgeable and reliable extension agents are available to beekeepers.

Reinforcing Factors. Two statements among the reinforcing factors elicited recommendations for change. Statement 35 focused on the value chain. The respondent was confused by the wording recommended changes that reduced the wordiness to clarify the statement. Statement 37 elicited a different response. The respondent commented that inclusion criteria could potentially be a useless measure which could be too stringent or arbitrarily

exclusive. They recommended removing the statement. However, based on the findings of the literature review, the statement was retained and emphasizes developing a flexible inclusion criterion based on the likeliness for adherence, resilience, and motivation towards profits. Statement 38 was marked as uncertain, during the survey, but upon re-reading the statement during the cognitive interview, respondent ID 6 noted that they did not know why they marked the statement as they did and that they recommended no change.

Statement 35. Initial statement: The organization actively involves other players (also known as actors or members) from the value chain in its programming to promote an enabling environment.

ID 6 feedback: "I didn't understand that at all from the statement." [I explained what the literature says about promoting a value chain. The respondent stated that they were reading "value added" rather than value chain. This changed their perspective towards the statement, and they stated that they thought value chain development was important]. Recommendation: Change to: "the organization includes value chain players in its program to promote an enabling environment." [The current statement is wordy and could be simplified].

Action taken: Simplified the sentence and adopted the recommended version.

Revised version: The organization actively includes value chain players in its program to promote an enabling environment.

Statement 37. Initial statement: The organization uses a selection criterion.

ID 6 feedback: Need to know more about the population. Selection criteria could be too stringent. Recommendation: Consider removing the question.

Action taken: Determined the importance of a selection criteria. From the evidence matrix, "participant selection, such as a sifting process, which selects members over time based

on resilience, adherence, and motivation towards profits (Lee, 2014; Schouten & Lloyd, 2019) can help identify serious, persistent beekeepers."

Revised version: The organization has a participant selection criterion that considers factors such as likeliness for adherence, resilience, and motivation towards profits.

Statement 38. Initial statement: Interventions are adapted to the local context.

ID 6 feedback: After re-reading and or hearing the statement, respondent ID 6 stated that they agree with the statement and recommend no change.

Action taken: Made no change.

Impact Factors. Both respondents commented on impact factors. Their comments resulted in a complete replacement of statement 40, rewording to 41 and 44, and no change to 43. The expert panel provided key insights into the need for organizations to possess quality standards that are disseminated to producers. ID 6 provided key insight into goal setting that is appropriate for beekeepers who face multiple challenges in each season. Instead, progress towards goals rather than goal attainment may be a more appropriate measure of impacts. Finally, ID 4 provided insight into different modes of economic value capture. Instead of only viewing bee products as potential sources of cash through sales, having bee products on-hand may eliminate the need for cash to purchase bee or honey products and free-up household income for medicine, food, or other expenses providing a different form of value capture. The cognitive interviews provided potentially valuable insights into the need for careful wording to encompass the complex nature of impact related factors.

Statement 40. Initial statement: Beekeepers produce high quality products for sale.

ID 4 feedback: This statement is highly subjective. For example, does the NGO have any knowledge about quality standards? Recommendation: Remove question 40 and replace it with

"Does the organization understand product quality standards, or do they work with a partner that does?"

Action taken: Removed question 40 and replaced it with the recommended version.

Revised version: The organization understands quality standards, or they work with a partner that does.

Statement 41. Initial statement: Beekeepers meet their seasonal (production or financial) goals.

ID 6 feedback: Some things are out of the control of the beekeeper. This statement may be shortsighted. Beekeepers may not meet their goals one year due to droughts or pests, but they may be successful the next year. It is more difficult to predict success over one year than to consider a longer period. The goal of the first year should be to build up the hive and survive the dearth period or the rainy season. Recommendation: Consider changing to: Beekeepers make progress towards their goals instead of beekeepers reach their goals. Consider combining with 42: beekeepers got their bees through the first season.

Action taken: Reworded the statement to focus on making progress towards goals as recommended.

Revised version: Beekeepers make progress towards their goals.

Statement 43. Initial statement: Beekeepers utilize the organization's services longer than 1-year after the intervention.

ID 6 feedback: [I explained that the purpose of this statement was to build a long-term relationship with beekeepers and to consider an enabling environment.]

The respondent agrees with the statement and recommends no change to its wording.

Action taken: After considering whether this statement was redundant or if it needed to be reworded, no change was made.

Statement 44. Initial statement: Most of the organization's trained beekeepers sell their goods (for example: honey, wax, and or value-added products).

ID 4 feedback: Even if they are not selling the product, but still using it, this is still an improvement. In farming communities, even in the U.S., bartering is still used and there is still economic value, in a different capture. With honey on hand, the household may reduce spending on sugar, which frees up money for other purposes. Recommendation: Add, “do they utilize the products themselves or barter with their goods?” to the wording.

Action taken: Revised the statement to reflect the recommendation.

Revised version: Beekeepers benefit from their bee or hive products through sales, bartering, or household consumption.

Outcome Factors. Again, the cognitive interviews provided feedback to improve the survey. Respondent ID 4 found two problematic areas among the outcome factors. Primarily, without universal indicators, statement 47 was seen as highly subjective and recommended the addition of a new statement that would elicit an open-ended response and allow respondents to describe the outcomes of their organization’s intervention. This would increase the universal application of the survey and allow organizations to determine local indicators which are relevant to their context. Statement 48 was designed for the cognitive interview respondents and not intended to remain in the final version of the organizational assessment. It elicited an addition to the survey that addressed a potential gap in organizational expertise in beekeeping.

Statement 47. Initial statement: It is evident that beekeepers have been able to improve their quality of life through beekeeping.

ID 4 feedback: This statement is highly subjective. Recommendation: Don't throw it out necessarily. It needs a specific parameter. Suggestion: Add a quantitative variable. Define quality of life. Maybe add a comment box asking the participant to "describe how the project improves the quality of life of its beekeepers." This will give you the "so what."

Action taken: Kept the statement and added a comment box. Adopted the recommended version and added a definition of the quality of life to the survey.

Revised version: Please describe how the project improves the quality of life of its beekeepers.

Statement 48. Initial statement: What are your initial thoughts or reactions to this survey?

ID 4 feedback: Product quality is an example. If they don't understand what the market demands in terms of quality, how can they properly access this? Extension is another example that is highly subjective that would vary by resources and region. Recommendation: Add: Is your organization an expert in beekeeping and if not, do you work with partners who do?

Action taken: Added a statement to the survey.

Revised version: The organization has institutional expertise in beekeeping. If not, the organization works with partners that have expertise on beekeeping.

Aim 3) Provide BEECause Gambia with a Summary of the Assessment's Results and Provide Recommendations for the Organization to Consider in its Strategic Planning Processes.

The organizational assessment was disseminated to BEECause Gambia on November 4, 2022. The completed survey was submitted by the organization on November 18, 2022. BEECause's overall assessment score was 4.1. Based on this score, the organization would agree

that its design, implementation, predisposing, enabling, impact, and outcome factors contribute to alternative income generation among beekeepers in The Gambia. Table 12 provides a scorecard of BEECause's assessment results. The scorecard indicates two areas that need to be addressed: enabling and reinforcing factors. While the composite scores for these sections are below 4, each of these components will be explored to identify strengths, weaknesses, opportunities, and threats.

Table 11

BEECause Gambia's Organizational Assessment Results Summary

BEECause Gambia Organizational Assessment Results	
Factor	**Composite**
Design	4.1
Implementation	4.1
Predisposing	4.2
Enabling	3.1
Reinforcing	3.8
Impact	4.2
Outcome	5.0
Overall Assessment Score	**4.1**

Design Factors

Table 12

Assessment Results: BEECause's Design Factors

Design Factors	
Statement	**Component Value**
The organization has institutional expertise in beekeeping. If not, the organization works with partner(s) that have expertise in beekeeping.	4.0
The organization conducts regular needs assessments of the beekeepers.	4.0

The organization has identified feasible constraints, obstacles, or barriers among local beekeepers that it wants to address through an intervention.	5.0
Interventions are designed to support the predisposing, reinforcing, and enabling factors that relate to successful outcomes for beekeepers.	3.0
Interventions include business and or goal-setting training in addition to beekeeping training.	5.0
The organization can source all or most of the materials to implement the intervention in the host country or region.	4.0
The organization plans an intervention before implementation.	3.0
Budgets are developed to estimate the cost of an intervention before implementation.	5.0
Composite Score	**4.1**

Overall, BEECause's design factors represent strengths in promoting beekeepers for alternative income generation. The organization perceives itself as having the institutional expertise to promote local beekeepers. Interventions are informed by regular needs assessments, identification of barriers and constraints, and attempts are made to address problem areas. Interventions include business or goal-setting training and are adapted to local context. These are strengths that ensure the organization understands the needs of its beekeepers and that its interventions are designed to promote the holistic needs of beekeepers. However, the organization expressed that it is uncertain about predisposing, reinforcing, and enabling factors. It also expressed uncertainty about planning interventions before implementation. The recommendation will include a description of these factors and their relationship to positive outcomes for beekeepers.

Implementation Factors

Table 13

Assessment Results: BEECause's Implementation Factors

Implementation Factors	
Statement	**Component Value**
Interventions are monitored throughout implementation.	5.0
Budgets are monitored throughout the implementation process.	5.0
The organization has access to available human resources to implement the intervention.	5.0
The organization has the financial resources to implement the intervention.	3.0
The organization has strategies to secure financial funds for interventions.	4.0
The organization utilizes partnerships, when feasible, to fill gaps that the organization cannot meet.	4.0
The organization collects data about its interventions.	3.0
The organization has the capacity (human and or financial) to collect data about its interventions.	4.0
The organization conducts regular evaluations (for example: financial, program, process, impact, and outcome evaluations).	4.0
Composite Score	**4.1**

Implementation factors represent strengths for the organization and for the beekeepers it serves. BEECause develops and monitors budgets to guide interventions; has human resources to implement its programs; and it monitors the implementation of its interventions. Further, BEECause has financial strategies to secure funds; utilizes partnerships to fill gaps; has the capacity to collect data; and conducts regular evaluations. Despite these strengths, the organization reported that it is uncertain about the availability of financial resources and data collection.

Predisposing Factors

Table 14

Assessment Results: BEECause's Predisposing Factors

Predisposing Factors	
Statement	**Component Value**
Most of the beekeepers the organization serves are motivated to earn a profit from beekeeping.	5.0
Beekeepers have access to training opportunities to help them get started.	4.0
Beekeepers are willing to use available tools, information, and resources to effectively problem-solve and address issues that arise in their apiaries.	4.0
Beekeepers set goals each season (for example: improving hive health, production, sales, pest management, quality, etc.).	4.0
Beekeepers are willing to try new management techniques if it results in higher yields or profits.	3.0
Beekeepers are open to trying new methods.	5.0
Composite Score	**4.2**

BEECause's predisposing factors represent strengths that include the motivation of participants to earn a profit and set seasonal goals; the availability of training opportunities; and an openness and willingness to use available tools to effectively problem-solve issues that arise and to try new methods. However, BCG reported that it is uncertain on beekeepers' willingness to try new management techniques to increase yields.

Enabling Factors

Table 15

Assessment Results: BEECause's Enabling Factors

Enabling Factors	
Statement	**Component Value**
There are sufficient nectar and floral resources to meet the needs of honeybees in the region.	4.0
Beekeepers have strategies to overcome dearth periods when nectar flows are low or non-existent.	3.0
Beekeepers have access to equipment they need to meet their goals (i.e., hives, tools, safety equipment, smokers, etc.).	3.0
Beekeepers can maintain their equipment after the initial intervention.	4.0
Beekeepers have access to capital through savings, micro-finance, pay-it-forward commitments, or other arrangements.	2.0
Credit schemes, including micro-finance or micro-loans, for beekeepers are not burdensome.	2.0
The use of credit schemes, such as microfinance or micro-loans, have helped beekeepers reach their personal, project, or financial goals.	2.0
Beekeepers have access to markets for their honey, wax, and other bee or hive products.	4.0
Knowledgeable and reliable extension agents are available to beekeepers.	3.0
Beekeepers utilize mentors.	4.0
Beekeepers have access to ongoing educational opportunities after the initial intervention covering relevant topics.	3.0
The organization has the resources or can leverage partnerships to provide ongoing educational opportunities for beekeepers.	3.0
Composite Score	**3.1**

Overall, enabling factors represent potential opportunities, weaknesses, or threats to BEECause's ability to promote alternative income generation. BEECause self-reported that it is uncertain whether beekeepers have strategies to overcome dearth periods; have access to

equipment; that extension agents are knowledgeable, reliable, and available. The organization is also uncertain about continuing education opportunities beyond initial interventions through its own resources or by leveraging partnerships. BEECause reported that it disagrees that beekeepers have access to capital; that credit schemes are not burdensome; or that credit schemes have helped beekeepers reach their goals.

Reinforcing Factors

Table 16

Assessment Results: BEECause's Reinforcing Factors

Reinforcing Factors	
Statement	**Component Value**
The organization actively includes value chain players in its program(s) to promote an enabling environment.	4.0
The organization is committed to the long-term success of local beekeepers through its own resources or by leveraging partnerships, local resources, or by other means.	4.0
The organization has a participant selection criterion that considers factors such as likeliness for adherence, resilience, and motivation towards profits.	5.0
Interventions are adapted to the local context.	4.0
The organization understands quality standards or works with a partner that understands quality standards.	3.0
The organization offers a competitive price to its trained beekeepers for their products.	3.0
The organization has a marketing strategy to help capture value for its beekeepers' bee and hive products.	4.0
Beekeepers utilize the organization's services longer than 1-year after the intervention.	3.0
Composite Score	**3.8**

Reinforcing factors associated with BEECause represent potential opportunities, weaknesses, and threats to promote alternative income generation. Strengths include the organization's inclusion of value chain players; its commitment to long-term relationships with

its beekeepers; utilization of a selection criteria; the adaptation of interventions to local context; and the existence of a marketing strategy to capture value for beekeepers. Despite the several strengths, the overall score of this section indicates that significant weaknesses, opportunities, and threats exist in factors that relate quality standards, offering beekeepers competitive prices, and utilization of services beyond the intervention.

Impact Factors

Table 17

Assessment Results: BEECause's Impact Factors

Impact Factors	
Statement	**Component Value**
Beekeepers profit from beekeeping.	4.0
Beekeepers make progress towards their goals.	5.0
Beekeepers continue to keep bees longer than 1-year after the intervention.	4.0
Beekeepers benefit from their bee or hive products through sales, bartering, or household consumption.	4.0
Most of the organization's beekeepers take a business approach to beekeeping.	4.0
Composite Score	**4.2**

Impact variables indicate general strengths including beekeepers profiting and or benefiting from beekeeping; utilization of a business approach; general progress towards goals; and adherence to beekeeping beyond one-year. An area of weakness, opportunity, and threat exists in the utilization of services beyond 1-year after the initial intervention.

Outcome Factors

Table 18

Assessment Results: BEECause's Outcome Factors

Outcome Factors	
Statement	**Component Value**
It is evident that beekeepers have been able to improve their quality of life through beekeeping.	5.0
Composite Score	**5.0**

BEECause's self-reported outcome factors indicate that BEECause strongly agrees that it is evident their intervention has improved the quality of life of beekeepers. BEECause's efforts and activities throughout the country have expanded apiculture, honey-bee preservation, and habitat; provided opportunities for employment and income generation; and contributed to local agriculture production. BEECause has been able to promote income generating activities among women and provide a platform for training and improved access to inputs. It has also introduced new technologies, such as catcher boxes in improve colonization rates and honey yields, and activities to promote bee fodder through local species propagation. BEECause also provides a link to a market for beekeepers to sell their products and earn income.

SWOT Analysis

Each factor was analyzed using SWOT analysis to develop specific recommendations for BEECause to consider. Strengths were identified by scores four (4) and above. Weaknesses, opportunities, and threats were identified by scores below four (4). Table 20 outlines the strengths, weaknesses, opportunities, and threats based on the survey results. Below is a description of the SWOT analysis and recommendations for BEECause to consider in its strategic planning.

Table 19

BEECause Gambia's SWOT Analysis Results

Strengths	Weaknesses	Opportunities	Threats
Design factors, overall Implementation factors, overall Predisposing factors, overall Impact factors, overall Outcome, overall	Reinforcing factors, overall Enabling factors, overall Financial resources Data collection Planning Interventions designed to address predisposing, enabling, and reinforcing factors	Enabling (apiary management strategies, access to equipment & capital, mentors, ongoing education, partnerships) Reinforcing (quality standards, competitive price structure for producers) Mission alignment (planning, conceptual framework) Demonstrate impact (local indicators) Build stakeholder confidence and buy-in Diversify revenue, resources	Resource dependence Demonstrating progress towards mission

Strengths. BEECause expressed strengths in five (5) out of the seven (7) organizational, environmental, and outcome factors including design, implementation, predisposing, impact, and outcome. Program and intervention factors related to design and implementation have several strengths, demonstrated by composite scores of 4.1 for both program design and implementation. Overall, BEECause's design factors represent strengths in promoting beekeepers for alternative income generation. The organization perceives itself as having the institutional expertise to promote local beekeepers. Interventions are informed by regular needs assessments, identification of barriers and constraints, and attempts are made to address problem areas. Interventions include business or goal-setting training and are adapted to local context. These are

strengths that ensure the organization understands the needs of its beekeepers and that its interventions are designed to promote the holistic needs of beekeepers.

Implementation factors represent strengths for the organization and for the beekeepers it serves. BEECause develops and monitors budgets to guide interventions and has human resources to implement its programs. The organization monitors the implementation of its interventions. Further, BEECause has financial strategies to secure funds; utilizes partnerships to fill gaps; has the capacity to collect data; and conducts regular evaluations.

The ecological domain that includes predisposing, enabling, and reinforcing factors also exhibits some strengths despite overall lower composite scores. BEECause's predisposing factors scored a 4.2, which represents overall strengths that include the motivation of participants to earn a profit and set seasonal goals; the availability of training opportunities; and an openness and willingness to use available tools to effectively problem-solve issues that arise and to try new methods. The enabling factors are less strong for the organization and its beekeepers. Despite a lower composite score of 3.1, strengths in the enabling environment include availability of nectar and flowering resources; beekeepers can maintain their equipment after the intervention; have access to markets; and they utilize markets. These strengths provide a foundation upon which the organization can contribute to the enabling environment.

Reinforcing factors also scored lower than program intervention design, implementation, or predisposing factors with a composite score of 3.8. However, there are several strengths among the reinforcing factors including active engagement of the value chain; long-term commitment to beekeepers' success; possession of a selection criterion; adaptation to local context; and the presence of a marketing strategy. The 3.8 score indicates that strengths are

considerable for this section and that they can be leveraged to further improve the organization's attitudes and policies to achieve positive outcomes for its beekeepers.

Impact and outcome factors represent overall strengths for the organization. Among the impacts, beekeepers earn a profit from their activities; make general progress towards their goals; adhere to beekeeping over the long-term; benefit from their hive products; and have adopted a business approach to beekeeping. Among outcomes, BEECause feels confident that there are evident improvements in the quality of life of the beekeepers it serves. This is the result of the organization's mission and activities to promote honeybee populations and habitat and its focus on poverty alleviation. BEECause sees itself as an innovator to promote sustainable livelihoods and its programs strengthen the capacity of women throughout the Gambia. Through BEECause, beekeepers have access to training opportunities, inputs that aid in honey production, and access to markets. While respecting traditional practices, BEECause has also introduced new technologies, such as catcher boxes to catch swarms and improve colonization rates. Finally, the organization actively promotes tree planting of native species to conserve forest resources, pollinator habitat, and further promote foraging species throughout the region.

Weaknesses. Despite its strengths, it has several weaknesses embedded throughout the organizational, ecological, and outcome factors. Weaknesses are particularly pronounced in the overall enabling and reinforcing factors. Among enabling factors, weaknesses include beekeepers' strategies to endure dearth periods, access to equipment, capital, available, reliable and knowledgeable extension agents, and ongoing education. The organization also lacks the resources or partnerships to fill its gaps in capacity, especially as they relate to providing ongoing education. Among reinforcing factors, there are weaknesses in the organization's understanding of quality standards, competitive price structures for producers, and long-term

utilization of the organization's services. Other weaknesses include the organization's financial condition, data collection, planning, and responsiveness to the long-term needs of beekeepers in its intervention design process.

Opportunities. There are several opportunities for BEECause to employ its current strengths, especially regarding the enabling and reinforcing environment. These include: 1) Increasing its awareness of predisposing, enabling, and reinforcing factors by looking at the holistic needs of beekeepers and the value chain. 2) Designing interventions before implementation in a way that responds to those holistic needs. 3) Improving the organization's financial condition. 4) Improving data collection and management. 5) Fostering beekeepers who are willing to try new management techniques if it results in higher yields. 6) Providing ongoing education opportunities so that beekeepers have strategies to survive dearth periods. 7) Leveraging partnerships and networks to improve access to equipment and connections with extension agents and mentors. Other opportunities include understanding quality standards; competitive pricing for beekeepers; and fostering utilization of services beyond initial interventions. The organization could also work with beekeepers to establish local indicators to measure improvements, build long-term relationships, and build organizational capacity in data collection and reporting.

Threats. There are two considerable threats to the organization based on the assessment. The organization may be financially dependent and uncertain that it has the funds to operate over the long term. While it has strategies to address this problem, it is a major concern. Potentially related to financial constraints is the organization's ability to demonstrate progress towards its mission. Given that BEECause has few donors or funding sources, it is important that they be able to demonstrate their impact and prove that their model works and is deserving of continued

funding. Addressing these threats will improve BEECause's position to reduce poverty among beekeepers in the Gambia and its ability to plan, respond, evaluate, adapt, and demonstrate the important work with which it engages.

Chapter 5. Discussion by Aim and Conclusion

Each aim and objective competency of this ILE informed the development of an organizational assessment tool that may be used to promote alternative income generation among global beekeepers. During the first aim, PRECEDE-PROCEED, a literature review, and the process of creating an evidence matrix helped to identify and organize evidence-based variables that relate to profitable income generation into a draft survey. The evidence matrix can be found in the appendices. Table 21 summarizes the evidence matrix and organizes relevant variables into the PRECEDE-PROCEED framework. The first aim demonstrated competence in DrPH competencies in leadership, management, and governance (6), policies and programs (14, 15, and 16), and data analysis (2).

Table 20

Evidence-based Factors Identified During the First Aim

Beekeeping Intervention	**Predisposing Factors**	**Enabling Factors**	**Reinforcing Factors**	**Impact**	**Outcomes**
Design Implementation	Purpose (profit orientation) Self-efficacy Knowledge	Training and education Mentors Ongoing education Access to equipment, credit, and markets Beekeepers' skills Organizational policies	Yield Adherence Utilization of services Reinvestment	Income Profit	Quality of life

During the second aim, the instrument was pretested through a survey by content experts to identify and eliminate problems. Pretesting the instrument demonstrated competence in data and analysis (2) through the dissemination of the instrument and collecting results; developing an interview protocol and conducting interviews; analyzing feedback and revising the instrument. Cognitive interviews helped respondents clarify their survey responses and delve into problems

which the pre-test survey posed such as confusing wording or misleading statements. The cognitive interviews elicited suggestions to help improve content validity and meaningfulness. Both respondents commented that while the survey was long, its sections and statements were relevant, and representative of the holistic factors associated with successful outcomes. The content experts provided recommendations to better capture meaningful data from the survey before administering it to BEECause Gambia. Table 22 summarizes the evidence-based factors from the second aim and their relationship within PRECEDE-PROCEED.

Table 21

Revised Evidence-Based Factors

Design	**Implementation**	**Predisposing**	**Enabling**	**Reinforcing**	**Impact**	**Outcomes**
Institutional expertise Needs assessments Identified feasible constraints Inclusive of environmental factors Business or goal-setting training Locally sourced materials Pre-planning Budgeting	Monitoring (implementation & budgets) Human & financial resources Financial strategies Partnerships Data collection (practice & capacity)	Profit motivation Access to training Willingness to try existing and new methods and technologies Problem-solving Goal setting	Nectar and floral resources Strategies to overcome dearth periods Access to equipment, capital, & markets Ability to maintain equipment Extension agents Mentors Ongoing education	Value-chain approach Long-term commitment Selection criterion Adapted to local context Org. understanding of quality standards Competitive price structure Marketing Utilization	Profit Progress towards goals Adherence General benefit Adoption of business approach	Locally determined indicators of quality-of-life improvements

To achieve the third aim, competence was demonstrated through dissemination of the survey to the organization; analysis of the data and a SWOT analysis; and finally, by developing recommendations. These actions demonstrated competence in leadership, management, and governance (9 and 12); policies and programs (16); education and workforce development (18); and HSMP (1, 3, 5, and 6). The third aim included an organizational assessment using the instrument and an analysis of the results. The results indicate that BEECause Gambia has several strengths associated with its current beekeeping program including intervention design, implementation, predisposing factors, positive impacts, and outcomes. However, weaknesses, opportunities, and threats emerged in the SWOT analysis. Table 23 outlines the results of the SWOT analysis, which were used to develop recommendations to the organization.

Table 22

SWOT Analysis Results

Strengths	**Weaknesses**	**Opportunities**	**Threats**
Design factors, overall Implementation factors, overall Predisposing factors, overall Impact factors, overall Outcome, overall	Reinforcing factors, overall Enabling factors, overall Financial resources Data collection Planning Interventions designed to address predisposing, enabling, and reinforcing factors	Enabling (apiary management strategies, access to equipment & capital, mentors, ongoing education, partnerships) Reinforcing (quality standards, competitive price structure for producers) Mission alignment (planning, conceptual framework) Demonstrate impact (local indicators) Build stakeholder confidence and buy-in Diversify revenue, resources	Resource dependence Demonstrating progress towards mission

Recommendations

To advance beekeeping in Gambia, increased focus on long-term sustainability will be important to ensure that the organization meets its mission to reduce poverty through beekeeping. The threats have the potential to undermine the organization's integrity as an effective agency that alleviates poverty as well as the practical threat to operations through financial constraints. The opportunities outlined in the SWOT analysis represent actionable measures BEECause can take to improve the enabling and reinforcing environment as well as build confidence among its stakeholders. Many of these factors overlap and influence each other. Understanding the organization's strengths and weaknesses will help the organization understand where it needs to build its capacity. Based on the SWOT analysis three recommendations have emerged: 1) Build the organization's financial security. 2) Demonstrate the impact to build confidence among stakeholders, improve planning, and evaluate its programs. 3) Leverage design and implementation strengths of the organization to address enabling and reinforcing factors.

Build Financial Stability

Poverty is a complex financial condition which requires a multi-pronged approach and responsive strategies to be effective. BEECause needs to have the flexibility to promote beekeeping to new beekeepers while also remaining relevant to existing beekeepers. Given that BEECause depends on its beekeepers to some degree to provide quality honey for revenue from sales, it is to the organization's advantage to build confidence in its producers and to remain involved in their success through ongoing education, coaching, mentorship, and promoting reinvestment activities that help beekeepers grow their enterprises. However, BEECause may be financially dependent on a few grants which limit its ability to meet all the needs of beekeepers.

Resource dependence can hamper the organization's control over how it reaches its mission (AbouAssi, 2013; Arhin et al., 2018; Froelich, 1999). However, it is worth noting that there are risks to reducing resource dependence. By diversifying revenue streams, the organization may signal to current funders that they are no longer needed (Sacristan Lopez de los Mozos et al., 2016). It is therefore important to communicate how all stakeholders are contributing to the success of the beekeepers and that the organization would not be able to achieve progress without their continued support.

Human resources may be a challenge at BEECause. It may be worth building the internal capacity of staff and board members to improve BCG's financial position. Staff may be hired or developed to scan foundations, governments, and donors for funding opportunities and to write grants. Board members can leverage their networks, experience, and skills to fundraise, build partnerships, and improve the organization's image (Callen et al., 2010). Fundraising and resource diversification can consume limited resources and increase risks that may negatively affect the organization (Froelich, 1999). It will be important to manage the organization's resources efficiently and to align any efforts with the organization's mission and strategic plan (Brunt & Akingbola, 2018). It is important to build partnerships and a network committed to the progress of the beekeepers. Identify agencies or groups that have financial resources that they are willing to commit to the mission. Current funding agencies may be interested in supporting the long-term needs of the producers and may be able to recommend other funding sources beyond the first year of training and getting started. Board members may be able to play an vital role towards these ends (Callen et al., 2010).

BEECause may also consider diversifying revenue from the sale of bee and hive products. This will promote the enabling environment through access to markets, building long-

term relationships, and increasing the volume of goods to be sold. Revenues from market activities could support BEECause as a social enterprise and provide support to overheads to support the needs of existing beekeepers beyond the initial training. The organization would also benefit from conducting a cost-benefit analysis of its current revenues and expenses to identify areas for improvement.

Build Stakeholder Confidence

BEECause might consider how to build stakeholder confidence through several actions that would support its environmental factors and its long-term sustainability. Stakeholder confidence is built through the process of establishing and maintaining relationships with stakeholders (Mohammed, 1989). Data collection and competitive pricing are two examples that could build the commitments on the part of donors and producers alike (Meaton et al., 2021). Data collection is crucial to demonstrate the organization's impact and progress towards its mission. An important aspect of data collection would include establishing meaningful, local indicators with the beekeepers on obtainable, measurable, and appropriate markers that progress is being made (Amulen et al., 2017; Schouten, 2020). Local indicators may include income and well-being (Yap et al., 2015), or household improvements such as new doors, roofing, food, or clothes. Health outcomes may be measured through income for medication and visits to local clinics but may also include the quantity and quality of healthy foods which are affordable due to increased income. Social and personal changes may be measured by having available funds to pay school fees. Business improvements may be seen in reinvestment in beekeeping or other activities because of earnings from honey, wax, or other bee and hive products. BEECause could create a basic survey to measure pre- and post-intervention conditions and measure changes over-time. Perhaps these changes will be significant over the years and can be used as evidence

to demonstrate to funders that BEECause's program is effective. To do this, the organization needs some capacity development and training. Data collection could inform program design, financial management, and evaluation activities.

To build the confidence of the beneficiaries and eventual producers, BEECause could try to build long-term relationships and confidence with beekeepers by offering competitive prices. BEECause could also communicate how mutual commitments, such as responsive programming and sales commitments or contracts between producers and the organization build a long-term enabling environment. Investing in the value-chain is another way to build local confidence. Providing business training to entrepreneurs builds BEECause's reputation, a sense of shared commitment to development, and promotes the value-chain (Meaton et al., 2021).

Focus on the Enabling and Reinforcing Factors

Finally, BEECause's enabling and reinforcing factors represent weaknesses of the organization's current design and implementation components. While these may not be threats, there are opportunities to contribute to the income potential of beekeepers and the success of the organization. Activities to support the enabling environment might include a yearly program of workshops or ongoing education conducted by mentors, network members, extension agents, partners such as Peace Corps Volunteers, or by BEECause trainers on seasonal apiary management and coaching to make progress towards individual goals. There are cost effective measures that can be taken to support the enabling environment, such as linking beekeepers with mentors to build confidence and local relationships. BEECause could also maintain regular contact with its network representatives to identify current challenges among producers and to come up with solutions together to address constraints such as access to capital, equipment, or markets. Finally, BEECause could collaborate with local microcredit institutions (Tomaselli et

al., 2013) and take on a microcredit loan that BEECause would pay back instead of the beekeepers. These funds could be used as seed money to start a group lending (Tomaselli et al., 2013) or reinvestment program that helps beekeepers grow their enterprises. Beekeepers would need to repay the loans, but they could repay them on a less risky schedule than would be expected by banks and a lower or zero interest rate. BEECause may be able to repay the loan from its revenues in honey and wax at less risk than its beekeepers would face. This would help beekeepers access credit with minimal risk to themselves or the organization.

Activities that build the reinforcing factors may include understanding quality standards and promoting high quality honey at the marketplace. This would increase quality production among beekeepers and increase their returns as well as those of the organization. As discussed in the financial section, offering competitive pricing for bee and hive products also reinforces beekeepers' willingness to adhere to beekeeping, builds confidence in the organization, and promotes a long-term relationship between the stakeholders.

BEECause Gambia is in a good position to continue effective programs, build internal capacity, and improve its long-term impact among beekeepers. The results of the SWOT analysis and the recommendations provide a starting point for BEECause to engage in strategic planning. By adopting the PRECEDE-PROCEED framework, BEECause can choose specific factors to target for improvement. While the recommendations are not prescriptive, BEECause has an opportunity to collaborate with its stakeholders to determine effective and meaningful indicators, goals, objectives, and strategies to overcome existing constraints. As a result, BEECause's position may become more sustainable, and beekeepers may improve their chances of realizing their goals for income generation.

All of this information has been distilled into an evaluation report to BEECause Gambia that outlines the key strengths of the organization and summarizes the recommendations to improve on weaknesses, opportunities, and threats. Additionally, the report includes a blank version of the instrument with instructions for use and scoring. Together, these elements comprise ILE Product Number 2. A copy of the product is included in the appendices.

Chapter 6. Summary and Dissemination Plan

Summary of ILE competencies, design, results, and implications.

Attaining the ILE competencies required adherence to the methodology and framework to help maintain an organized approach capable of integrating information from multiple perspectives and disciplines. Each of the aims of the ILE process required the demonstration of competencies that were both foundational to public health and to the health services management and policy concentration. To achieve the first aim of developing an organizational assessment instrument, competence was demonstrated integrating knowledge, approaches, methods, values, and potential contributions from multiple professions and systems in addressing public health problems (Leadership, Management, and Governance, 6). Poverty, income generation, and beekeeping are multi-disciplinary issues and the evidence based-factors selected for the instrument represent a hybrid of a well-known public health framework, PRECEDE-PROCEDE, organizational behavior theory, and factors specific to apiculture, small-holder producers, and healthy food systems. To identify holistic factors with relevance to multiple domains that assessed both an organization and its beneficiaries required a thorough review of the literature, the development of an evidence-matrix that highlighted key findings, and then further distilling those findings into evidence-based factors.

Data and analysis competency (2) was demonstrated in the first aim and second aim in identifying factors that would inform the survey for a mixed methods evaluation project (Data and Analysis, 2). The first aim involved the identification of evidence-based factors and the initial draft of the assessment instrument. The second aim refined the design elements through a pretest survey and cognitive interviews to promote content validity and meaningfulness of the included constructs.

Foundational DrPH competencies were demonstrated in fulfilling the third aim. By assessing BEECause's results, conducting a SWOT analysis, and proposing recommendations, competence was demonstrated in creating organizational change strategies and proposing human, fiscal and other resources to achieve a strategic goal (Leadership, Management, and Governance, 9, 12). Health service management and policy (HSMP) competencies were also demonstrated during the third aim. By analyzing BEECause's results against the PRECEDE-PROCEDE framework and by conducting a SWOT analyses (HSMP 1, 3, 5, and 6). The holistic nature of the survey design and its subsequent evaluation demonstrated competence in evaluating different organizational behaviors, cultures and structures across sectors and levels of governance to improve organizational effectiveness (HSMP 1). Administering, analyzing, and interpreting the instrument results demonstrated ability to assess the effectiveness of public health and healthcare services aimed at improving health using applied research and evaluation methods. The survey design incorporated elements of organizational theory and promotes evidence-based decision-making, demonstrating competence in HSMP 5. Finally, the instrument aligns quality improvement with evidence-based initiatives to improve organizational effectiveness to support small-holder beekeepers in their pursuits for profitable alternative income generation (HSMP 6).

A major implication for this instrument is that it has the potential to improve the quality of life for global beekeepers by giving organizations a tool that can guide intervention design, diagnosis, monitoring, and evaluation. By demonstrating the foundational and concentration competencies in this project, the survey instrument is multi-disciplinary in its design, inclusive of organizational theory, supported by evidence-based factors, and can be used to promote and influence evidence-based decision-making. The project also demonstrates the usefulness of PRECEDE-PROCEDE for organizations seeking to address social determinants of health.

Translation and Dissemination Plan

The Center for Disease Controls, National Center for Chronic Disease and Public Health Promotion's Knowledge to Action (K2A) Framework will be used to guide the dissemination plan for the ILE (CDC, 2014). The K2A framework consists of three phases: research, translation, and institutionalization. The literature review, instrument, and ILE findings comprise the research phase of the K2A framework. The dissemination plan is focused on the translation phase of the framework and consists of translating knowledge into products, dissemination and engagement, decisions to adopt, and implementation into practice. Institutionalization of recommendations are outside of the scope of the ILE and the author's control. As such, the dissemination plan is focused on the translation component of the K2A framework.

Translation Phase

The first aim of the ILE included an extensive literature review which resulted in the evidence matrix of factors that are now summed up in the BAIG-A instrument. Evidence-based factors were determined from evaluative studies of the effectiveness of beekeeping interventions as well as peer-reviewed studies on organizational assessments and sustainable food systems. The instrument is aligned with PRECEDE-PROCEED to structure evidence-based organizational, ecological, impact, and outcome factors relevant to successful outcomes. The second aim of the ILE pretested the instrument to identify problems with the survey and its component factors and it was determined that its contents are valid and meaningful. Use of the instrument will promote effective intervention design and implementation to promote an enabling ecology and desired impacts and outcomes.

The instrument was administered to BEECause Gambia, a nonprofit organization that serves beekeepers to reduce poverty and promote honeybees in West Africa. The organization

agreed that the project was needed and that it aligned with the goals of the organization to promote profitable income generation. The intervention was determined to fit well in the context of The Gambia as BEECause was transitioning into a newly independent organization that lacked executive capacity and would benefit from an evidence-based decision-making tool. BEECause is a small organization whose human resource capacity includes a country director, organizational staff, and a board of directors with authority to make decisions, set priorities, and implement interventions. The organization has expressed an eagerness to use the project to build its capacity.

West Africa is not a favorable environment for small, locally governed non-profits. There are many challenges for groups operating in such an environment. BEECause's leadership has demonstrated its commitment to the organization and local beekeepers through over ten years of service. The board exhibits skills, attitudes, and connections that may be leveraged in ways to overcome future challenges. Still, the organization lacks institutional knowledge of evidence-based practices. This intervention will benefit BEECause whose resources are constricted to conduct research of this nature.

Based on the needs of the Gambia, described in chapter one (1) of the ILE, mainly the high levels of poverty and the hardships which Gambian producers face in an environment that lacks enabling infrastructure, translating the evidence-based instrument into recommendations which the organization can use to promote profitable outcomes is both relevant and appropriate. The effects and unintended consequences cannot be determined at this time. The instrument is not a grading or a prescriptive tool, but instead a gauge to determine an organization's position in relation to current, evidence-based factors. It is a tool that can inform organizations on factors relevant to design, implementation, and evaluation relevant to successful outcomes for

beekeepers. The tool is most effective when it is used alongside community needs assessments and locally determined indicators and when its results are interpreted to consider the organization's unique and specific context. Based on these factors, the instrument was developed, administered, and the results are translated for BCG to consider in ILE Product Number 2, which can be found in the appendices. ILE Product Number 2 summarizes the results of the SWOT analysis and key recommendations BCG might consider in its future strategic planning, intervention designing, and capacity building processes. This product also includes the instrument for BCG's future uses.

Knowledge to Products

Beekeeping interventions that lack evidence-based inputs are at risk of failing to achieve their aims of promoting profitable alternative income generation for people living in low-resource, less favored areas. The ILE products serve to enhance the enabling environment. The BAIG-A is an instrument that sums up and teaches current and evidence-based factors while also assessing an organization's position in relation to those factors. A summary of the results, recommendations, and instrument serves to provide the organization with feasible and specific goals that may improve the organization's position. Adoption, practice, and institutionalization of the recommendations is dependent on the organization's resources and motivation to assimilate the recommendations and the instrument into their regular procedures.

After the ILE intervention, BCG may use the instrument to assess and perform internal SWOT analyses on its own. The first two products and the dissemination plan provide a framework which can be replicated by the organization. Based on their own SWOT analysis, the organization can develop SMART goals and objectives to improve its services to beekeepers. BEECause will need to consider its constraints, such as financial, human resource, material,

market, and others, while determining SMART goals and objectives and adapt them to its local context. It will benefit BCG to work with its trained beekeepers to determine local indicators to set appropriate impact and outcome measures. It will also be important to maintain the flexible, multi-purpose use of the instrument to build institutional knowledge about beekeepers' needs as well as its utility to diagnose, plan, monitor, and evaluate its position on a regular basis. Goals and benchmarks may be set in a way that represent local need. The factors are broad enough to allow for interpretation, adaptation, and continuous improvement. It will be up to the organization to determine when it has met its goals and when to shift its focus to new goals or to further improve existing goals. Bi-annual follow-up and consultations will be made available to BEECause to assess changes in position over time.

Dissemination and Engagement

The results of the ILE were disseminated to BEECause Gambia on March 8, 2023, through the defense presentation to the committee, a BCG board member, Mr. Momodou Bah, members of the College of Public Health, community members, and an independent auditor. The presentation summarized the background, methodology, results, and recommendations of the ILE project. In an email correspondence following the presentation, the BCG representative expressed enthusiasm for the project and an eagerness to receive the recommendations. The report is included in the appendices and includes a summary of the SWOT analysis results, recommendations, and a blank instrument. The report also includes an email address for questions, comments, or correspondence.

In terms of engagement, the leadership team has expressed buy-in and commitment to the ILE project. Their attendance at the dissertation defense demonstrated this commitment as did the follow-up correspondence. Other stakeholders could be engaged, but considering the

financial constraints, having the organization's board and management buy-in and willingness to collaborate beyond the ILE indicates positive potential for future adoption, practice, and institutionalization.

Further dissemination of the instrument and related products will directly benefit BEECause and the beekeepers which they serve. If the organization decides to adopt the instrument, put it into practice, institutionalize and operationalize it into regular practice, the organization will be better able to measure its progress and demonstrate achievements with data. The organization may also be able to determine local indicators to directly measure improvements to health and quality of life that result from their beekeeping interventions and by promoting the enabling ecology.

There are expected barriers to communication that can be overcome with patience and other diverse means including emails, apps like WhatsApp, and letter correspondence. There are also partnerships available in Gambia which can be leveraged, such as Peace Corps volunteers and staff, to build organizational capacity, conduct surveys and collect field data, and to provide support services of extension, mentorship, training, and help make linkages for people with limited access to means of travel or financial resources. A follow-up correspondence will be sent biannually for one year to determine attitudes towards adoption and readiness for practice and institutionalization. Correspondence beyond the first year will be based on the desire of the organization to continue collaboration.

The instrument promotes a long-term commitment, which will be embodied in the dissemination. There will be no deadline or end-date of collaboration with the author after the ILE. Effectiveness of the instrument may be assessed by the organization's adoption, practice, and institutionalization. Additional assessments of the instrument's effectiveness may include a

comparison of instrument results over time, especially changes in statement 50, which asks the organization to describe improvements to quality of life. Ideally, these responses will represent locally determined and agreed upon indicators established between the organization and its beekeepers. Again, those matters are beyond the scope of the ILE project or the influence of the author and are dependent on the organization's decisions going forward.

Decisions to Adopt

The results, recommendations, and instrument from this ILE project will be made available to BCG's decision-makers. The evaluation report provides foundational elements that may inform strategic planning and intervention improvement efforts taken by the organization. Additionally, the recommendations reflect the responses from the organization and have been tailored to BCG's position and demonstrated need. The recommendations and instrument reflect evidence-based factors based in an extensive literature review including evaluation studies of global beekeeping interventions.

The recommendations and the factors included in the instrument are not prescriptive, but broad enough to be adaptable to the Gambian context. The instrument is designed to cultivate a long-term commitment between organizations and small-holder producers to promote a sustainable enabling ecology. The instrument also includes a value-chain approach and a holistic approach that allows the organization to remain relevant to shifting needs among its target population beyond beekeeping including business development. This aspect of the instrument increases its utility to the organization to inform intervention design and strategic plans. Additionally, the instrument encourages stakeholder engagement to determine local indicators, which will improve future evaluation of the instrument and its effectiveness.

Adoption of the instrument will improve BCG's services to its stakeholders and target population. It has the potential to increase the organization's financial security, build stakeholder confidence, and directly benefit beekeepers enabling and reinforcing factors. All of these improvements have the potential to improve impacts and outcomes. If the organization is able to communicate its role in successful outcomes for its beneficiaries, the enabling environment may become stronger as beekeepers realize, materially and cognitively, improvements in their quality of life as a result of their participation in BCG's beekeeping interventions.

The organization faces some barriers to implementation, which may affect their adoption. One key barrier is cultural in nature. Many Gambians do not share information about their income. However, this barrier can be overcome in a way that benefits the beekeepers and the organization by developing relevant and appropriate indicators which are observed rather than declared. This will require that BCG sit with stakeholders to determine changes they want or have experienced as a result of income generating activities such as beekeeping. This will also require that BCG conduct observational surveys of their beekeepers. This particular barrier may be reduced by coupling surveys with field treks, site visits, or when passing through areas enroute to other training events.

The decision to adopt is beyond the control of the author or the scope of the ILE. However, a follow-up correspondence will be conducted in six-month intervals after Product 2 is delivered to gauge the organization's current position to adopt. The author will ask whether the tool has been adopted, put into practice, and to what degree it informs annual budget and planning meetings, and decision-making.

Implementation Into Practice

Implementation into practice will be the responsibility of the organization. However, the ILE products provide sufficient information and post-ILE collaborations will provide further information and respond to questions that help the organization determine if and how to implement the instrument into practice. The instrument's broad nature makes it scalable to fit future growth of the organization. It is also adaptable in nature and allows for interpretation of factors and results to remain relevant to shifts in ecology and needs. For instance, access to markets is a broad concept and open to interpretation. Perhaps gaining access is achieved, but as the organization grows, it may be able to access new, differentiated markets, and grow in sophistication. Each variable may be measured in terms of the desires of the beekeepers and the organization, which increases its long-term value. The factors are also adaptable, which reinforces the relevant nature of the domains to the needs, impacts, and outcomes of its beekeepers.

Product 2, the summary of results and recommendations, provides the organization with the basic tools to implement the instrument into practice. More information will be provided as needed. The survey may also be updated over time to represent changing needs and current evidence-based factors. These actions are beyond the scope of the ILE but may be performed as resources allow. The instrument is included in the product and the organization may use the original scoring methodology, which will promote fidelity. The instrument will be optimized with local indicators, but this will be the responsibility of the organization. Long-term studies may be conducted to evaluate practice. This too is beyond the scope of the ILE. However, the organization will be better able to evaluate progress towards its mission with the instrument and the identification of specific local indicators associated with impact and outcome.

References

AbouAssi, K. (2013). Hands in the Pockets of Mercurial Donors: NGO Response to Shifting Funding Priorities. *Nonprofit and voluntary sector quarterly*, *42*(3), 584-602. https://doi.org/10.1177/0899764012439629

Ahmad, T., Shah, G.-M., Ahmad, F., Partial, U., & Ahmad, S. (2017). Impact of Apiculture on Household Income of Rural Poor in Mountains of Chitral District in Pakistan. In (Vol. 6, pp. 519-531): Journal of Social Sciences.

Amulen, D. R., D' Haese, M., Ahikiriza, E., Agea, J. G., Jacobs, F. J., de Graaf, D. C., Smagghe, G., Cross, P. (2017). The buzz about bees and poverty alleviation: Identifying drivers and barriers of beekeeping in sub-Saharan Africa. *PloS one*, *12*(2), e0172820-e0172820. https://doi.org/10.1371/journal.pone.0172820

Arhin, A. A., Kumi, E., & Adam, M. S. (2018). Facing the Bullet? Non-Governmental Organisations' (NGOs) Responses to the Changing Aid Landscape in Ghana. *Voluntas (Manchester, England)*, *29*(2), 348-360. https://doi.org/10.1007/s11266-018-9966-1

Bankova, V. (2005). Recent trends and important developments in propolis research. *Evidence-based complementary and alternative medicine*, *2*(1), 29-32. https://doi.org/10.1093/ecam/neh059

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of management*, *17*(1), 99-120. https://doi.org/10.1177/014920639101700108

BEECause, A. (2020). *Africa BEECause: BEECause People*. Retrieved May 10, 2022 from https://www.africabeecause.org

BEECause, A. (2021). *Africa BEECause: Facebook page.* Retrieved May 10, 2022 from https://www.facebook.com/africabeecause/

Berhe, A., Asale, A., & Yewhalaw, D. (2016). Community Perception on Beekeeping Practices, Management, and Constraints in Termaber and Basona Werena Districts, Central Ethiopia. *Advances in agriculture (Hindawi Publishing Corporation)*, *2016*, 1-9. https://doi.org/10.1155/2016/4106043

Berkum, V. S., & Ruben, R. (2021). Exploring a food system index for understanding food system transformation processes. *Food security*, *13*(5), 1179-1191. https://doi.org/10.1007/s12571-021-01192-6

Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quiñonez, H. R., & Young, S. L. (2018). Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer. *Frontiers in public health*, *6*, 149-149. https://doi.org/10.3389/fpubh.2018.00149

Bolwig, S., Ponte, S., Du Toit, A., Riisgaard, L., & Halberg, N. (2010). Integrating Poverty and Environmental Concerns into Value-Chain Analysis: A Conceptual Framework. *Development policy review*, *28*(2), 173-194. https://doi.org/10.1111/j.1467-7679.2010.00480.x

Bonney, L., Clark, R., Collins, R., & Fearne, A. (2007). From serendipity to sustainable competitive advantage: insights from Houston's Farm and their journey of co-innovation. *Supply chain management*, *12*(6), 395-399. https://doi.org/10.1108/13598540710826326

Brandt, J. A., Reed Edwards, D., Cox Sullivan, S., Zehler, J. K., Grinder, S., Scott, K. J., Cook, J. H., Roper, D., Dickey, A., Maddox, K. L. (2009). An Evidence-Based Business Planning Process. *The Journal of nursing administration.*, *39*(12), 511-513. https://doi.org/10.1097/NNA.0b013e3181c18026

Brownson, R. C., Baker, E. A., Deshpande, A. D., & Gillespie, K. N. (2018). *Evidence-based Public Health* (Third ed.). Oxford University Press.

Brownson, R. C., Colditz, G. A., & Proctor, E. K. (2017). *Dissemination and Implementation Research in Health: Translating Science to Practice*. Oxford University Press. https://doi.org/10.1093/oso/9780190683214.001.0001

Brunt, C., & Akingbola, K. (2018). How Strategic are Resource-Dependent Organisations? Experience of an International NGO in Kenya. *European journal of development research*, *31*(2), 235-252. https://doi.org/10.1057/s41287-018-0144-5

Callen, J. L., Klein, A., & Tinkelman, D. (2010). The Contextual Impact of Nonprofit Board Composition and Structure on Organizational Performance: Agency and Resource Dependence Perspectives. *Voluntas (Manchester, England)*, *21*(1), 101-125. https://doi.org/10.1007/s11266-009-9102-3

Camara, S., & Hunt, L. (2018). Gambia's Migration Paradox: The Horror and the Promise of the Back Way. https://deeply.thenewhumanitarian.org/refugees/articles/2018/03/26/gambias-migration-paradox-the-horror-and-promise-of-the-back-way

Catalano, R., Goldman-Mellor, S., Saxton, K., Margerison-Zilko, C., Subbaraman, M., LeWinn, K., & Anderson, E. (2011). The health effects of economic decline. *Annual review of public health*, *32*(1), 431-450. https://doi.org/10.1146/annurev-publhealth-031210-101146

CDC. (2014). *Applying Knowledge to Action (K2A) Framework: Questions to Guide Planning.* Atlanta, GA: Centers for Disease Control and Prevention Retrieved from https://www.cdc.gov/chronicdisease/pdf/k2a-framework-6-2015.pdf

Chesbrough, H. (2007). Business model innovation: it's not just about technology anymore. *Strategy & leadership*, *35*(6), 12-17. https://doi.org/10.1108/10878570710833714

Chesbrough, H. (2010). Business Model Innovation: Opportunities and Barriers. *Long range planning*, *43*(2), 354-363. https://doi.org/10.1016/j.lrp.2009.07.010

CIA. (2021). *Explore All Countries: Gambia, The*. CIA. Retrieved September 12, 2021 from https://www.cia.gov/the-world-factbook/countries/gambia-the/

CTB. (2022). *Section 2: PRECEDE-PROCEDE*. Center for Community Health and Development. Retrieved August 1 from https://ctb.ku.edu/en/table-contents/overview/other-models-promoting-community-health-and-development/preceder-proceder/main

Dung, T. Q., Bonney, L. B., Adhikari, R. P., & Miles, M. P. (2020). Entrepreneurial orientation, knowledge acquisition and collaborative performance in agri-food value-chains in emerging markets. *Supply chain management*, *25*(5), 521-533. https://doi.org/10.1108/SCM-09-2019-0327

Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *The Academy of Management review*, *23*(4), 660-679. https://doi.org/10.2307/259056

Elisante, F., Ndakidemi, P. A., Arnold, S. E. J., Belmain, S. R., Gurr, G. M., Darbyshire, I., Xie, G., Tumbo, J., Stevenson, P. C. (2019). Enhancing knowledge among smallholders on pollinators and supporting field margins for sustainable food security. *Journal of rural studies*, *70*, 75-86. https://doi.org/10.1016/j.jrurstud.2019.07.004

Elzaki, E., & Tian, G. (2020). Economic evaluation of the honey yield from four forest tree species and the future prospect of the forest beekeeping in Sudan. *Agroforestry systems*, *94*(3), 1037-1045. https://doi.org/10.1007/s10457-019-00478-1

FAO. (2018). Sustainable food systems: Concept and framework. In: Food and Agriculture Organization of the United Nations.

Fearne, A., Garcia Martinez, M., & Dent, B. (2012). Dimensions of sustainable value chains: implications for value chain analysis. *Supply chain management*, *17*(6), 575-581. https://doi.org/10.1108/13598541211269193

Froelich, K. A. (1999). Diversification of Revenue Strategies: Evolving Resource Dependence in Nonprofit Organizations. *Nonprofit and voluntary sector quarterly*, *28*(3), 246-268. https://doi.org/10.1177/0899764099283002

Gagnon, M.-P., Attieh, R., Ghandour, E. K., Légaré, F., Ouimet, M., Estabrooks, C. A., & Grimshaw, J. (2014). A systematic review of instruments to assess organizational readiness for knowledge translation in health care. *PloS one*, *9*(12), e114338-e114338. https://doi.org/10.1371/journal.pone.0114338

Garibaldi, L. A., Carvalheiro, L. G., Vaissiere, B. E., Gemmill-Herren, B., Hipolito, J., Freitas, B. M., . . . Zhang, H. (2016). Mutually beneficial pollinator diversity and crop yield outcomes in small and large farms. *Science (American Association for the Advancement of Science)*, *351*(6271), 388-391. https://doi.org/10.1126/science.aac7287

Geslin, B., Aizen, M. A., Garcia, N., Pereira, A.-J., Vaissière, B. E., & Garibaldi, L. A. (2017). The impact of honey bee colony quality on crop yield and farmers' profit in apples and pears. *Agriculture, ecosystems & environment*, *248*, 153-161. https://doi.org/10.1016/j.agee.2017.07.035

Goshme, D., & Ayele, T. (2020). Constraints of Honey Production and Marketing in Ethiopia: A Review. In (Vol. 41, pp. 393-397): *Agricultural Reviews*.

Goto, R., Devine, J., Nicholas Mascie-Taylor, C. G., Ormand, J., & Jufry, A. J. (2019). The impact of an income-generating activities programme on children and mothers' undernutrition in extreme poor rural Bangladeshi households. *Public health nutrition*, *22*(16), 3073-3082. https://doi.org/10.1017/S1368980019002015

Hopkins, M. S. (2009). Long-viewed, see-through, collaborative and retooled. *MIT Sloan management review*, *51*(1), 46.

Hoshide, A., Drummond, F., Stevens, T., Venturini, E., Hanes, S., Sylvia, M., Loftin, C., Yarborough, D., Averill, A. (2018). What Is the Value of Wild Bee Pollination for Wild Blueberries and Cranberries, and Who Values It? *Environments (Basel, Switzerland)*, *5*(9), 98. https://doi.org/10.3390/environments5090098

IBR. (2003). *Organizational Readiness for Change (TCU ORC) Treatment Director Version (TCU ORC-D): Instruction Page*. Texas Christian University Institute of Behavioral Research. https://ibr.tcu.edu/wp-content/uploads/2016/01/ORC-D-pdf.pdf

Ilia, G., Simulescu, V., Merghes, P., & Varan, N. (2021). The health benefits of honey as an energy source with antioxidant, antibacterial and antiseptic effects. *Science & sports*, *36*(4), 272.e271-272.e210. https://doi.org/10.1016/j.scispo.2020.10.005

Issel, I. M., Wells, R., & Williams, M. (2022). *Health Program Planning and Evaluation: A practical, systematic approach for community health* (5th ed.). Jones & Bartlett Learning.

Johnson, N. L., Kovarik, C., Meinzen-Dick, R., Njuki, J., & Quisumbing, A. (2016). Gender, Assets, and Agricultural Development: Lessons from Eight Projects. *World development*, *83*, 295-311. https://doi.org/10.1016/j.worlddev.2016.01.009

Komosinska-Vassev, K., Olczyk, P., Kaźmierczak, J., Mencner, L., & Olczyk, K. (2015). Bee Pollen: Chemical Composition and Therapeutic Application. *Evidence-based complementary and alternative medicine*, *2015*, 297425-297426. https://doi.org/10.1155/2015/297425

Kuyvenhoven, A. (2004). Creating an enabling environment: policy conditions for less-favored areas. *Food policy*, *29*(4), 407-429. https://doi.org/10.1016/j.foodpol.2004.07.010 (Food Policy)

Lee, D. (2014). Factors of Success in Beekeeping Development Projects and Their Application to South Africa's Beekeeping Industry. In: Pomona Senior Theses.

Lehman, W. E. K., Greener, J. M., & Simpson, D. D. (2002). Assessing organizational readiness for change. *Journal of substance abuse treatment*, *22*(4), 197-209. https://doi.org/10.1016/S0740-5472(02)00233-7

Li, L., Jiang, F., Pei, Y., & Jiang, N. (2017). Entrepreneurial orientation and strategic alliance success: The contingency role of relational factors. *Journal of business research*, *72*, 46-56. https://doi.org/10.1016/j.jbusres.2016.11.011

Lowore, J., Meaton, J., & Wood, A. (2018). African Forest Honey: an Overlooked NTFP with Potential to Support Livelihoods and Forests. *Environmental management (New York)*, *62*(1), 15-28. https://doi.org/10.1007/s00267-018-1015-8

Madigan, J. (2020). *Industry Report 11291: Beekeeping in the US.* IBISWorld Inc. Retrieved July 1, 2021 from https://www.ibisworld.com

Madigan, J. (2021). *Industry Report 11291: Beekeeping in the US.* IBISWorld, Inc. https://my-ibisworld-com.iris.etsu.edu/download/us/en/industry/68/1/0/pdf

Mallett, D. (1990). *Inches & miles 1977-1980* Chicago, IL, Flying Fish Records.

Marshall, Q., Fanzo, J., Barrett, C. B., Jones, A. D., Herforth, A., & McLaren, R. (2021). Building a Global Food Systems Typology: A New Tool for Reducing Complexity in Food Systems Analysis. *Frontiers in sustainable food systems*, *5*. https://doi.org/10.3389/fsufs.2021.746512

Meaton, J., Lowore, J., & Wood, A. (2021). Assessing value chain interventions in Zambian and Ethiopian forest beekeeping systems. *Business strategy & development*, *4*(2), 159-169. https://doi.org/10.1002/bsd2.136

Miller, K., Chepp, V., Willson, S., & Padilla, J. L. (2014). *Cognitive Interviewing Methodology: A Sociological Approach for Survey Question Evaluation*. John Wiley & Sons, Incorporated.

Mohammed, O. (1989). Beekeeping In a Gambian Village. *Community development journal*, *24*(4), 240-246. https://doi.org/10.1093/cdj/24.4.240

Muflikh, Y. N., Smith, C., & Aziz, A. A. (2021). A systematic review of the contribution of system dynamics to value chain analysis in agricultural development. *Agricultural systems*, *189*, 103044. https://doi.org/10.1016/j.agsy.2020.103044

Novelli, S., Vercelli, M., & Ferracini, C. (2021). An Easy Mixed-Method Analysis Tool to Support Rural Development Strategy Decision-Making for Beekeeping. *Land (Basel)*, *10*(7), 675. https://doi.org/10.3390/land10070675

Pasupuleti, V. R., Sammugam, L., Ramesh, N., & Gan, S. H. (2017). Honey, Propolis, and Royal Jelly: A Comprehensive Review of Their Biological Actions and Health Benefits. *Oxidative medicine and cellular longevity*, *2017*, 1259510-1259521. https://doi.org/10.1155/2017/1259510

Patel, V., Pauli, N., Biggs, E., Barbour, L., & Boruff, B. (2020). Why bees are critical for achieving sustainable development. *Ambio*, *50*(1), 49-59. https://doi.org/10.1007/s13280-020-01333-9

Pocol, C. B., & McDonough, M. (2015). Women, Apiculture and Development: Evaluating the Impact of a Beekeeping Project on Rural Women's Livelihoods. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Horticulture*, *72*(2). https://doi.org/10.15835/buasvmcn-hort:11423

Potts, S. G., Imperatriz-Fonseca, V., Ngo, H. T., Aizen, M. A., Biesmeijer, J. C., Breeze, T. D., Dicks, L. V., Garibaldi, L. A., Hill, R., Settele, J., Vanbergen, A. J. (2016). Safeguarding pollinators and their values to human well-being. *Nature (London)*, *540*(7632), 220-229. https://doi.org/10.1038/nature20588

Rahimi, M. K., Abbasi, E., Bijani, M., Tahmasbi, G., & Azimi Dezfouli, A. A. (2020). Sustainability criteria of apicultural industry: evidence from Iran. *Ecosystem health and sustainability*, *6*(1), 1818630. https://doi.org/10.1080/20964129.2020.1818630

RHIHUB. (2022). *PRECEDE-PROCEED*. Retrieved March 31, 2022 from https://www.ruralhealthinfo.org/toolkits/health-promotion/2/program-models/precede-proceed

Ruben, R., Cavatassi, R., Lipper, L., Smaling, E., & Winters, P. (2021). Towards food systems transformation—five paradigm shifts for healthy, inclusive and sustainable food systems. *Food security*, *13*(6), 1423-1430. https://doi.org/10.1007/s12571-021-01221-4

Rutten, L. F., Yaroch, A. L., & Story, M. (2011). Food Systems and Food Security: A Conceptual Model for Identifying Food System Deficiencies. *Journal of hunger & environmental nutrition*, *6*(3), 239-246. https://doi.org/10.1080/19320248.2011.597705

Sacristan Lopez de los Mozos, I., Rodriguez Duarte, A., & Rodriguez Ruiz, A. (2016). Resource Dependence In Non-profit Organizations: Is It Harder To Fundraise If You Diversify Your Revenue Structure? *Voluntas (Manchester, England)*, *27*(6), 2641-2665. https://doi.org/10.1007/s11266-016-9738-8

SAGE. (2016). Pretesting and Pilot Testing. In (pp. 101-119). SAGE Publications, Inc.

Sahle, H., Enbiyale, G., Negash, A., & Neges, T. (2018). Assessment of honey production system, constraints and opportunities in Ethiopia. In (Vol. 6, pp. 42-47): Pharmacy & Pharmacology International Journal.

Saner, G., Cukur, F., & Engindeniz, S. (2004). The Economic Analysis of Beekeeping Enterprise in Sustainable Development: A Case Study of Turkey. In (Vol. 38, pp. 342-351): Apiacta.

Schnake-Mahl, A., Williams, J. A. R., Keppard, B., & Arcaya, M. (2018). A public health perspective on small business development: a review of the literature. *Journal of urbanism*, *11*(4), 387-411. https://doi.org/10.1080/17549175.2018.1461678

Schouten, C. N. (2020). Factors influencing beekeepers income, productivity and welfare in developing countries: a scoping review. *Journal of apicultural research*, *60*(2), 204-219. https://doi.org/10.1080/00218839.2020.1844464

Schouten, C. N., & Lloyd, D. L. (2019). Considerations and Factors Influencing the Success of Beekeeping Programs in Developing Countries. *Bee world*, *96*(3), 75-80. https://doi.org/10.1080/0005772X.2019.1607805

Simpson, D. D. (2002). A conceptual framework for transferring research to practice. *Journal of substance abuse treatment*, *22*(4), 171-182. https://doi.org/10.1016/S0740-5472(02)00231-3

Singh, G., Tiwari, D., & Yadav, S. P. (2016). Income Enhancement and Employment Generation Through Apiculture Enterprise for Rural Youth in Punjab. In (Vol. 16, pp. 112-115): Indian Research Journal of Extension Education.

Tomaselli, M. F., Timko, J., & Kozak, R. (2013). Assessing Small and Medium Forest Enterprises' Access to Microfinance: Case Studies from The Gambia. *The Journal of development studies*, *49*(3), 334-347. https://doi.org/10.1080/00220388.2012.740018

Tutuba, N. B., Msamula, J. S., & Tundui, H. P. (2019). Business Model Innovation for Sustainable Beekeeping in Tanzania: A Content Analysis Approach. *American Journal of Management*, *19*(1), 74-88.

UNDP. (2020). *Human Development Report 2020: Gambia*. United Nations Development Program. Retrieved September 20, 2021 from http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/GMB.pdf

Vorley, B., Lundy, M., & MacGregor, J. (2009). Business models that are inclusive of small farmers. In *Agro-industries for development* (pp. 186-222). CABI. https://doi.org/10.1079/9781845935764.0186

Wagner, K., Meilby, H., & Cross, P. (2019). Sticky business - Why do beekeepers keep bees and what makes them successful in Tanzania? *Journal of rural studies*, *66*, 52-66. https://doi.org/10.1016/j.jrurstud.2019.01.022

WBG. (2022a). *Gambia, The: SDG Goal*. World Bank Group. Retrieved May 12, 2022 from https://data.worldbank.org/country/gambia-the

WBG. (2022b). *GDP per capita (current US$) - Gambia, The*. World Bank Group. Retrieved May 12, 2022 from https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=GM

Wegerif, M., & Hebinck, P. (2016). The Symbiotic Food System : An 'Alternative' Agri-Food System Already Working at Scale. *Agriculture (Basel)*, *6*(3), 40. https://doi.org/10.3390/agriculture6030040

Wright, D. R. (2004). *The World and a Very Small Place in Africa: A History of Globalization in Niumi, The Gambia.* M.E. Sharpe Incorporated.

Yap, N., Devlin, J. F., Gard, O., Thang Van, D., & Hang Thi, N. (2015). Beekeeping, Wellbeing, Transformative Change: Development Benefits According to Small Farmers in Vietnam. *Journal of rural and community development*, *10*(1), 19.

APPENDICES

Appendix A: ILE Product Number 1 – The Evidence Matrix

Reference	Exclusion Criteria	Results	Conclusions
Ahmad, T., Shah, G.-M., Ahmad, F., Partial, U., & Ahmad, S. (2017). Impact of Apiculture on Household Income of Rural Poor in Mountains of Chitral District in Pakistan. In (Vol. 6, pp. 519-531): Journal of Social Sciences.	Must be beekeepers in intervention villages, who did not receive pilot intervention.	IMPACTS: Higher income, rates of decision-making and equal involvement among women, and money for school, health, re-investment, and donation-giving to community needs. -Average income from beekeeping increased by 51.54% from beginning to end of intervention (524) -Beneficiary income from beekeeping: PKR 67,374.77; non-beneficiary income from beekeeping: PKR 11,286.45 (524). -Higher rates of women's equal involvement (49% compared to 37%) and decision making in apiary management (53%) and in how to spend the honey-based income (46% compared to 16%) compared to non-beneficiary households. Also, only 39% of beneficiary households were characterized by solely male decision making compared to 73% of non-beneficiary households. -33% of beneficiaries spent up to 25% of honey earnings on better schooling for children; spent more than 10% on household health including doctor visits, medicines, and transportation to health centers. A "considerable amount" of beneficiaries reinvested in beekeeping enterprises. (527) -On average, beneficiary households consumed 6 kg/ year and gifted 5 kg to friends and family. -80% adherence rate 4 years post-intervention. Reasons for abandonment include disease and pests. -Managing goats near the apiary tended to lead to neglect from limited time to manage hives. -Interventions are sustainable when "livelihood options are carefully considered and implemented in a participatory manner."	At scale, need to concentrate on value-chain development to increase value of honey and reduce under-purchasing practices where competition between beneficiary and non-beneficiary producers lowers the price to the farmer. Need to focus on branding and packaging. Beekeepers and related value chain actors need training in business management. Factors that contributed to sustainability: 1. evidence based research informed design 2. relevant to needs of environment and community 3. livelihood of community dependent on subsistence agriculture and beekeeping is an alternative source of income 4. beekeeping is "manageable besides an engaging primary occupation" (528); does not require ownership of land; conducted on margins and community periphery 5. intervention is owned by community and/or organization

Amulen, D. R., D'Haese, M., Ahikiriza, E., Agea, J. G., Jacobs, F. J., de Graaf, D. C., . . . Cross, P. (2017). The buzz about bees and poverty alleviation: Identifying drivers and barriers of beekeeping in sub-Saharan Africa. *PloS one*, *12*(2), e0172820-e0172820. https://doi.org/10.1371/journal.pone.0172820	Included beekeepers and farmers.	Not associated with a specific intervention. Study looks at beekeeping in general in Uganda. Honey sales contributed to 7% of annual household income, which would not have been there otherwise. In the absence of training, extension services, or other support measures, beekeeping did not contribute to higher annual income compared to non-beekeepers, nor did it contribute to improved well-being indicators. Drivers: household nutritional needs; market for products; labor demands; presence of local knowledge; profitability; seeing others do it; information from government or NGO agencies. Barriers: insufficient knowledge; fear; start-up capital; land; unsure of profitability; market access Adoption factors: access to extension services (relevant information); Knowledge transfer outlets is considered essential to beekeeper success. Hive management skills and capacity were independent from previous contact with previous NGO/government agency, yet hive type was directly related to previous contact with NGO, especially for the top-bar and frame hives. The study identifies well-being variables that were determined and agreed-upon locally. The study demonstrates that beekeepers are relatively less wealthy than non-beekeepers, which may be a function of the project selection criteria focusing on poorer households. Other important factors that distinguish beekeepers from farmers include participation in a savings group, material and physical goods and assets (i.e., cattle). Beekeeping failed because of lack of training and equipment. (i.e., safety equipment).	Household well-being metrics gaps: post-intervention support, savings programs, access to equipment (hives and safety equipment) Need: more evaluation on effectiveness of agencies to implement beekeeping programs Success dependent on provision of "appropriate and repeated" (10/14) training and safety equipment. NB. Beekeeping may not be profitable if the enabling environment does not exist. Opportunity costs, options for alternative income sources, and profitability needs to be determined before promoting beekeeping. Profitability needs to be an ongoing measure and aim of beekeeping interventions.

Berhe, A., Asale, A., & Yewhalaw, D. (2016). Community Perception on Beekeeping Practices, Management, and Constraints in Termaber and Basona Werena Districts, Central Ethiopia. *Advances in agriculture (Hindawi Publishing Corporation)*, *2016*, 1-9. https://doi.org/10.1155/2016/4106043	Cochran and proportional allocation to determine sample size	Majority male: 84% and 82%; average age: 46; Majority married: 85% and 84% Majority do not have knowledge on modern beekeeping management, 92.64% and 79.34%, including frame-hive management. (3) Majority of beekeepers more familiar with and use traditional hives, 67% and 56%. (4) Majority did not receive training in beekeeping management, 77.5% and 69.3%. (4) Majority used local materials (bamboo hive with dung), 70% and 56% (4). Observed decline of transfer from traditional to modern hive between 2007 and 2013. Honey production increased between 2010-2012. Nearly two-thirds of study participants, 67% and 70%, reported use of metal or plastic sheeting to protect hives from weather, and one-third, 33% and 29%, reported not having sufficient means to protect against disease. Opportunities identified included potential for increased honey production, improved livelihoods, especially for landless participants. Participants viewed beekeeping as feasible because it requires little land, time, and capital if hives are made from local material (5). Participants identified the following problems: absconding colonies, land, drought, disease.	Constraints include: skilled manpower and training institutions; low-level of technology; poor quality of honey harvesting; absconding, drought; poor awareness of beekeeping; shortage of floral resources; pesticides; disease; shortage of colonies; market access. Berhe recommends transitioning from traditional to modern hives and management and providing training for farmers.

Elisante, F., Ndakidemi, P. A., Arnold, S. E. J., Belmain, S. R., Gurr, G. M., Darbyshire, I., . . . Stevenson, P. C. (2019). Enhancing knowledge among smallholders on pollinators and supporting field margins for sustainable food security. Journal of rural studies, 70, 75-86. https://doi.org/10.1016/j.jrurstud.2019.07.004	Farmers in Moshi Rural District, Kilimanjaro, Tanzania	Education is associated with Increased awareness of the role, value, importance of pollinators. Before training, 52% were aware of the role of pollinators in the food system; 80% and 98% were unaware of the benefit of wild bees and hoverflies. Post training, knowledge and awareness increased among farmers in both pollinator identification, 99%, 54%, and 62%, and importance to crops, 90%, 69%, and 60%. Most farmers recognized the importance of biopesticides in protecting pollinator species. Study demonstrates education is both "feasible and essential" in achieving sustainable intensification.	Training on pollinators and their importance in the food system and agricultural yield Note: Agro-ecological intensification is the use of natural processes for sustainable crop production and requires more knowledge than conventional methods.
Elzaki, E., & Tian, G. (2020). Economic evaluation of the honey yield from four forest tree species and the future prospect of the forest beekeeping in Sudan. *Agroforestry systems*, *94*(3), 1037-1045. https://doi.org/10.1007/s10457-019-00478-1	Beekeepers	Average annual yield of honey/bee hives is 13 kg, ranging between 10 and 16 kg, 15 bee colonies/hectare is more suitable with a return rate of 780 US$/hectare annual income. Inputs on one apiary for ten years in Sudan: Y1 Langstroth box Y1 Honeybee colony Y1 Wax foundation Y1 Honey extractor Y1 Protective clothe Y1 Smoker Y1 Tools Year 1, and Year 2-10: Management & operation and guarding Others Obstacles & constraints: Production input costs (management and operation cost; beekeeping equipment and tools; transportation cost; levies and fees) Bee habitats and foraging area (Wildfires; deforestation and forest degradation, agricultural expansion; spread of insecticide use; migration of bee colony) Beekeeping as general (Low prices in the production area; lack of credit; lack of technical assistance; the absence of the state's interest; Lack of the beekeeper's awareness)	Possible to demonstrate impact through revenue from honey/hectare or hive. This would include a realistic understanding of the costs, revenues, constraints, and barriers of beekeepers and other actors in the value chain.

Geslin, B., Aizen, M. A., Garcia, N., Pereira, A.-J., Vaissière, B. E., & Garibaldi, L. A. (2017). The impact of honey bee colony quality on crop yield and farmers' profit in apples and pears. *Agriculture, ecosystems & environment*, *248*, 153-161. https://doi.org/10.1016/j.agee.2017.07.035	Apple and pear farms	High quality pollinators are associated with increased yield, fruit weight, and profit. However, this is crop dependent. Profits increased from apples pollinated by high-quality pollinators, while pears did not reap the same benefit. [This may relate to market forces].	Quality bees, colonies, hives, etc. is important for bee health and crop yields.
Goshme, D., Ayele, T. (2020). Constraints of Honey Production and Marketing in Ethiopia: A Review. *Agricultural Reviews.* 41(4), 393-397.	n/a	Pests, disease and predators; weather problem; Shortage of bee forage; Absconding; shortage of trained manpower; shortage of equipment; poor management practices; chemicals; weak research and extension; poor infrastructures and etc. are constraints linkages problem; lack of market center; lack of market information; price fluctuation; low awareness of post-harvest handling; lack of technology; poor market infrastructure, lack basic business concepts and etc. are constraints honey marketing in Ethiopia	Adopting effective honeybee pests, disease and predators controlling methods; Introducing and expanding of full package improved beekeeping technologies with adequate practical skill; strengthen full package extension services; Support farmers for beekeeping business through credit availability, improving the barging power of beekeepers, strengthen linkage among different concerned institutions, cooperative formation, input supply, market facilitation and infrastructures as a whole; giving attention on research and human resources development; Expanding coverage of flowering plants especially economically important ones like horticultural crops and reducing the impact of agrochemicals and others are suggested recommendations.

Goto, R., Devine, J., Nicholas Mascie-Taylor, C. G., Ormand, J., & Jufry, A. J. (2019). The impact of an income-generating activities programme on children and mothers' undernutrition in extreme poor rural Bangladeshi households. *Public health nutrition*, *22*(16), 3073-3082. https://doi.org/10.1017/S1368980019002015	Income generating activity intervention participants	Nutritional improvements from income generating activities after two years include: decrease in stunting, 40.3% to 33.0%, and anemia, 51.6% to 44.0%, among children, and chronic energy deficiency, 52.0% to 42.7%, in mothers; Improved socio-economic status, socio-economic security, including cash savings and net income; food quality and quantity, including greater diversity of food and animal protein.	The interventions included a range of programs including asset and technology transfers, strengthening market linkages, development of small businesses, access to land, and improving access to rights and social entitlements. [These can also be demonstrated in beekeeping projects]
Hoshide, A., Drummond, F., Stevens, T., Venturini, E., Hanes, S., Sylvia, M., . . . Averill, A. (2018). What Is the Value of Wild Bee Pollination for Wild Blueberries and Cranberries, and Who Values It? *Environments (Basel, Switzerland)*, *5*(9), 98. https://doi.org/10.3390/environments5090098	Blueberry and cranberry producers in Maine and Massachusetts identified by land use maps and datasets	Diminishing returns of additional hives beyond 3-4 per hectare - this can be crop dependent.	Diminishing returns may be a factor, as demonstrated between adding 3 or 4 additional hives in cranberries compared to adding 9 or 10 hives in apples; However, one study shows that 15 hives per hectare produces the optimal return (Elzaki).

Lee, D. (2014). Factors of Success in Beekeeping Development Projects and Their Application to South Africa's Beekeeping Industry. In: Pomona Senior Theses.	n/a	[Ethiopia] went from a net importer to a net exporter of honey (1); increased honey production 26% and primarily exports to Sudan(24); Beekeeping cannot address large scale issues alone (18). 75% of the world's poor live in rural areas, but only 4% of development funds go towards agriculture (19). General description of diffusion of knowledge (20). Bees for Development Values: 1) promote use of local resources; do not send equipment or bees to poor countries 2) advise use of indigenous bees to promote optimal health of bees and fight indigenous parasites, viruses, etc. 3) build capacity through information an knowledge sharing to build self-reliance and empowerment. 4) the best hive type is the one appropriate to the local context, good for bees, and affordable to beekeepers. 5) Income can be raised by tracking beekeepers to analyze their own market. Intervention Notes: 1) Introducing modern hives: Comparison of traditional vs modern hives: traditional (can't manipulate/manage/inspect for insects), modern (allows for insect inspection/management). 2) Market-oriented beekeeping: working with beekeepers to design products for the market, emphasis on quality.	Some useful insights and takeaways that align with general literature.

		3) value chain promotion: setting up businesses/organizations within the value/production chain. 4) Promoting local leadership Turkey 2010 world's 2nd largest producer of honey; 1885-1999 jumped from 4 tons/year to 5,306 tons/year. 2010: 81,115,000 tons! Apiservices online resource (database, books, catalogues, beekeeping-related information). Mentoring Programs need 1)program support, 2) mentor training, 3) participant selection process, 4) ongoing evaluations (43). Sifting process: a process in S. Africa where the project creator "sifts" people out based on their performance (43) Equipment was given in the SA Bee Pilot Project, but Oudtshoorn makes his own equipment after receiving the initial kit. Interesting model of value chain development: train hive builders to build and sell to beekeepers; train processors to buy and process/package honey from beekeepers. Personal investment is noted as an important aspect on the part of the S. Africa project's success. Mr. Steenkamp is the founder/creator and personal mentor of the beekeepers and does what he can help solve problems the beekeepers face and to help them grow their businesses. Lessons learned: 1) environmental context is important, 2) market access and structure; other lessons: need to work with the community to determine hive suitability and perceptions of this may change over time as people see the need for different types of hives; diversification of opportunities; sifting; mentorship; data collection for audits and funding/investment.	

Meaton, J., Lowore, J., & Wood, A. (2021). Assessing value chain interventions in Zambian and Ethiopian forest beekeeping systems. *Business strategy & development*, *4*(2), 159-169. https://doi.org/10.1002/bsd2.136	Forest beekeeper stakeholders	7 types of interventions identified: 1) rights, 2) technological development, 3) gender issues, 4) product quality, 5) trade development, 6) product processing, and 7) value added, such as fair trade certification. Upstream interventions: government policy allowing community access to forests; buy-led introduction of food-grade receptacles for honey collection and storage; introduction of modern hives may not be sustainable in the long-term; changes to traditional value-chain may undermine cultural and traditional players, connections, and trust within communities; encouraging producers to focus on value-added or processing in addition to beekeeping may not be economic and may be counterproductive; no comparative advantage is seen for beekeeping in processing, but they do have an advantage in providing pure, raw honey. Downstream interventions: benign monopolies may benefit the value chain in terms of training and support, infrastructure and logistics, quality, meeting demand, sales and income; farmer-owned enterprises can increase income, power, and agency of beekeepers; participatory forest management that includes beekeepers can increase forest access and create new market linkages. This could lead to a multiplier effect.	Choice between traditional and modern hives an important one; important to recognize, respect, and integrate traditional methods; they may be more appropriate and still generate revenue; people can decide on their own over time which they prefer based on returns and preference; Quality goals: not too smokey, low water content, fully capped. Consider purchasing honey from the comb instead of asking beekeepers to process it. Pay/kg; estimate weight of wax; purchase price could include wax and honey for a fair-trade purchase. Research is needed to determine variance in pest infestation between grounded and hanging apiaries. "Interventions that seek to create opportunities for sustainable trade are far more important." "The key issue is access to markets, and interventions that support the development and empowerment of communities so that they have stronger, more powerful and sustained relationships with buyers are those that should be the focus of governments and NGOs, with long-term private sector involvement." (167)
Novelli, S., Vercelli, M., & Ferracini, C. (2021). An Easy Mixed-Method Analysis Tool to Support Rural Development Strategy Decision-Making for Beekeeping. *Land (Basel)*, *10*(7), 675. https://doi.org/10.3390/land10070675	Beekeepers from River Park and wine-growing areas in Piedmont, Italy.	Strengths: motivation, collaboration. Weaknesses: time, labor-intensive; management costs. Opportunities: recent retail price increases; increase in public awareness the role of bees. Threats: climate change, agricultural practices (i.e., pesticides), disease and pests; misaligned support from public sector; price competition with imported, lower quality honey.	SWOT analysis matrix can be easily taught and utilized by non-trained, non-professional participants. This approach is useful to increase participation and can be used to as a bottom-up or top-down methodology.

Patel, V., Biggs, E.M., Pauli, N., Boruff, B. (2020). Using a social-ecological system approach to enhance understanding of structural interconnectiveness within the beekeeping industry for sustainable decision making. *Ecology and Society.* 25(2), 24. https://doi.org/10.5751/ES-11639-250224	Full-time beekeepers, part-time beekeepers, government officials, research experts, retired beekeepers	Variables identified: Resource system: bee resources, flora, nectar, visitation trends and locations (farms, forests) Resource unit: mobility of hive (for genetic health and variation) Governance system: focused on managing bee resources and bee stock Focal action situation (key interactions and outcomes): information sharing between beekeepers on forage locations Sustainability pressures: Availability, access, and utilization of apiaries Climate change Fires (controlled and non-controlled burning) Structural interconnectedness	Important metrics/considerations: - Knowledge of flowering plants - Climate (rainfall & temperature) - Knowledge of burn patterns & fire (protection and cultural practices)
Pocol, C. B., & McDonough, M. (2015). Women, Apiculture and Development: Evaluating the Impact of a Beekeeping Project on Rural Women's Livelihoods. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Horticulture*, *72*(2). https://doi.org/10.15835/buasvmcn-hort:11423	Villages in the Somes River Valley	Increased consumption of honey, social interaction for women, community involvement, revenue; "fresh air," responsible participation in the environment through supporting pollination, age is not necessarily a disqualifier for participation compared to other agricultural activities. Increased personal empowerment. (Not as effective for community empowerment). Increased: independence, pride, and well-being; family nutrition.	Might include family nutrition variables to future surveys and qualitative questions that focus on personal reasons for beekeeping and well-being (i.e., fresh air). Pass on the gift Trainings included marketing skills.

Potts, S. G., Imperatriz-Fonseca, V., Ngo, H. T., Aizen, M. A., Biesmeijer, J. C., Breeze, T. D., . . . Vanbergen, A. J. (2016). Safeguarding pollinators and their values to human well-being. *Nature (London)*, *540*(7632), 220-229. https://doi.org/10.1038/nature20588	n/a	"Pollinators are inextricably linked to human well-being" (220). Bees visit 90 percent of 107 leading crops. Diversity of values: secure diverse seed and fruit supply; honey & bee-related products; cultural value. 5-8% of global crops would be lost without pollination services, and food volume would not meet global need. "Pollinator-dependent crops inform human diet; nutritional dependency of pollination overlaps geographically with incidence of malnutrition" (220). "Loss of pollinators could correlate with rise in preventable chronic disease resulting in an estimated 1.4 million additional deaths per year and 29 million lost years of healthy life" (220). Pollination could potentially increase a food production gap by 24% globally. "Pollinator dependent plants contribute to: medicines, biofuels, fibers, construction materials, musical instruments, arts, crafts, and recreation" (221).	Pollinator-dependent plants are threatened by changes in land-use trends towards conventional agriculture. (224). Three approaches are required to safeguard the food system: 1) Ecological intensification a) biotic pest regulation, nutrient cycling, pollination, reduced reliance on agro-chemicals 2) Strengthening diversified farming systems a) intercropping, crop rotations, agroforestry, native flower habitat restoration/conservation, 3) Ecological infrastructure a) semi-natural habitat, landscapes for pollinators along highways, power lines, railway banks, waterways Foster benefits through: food sovereignty biocultural conservation approaches address negative multipliers, such as loss of cultural lands and knowledge
Rahimi, M. K., Abbasi, E., Bijani, M., Tahmasbi, G., & Azimi Dezfouli, A. A. (2020). Sustainability criteria of apicultural industry: evidence from Iran. *Ecosystem health and sustainability*, *6*(1), 1818630. https://doi.org/10.1080/20964129.2020.1818630	Some college education or higher; knowledgeable or experienced in beekeeping	Provides sustainability criteria: [Conceptual model] Sustainability of Iran's apiculture industry relates to: <u>1)Social</u> a) level of social development, b) level of cultural development, c) quality of extension services <u>2)Environmental</u> a)farmers' env behavior quality, b) beekeepers' env behavior quality <u>3)Economic</u> a) quality of marketing and sales of honey, b) productivity and performance improvement, c) among of monetization from pollination, d) among of monetization of byproducts and value added, e) employment rate and job stability <u>4)Institutional</u> a) comprehensiveness of laws and programs, b) quality of role-playing of stakeholder NGOs, c) quality of role playing of gov stakeholders	Systemic criteria for sustainability
Sahle, H., Enbiyale, G., Negash, A., & Neges, T. (2018). Assessment of honey production system, constraints, and opportunities in Ethiopia. In (Vol. 6, pp. 42-47): Pharmacy & Pharmacology International Journal.	n/a	Major constraints to Ethiopian honey production: knowledge, skills, labor, equipment; pest management; pesticide use; infrastructure; bee forage; extension services. Cost of hives and equipment for management, harvesting, processing, and packaging (900-6,000 ETB). Lack of microfinance institutions. Deforestation-led shortage of flowering plants. Lack of trained, skilled labor on best practices. Opportunities: income from wax, honey, pollination services,	Opportunities and need exist for: cooperative development, collection centers, training services, value-chain development, traditional knowledge capture and inclusivity.

Saner, G., Cukur, F., & Engindeniz, S. (2004). The Economic Analysis of Beekeeping Enterprise in Sustainable Development: A Case Study of Turkey. In (Vol. 38, pp. 342-351): Apiacta.	Beekeepers from 2 provinces in Turkey	Average age of beekeepers: 43.4 years Average experience beekeeping: 16.1 years Average education: 6 years Average family population per apiary: 4 persons Average % of household income by apiary size: less than 100, 46.2%; 101-149, 72.7%; 150 or more, 60.9%. Average age of queens: 2 years; Average queen replacement cycle: 2 years. Apiary based swarm collection and growth: 88.34% Average frame size: 6 - 10 in autumn % of beekeepers who use sugar water: 48.3% (most common sugar-to-water ratio: 1:1 Average honey production per hive: 23.1kg/colony % who sell to dealer: 70.8%; at local market, 10.8%; exporter, 9.2% Average price direct to consumer: 5.14€/kg; wholesale, 1.56-2.12 €/kg.	Honey production has potential to contribute to income generation in significant ways. Several constraints exist in Turkey with regard to production and export: quality, variety, mix harvest, sugar, and residues (chemical, various sources).
Schouten, C. N. (2020). Factors influencing beekeepers' income, productivity, and welfare in developing countries: a scoping review. *Journal of apicultural research*, *60*(2), 204-219. https://doi.org/10.1080/00218839.2020.1844464	beekeeping and beekeeping interventions in developing countries	Beekeepers owned an average of 19 ± 18 colonies; income from beekeeping contributed on average to 29% of household earnings each year. 15 predictive variables identified as having a significant, positive association with honey yields: 1. Langstroth hive type 2. number of hives 3. household size 4. frequency of requeening 5. access to grant scheme 6. credit access 7. capital re-investment 8. on-farm income 9. supplementary feeding 10. age 11. labor 12. years' experience 13. education 14. no. of beekeeping training days 15. contract sales scheme	As a measure, number of hives is a common metric, however it can be misleading since increasing the number of hives can lead to reliance on beekeeping for income rather than diversified income streams, and after a point of diminishing return, increasing hives does not always translate into profitability. Best practices: training should include business development, stocking rates, profitability that includes labor and opportunity cost. training should be positive outcome driven well-being should be a factor: resilience, agency, voice, and empowerment participation of stakeholders beekeepers defining their own success locally relevant data (colony loss, stocking rates, local floral resources) [stocking rates must mean the rate of filling/capping comb after floral blooms] theoretical assumptions and formulas should not be applied to loan repayment schemes as these can further exacerbate the problem these programs are designed to address (poverty) livelihood improvement factors: welfare, cost-benefit analysis (input costs, access to and cost of inputs, overall profitability, returns to labor, opportunity costs, risk, and vulnerability should be considered. focus on business plans, serious beekeepers, increased hives….

Schouten, N.C., & John Lloyd, D. (2019). Considerations and Factors Influencing the Success of Beekeeping Programs in Developing Countries. Bee world, 96(3), 75-80. https://doi.org/10.1080/0005772X.2019.1607805	People working in beekeeping-related development projects in low- and middle-income countries.	7 themes emerged: 1. Market access 2. Floral resources 3. Extension 4. Capacity building and training 5. Program management and design 6. Participant and beneficiary selection 7. Technology Notes on each: 1. Market access - essential to long-term success 2. Floral resources - essential knowledge; understanding of timing of flowering; access to rich nectar sources 3. Extension - local, reliable; strong working relationships; develop confidence; MENTORS are essential; need to be" employed by a trusted source of information by beekeepers" 4. Capacity building and training - focus on practical over theoretical; provided by competent trainers; ideal trainers are enthusiastic, effective, and engaging; training on business side is essential. "If it does not earn money, it will fail." 5. Program management and design: experience, leadership, communication, engagement, and project management are important skills; don't "give too much too soon;" giving money and equipment are not enough; don't give inputs for free without long-term engagement; participatory approaches are important; beekeepers need continual encouragement and support to find their own solutions; don't over emphasize the importance of number of hives (while important) as a metric; consider local context; promote a shared understanding of objectives. 6. Participant and beneficiary selection - important for success; "train only those genuinely interested and dedicated to making money from beekeeping;" need to be "motivated, hardworking, eager to learn, committed, ambitious, dedicated and "have a love for bees." 7. Technology - focus on local and appropriate technology; " bringing "improvements" does not necessarily lead to improvements;" dependence on imported materials is a major issue; utilize local resources, skills for sustainability. Technological applications or innovations should include: 1) pilot studies, 2) timing of introduction, 3) improvements to	Generally, need to have locally and beekeeper determined metrics for profitability rather than simply counting the number of colonized hives. Factors include confidence, meeting goals, financial return, opportunity costs, utilization of a business model, etc.

		existing technologies, and 4) utilizing local resources. Associations and cooperatives can overcome challenges to market access, but they can also be limited by access to products based on sufficient quantity, quality, and collecting honey. to overcome market uncertainty, rural isolation, and poorly functioning value chains, strengthening linkages between beekeepers, processors, and markets is essential. DQ It may be tempting to aim for international trade of honey to get a better price per pound, but this can be expensive and demands quality standards are met. It may be more profitable for associations, despite earning less per pound, to market at the local level. (paraphrase) Cooperatives can become dysfunctional (DQ) Good management and governance at the organizational level helps keep the value chain strong (orlegge & Gonapa, 2011). (Paraphrase). Interventions that collect and market honey are beneficial beekeepers (Bradbear, 2009, Schouten, Lloyd, & Lloyd, 2019). K of bee nutrition is required! Beekeepers and development organizations need to know and have local floral calendars and supplemental feeding programs to help bees survive dearth periods. Profitability needs to be a metric over number of hives. Profitability can be demonstrated even without modern hives and in some cases, fixed comb hives have provided higher returns (paraphrase).	

Singh, G., Tiwari, D., & Yadav, S. P. (2016). Income Enhancement and Employment Generation Through Apiculture Enterprise for Rural Youth in Punjab. In (Vol. 16, pp. 112-115): Indian Research Journal of Extension Education.	Beekeepers in Mansa and Ludhiana districts of the Punjab State	Migratory apiaries were utilized predominately by rural youth and stationary apiaries were more common among small farmers. Migratory apiaries produced more honey, 46 kg/hive, than stationary apiaries, 17 kg/hive. Cost: Benefit ratio for migratory apiaries: 2.77; for stationary apiaries, 1.91.	Migratory apiaries may be a viable income generating activity for unemployed youth. Beekeeping has a good cost: benefit ratio for both migratory and stationary apiaries. More needs to be done to develop awareness, market access, training, nectar sources and plantings, along with access to credit facilities.
Tutuba, N.B., Tundui, H. P., & Msamula, J.S. (2020). Governance of the Business Ecosystems to Commercialize Beekeeping Activities in Emerging Markets. *Journal of Strategic Innovation and Sustainability*, *15*(5), 103-115.	Tanzanian beekeeping organizations	Ecosystem divided into primary and secondary actors. Primary: carpenters, artisans, tailors, traders, producers (beekeepers/hunters), cooperatives, orchestrators (entrepreneurs involved in processing, packaging, distribution, marketing, and sales). Secondary: supporting actors (development organizations, funders, foundations who fund capital building or other activities). Governance histories reveal distrust, inefficiency, ineffectiveness, and long-term failure. Beekeepers skeptical of cooperatives; prefer selling at highest price instead of contracts. Trader-based governance characterized by arms-length relationships and competition between producers and buyers. Cooperative governance increases value, bargaining power, and garnering external support from secondary actors. Corruption, inefficiency, and inconsistent stock levels caused this model to fail, and beekeepers currently do not trust this system. Hybrid governance model may provide incentive, income, and accountability for independent actors to cooperate and produce quality honey.	Hybrid structure involves beekeepers, cooperative, and entrepreneur centered around collection center. Cooperative is made up of beekeepers and determines rates, quality standards, and other regulatory features. Beekeepers paid above market rate for quality honey and have buy-in/voice through cooperative membership. Entrepreneur (orchestrator) owns processing equipment; buys, sells, packages, markets, distributes honey. Percentage of profits paid to cooperative who provide equipment, training, etc. to beekeepers. The focal point for all players if value creation for customer: i.e., high quality, pure, branded honey. The orchestrator (i.e., entrepreneur) must structure and manage the ecosystem to maximize value creation. Trust and mutual agreements are important to create value equitably throughout system.

Wagner, K., Meilby, H., & Cross, P. (2019). Sticky business - Why do beekeepers keep bees and what makes them successful in Tanzania? *Journal of rural studies*, *66*, 52-66. https://doi.org/10.1016/j.jrurstud.2019.01.022	Beekeepers	Most training models are currently inadequate and do not result in increased yields. Propose that requirement to form associations may lead to divisions within the community. Primary drivers for adoption (of beekeeping): income & food provision moderated by cultural background and perceived risk to health from working with African bees. Constraints: land ownership, technical knowledge, initial capital inputs, hive theft	Needs: land, knowledge, capital, and training

Appendix B: BEECause Gambia Letter of Support

15th September 2022

Chris Honeycutt
83 Cloverdale Lane
Johnson City, TN 37604

Dear Doctoral Committee,

We are writing in support of Chris Honeycutt's Doctoral Integrated Learning Experience project. Our Board of Directors and the Management team agreed to support him on his research project.

We are looking forward to working together on the project to achieve the aims of the project.

With regards

Thank you,

Gibbeh Bah
General Manager

Appendix C: Pretest Cognitive Interview Protocol

BAIG-A Pre-Test Cognitive Interview Protocol

Thank you for taking the Pretest Survey in REDCap.

Today, we will go over your responses the survey and you will have an opportunity to provide more feedback to help improve the survey.

We will start with your survey responses and then move to more general questions about the survey.

Do you have any questions before we begin?

Your survey responses are below. They are separated the content area of the survey and conceptual framework to which they relate.

[If conducting the cognitive interview with participant ID 4, continue to the section labeled **ID 4** below.

If conducting the cognitive interview with participant ID 6, skip the ID 4 section and continue to the section labeled **ID 6** below.]

ID 4: The first statement we will look at is number 18 from the survey. This section of the survey is called Predisposing factors, which refer to the factors that make individuals more or less likely to adopt behaviors or attitudes. Question 18 looks at self-efficacy of beekeepers to succeed, and reads **Beekeepers are able to problem-solve and address issues that arise in their apiaries.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Like question 18, Question 20 was selected for its relationship to self-efficacy and reads **Beekeepers can efficiently manage their hives and apiaries to increase honey production (including pest management).**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

The next statement, number 40, is from the section of the survey which measures impact variables, which are the initial effects of an intervention.

Question 40 states **Beekeepers produce high quality products for sell.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

The next statement, number 44, is another impact statement.

Statement 44 states, **most of the organization's trained beekeepers sell their goods (for example: honey, wax, and or value-added products).**

You responded this statement **Very weakly represents the construct**. Please explain why this statement very weakly represents the construct.

Next, number 47, aims to measure the outcome, defined as long-term effects of an intervention.

Number 47 states that **it is evident that beekeepers have been able to improve their quality of life through beekeeping.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Finally, number 48 sought to get your initial reaction to the survey, and asked, **what are your initial thoughts or reactions to this survey?**

Your response reads, **the only concern I had was whether the organization was aware enough to know what they didn't know. They might consider themselves knowledgeable when they were in fact deficient**.

Could you please explain this response.

What do you think needs to be included in the survey to address this factor?

Thank you for explaining your responses to the statements above. In the next section of the interview, we will cover general questions about the survey itself.

[Skip the section for ID 6 and continue with the general questions below.]

ID 6: <u>Section I. Social and Epidemiological Factors</u>

The first section, social and epidemiological factors, aims to assess whether the organization utilizes an evidence-based approach to designing interventions. A key component in implementation design includes understanding social and epidemiological factors, which are to problems, needs, and determinants for success among a population.

Statement number 2 reads **the organization has identified constraints among local beekeepers that it wants to address through an intervention.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

<u>Section II. Implementation Factors</u>

The next section assesses implementation factors associated with an intervention. While implementation includes design components, it also focuses on planning, adherence to plans, as well as the availability of human and financial resources, including partnerships, to implement the intervention.

Statement 13 reads **the organization utilizes partnerships, when feasible, to fill gaps that the organization cannot meet.**

You responded that you are **Unsure** about this statement. What are you unsure about this statement?

<u>Section IV. Ecological Assessment – Enabling Factors</u>

Section IV assesses the enabling factors associated with beekeepers served by an organization. Enabling factors are the internal and external conditions that directly relate to an issue and help in the adopting and maintenance of behaviors or lifestyles (Community Tool Box, 2022). Enabling factors may inform program or intervention design components and services provided by an organization or its partners. Specifically, enabling factors associated with beekeepers include training and education;

extension, mentors; access to equipment, capital, and markets; beekeepers' skills, and organizational policies.

Number 26 relates to access to capital and reads, **Credit schemes for beekeepers are not burdensome.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Similarly, number 27 relates to access to capital and reads, **Credit schemes have been effective in helping beekeepers reach their project or financial goals.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Next, number 29 relates to an enabling factor associated with the literature: extension, and reads, **Extension services are available to beekeepers.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Similarly, number 30 reads, **Extension agents are knowledgeable about beekeeping.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Again, number 31 relates to extension and reads, **Extension agents are reliable, dependable.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Section V. Ecological Assessment – Reinforcing Factors

Section V assesses the reinforcing factors associated with an organization and the beekeepers served by a program or intervention. Reinforcing factors include attitudes of the individuals and communities that impact adoption of behaviors or lifestyles (Community Tool Box, 2022). In terms of beekeepers, reinforcing factors attitudes towards beekeeping and support for beekeepers, such as promoting the overall enabling environment through inclusion of the value chain and identifying organizational policies that increase the chances for adoption, and adherence to beekeeping over the long-term.

Number 35 **The organization actively involves other players (also known as actors or members) from the value chain in its programming to promote an enabling environment.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Similarly, number 37, is associated with organizational policies on inclusion criteria and reads, **the organization uses a selection criterion.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Again, number 38 relates to organizational policy and attitude and reads, **Interventions are adapted to the local context.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Section VI. Impact Evaluation

Section VI aims to measure impact, which is defined as the initial effects of an intervention or program (Community Tool Box, 2022). Impact variables associated with beekeepers and income generation include adherence to beekeeping, utilization of services, behaviors such as goal setting and attainment, income generation, and profit generation.

Survey statement number 41 reads, **Beekeepers meet their seasonal (production or financial) goals.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Similarly, statement number 43 reads, **Beekeepers utilize the organization's services longer than 1-year after the intervention.**

You responded that you are **Unsure** about this statement. What are you unsure about regarding this statement?

Thank you for explaining your responses to the statements above. In the next section of the interview, we will cover general questions about the survey itself.

General Questions

Was there anything unclear about the instructions? Please specify what you found unclear and what information would have been helpful for you to better understand the purpose and intent of the survey or how to take the survey.
Please describe the intended audience and use of the survey instrument.

Were there any terms that you found unclear or confusing?

Were there any statements that you thought were out of place or not in the section that fit best with their content?

Please comment on the survey's length.

Please comment on the content of the survey:

Is there anything that you would remove from the survey?

Is there anything missing from the survey?

Do you have any other comments or suggestions about the survey to improve it before we administer it to the study organization?

Appendix D: ILE Product Number 2 – Evaluation Report Including Summary of Results, Recommendations, and Blank Instrument

COLLEGE of PUBLIC HEALTH
EAST TENNESSEE STATE UNIVERSITY

BAIG Organizational Assessment Summary of Results & Recommendations

This report summarizes recommendations resulting from a SWOT analysis examining BEECause's position in relation to evidence-based factors for profitable outcomes for global beekeepers. It also includes a blank version of the BAIG-A instrument.

BACKGROUND

Beekeeping can help to improve quality of life through profitable, alternative income generation. In the absence of evidence-based tools to inform interventions, organizations have achieved mixed results ranging from profitable income to no-income for beekeepers. The Beekeeping for Alternative Income Generation Organizational Assessment (BAIG-A) is an evidence-based instrument aligned with the PRECEDE-PROCEED conceptual framework designed to help organizations achieve profitable outcomes among global beekeepers. The instrument was developed following an extensive review of previous studies and reports that summarize evidence-based strategies to ensure successful use of beekeeping as an alternative source of income for individuals in developing countries.

The organization was assessed to examine the extent to which existing operations are in-line with documented evidence-based strategies to support beekeeping. Overall, the organization is in a strong position to support these activities. However, the assessment of BEECause also reveals potential weaknesses, opportunities, and threats for improvement—specifically as it relates to enabling and reinforcing factors needed to support local keepers. There are also several stand-alone factors that represent potential weaknesses, opportunities, and threats. This brief report provides an overview of findings, recommendations, and a blank instrument for BEECause to adopt into practice moving forward.

SUMMARY of RECOMMENDATIONS

Overall, BEECause has several strengths to promote beekeeping to reduce poverty and promote honeybees in The Gambia. BEECause's strengths include design components such as needs assessments, identification of barriers and constraints, and the adaptation of interventions to local context. Developing and monitoring budgets and intervention activities are strengths associated with implementation. There are also strategies to secure funds, partnerships to fill gaps, and capacity to collect data and conduct evaluations. Among ecological factors, beekeepers are motivated by profit, have access to education, and possess a willingness to try new methods to improve yields. The organization believes it has made a positive impact. Beekeepers profit from beekeeping and make progress towards their goals. While the organization has not identified local indicators to measure improvements to quality of life, the organization is confident that its services improve beekeepers' abilities to succeed. However, there are areas for improvement to build the organization's capacity and promote positive, profitable outcomes for beekeepers. Three recommendations for BEECause are provided:

- Build the organization's financial security.
- Build stakeholder confidence.
- Address weaknesses among enabling and reinforcing factors.

BCG is encouraged to use the recommendations in its strategic planning and capacity-building. While not prescriptive, the recommendations may be seen as a starting point to determine how best to leverage strengths, local resources, or build its capacity. It will help to identify SMART (specific, measurable, achievable, realistic, and timely) goals and objectives.

BUILD FINANCIAL SECURITY

BEECause's financial security is a potential weakness and threat to Gambia's enabling environment for beekeepers. BEECause must balance its need to remain financially viable while also promoting profitable outcomes among beekeepers. Building financial security may be done by:

1. Diversifying revenue from grants.
2. Increasing revenue from bee-related products.

Firstly, BCG may consider how to bring a grant-writer onboard who can identify and write grants on behalf of the organization. While this may seem benign, BCG must be aware of the potential negative impact of diversifying revenue streams. Current funders may feel their resources are no longer needed. BEECause must be prepared to communicate how and why their current funders are vital to their operations, interventions, and the enabling environment of beekeepers.

Secondly, BEECause might consider increasing its revenue from bee-related products. Purchasing goods from BCG's trained beekeepers will promote the value chain and link producers to a market. Regular production meetings could help understand available and predicted volumes and resources that may be available to BEECause. The dual aspect of purchasing from BCG producers and investing in their success builds buy-in, confidence, and can help contribute to BCG's long-term financial stability. It will be important to pay beekeepers a rate that satisfies their need for profit while also communicating why buying from BCG promotes their long-term success when producers are tempted by immediate gratification from a higher bidder that may not be present over the long-term or committed to their overall success. The financial security of BCG is vital to its ability to support beekeepers in a meaningful way over the long-term. The entire organization, especially board members, must be committed to leveraging their skills, resources, and networks to promote the success of the organization.

BUILD STAKEHOLDER CONFIDENCE

Stakeholders include donors, customers, beekeepers, members of the value chain, and anyone else who has an interest in the outcomes of the organization. While all these play a role in BCG's success, having the confidence of donors and beekeepers is vital. Confidence is built by establishing and maintaining relationships. BCG may build stakeholder confidence by:

1. Committing to long-term relationships and prioritizing profitable outcomes for beekeepers.
2. Building its capacity to collect data and demonstrate impacts and outcomes.

First, BCG might build stakeholder confidence by committing to the long-term needs of its beekeepers and prioritizing ways to help beekeepers profit from their activities. Beekeepers need to feel confident that BCG has their best interest at heart to build mutual commitment. BCG needs to constantly consider its price structure when it purchases honey from beekeepers. While not undercutting the organization's financial condition, it needs to be careful not to undermine its beekeepers by offering prices that are not competitive or advantageous. If prices are not as competitive as other buyers, BCG might communicate the importance of selling to BCG over the long-term in terms of a dependable buyer and access to education and other supports.

Secondly, BCG could build its capacity for data collection and dissemination to build stakeholder confidence. BCG must be able to demonstrate its impacts, such as income or volume of honey, and outcomes, such as improvements to quality of life. Data collection and dissemination increases satisfaction and confidence among donors who are concerned that their funds are used in a meaningful way. Beekeepers can also increase their confidence if they are made aware of observable benefits to their household, financial condition, and other locally determined indicators.

ADDRESS ENABLING AND REINFORCING FACTORS

Enabling factors and reinforcing factors are ecological factors that relate to positive impacts and outcomes that BCG can potentially assist or improve through intervention design and implementation. Beekeepers benefit and are more likely to remain committed to beekeeping and achieve a profit when these factors are present. There are several areas that BEECause could focus its attention including:

1. Choosing feasible improvements to the enabling and or reinforcing domains.
2. Getting creative to Improve access to credit for local beekeepers.

Among enabling factors, beekeepers need apiary management strategies as well as access to equipment, markets, and capital. Ongoing education is important to help beekeepers feel confident in managing pests, knowing what to expect in their hives, harvesting techniques, or post-harvest activities. Ongoing education may cover basic or advanced beekeeping concerns but may also be used to address other needs such as profitability, maintenance, growth, or ways to reinvest – even in projects unrelated to beekeeping to generate profitable incomes. Partnerships may also be leveraged to provide ongoing education or other services with Peace Corps Volunteers, other nonprofits that focus on business development, or other agencies with skills relevant to the needs of beekeepers and the value chain. Reinforcing factor objectives may include the adoption and adherence of quality standards by BCG and competitive prices for beekeepers. Both quality standards and pricing promote profitable impacts.

Access to capital or microcredit that is not burdensome, and which helps beekeepers achieve their goals was identified as a weakness. How can BCG help improve this situation? Perhaps the organization could provide micro-credit products to its beekeepers in a way that does not disrupt the organization's financial needs while helping beekeepers grow their enterprises, maintain equipment, or reinvest in beekeeping or other income generating activities. BCG may consider taking on a microcredit loan to acquire seed money and paying off the loan through sales revenue. The seed money could be given to beekeepers at a low or no-interest rate at a longer term. Another idea borrowed from the Gambian tekko system would be to establish groups where individuals commit to paying back a small loan within a reasonable period so that another member of the group can access the seed money. Members may also pay monthly dues which are collected, and the sum given to one member for business purposes such as reinvestment, equipment maintenance, or investment in another entrepreneurial activity. Money would only be available when funds are repaid, which would create a social pressure to pay back funds so that other members can benefit. No member could receive seed money again before everyone in the group has benefited from the credit. The amount should not be burdensome or put members at risk of being unable to repay the loan. Capital could be raised among the beekeepers or from external,

microcredit institutions. The exact program would need to be developed carefully by BCG's leadership team in collaboration with beekeepers or credit institutions to ensure it fits with the needs and realities of local beekeepers in a manner that promotes income generation.

Table 1: Recommendations and Evidence Based Strategies

Recommendation	Evidence-based Considerations
1. Build financial security	a. Diversify revenue streams b. Maintain current funding streams c. Demonstrate importance of current partnerships d. Increase market presence e. Increase products from trained producers f. Improve farm-gate price structure g. Build long-term relationships, mutual commitment
2. Build stakeholder confidence	a. Demonstrate impact b. Data collection, analysis, utilization, and presentation c. Establish local indicators with beekeepers d. Remain connected with current and new beekeepers e. Responsive programs for current and new beekeepers f. Encourage business approach, reinvestment, savings g. Build long-term relationships, mutual commitment
3. Address enabling and reinforcing factors	a. Ongoing education (workshops, trainings, seminars) b. Inclusive of and responsive to value-chain c. Mentor promotion, connection, and utilization d. Regular production meetings with stakeholders, producers e. Micro-credit innovation to reduce burden on producers f. Understand quality standards g. Competitive price structure

SUMMARY

Beekeeping is an alternative income generating activity that can improve quality of life for beekeepers. However, if organizations do not understand the needs of beekeepers or commit to promoting an enabling ecology, beekeepers may not make progress towards their goals. The BAIG-A is an assessment tool designed for organizations to use regularly to plan, monitor, and evaluate strategic priorities and interventions. Currently, BEECause's interventions possess strengths in design, implementation, reinforcing, impact, and outcome factors. However, there are areas of weakness, opportunity, and threat, especially in terms of financial resources, stakeholder confidence, and enabling and reinforcing factors. By building its financial security, stakeholder confidence, and addressing the enabling and reinforcing factors, BCG will be in a stronger position to promote successful outcomes and improve beekeepers' quality of life. This report includes recommendations for BCG to consider as it develops strategic plans and seeks to build its capacity.

CONTACT INFORMATION

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Appendix

Beekeeping for Alternative Income Generation Organizational Assessment Instrument (BAIG-A)

The BAIG-A consists of 49 statements and one (1) open-ended response question. The statements are divided into seven (7) domains that align with PRECEDE-PROCEED. Please read each statement and determine whether you agree strongly, agree, are unsure, disagree, or disagree strongly that the statement describes your organization or your beekeepers. Each component value reflects an evidence-based factor. To determine your organization's position, calculate the composite score for each domain by adding each component value and taking the average. Next, create a SWOT table. All domain and component scores equal to or greater than four (4) represent potential strengths. All domain and component scores below four (4) represent potential weaknesses, opportunities, and threats. List the domains and component factors within the SWOT table. Use this data to determine strategic priorities, SMART goals and objectives, and improvements to your organization's beekeeping interventions. All priorities, goals, objectives, and improvements need to be feasible, specific, measurable, achievable, relevant, and timely. Please send questions, comments, or other correspondence to Chris Honeycutt at honeycuttcm@etsu.edu.

Design Factors	
Statement	**Component Value**
The organization has institutional expertise in beekeeping. If not, the organization works with partner(s) that have expertise in beekeeping.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization conducts regular needs assessments of the beekeepers.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization has identified feasible constraints, obstacles, or barriers among local beekeepers that it wants to address through an intervention.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Interventions are designed to support the predisposing, reinforcing, and enabling factors that relate to successful outcomes for beekeepers.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Interventions include business and or goal-setting training in addition to beekeeping training.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)

The organization can source all or most of the materials to implement the intervention in the host country or region.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization plans an intervention before implementation.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Budgets are developed to estimate the cost of an intervention before implementation.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Composite Score	**Average each component value above.**

Implementation Factors	
Interventions are monitored throughout implementation.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Budgets are monitored throughout the implementation process.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization has access to available human resources to implement the intervention.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization has the financial resources to implement the intervention.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization has strategies to secure financial funds for interventions.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization utilizes partnerships, when feasible, to fill gaps that the organization cannot meet.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization collects data about its interventions.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3)

	○ Disagree (2) ○ Disagree strongly (1)
The organization has the capacity (human and or financial) to collect data about its interventions.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization conducts regular evaluations (for example: financial, program, process, impact, and outcome evaluations).	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Composite Score	**Average each component within the domain.**
Predisposing Factors	
Most of the beekeepers the organization serves are motivated to earn a profit from beekeeping.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers have access to training opportunities to help them get started.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers are willing to use available tools, information, and resources to effectively problem-solve and address issues that arise in their apiaries.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers set goals each season (for example: improving hive health, production, sales, pest management, quality, etc.).	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers are willing to try new management techniques if it results in higher yields or profits.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers are open to trying new methods.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Composite Score	**Average each component value within the domain.**
Enabling Factors	
There are sufficient nectar and floral resources to meet the needs of honeybees in the region.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3)

	○ Disagree (2) ○ Disagree strongly (1)
Beekeepers have strategies to overcome dearth periods when nectar flows are low or non-existent.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers have access to equipment they need to meet their goals (i.e., hives, tools, safety equipment, smokers, etc.).	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers can maintain their equipment after the initial intervention.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers have access to capital through savings, micro-finance, pay-it-forward commitments, or other arrangements.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Credit schemes, including micro-finance or micro-loans, for beekeepers are not burdensome.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The use of credit schemes, such as microfinance or micro-loans, have helped beekeepers reach their personal, project, or financial goals.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers have access to markets for their honey, wax, and other bee or hive products.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Knowledgeable and reliable extension agents are available to beekeepers.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers utilize mentors.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers have access to ongoing educational opportunities after the initial intervention covering relevant topics.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2)

	○ Disagree strongly (1)
The organization has the resources or can leverage partnerships to provide ongoing educational opportunities for beekeepers.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Composite Score	**Average each component value within the domain.**
Reinforcing Factors	
The organization actively includes value chain players in its program(s) to promote an enabling environment.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization is committed to the long-term success of local beekeepers through its own resources or by leveraging partnerships, local resources, or by other means.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization has a participant selection criterion that considers factors such as likeliness for adherence, resilience, and motivation towards profits.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Interventions are adapted to the local context.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization understands quality standards or works with a partner that understands quality standards.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization offers a competitive price to its trained beekeepers for their products.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
The organization has a marketing strategy to help capture value for its beekeepers' bee and hive products.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers utilize the organization's services longer than 1-year after the intervention.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)

Composite Score	**Average each component value within the domain.**
Impact Factors	
Beekeepers profit from beekeeping.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers make progress towards their goals.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers continue to keep bees longer than 1-year after the intervention.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Beekeepers benefit from their bee or hive products through sales, bartering, or household consumption.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Most of the organization's beekeepers take a business approach to beekeeping.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Composite Score	**Average each component value within the domain.**
Outcome Factors	
It is evident that beekeepers have been able to improve their quality of life through beekeeping.	○ Agree strongly (5) ○ Agree (4) ○ Unsure (3) ○ Disagree (2) ○ Disagree strongly (1)
Please describe how the intervention improves the quality of life of its beekeepers.	Open-ended response. Ideally, the organization will identify local indicators with its stakeholders that reflect impact and outcome variables.
Composite Score	**Consider the outcome score and the description when analyzing outcomes.**

VITA

CHRISTOPHER M. HONEYCUTT

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