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# Identifying and Assessing Needs of Florida Commercial Beekeepers Using Nominal Group Technique

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**Abstract**

*The importance of honey bees to global agriculture is largely undisputed (Calderone, 2012; Southwick & Southwick, 1992). Simultaneously, commercial beekeeping operations face tremendous industry stressors that have led to increased management requirements and elevated colony losses in Florida and around the United States. in recent decades (Hodges et al., 2001; Kulhanek et al., 2017). The needs of such beekeepers are largely unknown due to a lack of published literature on beekeepers as a whole. Extension professionals and other agricultural educators can create educational programs to address the needs of constituents once they have assessed these gaps between current and desired states. The purpose of this study was to increase understanding of the issues facing commercial honey bee operations to better guide and develop research, instruction, and Extension programs in Florida and beyond. The objectives of this study were to (a) identify the needs of registered commercial beekeepers in Florida, and (b) prioritize registered Florida commercial beekeeper needs. The highest priority need identified by beekeepers in this study was related to controlling the parasitic mite, Varroa, in honey bee colonies. Other priority needs included effective nutritional management as well as control and management of viral infections, bacteria, and Nosema in honey bee colonies.*

***Keywords:*** beekeeper; needs assessment; nominal group technique

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## Background

Managed honey bee colonies have been widely documented as important contributors to the world's food supply (Calderone, 2012; Southwick & Southwick, 1992). Recent decades have seen transformations within the global beekeeping industry, such as increased management intensity, higher gross colony loss rates, and greater numbers of beekeeping operations. The beekeeping industry in Florida is significant within the national context of bees and crop production, ranking third in the United States in terms of number of colonies per state (United States Department of Agriculture, National Agricultural Statistics Service [USDA-NASS], 2019). Florida is home to around 4,500 beekeeping operations and around 620,000 managed colonies (Brandi Stanford, personal communication, December 10, 2018). With

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approximately 2.67 million managed honey bee colonies in the United States (USDA-NASS, 2019), Florida beekeepers are responsible for more than 20% of the managed colonies in the country, making them an important population within the beekeeping community.

With the adequate pollination of global crops being threatened by colony losses, institutions around the world are working to improve bee health and beekeeper success. Perhaps the most established and prolific of these organizations in the United States are the 100-plus land-grant institutions established across the country, which serve beekeeping and other agricultural communities through research, instruction, and Extension (United States Department of Agriculture, National Institute of Food and Agriculture, 2019). Formal agricultural education and instruction take place primarily in school settings, while Extension delivers nonformal agricultural education to beekeepers, growers, and other constituents. The University of Florida (UF) is one such land-grant institution that supports beekeepers through research, instruction, and Extension. Under the UF, Institute of Food and Agricultural Sciences (IFAS) fall beekeeper education programs at the county level and at the state level through the UF IFAS Honey Bee Research and Extension Laboratory. Other Florida organizations outside of the Land-Grant Institution System, such as the Florida Department of Agriculture and Consumer Services (FDACS) and the Florida State Beekeepers Association (FSBA), also provide beneficial services to beekeepers in the state and beyond including regulation of honey bee pests, research, and educational opportunities. Even with the broad educational offerings available to beekeepers in Florida and beyond, evaluation and assessment of these programs is rarely published or shared publicly.

Needs assessments are well documented as critical tools within Extension to determine needs, which guide the Extension program development process (Harder et al., 2009; Rumble et al., 2018; Waters & Haskell, 1989). Even considering this, however, published literature on the identification and prioritization of beekeeper needs is largely absent. The majority of beekeeper-focused research takes the form of colony loss surveys in which beekeepers report the number of honey bee colonies that died in their operations over a time period, as well as the perceived causes of those losses. The most established of these surveys in the United States are published annually by the Bee Informed Partnership (BIP) and USDA-NASS. These surveys, however, report only on factors that lead to colony losses, excluding other issues that may be facing the industry (Kulhanek et al., 2017; USDA-NASS, 2019).

Beyond colony loss, the small amount of published literature on beekeeper needs does not provide an adequate assessment of the beekeeping industry. For example, a survey of Greek beekeepers gathered valuable information about beekeeper demographics and preferences but did not identify greater industry needs (Androulidakis & Harizanis, 1996). A 2001 needs assessment of Florida beekeepers focused mostly on colony stressors and offered inadequate analysis and reporting of the results (Hodges et al., 2001). Furthermore, currently available research on beekeeper needs asks beekeepers to prioritize needs that were first identified by the researchers (Androulidakis & Harizanis, 1996; Hodges et al., 2001; Kulhanek et al., 2017; USDA-NASS, 2019). Needs, however, should be both identified and prioritized by representatives of the target population (Witkin & Altschuld, 1995).

In an established but growing industry, which is vital to much agricultural production around the world, published literature on the actual and perceived needs of commercial beekeepers is nearly non-existent. Researchers and education professionals have, for decades, developed programs with the intention of improving the health and success of the honey bee industry, but rarely have asked the beekeepers themselves how this should be done.

## Conceptual Framework

### Adult Education

The need for and benefit in direct stakeholder involvement in educational programs stems from adult learning, particularly from the conceptual framework known as andragogy. Knowles (1980), who first related andragogy to adult learning, saw pedagogy and andragogy as two ends of a spectrum on which any learner can fall. Recognizing where a group of learners falls on this spectrum can come from assessing learner needs (Knowles, 1980).

Knowles' (1980) andragogy framework listed five assumptions that can be expected of learners on the adult or andragogical end of the spectrum: higher independence, internal motivation to learn, diverse life experiences, needs associated with social roles, and problem-oriented individuals (Knowles, 1980). Andragogy additionally places heavy emphasis on the involvement of adult learners throughout their education, including during program development (Knowles, 1980). Knowles' general assumptions of adult learners should be used in combination with specific needs identified and prioritized in a needs assessment to inform adult education (Holton et al., 2001).

There are five distinct philosophical ideologies concerning adult education with which adult educators can align: liberal, behaviorist, progressive, humanistic, and radical (H. Boone et al., 2002). In the liberal philosophy, the educator is the authority figure who passes on knowledge to adult learners (H. Boone et al., 2002). Behaviorists focus on how the learning environment can lead to behavior changes in the learner (H. Boone et al., 2002). The progressive adult education philosophy emphasizes practical skills and problem-solving, with the educator guiding the learning process (H. Boone et al., 2002). Humanists put the responsibility and motivation to learn on the adult learner, while the educator facilitates (H. Boone et al., 2002). Finally, the radical philosophy of adult education emphasizes learner and societal change through learning (H. Boone et al., 2002).

The philosophy to which each agriculture or Extension educator aligns his/her instruction depends upon the individual beliefs of that adult educator (H. Boone et al., 2002). However, "it is possible to change agricultural educators response to the needs of the adult populations by demonstrating the needs of the adult population" (H. Boone et al., 2002, p. 38). Researchers, educators, and administrators can use the results of a needs assessment, which assesses the needs of an adult population, to encourage adult educators to change their philosophical ideologies to better meet the population's needs. Extension professionals, therefore, can more effectively develop instruction based on adult learner needs with appropriate applications of the five distinct philosophical ideologies of adult education. Ideological preferences, however, must be rooted in learner needs. An effective assessment of learner needs, in combination with the philosophical ideologies concerning adult education with which an adult educator aligns, can lead to the development of effective instruction.

### Program Planning

Land-grant institutions work to address stakeholder needs through the development and delivery of research, teaching, and Extension programs. According to Seevers et al. (1997), a program is a series of connected activities that collectively work towards a set goal. Program planning has a rich history in adult education and numerous models have been developed to provide a framework for program planners. The majority of such models involve three main stages: planning, design and implementation, and evaluation and accountability (E. Boone et al., 2002). The differences in the many models lies in how each model is used in context and which aspects of the model are emphasized (E. Boone et al., 2002). Despite any differences, most models for program planning consider the learner, stress the importance of the planning phase, and urge planners to assess learner needs (E. Boone et al., 2002). E. Boone et al. (2002) recognize,

"the nearly total agreement on the importance of needs identifications and assessment among the authors" ( p. 39) of program planning models.

The conceptual programming model as postulated by E. Boone et al. (2002) focuses on the identification of needs using key leaders of the target audience. With diverse leader involvement, programs developed from the data analyzed in a needs assessment are often perceived as meaningful by current and future learners. This positive perception can lead to the faster acceptance of new educational opportunities offered through Extension programming due to greater public buy-in (E. Boone et al., 2002). Furthermore, E. Boone et al. (2002) suggest through the conceptual programming model the ability to increase socialization between leaders of different target publics within the program's population. By involving a greater diversity of leaders from different subpopulations in the needs assessment process, the conceptual programming model encourages collaborative thought in regard to the needs of the population as a whole.

**Needs Assessments**

Altschuld and Watkins (2014) recognize a needs assessment as a tool that should lay the foundation for program planning. By identifying the gaps between what should be occurring and what is, a thorough needs assessment can help prioritize program efforts, leading to more effective and efficient programs (Witkin & Altschuld, 1995). Without properly assessing the needs of a community, programmatic efforts may be irrelevant to target audiences, leading to wasted organizational resources (Altschuld & Watkins, 2014).

Needs assessments should be conducted using a three-phase model:

1. The pre-assessment establishes the plan for the needs assessment process.
2. The assessment phase gathers, analyzes, and preliminarily prioritizes data related to needs.
3. The post-assessment phase prioritizes needs, creates an action plan, and disseminates results (Witkin & Altschuld, 1995).

There are three levels of needs on which any needs assessment can focus, each of which corresponds with a different level of needs assessment. A Level 1 needs assessment, focusing on primary needs, targets groups outside of an organization, called the service receivers (Witkin & Altschuld, 1995). Witkin and Altschuld (1995) note that "the people in Level 1 are those for whom the system ultimately exists; they are the heart of the needs assessment process" (p. 11). A Level 1 needs assessment for organizations that develop educational programs for beekeepers would focus on the needs of the beekeepers themselves. Level 2 needs assessments target secondary needs, those of individuals within an organization, known as service providers (Witkin & Altschuld, 1995). Level 3 needs assessments focus on tertiary needs or the resource needs of an organization (Witkin & Altschuld, 1995). Secondary and tertiary needs are directly or indirectly tied to the primary needs; therefore, needs assessments should start at Level 1 (Witkin & Altschuld, 1995). Focus can be shifted to the other levels of needs once the primary needs of an organization have been addressed.

**Purpose and Objectives**

The conceptual frameworks of adult education, program planning, and needs assessment provide justification for the purpose of this study, which was to assess the needs of commercial beekeeping operations in Florida to better guide research and educational programs for beekeepers in Florida and beyond. Knowles' five assumptions of adult learners all point to a need to involve beekeepers in the development of educational programs designed to improve their beekeeping success. Most program planning models used in Extension agree that the best way to involve adults in this development is through a needs assessment of the target audience, in this case commercial beekeepers in Florida. Because needs assessments should start by identifying Level 1 needs, the objectives of this study were to identify the needs

of registered commercial beekeepers in Florida and to prioritize registered Florida commercial beekeeper needs.

## Materials and Methods

In the pre-assessment phase of this study, we conducted a thorough literature review to explore previous research efforts and appropriate methodology, and to set the purpose for the rest of the needs assessment (Witkin & Altschuld, 1995). Additionally, we obtained approval for this study from the UF Institutional Review Board. Below describes the second phase of the three-phase needs assessment, in which we gathered and analyzed data on target audience needs (Witkin & Altschuld, 1995).

### Sampling

The target population for this study was Florida's registered commercial beekeepers ($N$ = 515). In Florida, commercial beekeeping operations are defined as those with at least 100 colonies (Fla. Admin. Code § 5B-54.001, 2018). We selected participants for this study through a two-pronged sampling approach, using convenience and purposive sampling techniques.

The first sampling effort involved convenience sampling, selecting individuals as nominators who were willing to participate and were easily accessible at a given time and location (Etikan et al., 2016). We chose this sampling method because of three expectations about the target population. First, given that commercial beekeepers in Florida were not frequent participants in Extension programming, we expected their willingness to participate in this study to be low. Second, because many commercial beekeepers were members of the FSBA we expected that asking for involvement in this study via a more familiar organization would increase beekeeper participation. Third, by deciding to attend the FSBA annual conference, these beekeepers were indicating that they were involved in or at least aware of the concerns of commercial beekeepers around the state. Therefore, we chose a convenience sample of commercial beekeepers at the 2018 FSBA annual conference, which brought together more than 60 Florida commercial beekeepers in October of 2018 in Gainesville, Florida. It would be unlikely that we could access this many willing Florida commercial beekeepers at any other time or location.

The second phase of two-pronged sampling approach involved purposive sampling. Purposive sampling is a non-probability sample that "involves identification and selection of individuals or groups of individuals that are proficient and well-informed with a phenomenon of interest" (Etikan et al., 2016, p. 2). Purposive samples are specifically chosen for the information that they can provide to a study. The purposive sample for this study involved multiple steps.

We first asked the conference attendees to nominate key informants from the commercial industry to participate in this needs assessment. Due to position or skills, key informants often can provide deeper information about a community at large (Marshall, 1996). Key informants are individuals who are exposed to and have knowledge about the community, and who are willing and able to impartially communicate those needs (Tremblay, 1957). During a whole group session, we informed conference attendees about the purpose of the needs assessment and how the results would be used. Afterwards, the attendees received slips of paper and were asked to indicate whether or not they were a commercial beekeeper and to provide a list of commercial beekeepers who they thought could clearly represent their voice and the needs of the Florida commercial beekeeping industry. Participants could nominate other beekeepers as well as themselves.

We collected completed slips of paper from 55 individuals, resulting in 116 non-unique nominated names. Forty-four names were not nominated by commercial beekeepers and were discarded from this study. We combined the remaining 72 non-unique names into a list of unique nominees ($n$ = 41) and compared the latter to the database of registered commercial beekeepers that is maintained by FDACS and

is available via public record (Florida Department of Agriculture and Consumer Services [FDACS], 2019). We edited the names on the list for proper spelling and removal of nicknames (e.g., "Dave" might be changed to "David" to match a name in the FDACS registration database) and tallied the number of nominations that each name received. We invited nominees to participate in this study if they (a) were registered as commercial beekeepers in Florida and (b) received two or more total nominations. More than half of the nominees only received one nomination and were removed from this study. We removed another four, because their names did not show up on the beekeeper registration database. We invited the remaining individuals ($n$ = 15) to participate in this study.

## Invitation to Participate

For the sake of participant convenience, we grouped together nominated beekeepers who were located within a one-hour drive of one another, resulting in three groups of five beekeepers each. We collected all contact information for attendees from the FDACS database of registered commercial beekeepers (FDACS, 2019). Nominees were invited to participate via an initial email, a follow-up email, a mailed letter, and by phone. After each invitation attempt, beekeepers who responded (affirmatively or negatively) were removed from future invitation attempts.

Two nominees did not respond to any of the communication attempts. One of the remaining 13 declined to participate. A total of six beekeepers who initially agreed to participate ultimately did not (two did not respond to follow-up communication to determine a time and place for a group session; three did not show up on the day of the session; one was not available at a time and place common to other beekeepers). Six (40%) total nominated individuals participated in the two group sessions of this study (four participants in Session 1, two in Session 2).

## Data Collection

This study structured focus group sessions using the nominal group technique (NGT) as developed and described by Delbecq et al. (1986). We chose to collect data via focus groups because such interactive communication processes are most appropriate in contexts where exploration of ideas and needs is important (Witkin & Altschuld, 1995). Given there was no pre-existing body of literature on commercial beekeepers or the needs of the beekeeping industry, an interactive form of data collection was essential for this needs assessment. NGT specifically was chosen for this study as a result of preliminary information gathered about the target audience. In the summer and fall of 2018, staff at the UF IFAS Honey Bee Research and Extension Laboratory held unstructured discussions with commercial beekeepers in central Florida. These sessions indicated that the range of needs perceived by commercial beekeepers might be diverse and beekeepers may not easily agree on prioritization. Moreover, these group discussions often dwelled on one topic for a long time and were regularly dominated by just a few individuals.

Given these expectations, we chose NGT for this study because of this data collection method's ability to (a) give all ideas equal consideration, (b) reduce confrontation among participants, (c) leave participants with a sense of accomplishment and (d) pool individual judgements (Delbecq et al., 1986). NGT is divided into four distinct rounds, which collectively lend to the strengths of this process.

We held two sessions on separate days at two separate UF IFAS facilities, chosen based on proximity to the beekeepers in each group. Each participant completed an informed consent form and indicated the primary and secondary foci of their beekeeping operations (Table 1). Participants could choose one or more foci from a provided list (honey production, pollination services, queen production, package/nuc production) and had the option to write-in any foci that did not appear on the provided list.

**Table 1**

*Foci of Commercial Beekeeping Operations of NGT Session Participants*

| Participant | NGT session | Primary foci of operation | Secondary foci of operation |
|---|---|---|---|
| 1 | 1 | honey production | pollination services |
| 2 | 1 | pollination services | honey production |
| 3 | 1 | honey production | package/nuc production |
| 4 | 1 | honey production, pollination services | queen production, package/nuc production |
| 5 | 2 | honey production, pollination services | "full hive sales" |
| 6 | 2 | honey production, package/nuc production | pollination services |

To start the NGT process, participants were presented this focus question verbally and in writing: What factors or concerns do you anticipate will most affect the future success of your beekeeping operation? Participants then independently and silently wrote down as many answers to the question as they could. This step gave all participants time to reflect and come up with their own unique ideas without concern over competition or social status (Delbecq et al., 1986). Silent idea generation results in a greater number of ideas as compared to group processes that do not include this step (Delbecq et al., 1986).

Following idea generation, participants in each session took turns sharing with the group one item on their list, which the facilitator wrote on a board in front of the group. This round robin process helped to separate each idea from the participant who shared it, which can lead to reduced emotional ties to responses and less confrontation later in the process (Delbecq et al., 1986). Moreover, participants are more likely to share more items on their list when they are not asked to provide all their ideas at one time (Delbecq et al., 1986). According to Delbecq et al. (1986), the written collaborative list "is an important early group reward" (p. 49) that can contribute to the group's overall sense of accomplishment. Furthermore, as with the silent idea generating, the second round allows each individual to have equal participation in the group process (McMillan et al., 2016).

The NGT facilitator then guided participants through a discussion of each of the ideas on the board. The purpose of this discussion was to clarify list items and to allow participants to express agreement or disagreement toward each idea (Delbecq et al., 1986). Each list item receives equal discussion time and no item is dwelled on for too long, ensuring that no one topic dominates the group discussion (Delbecq et al., 1986). Serial discussion, like round robin idea sharing, works to provide equal time to each idea, while avoiding unproductive arguments that can stem from differences of opinion (Delbecq et al., 1986).

In the final round of the NGT process, participants voted using the budget allocation method, which helps to make the prioritization of needs more realistic and tangible (Witkin & Altschuld, 1995). The facilitator numbered each list item on the board and gave each participant a hypothetical sum of money ($100,000). Participants individually allocated those funds towards addressing the needs on the board that each considered to be of highest priority for the Florida commercial beekeeping industry. The participants received no minimum or maximum allocation requirements, except that they had to allocate all $100,000 of their hypothetical funds. The result of each session was a prioritized list of ideas, pooled from the ideas generated by each individual. Pooled independent judgements and mathematical rating or ranking of items leads to higher, "judgmental accuracy (the ability of a group to arrive at a decision which reflects true group

preferences)" (Delbecq et al., 1986, p. 55). If a voting step was not included and no decision was reached, participants might have left with a low sense of accomplishment (Delbecq et al., 1986).

## Data Analysis

We transcribed into a spreadsheet the NGT lists, separated by session, and the allocated budget values, separated by participant. We performed content analysis, classifying each item into one of 14 categories based on overlap and relatedness (Delbecq et al., 1986). We combined the prioritized items from the two sessions into one list, organized by category. The allocated budget for each item was listed as were the average and total combined budgets for each category.

## Data Trustworthiness

Potential threats to trustworthiness are not well defined when using NGT for data collection (Cantrill et al., 1996; Makundi et al., 2005). Nonetheless, data transferability, credibility, and dependability all are essential to conducting trustworthy qualitative research.

Due to recruitment challenges and the low sample size, the results of this study are not generalizable to all commercial beekeepers. Rather, program planners must compare the context and participant demographics of this study to external target audiences to determine transferability to other groups (Dooley, 2007). Rich descriptions of participants in qualitative research allows readers to decide if a study's results can be transferred to others (Dooley, 2007). The description of the sampling techniques and the beekeeping foci of study participants indicated in Table 1 provide an adequately rich description of the participants in this study. Given this information, program planners must determine for themselves if the results of this study can be transferred to their constituents.

Witkin and Altschuld (1995) note that needs assessments should be conducted using more than one data collection technique to allow for triangulation of data. Multi-pronged collection techniques work to reduce threats to credibility in a study because the data can be triangulated between methods. Because this study only utilized one method of collecting data, the credibility of the results may be reduced; however, data from this study was compared to the quantitative results reported by national surveys of commercial beekeepers reported by BIP and USDA-NASS. Comparing the qualitative data in this study to quantitative beekeeper reports of colony losses offered a degree of data triangulation. The instances where there was considerable overlap between the results of this study and those of the national beekeeper surveys provided a more trustworthy picture of beekeeper needs.

Researchers also can minimize credibility threats through triangulation of data from multiple sources (Dooley, 2007). In this study, we compared the prioritized ideas of two separate focus group sessions to increase the credibility of our data. If, for example, we had only collected data from Group 2, we might have mistakenly concluded that "nutrition and feeding" was the highest priority concern for Florida commercial beekeepers. In comparing data collected from the two group sessions, however, we were able to conclude that while "nutrition and feeding" was a priority concern, it was likely of lower priority as compared to the "*Varroa*" category of needs.

The multiple rounds of the NGT process also worked to reduce threats to credibility in this study. For example, Delbecq et al. (1986) note the quality of problem-oriented ideas generated by groups is higher later in the process versus earlier. Because the NGT process delayed the groups' prioritizations of the generated ideas, those priorities are likely more credible. Furthermore, in the second round of the NGT process, the facilitator wrote the shared list of ideas in the participants' own words, rather than providing a summary of participant thoughts. Accurate recording of participant ideas led to higher credibility of our

data. The serial discussion round of NGT further contributed to this accuracy by allowing for clarification of ideas by the participants.

True replication of data collection is not possible in qualitative research, which is so dependent on the sample and its context; rather, qualitative researchers must consider a study's dependability (Dooley, 2007). Dependability of findings comes from documenting original data sources and the accuracy of how researchers analyze collected data (Dooley, 2007). Again, the NGT process works to minimize these threats. The final round of the NGT process requires participants to individually prioritize the list of ideas that they collectively generated. The ranking or rating process removes much of the burden of data analysis from the researcher and places it in the hands of the participants. Furthermore, each step of the NGT process provides a paper trail of raw data that comes directly from the participants (i.e., initial lists of ideas from round one and prioritized lists from the voting round). Such information sources provide a 'dependability audit' for qualitative findings (Dooley, 2007).

## Results

From the NGT sessions, the four Session 1 participants generated 32 unique ideas (Table 2), while the two Session 2 participants generated 24 unique ideas (Table 3). We assigned each idea to one of 14 categories. Participants in this study collectively indicated 25 priority needs by allocating any sum of hypothetical funds to an identified need (Table 4). Session 1 beekeepers collectively indicated 20 priority ideas through the budget allocation method, with individual ideas receiving between $5,000 and $60,000. Session 2 beekeepers collectively indicated five priority ideas, with individual ideas receiving between $15,000 and $50,000.

The individual needs that received the highest allocated funds were "mite control (legal and effective for Florida)" ($70,000), "planned, year-round mite control" ($60,000), "viral prevention independent of mite control", "type of feed for specific purposes/operations (what ratios/mixtures)" and "pH of water/feed" ($45,000 each), and "viable mite control (specific to migratory honey operations in south U.S.)" ($39,000). Participants collectively allocated the most money ($169,000, mean allocation $56,333) to needs in the "*Varroa*" category, nearly a third (28.2%) of the total allocated budget. The second highest priority category, based on allocated funds, was "nutrition and feeding", to which participants allocated $114,000 (19.0% of the total budget, mean allocation $28,500). Participants did not prioritize more than half (29) of the identified needs (Table 5).

**Table 2**

*Ideas Identified by Participants of Session 1, Organized by Category*

| Idea Category | Ideas identified |
|---|---|
| Academic research | dissemination of research |
| | slow speed of university research |
| | scientific reasoning behind products/practices |
| | solution-based research |
| Bacteria | alternative bacterial controls |
| | new, unknown bacteria |
| Bee quality | bee genetics (for migratory beekeepers) |
| | poorly mated queens |
| | queen longevity (shipping stress) |
| Habitat and forage | access to unused land |
| | habitat changes based on policy |

**Table 2**

*Ideas Identified by Participants of Session 1, Organized by Category, continued…*

| | |
|---|---|
| | loss of 'invasive' nectar producing plants<br>loss of palm<br>quality of locations |
| Invested costs | cost of mite control<br>personal time invested |
| Labor | trained workers (skilled for commercial operation) |
| Management | timing/schedule of management |
| *Nosema* | new *Nosema* control<br>return of fumagilin to market |
| Nutrition and feeding | effectiveness of probiotics<br>honey bee nutrition (protein patties)<br>worker longevity tied to nutrition |
| Other pests and pathogens | interactions between: *Varroa*, viruses, bacteria, *Nosema*<br>pathogens affecting queen longevity<br>products for sanitizing dead out equipment<br>sanitation protocol for stored or dead out equipment |
| *Varroa* | planned, year-round mite control<br>viable mite control (specific to migratory honey operations in south U.S.) |
| Viruses | viral prevention independent of mite control<br>viruses (need for schedule of tests) |

**Table 3**

*Ideas Identified by Participants of Session 2, Organized by Category*

| Idea Category | Ideas identified |
|---|---|
| Academic research | slow speed of research |
| Bee quality | honey quality due to bee quality |
| Habitat and forage | honey quality due to floral source<br>land manager perception of bees<br>land/habitat availability |
| Invested costs | cost of land<br>cost of operation<br>costs of broker fees<br>recovering costs of colony losses<br>unshared efforts among commercial beekeepers |
| Labor | labor sources from out of country (immigration issues)<br>labor -quality |

**Table 3**

*Ideas Identified by Participants of Session 2, Organized by Category, continued…*

| | |
|---|---|
| Management | poor beekeeping |
| Nutrition and feeding | pH of water/feed<br>type of feed for specific purposes/operations (what ratios/mixtures) |
| Other pests and pathogens | protocol for stored or dead out equipment<br>storage in/sanitation of feed buckets |
| Pesticides | contamination of honey and wax from mite controls<br>environmental chemicals (glyphosate)<br>mosquito control sprays<br>synergistic effects of pesticides |
| Regulation | regulations involved with California pollination |
| *Varroa* | mite control (legal and effective for Florida) |

**Table 4**

*Prioritized Ideas from Participants of NGT Sessions 1 and 2, Organized by Category*

| Idea category | Total allocated budget | Mean budget allocated to ideas in this category | Ideas prioritized | Allocated budget |
|---|---|---|---|---|
| *Varroa* | $169,000 | $56,333 | mite control (legal and effective for Florida) | $70,000 |
| | | | planned, year-round mite control | $60,000 |
| | | | viable mite control (specific to migratory honey operations in south U.S.) | $39,000 |
| Nutrition and feeding | $114,000 | $28,500 | pH of water/feed | $45,000 |
| | | | type of feed for specific purposes/operations (what ratios/mixtures) | $45,000 |
| | | | honey bee nutrition (protein patties) | $14,000 |
| | | | effectiveness of probiotics | $10,000 |
| Viruses | $64,000 | $32,000 | viral prevention independent of mite control | $45,000 |
| | | | viruses (need for schedule of tests) | $19,000 |
| Bacteria | $55,000 | $27,500 | new, unknown bacteria | $35,000 |
| | | | alternative bacterial controls | $20,000 |
| Other pests and pathogens | $44,000 | $14,667 | products for sanitizing dead out equipment | $29,000 |
| | | | interactions between: *Varroa*, viruses, bacteria, *Nosema* | $10,000 |

**Table 4**

*Prioritized Ideas from Participants of NGT Sessions 1 and 2, Organized by Category, continued…*

| | | | | |
|---|---|---|---|---|
| | | | sanitation protocol for stored or dead out equipment | $5,000 |
| Habitat and forage | $39,000 | $13,000 | land/habitat availability<br>quality of locations<br>habitat changes based on policy | $20,000<br>$14,000<br>$5,000 |
| *Nosema* | $35,000 | $17,500 | new *Nosema* control<br>return of fumagilin to market | $30,000<br>$5,000 |
| Pesticides | $20,000 | $20,000 | environmental chemicals (glyphosate) | $20,000 |
| Academic research | $24,000 | $24,000 | solution-based research | $24,000 |
| Bee quality | $15,000 | $7,500 | worker longevity tied to nutrition<br>bee genetics (for migratory beekeepers) | $10,000<br>$5,000 |
| Labor | $14,000 | $14,000 | trained workers (skilled for commercial operation) | $14,000 |
| Management | $5,000 | $5,000 | timing/schedule of management | $5,000 |

**Table 5**

*Identified, Unprioritized Ideas from Sessions 1 and 2, Organized by Category*

| Idea Category | Ideas identified |
|---|---|
| Academic research | dissemination of research<br>slow speed of university research<br>slow speed of research<br>scientific reasoning behind products/practices |
| Bee quality | honey quality due to bee quality<br>poorly mated queens<br>queen longevity (shipping stress) |
| Habitat and forage | honey quality due to floral source<br>land manager perception of bees<br>access to unused land<br>loss of 'invasive' nectar producing plants<br>loss of palm |

**Table 5**
*Identified, Unprioritized Ideas from Sessions 1 and 2, Organized by Category, continued…*

| | |
|---|---|
| Invested costs | cost of land<br>cost of operation<br>costs of broker fees<br>recovering costs of colony losses<br>unshared efforts among commercial beekeepers<br>cost of mite control<br>personal time invested |
| Labor | labor sources from out of country (immigration issues)<br>labor -quality |
| Management | poor beekeeping |
| Nutrition and Feeding | worker longevity tied to nutrition |
| Other pests and pathogens | protocol for stored or dead out equipment<br>storage in/sanitation of feed buckets<br>pathogens affecting queen longevity |
| Pesticides | contamination of honey and wax from mite controls<br>mosquito control sprays<br>synergistic effects of pesticides |
| Regulation | regulations involved with California pollination<br>protection for local beekeepers |

## Discussion

### Limitations

Care should be taken not to generalize the results of this study to all commercial beekeepers due to the following limitations of the study. Only a single method of data collection (NGT) was used in this study. Witkin and Altschuld (1995) note that needs assessments should be conducted using more than one data collection technique to allow for triangulation of data.

The NGT process itself also comes with limitations. The structure of the NGT process does not allow for deviation from the initial focus mid-discussion as is possible with some other group processes (Delbecq et al., 1986) and not all individuals in a target group will be comfortable with the rigid nature of the NGT (Delbecq et al., 1986). Additionally, participants from both sessions indicated that only needs that they felt the UF IFAS Honey Bee Research and Extension Laboratory could address should be prioritized. Although the NGT facilitator corrected this misconception, it is possible that some participants only voted on needs that fit within their perceived context of the lab, underprioritizing needs related to regulations, costs of operation, labor, and other factors.

Another limitation of this study involved the recruitment of participants. The nine beekeeper nominees who did not participate in the group sessions likely would have contributed valuable data on commercial beekeeper needs, and without those individuals some priority beekeeper needs may have been missed. Issues with recruitment also led to a limitation involving the number of participants in each group session. Fewer individuals in each group may have led to fewer ideas generated overall (Delbecq et al., 1986).

## Comparison to Previous Research Efforts

Many of the needs identified by participants in this study have not been reported previously, indicating that understanding the needs of the commercial honey bee industry goes beyond tracking colony losses and speaks to the importance of stakeholder involvement in program planning. Without first asking beekeepers themselves to identify industry needs, previous research may have missed important needs of the industry, including threats that are unrelated to honey bee pests or colony management. The present study suggests that such needs might include the lack of adequate labor for commercial beekeeping operations as well as a need for the timely delivery of honey bee research and education programs.

## Prioritized Beekeeper Needs

The highest priority needs identified by the participants of this study not only received the greatest allocations of hypothetical funds, but also were prioritized by multiple participants.

### *Varroa Control*

The "*Varroa"* category of needs received nearly a third of all the hypothetical $600,000 budget and should be considered the highest priority for the beekeepers in this study. Participants in both sessions also clearly stated the impact of *Varroa* in the discussion rounds of the group sessions. One beekeeper in Session 2 noted "we're out here spinning our wheels" in reference to *Varroa* and a participant in Session 1 said "*Varroa* is still the leading cause" of concern for the industry.

That *Varroa* is a serious threat to honey bees aligns with a previous survey of Florida beekeepers by Hodges et al. (2001) in which 57% of colony losses were attributed to parasitic mites. BIP also identified *Varroa* as a major driver of colony loss (Kulhanek et al., 2017) and USDA-NASS has reported that beekeepers consider *Varroa* to be a major industry threat (USDA-NASS, 2019). The results of the present study, however, are novel in that they indicate beekeepers not only link *Varroa* to losses of individual colonies, but also view the mite as a potential threat to the future success of their entire operations.

### *Bee Forage and Nutrition*

Needs in the "nutrition and feeding" category received the second highest amount of funds from the two sessions. Although these needs were identified in both sessions, the Session 2 beekeepers allocated most (78.9%) of the category's funds and discussed such needs more thoroughly. Session 1 and 2 beekeepers also allocated funds ($19,000 and $20,000 respectively) to needs in the "habitat and forage" category. Surveys of beekeepers conducted by BIP have similarly reported poor nutrition as a major factor contributing to colony losses in the U.S. (Kulhanek et al., 2017). Such findings may indicate needs for improved or increased research on honey bee nutrition as well as improved or increased dissemination of such information.

### *Dissatisfaction with Academic Programs*

The "academic research" category of needs only collectively received $24,000 from three beekeepers in Session 1. Outside of priority ranking, however, all participants in this study repeatedly indicated their dissatisfaction with the applicability and speed of the research conducted at academic institutions. The intensity and persistence of this topic in beekeeper discussions between the two sessions indicates the likelihood that this is a true need in the industry, even if it was prioritized relatively low. It is possible the low prioritization stemmed from the participant perception that this was not a need that could be directly addressed by this study. Participants from both sessions indicated that only needs that they felt the UF IFAS Honey Bee Research and Extension Laboratory could address should be prioritized.

A perceived need of improving the practicality of bee research gives some understanding of the philosophical ideology of adult education to which researchers and educators working with commercial beekeepers might align. For example, the liberal ideology is likely not appropriate for this experienced beekeeper audience. In the liberal ideology, the educator is an authority figure who passes on knowledge to adult learners (H. Boone et al., 2002). Rather the progressive ideology, which emphasizes practical skills and problem-solving, with the educator simply guiding the learning process (H. Boone et al., 2002), may be more appropriate for target audiences similar to the participants in this study.

**Identified, Unprioritized Needs**

Over half of the ideas recorded in the NGT sessions did not receive any votes via fund allocation (Table 5). It is important to not discount these ideas as trivial, however, simply because they were not prioritized as the highest needs. The identified needs that are addressed (i.e., given priority) by an organization should depend in part on the scope and abilities of that organization (Witkin and Altschuld, 1995). Furthermore, Delbecq et al. (1986) noted that while stakeholders have a role in both defining needs and setting priorities, "their most unique and influential role should be the identification of needs" (p. 118). Therefore, while insight can be gathered by the needs prioritized by the study participants, the more complete list of identified needs should also influence program planning (Delbecq et al., 1986).

**Recommendations for Practice**

Needs identified in this study can be used to guide program planning for commercial beekeepers in Florida. Certainly, agricultural educators such as the UF IFAS Honey Bee Research and Extension Laboratory and county Extension that aim to help commercial beekeepers must include *Varroa*-related content and likely should include content on bee nutrition in their programs. If research on controlling *Varroa* and bee nutrition is insufficient for commercial beekeepers in Florida, then research studying these topics should receive high priority and such research results should be disseminated through agricultural educators within county Extension, the UF IFAS Honey Bee Research and Extension Laboratory, FDACS, the FSBA, and others.

Commercial beekeeper dissatisfaction with academic research also should be addressed. We suggest that the UF IFAS Honey Bee Research and Extension Laboratory and county Extension agents partner with commercial operations to help the beekeepers themselves conduct research in their own bee yards. Such efforts could (a) localize research, thus increasing its applicability, (b) provide beekeepers better insight into the research process, (c) utilize the expertise of UF more efficiently, (d) utilize key informants' experiences and willingness to cooperate, and (e) decrease beekeeper distrust of academic research while strengthening a working relationship between beekeepers and UF. Furthermore, academic institutions that serve beekeepers should evaluate the applicability and speed of the research they conduct and the manner and speed at which new research is disseminated. Such evaluation is crucial to address not just this one beekeeper need, but also all other needs that the UF IFAS Honey Bee Research and Extension Laboratory and other academic institutions plan to address. If beekeepers do not trust or turn to the information coming from Extension, then all other Extension efforts aimed at addressing commercial beekeeper needs may be fruitless.

Although there are currently no known commercial beekeeper-focused educational programs at the county level in Florida, the results of this study and previous beekeeper surveys could serve as a foundation for the development of such programs. Educators should consider developing programs for commercial beekeepers using an appropriate philosophical ideology of adult education such as the progressive ideology in which practical skills are emphasized. Furthermore, county Extension programs for Florida backyard beekeepers and formal agricultural educators who teach beekeeping may be able to utilize some of the outcomes of this study. While some commercial-focused needs may not be relevant to small-scale

beekeepers (e.g., labor issues), other needs are very likely similar across all operation sizes (e.g., *Varroa* control). Similarly, organizations outside of Extension that serve beekeepers, such as the FSBA and FDACS, can incorporate the needs identified in this and future studies into the education programs they develop and the research projects that they conduct or fund.

**Recommendations for Future Research**

Participants in this study identified needs of commercial beekeepers in Florida. These findings, however, do not encompass all the industry's needs. Rather, further assessments of commercial beekeepers are essential to better understand needs beyond those reported in this study and should be conducted as time and monetary resources become available.

Beekeeping institutions around the world should conduct needs assessments of their constituents. For example, FDACS and other regulatory agencies that work with beekeepers should consider investigating the regulatory needs of beekeepers in the state, including those needs identified in this study ("regulations involved with California pollination" and "protection for local beekeepers"). Participants in this study also identified concerns related to lack of skilled labor and access to state lands. Groups like the FSBA that lobby for beekeeper affairs across Florida should consider investing efforts into future research of such beekeeper needs. Finally, needs assessments of beekeepers at the county level should be conducted by county Extension agents, developed based on the data from this study. Such efforts could target backyard, sideline, and/or commercial beekeepers, depending on the beekeeping demographics of the county.

We recommend that the UF IFAS Honey Bee Research and Extension Laboratory develop a series of questions to be addressed to commercial beekeepers regarding industry needs. Such questions can be worked into regular site visits to commercial beekeeping operations that are conducted by the lab and by county Extension agents. Informal interviews can then become a regular part of a more continuous, cyclical needs assessment process conducted by UF and other organizations. We also recommend expanding the present study to include a greater range of beekeeping operation types. Informal in person interviews could be expanded beyond commercial operations by partnering with FDACS apiary inspectors.

The needs identified via such qualitative techniques should also inform a quantitative survey that asks a broader range of randomly sampled Florida commercial beekeepers to prioritize the needs facing the industry. According to Altschuld and Watkins (2014), understanding needs "requires ascertaining what the circumstances are at a point in time" (p. 6), suggesting that needs assessments should be conducted with some regularity to be reflective of current stakeholder needs. Quantitative surveys, therefore, should be conducted every few years, based on the information that is regularly collected from beekeepers via informal interviews. This two-pronged, mixed methods approach should provide a strong guidance for long-term program planning by the UF IFAS Honey Bee Research and Extension Laboratory, county Extension agents, and other organizations. Future needs assessments should also look at secondary and tertiary needs. Greater understanding of resource needs and the needs of Extension agents around the state, for example, is essential for expansion of honey bee programs at the local or regional level.

Finally, the gap in literature on beekeeper needs may stem not only from an actual lack of conducted research, but also from a lack of reporting or publication of such research. For example, the UF IFAS Honey Bee Research and Extension Laboratory conducted a needs assessment of the Florida beekeeping industry over a decade ago but did not publish the results (Jamie Ellis, personal communication, January 24, 2018). The post assessment phase of needs assessments includes dissemination of the results of the assessment phase (Witkin & Altschuld, 1995). Post assessment is the most frequently overlooked needs assessment phase, but without it the efforts of the needs assessment are largely wasted (Witkin & Altschuld, 1995). Therefore, we implore institutions that conduct beekeeper needs assessments to publish such work and

suggest that to fail to share such information in a field in desperate need of guiding literature, is a failure of the needs assessment process.

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