



An Improved Beehive Design  
To Support Local Urban Agriculture

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**ANTI-PLAGIARISM DECLARATION**

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IZINDABA ZOKUDLA



### ABSTRACT

Honeybees provide the irreplaceable service of pollination for many of our food-crops and as such their survival is directly linked to food security. In South Africa there has been a recent movement towards localised food production through urban agriculture for socioeconomic development and access to healthy food in marginalised communities. Due to modern agricultural practices the annual survival rate of honeybees globally is in a severe decline, whilst the success of urban agriculture initiatives has been limited by low income generation. This Design Research study aimed to find solutions that would help urban farmers adopt beekeeping to increase their economic capabilities and protect their pollinators. The study borrows from Appropriate Technology Development whilst adopting Human-Centered Design methods to developing accessible beekeeping technology for local urban agriculture. Through participatory research with expert beekeepers and urban farmers the design approach to beehives was improved through the creation of a beehive design toolkit. The product outcomes were: an entry-level cardboard beehive, a permanent cement beehive and moulds to produce multiples of the cement beehive. All of these catered to an intervention framework intended to facilitate the development of sustainable beekeeping businesses through community driven manufacture and staggered implementation. The revised approach to beehive production resulted in reduced costs and presented further opportunities for sustainable beekeeping and social development. Initial testing confirmed the products technical performance, however testing through implementation would need to be undertaken to determine the further success of the intervention.

### KEYWORDS

Urban agriculture, beekeeping, appropriate technology, accessible technology, socioeconomic development, design for development, human-centred design, beehive design, industrial design, South Africa, Izindaba Zokudla.

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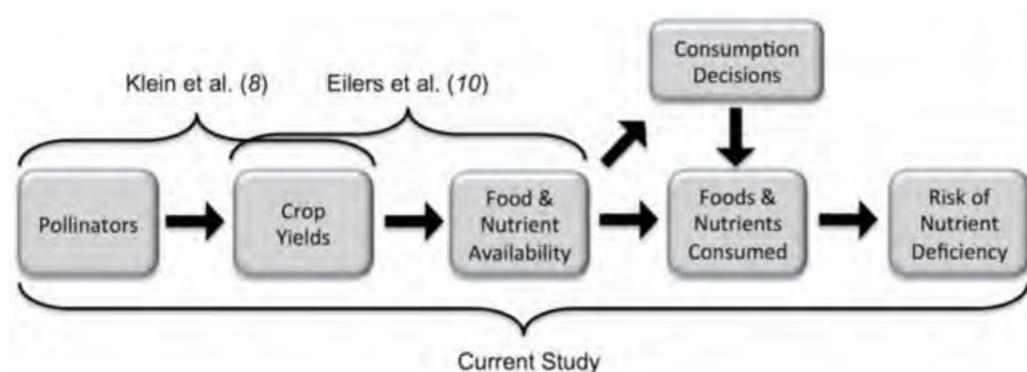


Figure 2: Ellis et al. (authors), 2012, Conceptual framework of the influence of pollinators on risk of nutrient deficiency. (Ellis et al. 2012:3).

## CHAPTER 1: INTRODUCTION

### 1.1 Background & Contextualisation

According to the Food and Agricultural Organisation (FAO 2015:8) of the United Nations in 2015 about 780 million people living in low-income communities do not have access to adequate nutritional sustenance. Although food security has improved in recent years, issues surrounding the sustainability of modern agriculture are threatening food supplies worldwide (FAO 2015:8; Allen 2010:295). Commercial agriculture is widely criticised for the detrimental effects that it has had on biodiversity, ecological systems and natural resources (Thrupp 2000:295). In their 2010 *Emerging Issues* publication the United Nations Environmental Programme (UNEP) (2010:1) state that “The Earth is losing between one and ten percent of biodiversity per decade, mostly due to habitat loss, pest invasion, pollution, over-harvesting and disease”.

Chief among the concerns this raises is the ‘pollinator crisis’ referring to a global decline in insect pollinator species, namely the honeybee (UNEP 2010:1). A recent Harvard University study (see Fig. 1) has shown that up to 56% of the population in developing nations are at risk of becoming ‘food insecure’ as a result of the ‘pollinator crisis’ (Ellis, Myers & Ricketts 2015:1). According to the UNEP (2010:1) the honeybee accounts for about 70% of food-crop pollination globally and animal pollinated crops can yield up to five times higher quantities than those pollinated by wind or rain. Modern apiculture (agricultural beekeeping) has had the adverse effect of spreading diseases, pathogens, bacteria and parasites that affect bees (ibid.). With pesticides, herbicides and monocultures contributing to the ailments, annual colony survival rates have declined consistently in the past few decades (UNEP 2010:3). The movement to rethink the future of agriculture in order to provide sustainable food access must therefore include a new holistic approach (see Fig. 2) to apiculture as a supporting component (Ellis et al. 2015:14).

In their publication titled *The State of Food Insecurity in the World 2015* the FAO indicates that:

Economic growth is a key success factor for reducing undernourishment, but it has to be inclusive and provide opportunities for improving the livelihoods of the poor. Enhancing the productivity and incomes of smallholder family farmers is key to progress (FAO 2015:ii).

In South Africa where over 60% of the population is urbanised and unemployment is prevalent small-scale farming is being advocated as a means of poverty-alleviation and food-security (Crush, Frayne & Pendleton 2012:273). However the success of Urban Agriculture (UA) has been called into question, with concerns surrounding income generation, food-production and social interest (Frayne, McCordie & Shlomboleni 2014:10; Crush et al. 2012:273; Stewart, Korth, Langer, Rafferty, Da Silva & van Rooyen. 2013:1). In the report titled *Situation Analysis of Beekeeping Industry* the Total Transformation Agribusiness (TTA) state that in 2008 beehives produced an average of 14kg of honey, earning beekeepers upwards of R3000 (TTA 2008:74). However the TTA also points out a 1000 ton insufficiency in honey production based on import quantities (TTA 2008:74). Further stating that that:



Figure 3: Photographer unknown, Canadian Feed the Children, 2015, rural beekeeper in Ethiopia. (Sweet success in Ethiopia 2015).

Although interest in beekeeping in the second economy is huge and increasing, the return in terms of income to beekeepers is still very low and unattractive. Methods which enhance honey production and other services such as pollination and bee removal must be developed. The individual profit motive should be recognized and encouraged.

With some hives recorded to produce over 380kg of honey per year leading bee expert Martin Johannsmeier (2001:5) believes that “with available natural resources, the industry could expand twice or three times its present size” this is a matter that can be addressed through design research and problem solving.

### 1.2 Rationale

The implementation of apiculture projects in rural Ethiopian (see Fig. 3), South African, Tanzanian, Nigeria and Kenyan communities has proven successful in terms of socioeconomic development by increasing crop yields and providing an additional source of income (UNEP 2010:4; Illgner, Nel & Robertson 1998:360; Shima, Ballo, Alemayehu & Belayhun 2008:2). This demonstrates the potential for apiculture to supplement small-scale farming (see Fig. 4), although as of yet local UA initiatives have not taken to keeping apiaries. Therefore there exists an opportunity to develop a beekeeping solution to assist local urban farmers, promote apiculture and indirectly help ensure the ongoing survival of the honey bee. Hence the main aim of this study was to make beekeeping more accessible to urban-farmers in Johannesburg.

### 1.3 Significance & Motivation

This study falls within the domain of Agricultural Research for Development (ARC 2015:[sp]) and was funded by the National Research Foundation of Southern Africa (NRF) and the University of Johannesburg (UJ) as a component of the UA initiative ‘Izindaba Zokudla’ (Conversations about Food). Izindaba Zokudla (IZ) focuses on the creation of a farmers’ market, participatory technology development, school gardens and security of tenure and the creation of a farmer’s school in Johannesburg’s South Western Township (Soweto) (Malan & Campbell 2014). In addition IZ develops research opportunities and interdisciplinary projects that emanate from the University of Johannesburg and intends to form sustainable food systems for the community stakeholders (farmers, retailers and customers/recipients) (Malan & Campbell 2014). The design and development of a more accessible beehive falls within the participatory technology development focus of IZ.

### 1.4 Challenge & Inquiry

**Central Problem Statement:** There is a lack of apiculture as a component of local urban agricultural projects, this limits the economic opportunities for farmers in such initiatives.

**Central Research Question:** How can a beehive be designed to assist urban farmers, promote apiculture and help ensure the ongoing survival of the honey bee?

**Auxiliary Question:** Why has apiculture not been adopted in local urban agricultural projects?



Figure 4: Chris Packman (presenter). British Beekeepers Association (design), list of crops dependant on honeybee pollination, 2014. (BBCi 2015).



Figure 5: Christopher List (photographer), urban farmers in Johannesburg, 2015. (Andrews 2015).



Figure 6: Christopher List (photographer), rooftop farm in Johannesburg, 2015. (Andrews 2015).

## CHAPTER 2: LITERATURE REVIEW

As part of the exploratory research this literature review is intended to examine research areas relevant to the project: synthesising critical theories and contemporary knowledge that is valuable to the objectives of the inquiry. Initially the literature focuses on the broad context of urban agriculture, which leads into the field of beekeeping, the science of bees, the industry and beehive design.

### 2.1 Urban Agriculture

In Africa rapid population growth and urban migration, coupled with slow economic development, have resulted in widespread urban poverty (Crush, Hovorka & Tevera 2011:285). The growing demand for food in cities has put strain on agricultural production (Allen 2010:295). The food imported into the cities comes at high costs financially and environmentally. In reaction cities have begun to contribute to food production with a global movement towards localised food production through small-scale urban farming (Carpenter & Rosenthal 2011:xiii).

As part of the City of Johannesburg's Integrated Development Plan (IDP) (2013:1) and the Social Development Department's Food Resilience Policy (2013:1) Urban Agriculture (UA)<sup>1</sup> has been implemented as a local food security strategy. Projects such as IZ aim to promote UA in low-income communities by facilitating skills and technology development that can increase access to food and income generation (Malan & Campbell 2014). This has garnered government investment of both funding and resources such as land and water (IDP 2013:2). In Johannesburg UA is conducted in backyards, privately owned plots and public/municipal allotments of land (see Fig. 5 & 6). Although the vast majority of Johannesburg households do not grow food, in 2009 UA accounted for 19% of the overall income in the participating households, generating an extra R14 per day (CDS 2009:23).

Some of the biggest problems facing UA locally, as stated by Angus Campbell in his paper entitled *Urban Agriculture: A Growing Field Of Research* (2013:10), are the compensation and level of ownership received by the participants who farm for organisations or on municipal land; the social aversion towards farming or lack of skills therein; the theft of electricity infrastructure or fencing, leaving farms unprotected and non-operational. The size of the land available, the short four month rainy season and the cold temperate winters are also inhibiting factors for UA in Johannesburg (CDS 2009:4). Farmers struggle to produce large quantities of food regularly enough to sell and support themselves (AFSUN 2012:20). In their study on local UA Bruce Frayne, Cameron McCordie and Helena Shimboleni (2014:10) found that constant investment of time and finance from participants is needed. Similarly the study of UA in South Africa by the Centre for Development Support (CDS 2009:38) found that UA participants received the bulk of their finances from other jobs and social grants.

<sup>1</sup> UA refers to food production from within peri-urban or intra-urban areas (Stewart, Korth, Lager, Rafferty, Da Silva & Rooyen 2013:2).



Figure 7: Illustrator unknown, Encyclopaedia Britannica, 2006, honeybee castes. (Encyclopaedia Britannica 2015:sp).

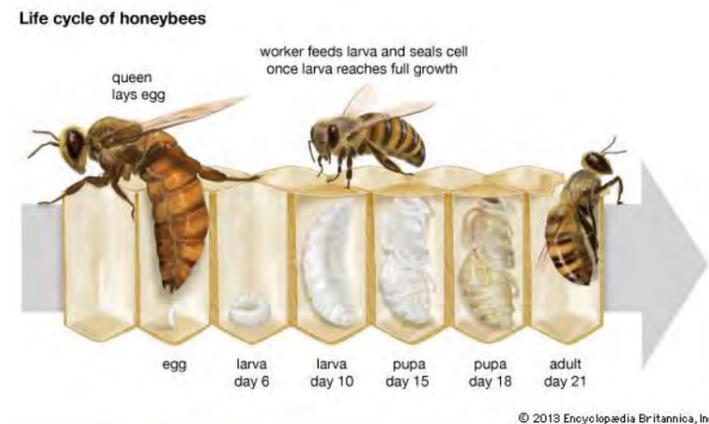


Figure 8: Illustrator unknown, Encyclopaedia Britannica, honeybee growth and development, 2013, (Encyclopaedia Britannica 2015:sp).

	European honey bees	African honey bees
Queen	16	14
Worker	21	19-20
Drone	24	24

Figure 9: Ellis & Ellis (authors), 2012, the development time (from egg to adult) of European and African Honeybees. (Ellis & Ellis 2012:5).



Figure 10: Ellis & Ellis (authors), USDA ARS (design), 2012, the spread of the African honeybee (A. m. scutellata). (Ellis & Ellis 2012:2).

## 2.2 Product Specific Research

Apiculture has been practiced for thousands of years and as such there is a great deal of knowledge within the field. In order to develop an understanding for beekeeping in the context specific to this project this section serves to summate the key issues regarding the practice.

### 2.2.1 Melitology

‘Melitology’ refers to the scientific study of the honeybee (*Apis mellifera*). Honeybees are social insects and live in colonies that typically consist of between 20 000 to 80 000 bees (Johannsmeier 2001:17). Colonies typically nest in hollow structures in which they build vertical wax comb structures. The comb consists of back-to-back hexagonal cells that are joined in the centre by a flat dividing wall, with the cells tilted upwards slightly to be used for storage.

Honeybees produce honey and wax by ingesting pollen, nectar and water, using the wax to build hexagonal (comb) structures (Warre 1942:8). There are three castes of honeybee (see Fig. 7); workers, drones and queens. A colony typically consists of one fertile queen, 70% workers and 30% drones (Warre 1942:7). The queen has a life span of up to 6 years, her primary role is egg-laying, although she is also known to excrete pheromones that control the colony. The workers are the smallest and their activities include construction, storage, foraging, feeding, guarding, caretaking, cleaning and scouting. Drones are slightly larger than worker bees and serve only to mate with new queens. ‘Brood-comb’ houses the eggs, larva and pupa of developing bees (see Fig. 8).

Specific to this study is the African honeybee (*A. m. scutellata*) which is the most common of its species in Southern Africa and South America (see Fig. 10) (Ellis & Ellis 2012:1). The practice of ‘honey hunting’ in African countries has resulted in a defensive bee species (Ellis & Ellis 2012:1). The African bee readily protects the area around its hive with force and has been nicknamed the ‘killer bee’ – not more poisonous but more easily provoked to sting (Ellis & Ellis 2012:3). African honeybees are also less selective of nesting locations and more prone to evacuating hives during swarming season. Although smaller than European bees, African honeybees are more resistant to pests and pathogens as they spend a shorter time confined to their cells during growth (see Fig. 9) (Ellis & Ellis 2012:5).

There are 29 recorded microbial diseases and a variety of parasites that negatively affect honeybees (see Appx. A) (UNEP 2010:7). According to *Honey bee diseases and pests: a practical guide* published by the FAO (1987:1) diseases and parasites are “spread by migration and sale of colonies, equipment and/or bees”; the most destructive of which, the Varroa mite and American foulbrood disease (AFD), have been distributed worldwide (UNEP 2010:7). Over the past decade Colony-Collapse Disorder (C-CD) has also become a global bee-epidemic (Lowore & Bradbear 2013:1). While the causes remain unknown experts attribute C-CD to the use of pesticides and malnutrition of the bee due to monocultures (UNEP 2010:7; Walsh 2013:32; Stokstad 2007:972).



Figure 11: Allan Gillingham (photographer), *Te Ara - the Encyclopedia of New Zealand*, burning an infected hive, 2012. (Gillingham 2012).



Figure 12: Photographer unknown, migratory beekeepers transporting hives on a flatbed truck, 2014. (Hemesath & Wolf 2014).

Until recently South Africa had been unaffected by AFD, however in 2015 an outbreak is reported to have killed 40% of the bee population in the Western Cape (Kings 2015:sp). The bacteria that is transmitted through spores and ingested by larvae is notoriously difficult to diagnose and even harder to eradicate. Stored in honey from infected hives commercial honey products help spread AFD, the spores of which can survive dormant for up to 50 years (UNEP 2010:7). Further, the use of antibiotic remedies is criticised for masking the symptoms and producing drug-resistant strains of the disease (Kings 2015:sp). As a result professional inspection bodies in Europe are tasked with a ‘search and destroy’ approach to AFD. The treatment utilises the most effective method of containing breakouts which involves identifying infected colonies, burning entire hives and burying the remains, shown in Figure 11 (UNEP 2010:7; CNG 2012:21).

In their guide the FAO (1987:31) make the following recommendations for minimising the risk of colony losses: the hive must be adapted to suit the strength of the colony; the site must not be subject to strong winds and damp, unhygienic surroundings; exposure to poisonous pesticides must be avoided; hives must be clean and functioning, and positioned on stands when necessary; harvesting and inspecting hives should be done with great care to avoid disturbing the bees; antibiotics and disease-preventing-chemicals should be administered only as a last resort. The above are aided by ‘good beekeeping practice’; stipulating that by regularly inspecting hives and maintaining their health C-CD and other problems can be prevented (Johannsmeier 2001:69).

### 2.2.2 Local Apiculture

‘Apiculture’ refers to agricultural beekeeping, traditionally focused on the production of honey, bees-wax and propolis as saleable commodities (Lowore & Bradbear 2013:1). It is common practice for beekeepers, locally and in other countries, to transport their hives (see Fig. 12) to farms during flowering seasons to assist in pollination and take advantage of the abundance of nectar and pollen, referred to as “migratory beekeepers” (UNEP 2010:12). Due to the current scarcity of pollinators beekeepers have taken to renting their colonies to farmers, adding another source of income (Lowore & Bradbear 2013:1). The TTA says a focus on beekeeping for pollination has led to the low national average of 14kg honey produced per hive yearly (TTA 2008:82). Migratory beekeeping is also criticised for helping spread diseases and pests, a factor that underpins this study with the intention that farmers take pollination into their own hands (Stokstad 2007:972).

Factor	Percentage
Absconding	88.6
Theft / Vandalism	74.3
Finance	71.4
Diseases & Pests	62.9
Limited land & Space	54.3
Forage Supply	51.4
Group Approach	23
Lack of Knowledge	14.3

Figure 13: TTA (author), factors limiting increased production amongst smallholder beekeepers in SA (each factor is measured separately out of 100%), 2008, (TTA 2008:82).



Figure 14: Photographer unknown, rooftop beekeeping in London., 2014. (Hemesath & Wolf 2014).

The industry is regulated by the South African Bee Industry Organisation (SABIO) and the Department of Agriculture, Forestry and Fisheries (DAFF) (SABIO 2013:sp). It is mandatory for all persons with beehives in SA to register them in accordance with the Government Notice R1674 of 1998 under the Agriculture Pest Act 36 of 1983 (SABIO 2013:sp). The registration is handled by the DAFF and is free of charge. The Agricultural Research Council (ARC) is committed to training and working with beekeepers to boost the industry in the second economy<sup>2</sup>. The ARC aims to establish 5000 smallholder beekeepers as part of the government’s Beekeeping for Poverty Relief™ Programme (ARC 2015:sp). The TTA found that amongst existing smallholder beekeepers the following factors limit increased production (see Fig. 13): absconding<sup>3</sup>, theft, finance, diseases, space and forage supply were most problematic; factors that directly affected the design direction of this project.

In terms of foraging and food supply for bees in SA, water availability has the biggest impact on colony productivity (Johannsmeier 2001:111). Nectar production from plants is heavily reliant on sufficient water availability. Plants have varying flowering periods and in Gauteng there are generally four ‘flows’<sup>4</sup> per year; in early-spring, mid-spring, early-summer and mid-summer (Johannsmeier 2001:8). Colonies deteriorate during cold weather or when food sources are scarce, and if necessary beekeepers will feed the bees with nutritional supplements.

### 2.2.3 Urban Apiculture

Some city municipalities do not allow residents to keep bees, or have legislation regarding the implementation of apiaries (Carpenter & Rosenthal 2011:362). In Johannesburg it is permissible to keep a colony of bees in a hive that has access to its own water source and is located at least five meters from a boundary and twenty-five meters from a dwelling or public space (Gauteng Provincial Gazette 2004:sp; Joemat-Petterson 2013). Further legislation states that hives must be hidden from public view by a 2m barrier, with a 1.5m area between the barrier and hive (Johannsmeier 2001:256). Adding barriers around hives forces the bees to adopt a high flight path and reduces their contact with surrounding human populations (Carpenter & Rosenthal 2011:364). The beehive must also be inaccessible to children or animals (see Fig. 14) and kept in the shade (Gauteng Provincial Gazette 2004:sp).

### 2.3 Beehive Design

The beehive is the most important piece of equipment in apiculture, representing centuries of development. There are a variety of hive designs that cater to different methods and techniques of beekeeping, with the basic function of housing a colony of bees and allowing a beekeeper to harvest the honey. This study looks at contemporary hive designs as precedents; the Langstroth (see Fig. 16), Horizontal Top Bar (HTB) (see Fig. 17), Warre (see Fig. 19), Sun

<sup>2</sup> ‘Second economy’ is the term used to describe economic marginalization, poverty and social alienation in SA – the aim is to focus attention and structure strategies to address the socioeconomic challenges therein (ARC 2015).

<sup>3</sup> ‘Absconding’ is the term used to describe a colony of bees that is leaving a hive and swarming.

<sup>4</sup> Times when nectar and pollen is abundantly available and colonies of bees are highly productive are referred to as ‘flows’.

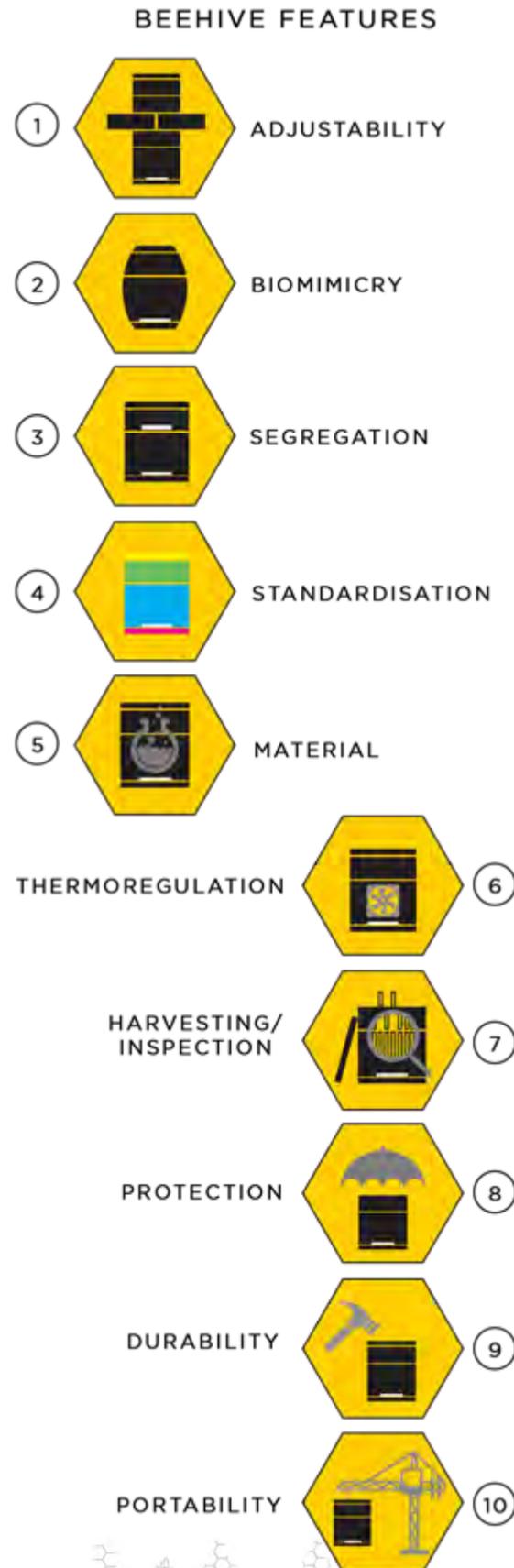


Figure 15: Icons representing the key features of beehive design, 2015 (design by author).

(see Fig. 19), BeePak (see Fig. 20) and Flow (see Fig. 21) hives. While Appendix B, *Analysis of Contemporary Beehive Design*, provides a more detailed description of the individual hives, the most important features of hives (see Fig. 15) have been identified in this section. The various aspects of hive design are based on the writing of Johansmeier (2001) in his book *Beekeeping in South Africa*, Gene Kritsky's (2010) in her book *The Quest for the Perfect Hive* and Abbe Emile Warre (1942) in his book titled *Beekeeping for All*.

① Adjustability

*Different space configurations for small, medium and large colonies.* Colonies fluctuate in size throughout the year. During heavy nectar and pollen flows the population of a hive will increase and in colder months honey production stops the numbers dwindle. When the colony is growing there should be enough room in the hive for the bees to expand the brood area and honey stores. Colony splitting or 'swarming' describes a colony's sudden evacuation of a hive; a common occurrence that is triggered by a hive becoming overcrowded (Johansmeier 2001:88). In Europe large colonies require two brood chambers on Langstroth hives, whereas the smaller African bee never requires more than one chamber for the brood to be laid and hatched at a sustainable rate (Johansmeier 2001:59). Expansion is also a good way to stagger the cost of a hive, starting small and buying more sections as the colony grows.

② Biomimicry

'Bee-space' is the term used to describe a set of bee-based measurements that govern the layout of the hive, including the spacing of the frames and the openings. In the book *Biomimicry: Innovation Inspired by Nature*, Janine Benyus (1997:2) explains that by learning from natural systems designers can realise more effective and self-sufficient solutions to contemporary problems. In dealing with the delicate natural system of bees it is important to design in such a way that will promote their natural tendencies. It is a natural tendency for bees to build downwards, rearing brood at the base of comb structures and storing honey above (Warre 1942:147). For the "bee-space" the gaps inside the hive, where no comb will be built, must be larger than 6.35 mm to prevent the bees from sealing it with propolis and smaller than 9.5 mm to prevent them from building comb (Stubbs 2012:sp; Johansmeier 2001:61). In HTB hives the bar width was been reduced to 32 mm to suit the smaller African bee (Johansmeier 2001:68). This change has eliminated the problem of 'burr-comb' experienced with wider, European frames that would cause African bees to often build parallel combs incrementally closer and fuse a set of frames at one end of the row (Stubbs 2012:sp).

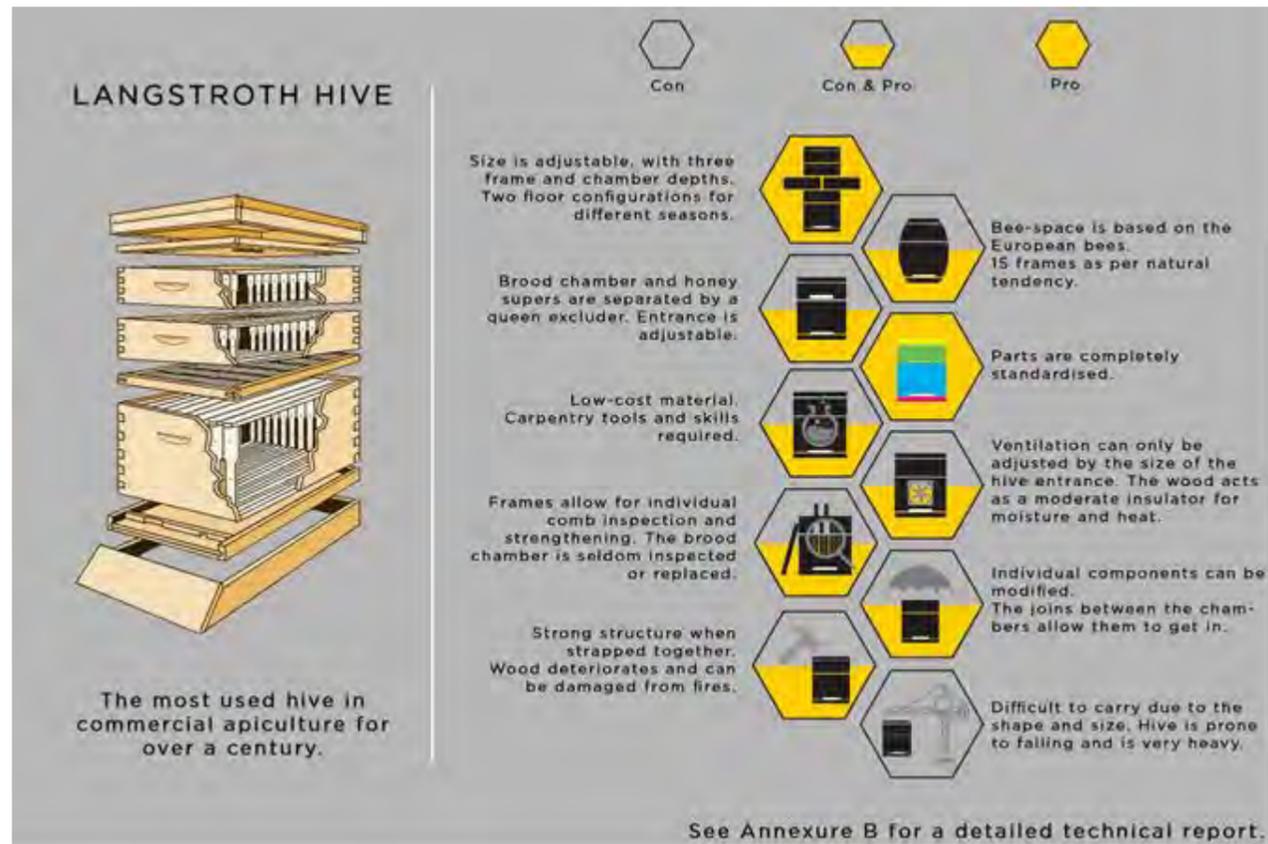


Figure 16: Analysis of the Langstroth beehive, 2015 (illustration by author).



Figure 17: Analysis of the HTB beehive, 2015 (illustration by author).

③ Segregation

Forcing functions that separate brood from honey comb. Generally achieved by use of a 'queen excluder' in the form of a mesh screen that the queen bee is unable to pass through; thus confining the queen her egg laying activities to one compartment of the hive. Only the smaller worker bees are able to pass through 4,0 to 4,2 mm gaps in the screen and as a result the supers are only filled with honey stores (Johannsmeier 2001:61). It is characteristic of apicentric beehives to not use excluders.

④ Standardisation

The use of parts that can be replaced by generic versions or fitted on other hives. To make harvesting less obtrusive beekeepers often swap out frames (see Appx. B) or chambers on hives. Using frames makes harvesting easier, and comb can be kept intact during honey extraction. However reusing comb on frames typically leads to the spread of diseases and pests (Warre 1942:147).

⑤ Material

The impact of hive materials on the health of colonies as well as maintenance and cost. Modern hives are made from particle board, Styrofoam, wood and composite plastics (Johannsmeier 2001:62). Professional beekeepers argue that natural materials are preferred by bees. The use of plastic in hives causes problems with internal humidity, electrostatic discharge and the vibration used by bees to communicate inside the hive (Hauk 2002:25). The material and manufacturing will determine the cost of the hive (Johannsmeier 2001:62). In a study on the effects of beehives on honey production it was shown that new hives produce more honey when compared to traditional hives (Vural & Karaman 2009:226). However traditional hives are also described as being more appropriate in terms of cost, manufacture and availability of materials in developing countries (Vural & Karaman 2009:226). In Africa these hives are traditionally made from clay-pots, tree-bark, logs or wicker baskets coated in mud and dung (Johannsmeier 2001:69).

⑥ Thermoregulation

The ability for the hive to be ventilated efficiently by a colony of bees in order to regulate the temperature in cold and hot weather. The ideal temperature inside the hive ranges from 33-36 °C (Johannsmeier 2001:28). Bees moderate the internal temperature and humidity of hives by fanning their wings to control the air-flow. This can be aided by the use of alternating entrances for cold and warm seasons (Warre 1942:88). Insulation also prevents the transmission of vibrations that disturb the colony, usually produced by machinery (Johannsmeier 2001:28).

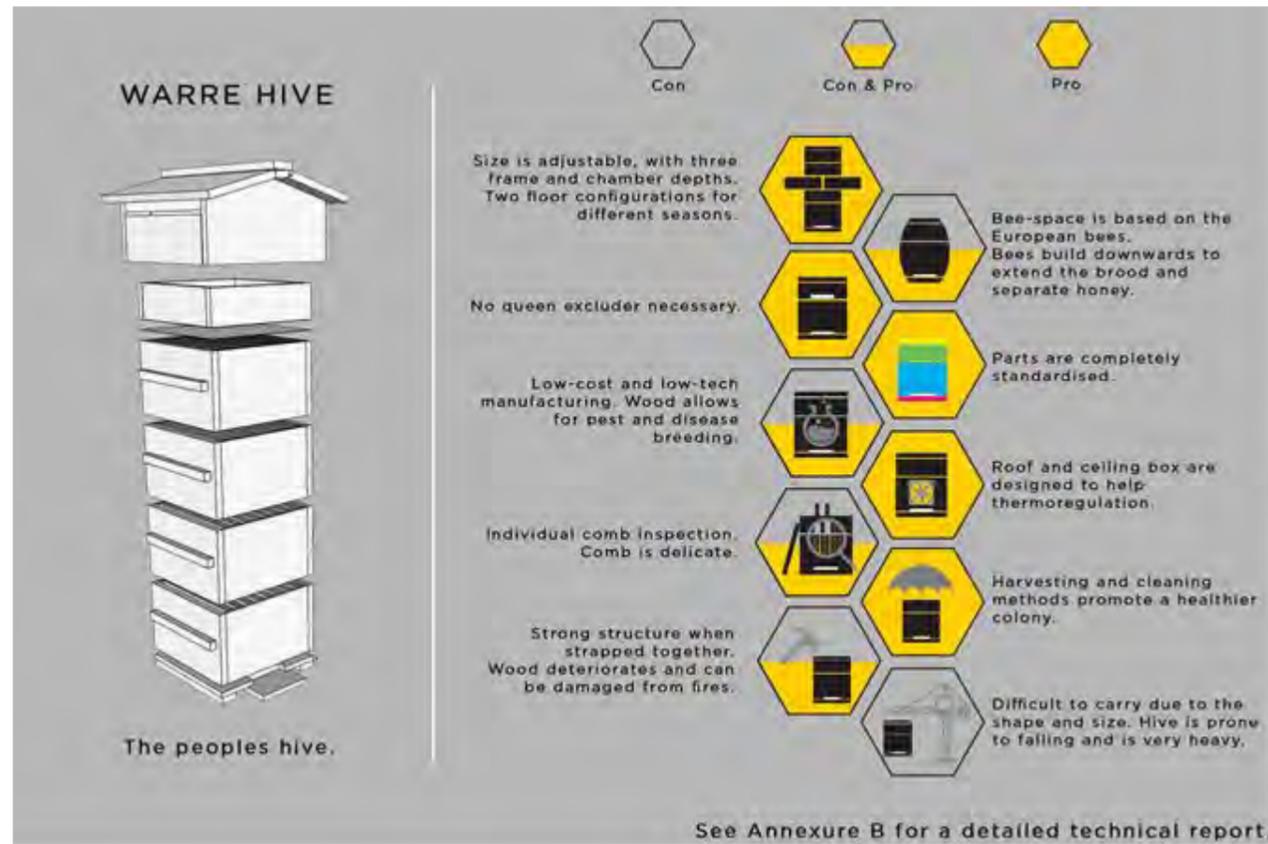


Figure 18: Analysis of the Warre beehive, 2015 (illustration by author).



Figure 19: Analysis of the Sun beehive, 2015 (illustration by author).

In a study on the effects of hive modifications that aid thermoregulation in harsh climates it was found that insulated hives outperformed those with electronic regulation devices or no modifications (Abou-Shaara, Al-Ghamdi & Mohamed 2013:45). Similarly in Ethiopia the International Livestock Research Institute (ILRI) and the Institute for Sustainable Development (ISD) conducted projects showing that insulated hives are favourable for small-scale farmers (Araya, GebreMichael, GebreAmlak & Waters-Beyer 2007:29; Girma, Ballo, Tegegne, Alemayehu & Belayhun 2008:2). The farmers were able to increase the productivity of hives by applying traditional methods of insulation (mud and dung coating) to modern hives, implications that have influenced the design direction of this study (Araya et al. 2007:31).

### ⑦ Harvesting/Inspection

*The difficulty and disturbance levels of extracting honey from the hive.* Opening a hive and removing components is a traumatic event for a colony and it is vital that the procedure can be done as quickly and gently as possible (Johannsmeier 2001:52). The colony will take longer to recover from a rough inspection or a harvest, however it is vital that beekeepers are able to inspect the hive and combs thoroughly. Beekeepers distinguish between two types of beekeeping; commercial beekeeping and apicentric beekeeping (Bradley 2013:sp). Apicentric beekeeping focuses first on the bee's role as a pollinator and second on low-impact methods of honey harvesting (Vural & Karaman 2009:363).

### ⑧ Protection

*Methods to limit damage from diseases and pests.* Although it is understood that a strong colony will be able to control diseases and pests through their natural protective and hygienic tendencies, beekeepers use methods to assist the bees. These methods are indicated in Appendix A 'Diseases and Pests Affecting Honeybees', along with the causes and symptoms and control methods. Theft and vandalism is also a serious problem for beekeepers in SA (Johannsmeier 2001:57). Beekeepers often chain hives together or manufacture housing structures to protect their hives.

### ⑨ Durability

*How the hive withstands exposure to the elements and use over a reasonable product life period, including maintenance procedures.* Largely determined by the material and manufacturing technique. Hives must be maintained regularly to protect them from the elements (Johannsmeier 2001:62). Wooden hives are often damaged by fire or destroyed by honey badgers, with beekeepers adding steel covers for reinforcement.



Figure 20: Analysis of the BeePak beehive, 2015 (illustration by author).

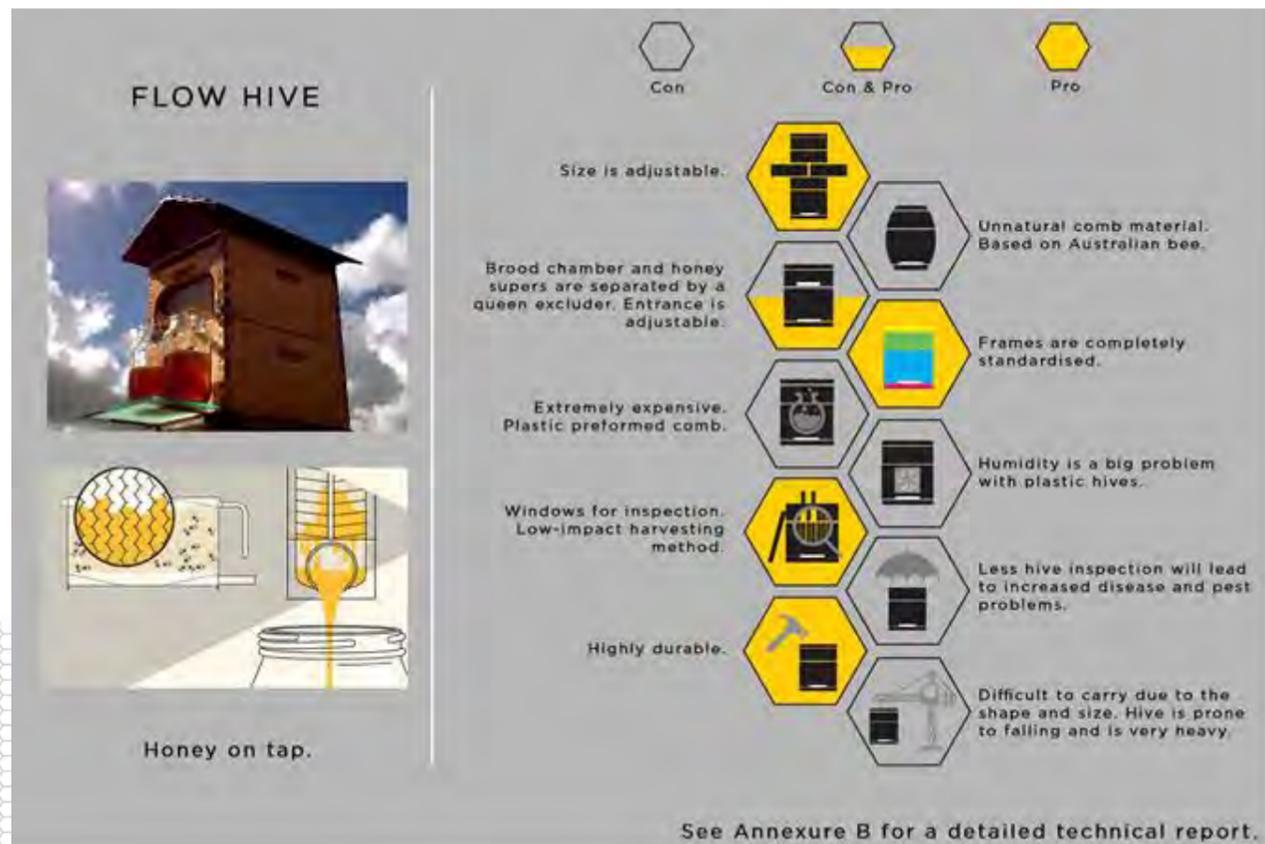


Figure 21: Analysis of the Flow beehive, 2015 (illustration by author).

⑩ Portability

Safety and ease of transportation, along with installation time and method. Wax-comb and honey stores add a great deal of weight to hives, and the entire unit can weigh up to 25kg. Migratory beekeepers often place hives on pallets that can be lifted by fork-trucks (Johannsmeier 2001:69). Relocation of hives has been shown to have no adverse effects on the colony health although the practice directly results in the spread of diseases and pests (Riddell, Pearce, Couvillon & Ratniecks 2013:7). This is due to colonies that are packed close together during transportation and placed at feeding sites with foreign hives.

**2.4 Summary**

The information gathered on UA and Apiculture helped to determine the initial design requirements of a beehive. The analysis of beehives and beekeeping approaches demonstrated the methods and techniques that could be used to produce an improved beehive design. However a theoretical understanding of the situation and technology was not enough to ensure a successful concept direction. The reliability of the data had to be reinforced with hands-on, field-research. Understanding the realities of beekeeping in SA would require the views of local beekeepers to verifying or dismiss the theoretical deductions made here.

## CHAPTER 3: RESEARCH METHODOLOGY

This section defines the structure and theoretical approach to this design research project through formative design research<sup>5</sup>. The methodological approach, research paradigm and knowledge generation processes are identified and elaborated upon.

### 3.1 Methodology

In developing countries, such as SA, which are faced with socioeconomic problems an emphasis should be placed on designing for the needs of the many (Papanek 1985:5), shifting the design conversation from consumerism to humanitarianism (Pilloton 2009:8). This is clearly evident in the statement by Richard Buchanan (2001:37) in his paper entitled *Human Dignity and Human Rights: Thoughts on the Principles of Human-Centered Design*:

It is true that usability plays an important role in human-centered design, but the principles that guide our work are not exhausted when we have finished our ergonomic, psychological, sociological and anthropological studies of what fits the human body and mind. Human-centered design is fundamentally an affirmation of human dignity. It is an ongoing search for what can be done to support and strengthen the dignity of human beings as they act out their lives in varied social, economic, political and cultural circumstances.

Buchanan suggests that designers should be responsible and socially productive enough to provide people with the means to support themselves. Designers can do this by adopting a ‘human-centered’ approach and applying their problem solving skills to the creation of sustainable solutions that are based on the requirements of marginalised communities, some examples of these are demonstrated in Figure 22 (Pilloton 2009:16).

Addressing the central problem of the study required that existing technology be adapted or modified to become more accessible to the end-users. As such the study falls under Appropriate Technology Development (ATD), based on Dr Ernst Schumacher’s (1975) theory of *appropriate technology* from his book *Small is Beautiful: Economics as if People Mattered*. Schumacher (1975:3) believed that products should provide a medium for social entrepreneurship. The theory offers an indirect method for easing poverty by providing marginalised communities with low tech<sup>6</sup> products that support skills development and economic growth (Schumacher 1975:172). In the paper *Appropriate Technology for Socioeconomic Development in Third World Countries* Anthony Akubue (2000:sp) states that now:

The appropriateness of technology is not limited only to job creation, using local resources, and utilizing renewable energy resources but it is also about being affordable, easy to maintain, compatible with existing infrastructure, efficient in the use of scarce natural resources, environmentally benign, and partial to small-scale.

<sup>5</sup> ‘Formative design research’ where the designer determines what research techniques and methods will be implemented throughout the study (Faste & Faste 2012:7).

<sup>6</sup> ‘Low tech’, short for ‘low technology’, is a term used to describe technologies that can be produced and implemented with minimal capital investment, specialization or compartmentalisation (Encyclopaedia Britannica 2015:sp).



Figure 22: Jang Ha-Won (author), Cambodia Appropriate Technology Centre (CATC), examples of Appropriate Technology Products, 2009, (CATC 2009).

(1) LifeStraw: Water filter designed to purify water to drink it safely (Ref. Vestergaard Frandsen)

(2) Pot-in-Pot Cooler: Refrigerator which can maintain the low temperature without electricity

(3) Super MoneyMaker Pump: Water pump designed to be used by people to raise water easily from the water source (Ref. KickStart)

(4) XO-1 Computer: Inexpensive computer intended to provide children in developing countries with access to knowledge and opportunities to be educated (Ref. One Laptop Per Child)



Figure 23: Photographer unknown, Bee Free Apiaries (publisher), rural beehive manufacturing training in Ethiopia, 2014, (Bee Free Apiaries 2014).

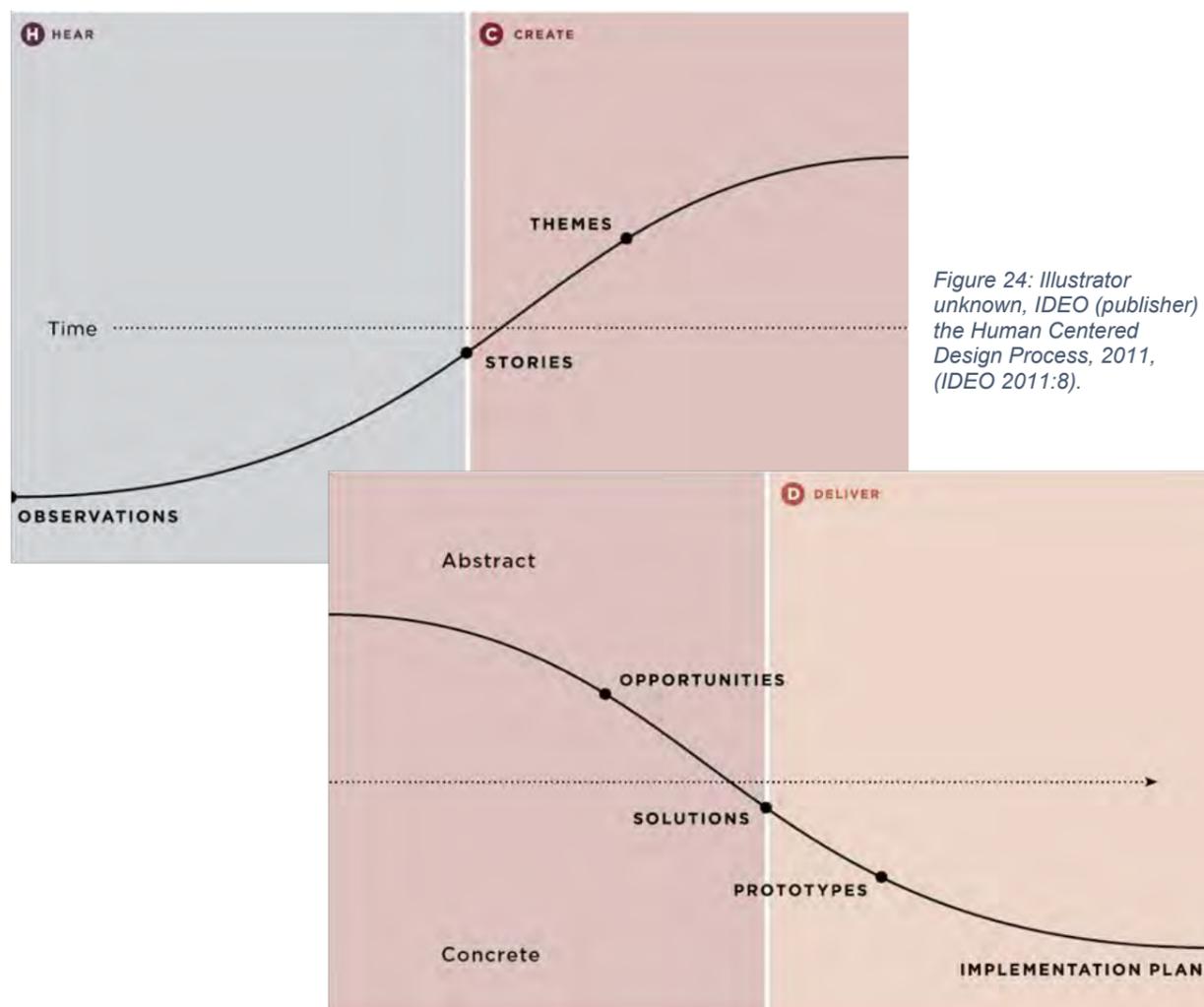


Figure 24: Illustrator unknown, IDEO (publisher) *the Human Centered Design Process*, 2011, (IDEO 2011:8).

Akubue (2000:sp) demonstrates that ATD has developed into a holistic approach, aimed at finding the most suitable tools to provide opportunities for development and although the technology is often simplified it must be progressive, allow for future advancement, or create progress through innovation. In the paper titled *A Framework for Sociotechnical Innovation: The Case of a Human Powered Shredder* Angus Campbell (2015:8) refers to opportunities created through ATD as 'Capabilities', using the enhancement of capabilities as a means to measure a technologies appropriateness. The principles of ATD were well suited to this study as the aim was to provide urban farmers with beekeeping 'Capabilities'.

### 3.2 Research Paradigm

The core principles of ATD are defined by the axioms 'recognition, correspondence and operation' (Sianipar et al. 2013:3385). This study adopts a Human Centred Design (HCD) approach to ATD, based on the process set out by IDEO with the axioms reclassified as 'Hear, Create and Deliver' (see Fig. 24) (IDEO 2011:8). HCD pertains to the development of solutions that cater for the needs and preferences of people in their social context (Steen 2014:2; ISO 2010:1). In this approach design practitioners recognise the knowledge that users have accumulated through their experience with a challenge, compiling this valuable information through empathic and participatory research to be utilised as a resource in the design process (Maguire 2001:588). The user is seen as an expert through experience with the challenge and context. Through their participation the user also becomes more invested in the intervention, developing the important aspect of ownership (Campbell & Harrison 2015:8).

The four principles of HCD as set out by the International Organisation for Standardisation (ISO) standard 9241-210 (ISO 2010:1) are: the active involvement of users, appropriate allocation of function to the system and the user, iteration of design solutions and multi-disciplinary design. The three most important reasons for using participatory design research are to: achieve better results; create cooperation and communication during the design process; and give people the ability to influence the products and systems or services they use (Steen 2014:49). The participatory technology development done by the ISD and ILRI with rural Ethiopian beekeepers demonstrated how innovation could occur from participants that had 'endogenous knowledge' and were stimulated by 'exogenous knowledge'<sup>7</sup> (Araya et al. 2007:29). Through HCD methods beekeeping technology was adapted by farmers to "fit their own reality and often improve its effectiveness, efficiency, productivity, profitability, durability, marketability, palatability, sustainability etc." (Araya et al. 2007:29) (see Fig. 23). IZ has also produced a variety of products that are more economically and technically accessible by adapting technology to fit the requirements of urban farmers through participatory design methods (Campbell 2013:12).

<sup>7</sup> 'Endogenous knowledge' is existing wisdom that exists within group/area, whilst 'exogenous knowledge' is new wisdom that originates outside of a group/area (Araya et al. 2007:29).

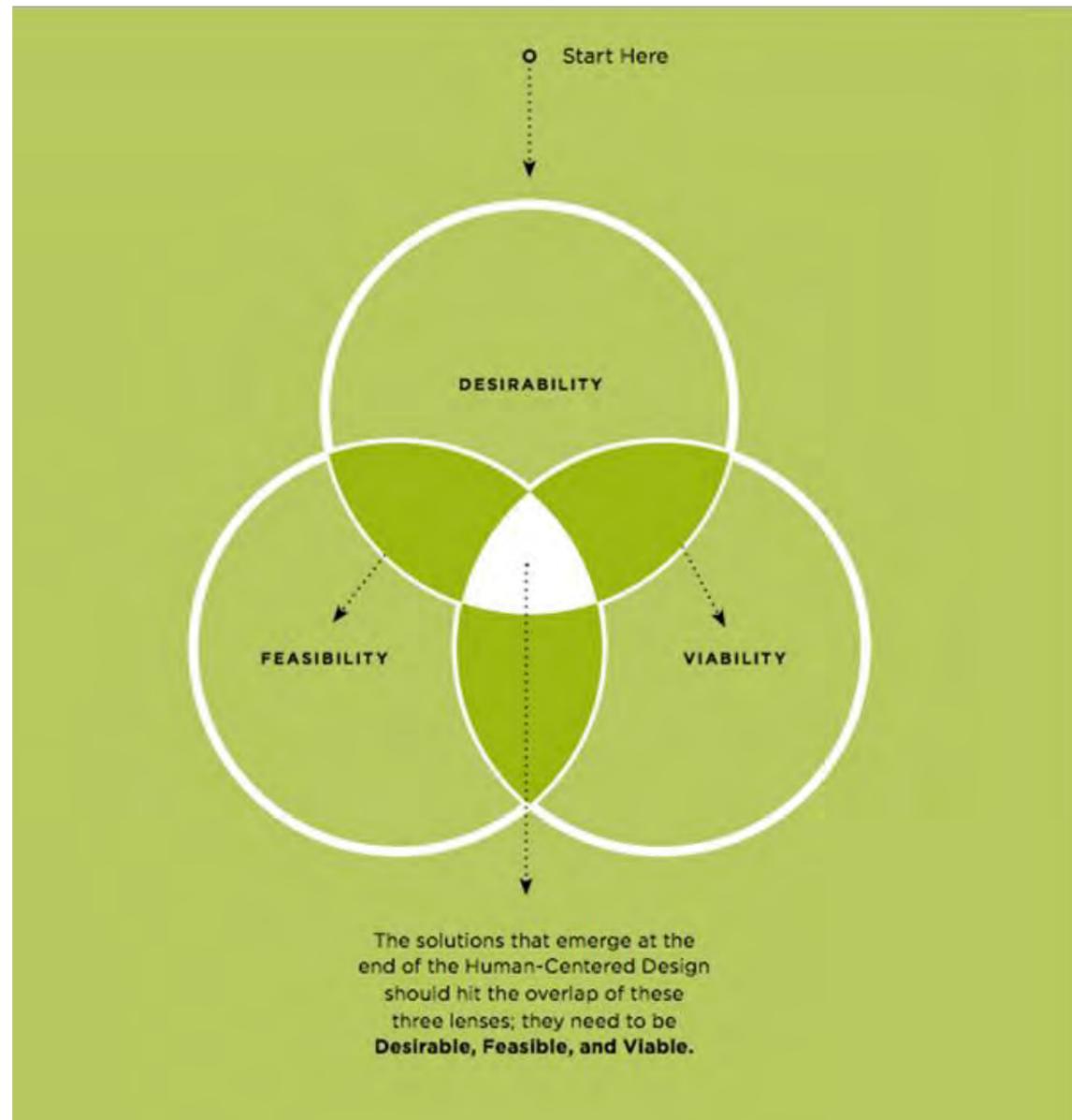


Figure 25: Illustrator unknown, IDEO (publisher) the Three Lenses of Human Centered Design, 2011, (IDEO 2011:7).

### 3.3 Population Sampling

In ATD the views and experience of experts in the fields concerned, including the end-user, should be enlisted as part of the design research (Schumacher 1975:129). This is a comprehensive approach to design research that uses qualitative data, gathered from users and multidisciplinary professionals for the purpose of developing appropriate, acceptable, useable and successful solutions. The participants should therefore represent the extremes of the problem or offer inspirational knowledge (IDEO 2011:41). The two sample groups from which participants were selected for this study are *expert beekeepers* (see Fig. 26) and *urban farmers* (see Fig. 27). Within the group 'expert beekeepers' three sub-groups were identified; urban, cooperative and commercial beekeepers. Participants from each of these groups became key-informants in the research. The participants were valuable in assessing the desirability, feasibility and viability of concepts (see Fig. 25) (IDEO 2011:7).

### 3.4 Ethics

This study dealt with human participants and was therefore subject to ethical considerations. During research studies the safety, confidentiality and basic rights of participants was correctly observed and adhered to (Oliver 2010:80). In this study the participants were all consenting adults who understood the nature of the study and had signed informed consent forms (see Appx. C) that offered confidentiality, anonymity and indemnity. All of the participants were also provided with a project information form (see Appx. D) that served to inform them of the nature of the project, the implications of their involvement and their rights to refuse to take part or request that the information they divulge is not publically distributed (Oliver 2010:81).

Many of the urban-farmers constituted a 'vulnerable-group' due to their economic positioning (Oliver 2010:87). Therefore it is important that they are aware of the academic nature of this study and not led to believe they would benefit financially from their participation. For the beekeepers and other professionals who were asked to divulge 'trade-secrets' during the research it was stressed that they had the right to withhold their information, and that the information they did reveal would be securely stored (Oliver 2010:89). Most importantly for the testing that involved exposing the participants to dangerous insects (bees) the consent form included a disclaimer for possible injury or bodily harm, although their safety was at all times ensured by a facilitator who was qualified to handle bees (Oliver 2010:164).

### 3.5 Data Collection (HEAR)

The first phase of the HCD process involves data collection and analysis through traditional research techniques (Faste & Faste 2012:7). In HCD designers collect reliable data through exploratory (observations), participatory (stories) and immersive research, using the data to understand or empathise with the situation. The data is triangulated between information from experts, on-the-ground informants and contemporary literature.



Figure 26: Beekeepers in Johannesburg inspecting a super frame, 2015, (photographed by author).



Figure 27: Themba Khoza, urban farmer in Johannesburg, 2015, (photographed by author).

### 3.5.1 Exploratory Research (Observations)

At the start of a design research project it is imperative for the designer to clearly identify the problem and then become fully versed in the subject matter surrounding the problem (IDEO 2011:39). This involves the collection and identification of ‘explicit knowledge’ that is readily available and can be made use of in research. The exploratory research done at this stage is intended to develop the designers’ ‘knowledge base’ (Martin & Hannington 2012:84). From the initial research in Chapter 1 a central problem statement and an actionable research question emerged, with objectives and goals (Patton & Cochran 2002:7). A series of informal *pilot-study* interviews were conducted at this stage to investigate the parameters of the challenge and the scope of stakeholders involved (IDEO 2011:38). The research areas pertaining to the challenge were disseminated in a literature review that synthesised the current knowledge from contemporary writings, with conclusions drawn based on ‘deductive reasoning’<sup>8</sup> (Martin & Hannington 2012:112).

### 3.5.2 Participatory Research (Stories)

Participatory research gathers ‘endogenous knowledge’ through communication, experience and observation (Martin & Hannington 2012:112). The data generated during this qualitative social research was captured through audio or video recordings. Where necessary the recordings were transcribed and are presented in Appendix E. In addition first-hand observations were recorded in a Field Diary (see Appx. G). Conclusions drawn from these activities were based on ‘inductive reasoning’<sup>9</sup>.

Within the identified sample groups a ‘cooperative inquiry’ was conducted by way of semi-structured, in-depth interviews featuring planned questions that could be replicated in other interviews<sup>10</sup>. Systematic questions based on the exploratory research were used to uncover aspirations, requirements and problems; following with broader discussions of the project details that included inductive coding questions leading to agreements (expectations) and disagreements (explanations) (Woods 2002:3).

An important way for designers to foster empathy with the participants is to ‘walk in their shoes’ and experience the problem first hand (IDEO 2011:46). As part of the *in-context immersion* it was beneficial to practice beekeeping to achieve a better understanding of the technology and to produce necessary resources for testing and implementation. This required the completion of a basic beekeeping course and keeping at least one hive for the duration of the project. The data generated through this experience was compiled by the designer through self-documentation and formed part of the field experimentation research (IDEO 2011:53).

<sup>8</sup> Deductive reasoning is based on existing knowledge that is substantiated and reliable (Faste & Faste 2012:2).

<sup>9</sup> Inductive reasoning is based on empirical observation (Faste & Faste 2012:2).

<sup>10</sup> Cooperative Inquiries are used in participatory research to address topics of behaviours, opinions/values, feelings, knowledge, sensory dissemination and background/demographics (Woods 2002:2).

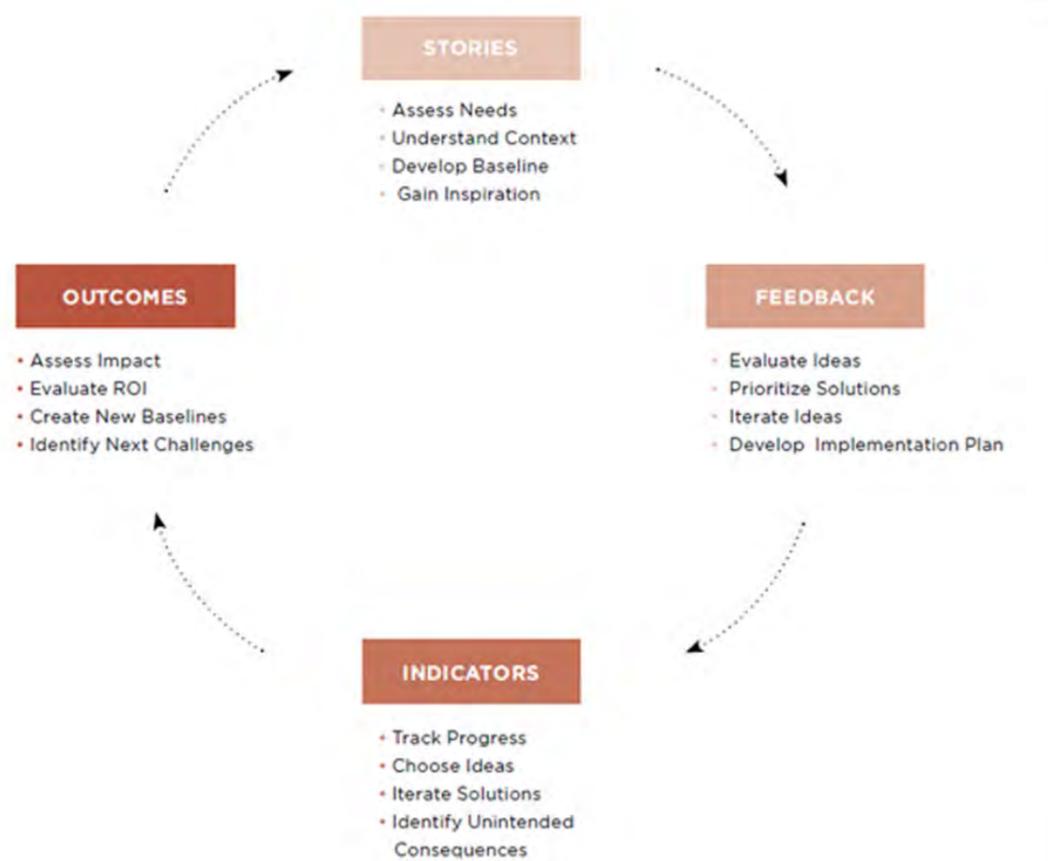


Figure 28: Illustrator unknown, IDEO (publisher) Participatory Research cycle, 2011, (IDEO 2011:97).

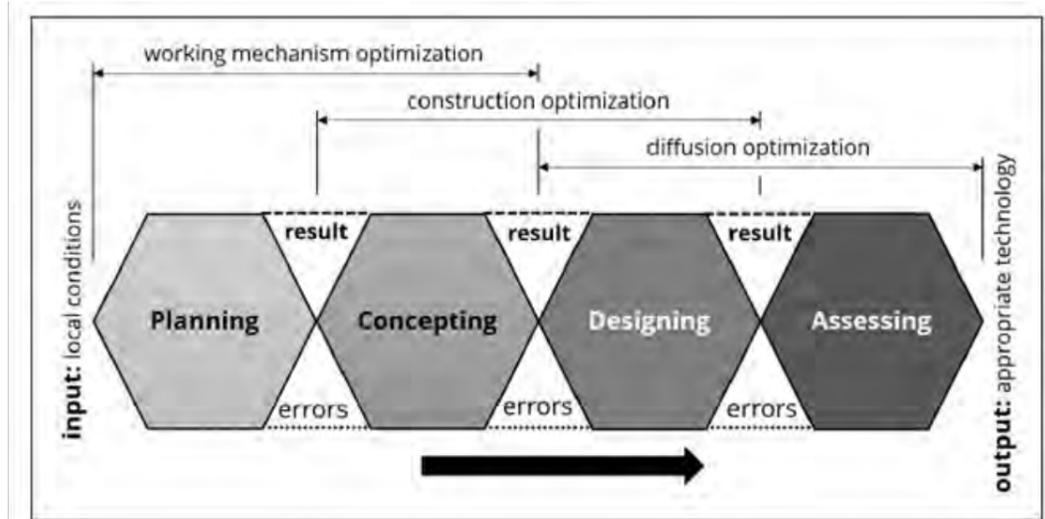


Figure 29: Sianapar et al. (authors), basic appropriate technology workflow, 2013, (Sianapar 2013:3388).

### 3.5.3 Analysis (Themes)

By synthesising the data into a basic set of requirements and opportunities the designer had a basis to begin to identify opportunities and brainstorm new ideas, concepts and solutions (IDEO 2011:79). A 'thematic analysis' (see Appx. F) was used to synthesise important issues from the large bodies of qualitative research (Patton & Cochran 2002:23). The data captured from the exploratory and participatory research was systematically organised through the process known as 'Cognitive Mapping' (Martin & Hannington 2012:30). By this process texts are read through and annotated with 'codes' that point out separate notions and attributes; referred to as *open coding* (Creswell 2007:156). The codes initially pertained to individual points which were then rearranged using *axial coding* and *affinity diagrams* to create groups based on similarities (Woods 2002:7; Martin & Hannington 2012:12). The groups helped narrow down the issues and produce potential 'themes' that outline the design parameters (Patton & Cochran 2002:23). From these 'themes' an Intervention Framework consisting of an implementation strategy was generated to guide the discourse of the ideation phase to identify possible scenarios of successful uptake (Martin & Hannington 2012:30).

### 3.6 Design Process (CREATE)

The second phase of HCD research is an iterative process of developing concepts based on the theoretical framework and refining them through further research (see Fig. 29) (IDEO 2011:79). The 'Hear' research was synthesised into a 'creative toolkit' to assist the designer and the participants in identifying *opportunities*; stimulating innovative and valid brainstorming (IDEO 2011:102). This process is used by designers to assess the potential outcomes of their concepts (Faste & Faste 2012:7). HCD makes use of a variety of tools and methods to produce and test 'real-world solutions' that ultimately results in tried, tested and proven solutions (IDEO 2011:79). Conclusions drawn from these activities were based on 'abductive reasoning'<sup>11</sup>.

#### 3.6.1 Development (Solutions)

The focus of brainstorming is to produce a wide and varying range of possibilities that attempt to present every possible solution; highlighting the best possibilities (IDEO 2011:104). The initial brainstorming used *concept sketches* and *development models* to illustrate a variety of solutions. To focus the inquiry three of the best concepts were selected and analysed through participatory research that involved two separate focus groups conducted within each of the two sample groups. Focus groups are used in HCD to incite interactions and responses between people that can be measured at a group level, while the views and beliefs of the participants can be validated through discussions (Patton & Cochran 2002:22; IDEO 2011:44). The three potential solutions were presented as

<sup>11</sup> Abductive reasoning uses themes to determine the value of conceptual solutions (Faste & Faste 2012:2).

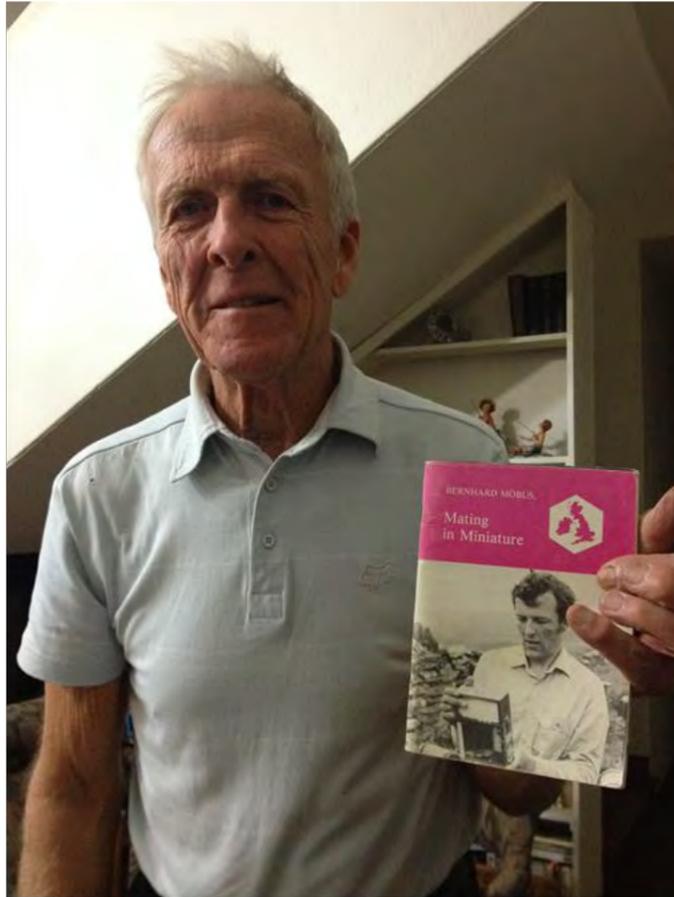


Figure 30: Expert cooperative beekeeper Tom Cain holding a melitology publication with himself on the cover, 2015, (photographed by author).

‘Sacrificial Concepts’<sup>12</sup> with the results used to select an appropriate concept direction. The methods used to capture data during these sessions included ‘desirability testing’, ‘context analysis’ and ‘participant observation’ as per *Universal methods of Design*, using ‘generative models’<sup>13</sup> to facilitate the participation of the users in evaluating the concepts (Martin & Hannington 2012). The intention for the beekeeper’s focus group was to assess the technical function of the technology in relation to the intentions set out by the project. The intention for the farmer’s focus groups was to assess the feasibility, viability and desirability of the intervention framework and concepts.

### 3.6.2 Refinement (Prototypes)

The chosen concept was further developed through detailed drawings and three-dimensional prototypes of design iterations and engineering considerations. The refined concept in the form of sketches, models and digital renders could then be used in a ‘key-informant interview’; conducted as unstructured interviews to evaluate the concept (IDEO 2011:55). The key-informant, an expert beekeeper (see Fig. 30) was selected to provide a final assessment of the design and point out any remaining issues prior to testing. A prototype was developed as a functional representation of the solution to test the concept in a real-world situation. The test involved furnishing the prototypes with live colonies and was conducted in an urban location. The insights from an ‘ergonomic analysis’ and ‘usability test’ conducted by the informant along with observations from testing influenced the final design iterations (Martin & Hannington 2012).

### 3.7 Final Design (DELIVER)

The final solution was the focus of this study, however the deliverables include supplementary components; a business proposal, engineering documents for patent applications and demonstration posters. The final prototype was an exact representation of the design and manufacturing intended for the components. The final concept was evaluated through a summary of the design research outcomes relating to the project requirements as set out by the themes as well as successful ATD criteria indicated in this chapter, upon which recommendations for further research were highlighted (IDEO 2011:148).

<sup>12</sup> Sacrificial Concepts are ideas that are presented together for the participants to identify the best option, ‘sacrificing’ those that are less viable, feasible or desirable (IDEO 2011:60).

<sup>13</sup> Generative Models are physical representations of concepts that can be manipulated by the participants; demonstrating their personal preferences or ideas.

## CHAPTER 4: ANALYSIS & FINDINGS

### 4.1 Field Research

As per ethical requirements, all interviewees signed informed consent forms (see Appx. C) prior to their interview.

The cooperative inquiry consisted of eight interviews within the sample population as follows:

Cooperative Inquiry	
Reference	Interview
UF01	Urban Farmer, Betrams Inner City Farm.
UF02	Urban Farmer, Izindaba Zokoudla Farm School, Soweto.
UF03	Urban Farmer, Izindaba Zokoudla Farm School, Soweto.
UF04	Urban Farmer, Izindaba Zokoudla Farm School, Soweto.
UF05	Urban Farmer, Izindaba Zokoudla Farm School, Soweto.
BK01	Urban Beekeepers, Cooperative Beekeeping, Melville.
BK02	Expert Beekeeper, Urban Beekeeper, Weltevreden Park.
BK03	Commercial Beekeeper, Carletonville.

### 4.2 Findings

Through a systematic analysis of the data, produced from the field research, codes were generated that highlighted important factors. The initial themes identified in Chapter 2's precedent analysis were included as codes. The codes were then revised and grouped into eight main themes (see Appx. F & Fig 31 & 33). The themes are indicated in this section and elaborated on with reference to the data that informed them.

#### ① Protection

The theme 'Protection' incorporates critical aspects from the codes 'Pests/Diseases' and 'Protection'. The value of honey and beekeeping equipment creates a serious problem for beekeepers, who stated that they experience up to 30% losses annually due to theft and vandalism (see Fig. 33) (BK03:488). Prevention methods such as cages, camouflage, chains, locks and strapping have proven ineffective in their experience. The beekeepers confirmed that AFD, ants, Wax Moth, Hive Beetles and Varroa-mites are the biggest natural problems, and that other pests and diseases are naturally manageable in strong colonies (BK01-BK03). According to the beekeepers AFD is spreading quickly in SA and beekeepers are burning infected hives (BK03:87). Wax-moth is prevented by storing the unused frames and supers in a sealed room (BK02:573). The beekeepers also indicated that Varroa-mites fall off bees inside the hives and are picked up when other bees walk across the floor at the hive entrance. Raised entrances can be used to force bees to enter the hive away from the floor (BK03:183). Ants are generally stopped by creating a moat of used engine oil around the legs of the stand supporting the hive (BK02:709; BK01:222).

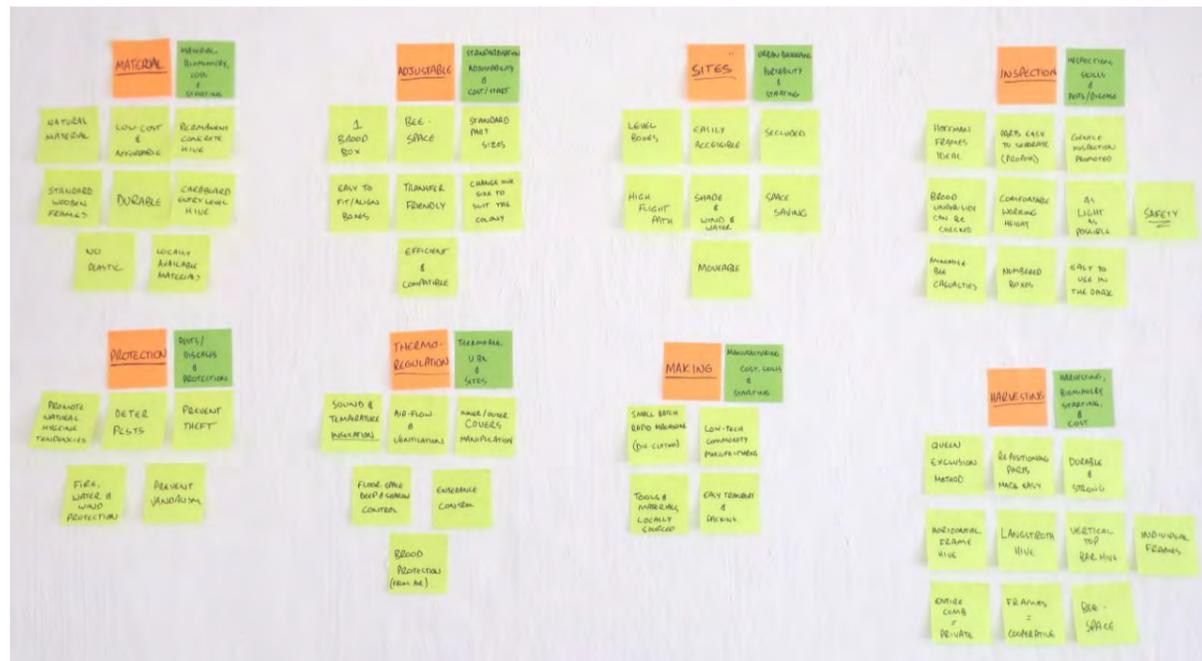


Figure 31: Thematic data analysis process work, 2015 (compiled by author).

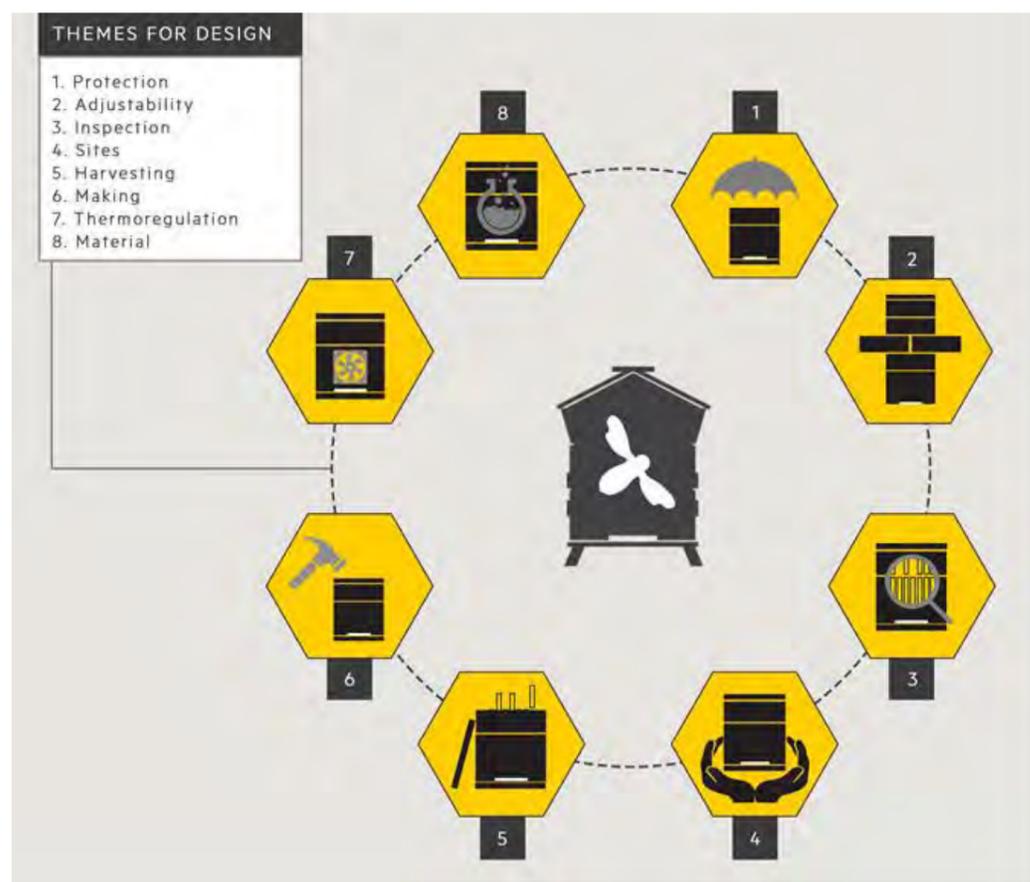


Figure 32: Chart of themes for appropriate beekeeping technology development, 2015 (illustration by author).



Figure 33: Vandalised hive components at commercial beekeepers farm in Carletonville, 2015, (photographed by author).



Figure 34: Beekeepers demonstrating a hive inspection in Midrand, Johannesburg, 2015, (photographed by author).

### ② Adjustability

The theme 'Adjustability' incorporates critical aspects from the codes 'Standardisation', 'Adjustability', 'Cost' and 'Beginning'. According to beekeepers the standardisation of frame sizes is integral for the use of harvesting equipment and managing an efficient apiary (BK03:380). However the standard sizes were also noted as a standardisation and low cost (BK01-BK03). However due to declining production levels and colony mortality rates some beekeepers have begun experimenting with different hive designs and modifying features (BK03:351).

### ③ Inspection

The theme 'Inspection' incorporates critical aspects from the codes 'Inspection', 'Skills' and 'Pests/Diseases'. By observing beekeepers (BK01) performing hive inspections (see Fig. 34 & Appendix G) the following insights were gained:

- The hive components are often sealed together with propolis and must be pried apart using a hive-tool<sup>14</sup>. This action leads to damage on the edges of the hive chambers that creates larger gaps that are then sealed with more propolis the following time (Field Diary: 30/5/2015).
- Beekeepers systematically inspect each frame, although the brood frames are seldom removed, instead the brood chamber is tilted away from the floor to inspect the bottom of the frames for swarm-cells (Field Diary: 30/5/2015).
- The removal and repositioning of Hoffman frames in hive chambers often results in bees being crushed where the parts meet, agitating the surrounding bees (Field Diary: 30/5/2015).
- Hives are often placed on stands to achieve an ideal working height (Field Diary: 30/5/2015).

Although they mentioned that the fragility of the comb makes inspection difficult in comparison to the well reinforced comb that is found on Hoffman frames (BK03:351). One beekeeper had chosen to use round entrances with rails mounted on either side to close the entrance with mesh for transport (see Fig. 35). The round entrance was observed to be easily controlled by the bees, and a 42mm diameter had been selected to deter honey badgers.

### ④ Sites

The theme 'Sites' incorporates critical aspects from the codes 'Urban Beekeeping', 'Portability' and 'Beginning'. According to the beekeepers (P006; P007; P008) there is sufficient food in the city to make urban beekeeping successful, "there's always food in the city... there's not really an off season" (BK03:31). The beekeepers indicated that the space in cities limits the amount of beehives that people can keep without risking the safety of the surrounding population (BK02:188). Although having a hive will prevent wild swarms from nesting nearby, "the more hives there are then technically the less wild hives or wild swarms there'll be" (BK01:408). Agricultural chemicals have rendered some crops dangerous or inaccessible to foraging bees, and beekeepers find that colonies return from pollination migrations weaker and with new diseases or pests (BK03:104). As such it has become more sustainable to keep hives in a permanent location where they will only be moved around the site occasionally.

<sup>14</sup> A hive-tool is a flat metal hand tool used to separate/pry-apart hive components, lift frames and scrape away propolis.



Figure 35: Circular hive entrances with rails and doors, made by commercial beekeeper Hans Steenpoort, Midrand, 2015, (photographed by author).



Figure 36: Bertrams inner city farm in Johannesburg, 2015, (photographed by author).

Local urban farmers generally work on small-plots that are partially secured by fences and are surrounded by residential and public spaces (see Fig. 36) (UF01-UF05). The farmers indicated that there were wild swarms located near their farms that they had observed through the presence of bees foraging amongst their crops (UF02). Many of the farmers share land with schools. There were concerns raised about the safety of the children and issues of getting approval from the school bodies arose (UF02).

#### ⑤ Harvesting

The theme 'Harvesting' incorporates critical aspects from the codes 'Harvesting', 'Biomimicry', 'Beginning', 'Pests/Diseases' and 'Cost'. Although the beekeepers acknowledged that queen excluders are useful in small apiaries and for beginner beekeepers, their view is that the excluders: waste time, are too costly, not durable, and are difficult to reposition (BK03:448). According to the beekeepers the brood comb should be replaced every two years as the cells become too small from cocoon deposits (BK03:419). Some beekeepers preferred to conserve the comb during harvesting, although the financial benefit of harvesting wax was noted (R100/kg). The beekeepers indicated that forcing the bees to build new comb by harvesting the wax simultaneously did not affect production levels, however the process would "lose probably 10 or 15 percent" of the honey (BK03:49). The beekeepers stated that harvesting tools and facilities are very expensive; for people with only one or two hives an established beekeeper's harvesting services can be hired for R350-R500, referred to as 'cooperative beekeeping', with the provision that the beehive uses standard frames (BK01:67). Alternatively the honey can be separated through 'low-tech'<sup>15</sup> methods such as solar-heaters.

According to the beekeepers African bees do not move their brood independently, noting that the bees also prefer to use higher openings in the hive as entrances (BK03:397). The use of thinner frames was noted to help slightly with burr comb formation, and given a choice the beekeepers would rather use 32mm frames (BK03:377). Through observation it was visible that burr comb was a problem in hives using ten frames rather than eleven, although some beekeepers were successfully using nine frames to allow the bees to build wider comb structures.

#### ⑥ Making

The theme 'Making' incorporates critical aspects from the codes 'Manufacturing', 'Cost' and 'Beginning'. The farmers generally have very little money available for investment in equipment (UF01-UF05). However many were in application processes for government funding. The beekeepers agreed that the initial investment in hives is costly, although it was indicated that "it's a useful income and you can quickly pay for the initial outlay of buying a beehive" (BK02:341).

<sup>15</sup> 'Low-tech' refers to technical skills or technology that is easily accessible and widely available.



Figure 37: Polystyrene, shade cloth and oil-moat stand protection on Scarlet Dymond's hives in Melville, 2015, (photographed by author).



Figure 38: Theft-proof concrete hives manufactured by commercial beekeeper Edward van Zyl, 2015, (photographed by author).

The urban farmers demonstrated a strong interest in beekeeping, although they had little to no experience in keeping bees. As high ranking members of the Southern Beekeeping Organisation, Tom Cain and Edward van Zyl expressed interest in growing the industry to create a wider pool of skills for commercial apiculture by working to provide training workshops for marginalised communities (BK01 & BK03). The beekeepers indicated that it is beneficial for beginners to make their own hives and learn through practice or by watching a skilled beekeeper (P008:I322). However the farmers only have access to low tech construction skills and equipment.

#### ⑦ Thermoregulation

The theme 'Thermoregulation' incorporates critical aspects from the codes 'Thermoregulation' and 'Sites'. It was observed that beekeepers use insulating materials such as Allu-bubble, shade-cloth and Polystyrene to cover their hives where shade was not available (Field Diary: 30/5/2015). The participants agreed that local weather is moderate enough for the bees to regulate the internal hive temperature in winter (BK01-BK03). BK03 mentioned that the HTB hive was less effective at regulating airflow and in hot weather 'bearding'<sup>16</sup> would occur more regularly.

#### ⑧ Material

The theme 'Material' incorporates critical aspects from the codes 'Material', 'Cost', 'Manufacturing' and 'Beginning'. The beekeepers all agreed that in their experience bees "don't like plastic hives" and that natural materials are generally preferred (BK02:441). Plastic was said to cause internal condensation and disturb the bees due to the electrostatic discharge. It was indicated that the durability and strength of materials is a key factor for beekeepers, who preferred to use cheap, low-quality wooden hives knowing that they would be destroyed within four years (BK03:494). As an alternative beekeepers have resorted to making low-cost cement hives for permanent apiaries and using disposable cardboard 'catch-hives'<sup>17</sup> (see Fig. 39; BK03). Beeswax is used in the cement hives (see Fig. 38) to make the interior environment more hospitable.

<sup>16</sup> 'Bearding' is term used to describe the bees collecting on the hive exterior around the entrance to help fan air into the hive when the internal temperature exceeds 36°C (Johannsmeier 2001:28).

<sup>17</sup> A 'catch-hive' (nucleus-hive) is a 6-frame chamber used to lure swarming colonies and house them for up to four weeks before the bees run out of space. These hives are generally made from wood, although recently disposable cardboard catch-hives have become more popular.

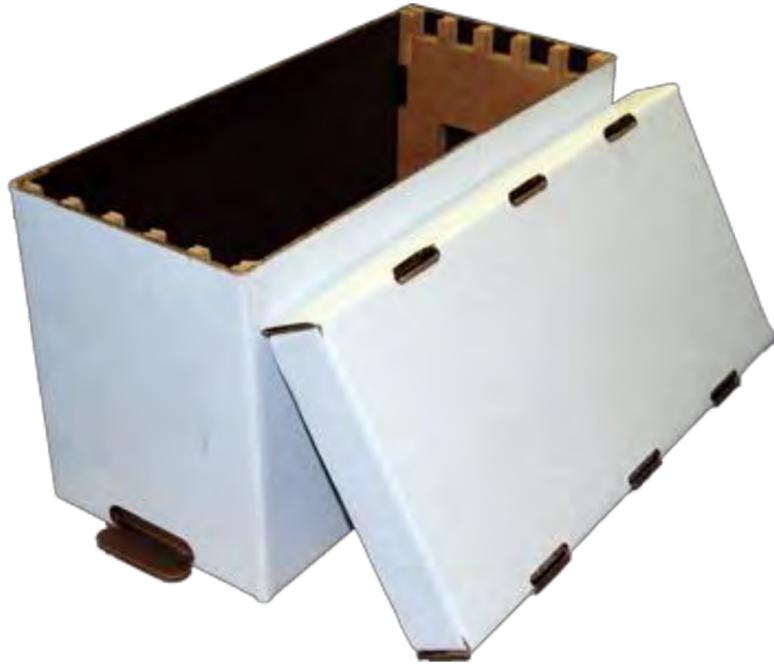


Figure 39: Designer unknown, waxed disposable nucleus hive, 2015, (Brushy Mountain Bee Farm 2015:sp).

### 4.3 Intervention Framework

The themes provide guidelines for the development of a solution, with the overall aim to make beekeeping accessible to urban farmers. The analysis was disseminated into a framework for the intervention process (see Fig. 40), that follows a staggered, three-stage process starting with an entry level hive and working towards a permanent and effective apiary. The income generated from the entry-level hive would enable the transition to a permanent hive, with two options for harvesting and hive maintenance: private or cooperative harvesting. The farmers could harvest the honey themselves using low-tech equipment and methods, or pay an established beekeeper to harvest the honey for them. For private harvesting the farmer would need basic training, a protective suit, a smoker and basic processing equipment. The cooperative method would allow the farmer to delay the purchase of equipment and learn valuable skills through assisting the experienced beekeeper, although the service would incur a cost. The choice would depend on the initial available capital and the approach the farmer wishes to adopt. The choice would also influence the use of frames or top-bars in the hive.

To achieve an accessible hive in terms of cost, functionality and productivity a number of potential manufacturing approaches could be explored. Mass-manufactured components such as die-cut cardboard or injection-moulded polystyrene could reduce the individual product cost, however the initial cost needs to be compatible with the demand. Batch manufactured parts could be produced rapidly with professional machinery, with a focus on wood and reclaimed materials however the labour and tools would add to the cost. Low-tech manufacturing systems such as hand-carpentry, basic construction and moulding could be explored as a community driven method.

The entry level hive would need to be affordable enough to encourage the initiation of beekeeping and limit the portion of the investment that comes from the existing farm income. This hive would also allow the farmers to assess their capacity to keep bees over a one to two year period. The entry level hive could act as a catch hive that may also house a colony of bees for a longer time by increasing in size as the colony grows. Cardboard suits the requirements of the entry-level hive as it is an inexpensive material with which to manufacture, however the durability and strength would need to be revised. The permanent hive would also need to be low-cost although it could incorporate additional and/or beneficial features. Concrete is durable, low-cost and low-tech in terms of manufacturing, lending itself as a suitable material for the permanent hive. Concrete hives were shown to be better protected, with the added benefit of fire resistance in the case of burn treatments for bacterial infestations. The manufacture of concrete hive components could easily be community driven with minimal training and setup costs. Although the weight of the concrete components poses a potential problem to usability and would need revision. Although reconstituted, concrete and cardboard consist mainly of natural materials and treating the materials it was believed that the materials would be suitable.

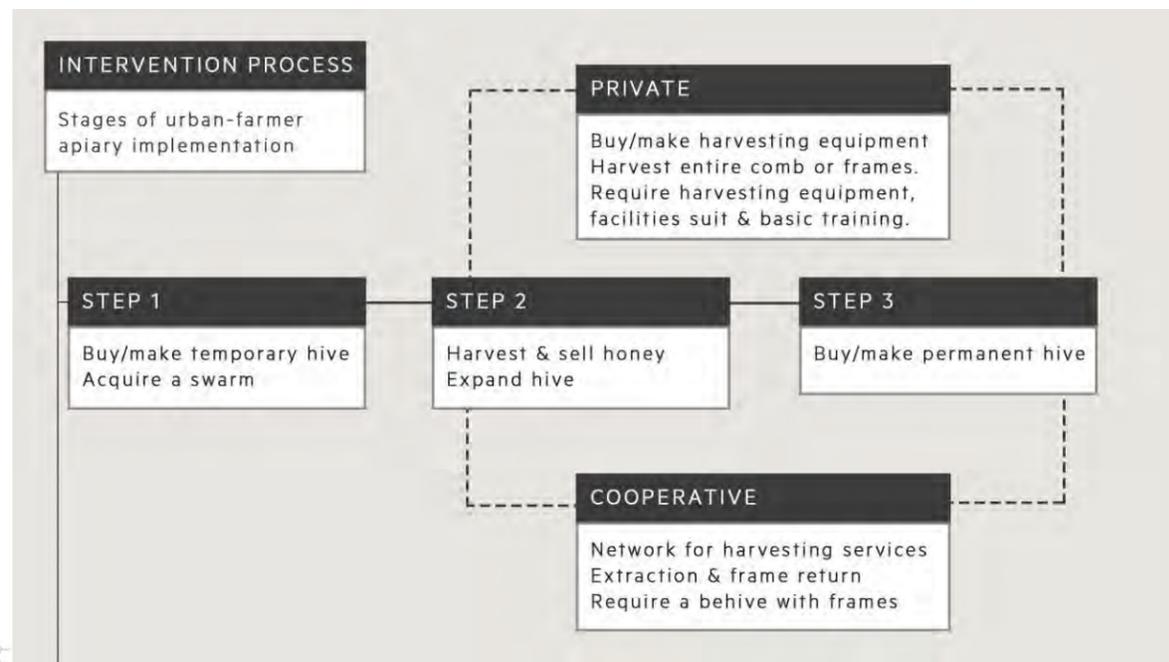


Figure 40: Intervention framework process for urban beekeeping, 2015 (illustration by author).

## CHAPTER 5: PRODUCT DEVELOPMENT

The initial ideation phase was focused on revising modern approaches to beekeeping in line with the eight central themes and the intervention framework. The design intention was to create two beehives that would support the introduction and development of beekeeping at different stages, exploring different opportunities for local urban farmers to set-up sustainable apiaries. The findings chapter highlighted a number of functional issues, design requirements and potential solutions that could be used as design parameters. Using the HCD approach, outlined in Chapter 3, the conceptual development was largely informed by participation of users and experts, utilising their experience and expertise to refine and verify the development concepts.

### 5.1 Initial Ideation

Through brainstorming a variety of scenarios surrounding the intervention framework emerged. The scenarios reflected the varying options offered by different beekeeping systems that could benefit the intervention. The three strongest concepts that emerged from the initial ideation phase were each based on a different system of beekeeping; Langstroth, HTB and VTB (Warre). The concepts each included a cardboard (entry-level hive) and concrete (permanent hive) design in line with the intervention framework and through application of manufacturing and design considerations the concepts were refined to a point of theoretical feasibility.

The first concept (see Fig. 41), based on the Langstroth system, explored standardisation, where the entry-level and permanent hives would follow the same system, allowing the user to develop specific operational knowledge as their beekeeping enterprise grew. The hives would also be standardised to suit existing beekeeping technology (two chamber and frame sizes), catering to cooperative beekeeping. This approach would favour skills development through mentorship over the economic disadvantage of paying for the beekeepers services.

The second concept (see Fig. 41), based on the HTB system, was concerned with the user's initial outlay when buying both hives and the future costs incurred thereafter. The simplest way to reduce cost would be to reduce the parts required to produce a functional hive. With adjustable hives the user would have to continually buy more parts to maintain the hive, whereas if the hive was made up of one complete unit the initial price may be higher, but the user would be saved from having to travel to the retailer to purchase more parts.

The third concept (see Fig. 41), based on the VTB (warre) system, was concerned with simplification, with one chamber size, top-bars and reduced costs. The honey-comb would have to be harvested through pressing and draining, however the cost of the hives would be significantly lower. In this case accessibility and self-reliance would be increased at the cost of inspection complexity and limited harvesting productivity. The entry-level hive was reduced to a catch-hive size chamber, although it was designed to be stackable as with a regular hive.



Figure 41: Initial concept based on different systems of beekeeping, 2015 (illustrated by author).



Figure 42: Full scale cardboard demonstration models for each concept, (produced by author).



Figure 43: Beekeeper focus group, HTB discussion, 2015 (photographed by author).



Figure 44: Beekeeper focus group, top entrance discussion, 2015 (photographed by author).

A common design attribute across all the concepts was to improve insulation in the entry-level hive by creating a cavity between two walls and an interchangeable lid and base for the concrete hive. Other details such as the adjustability, entrance location, ventilation, etc. were intentionally varied in order to explore new possibilities in hive design. These design variations and the different scenarios were used to facilitate user participation.

## 5.2 Participatory Development

Focus groups were conducted at this stage to determine which concept would be taken forward. To aid the discussions posters of each concept were produced (see Appx H), demonstrating and clearly labelling the approach to each theme. Full-scale cardboard demonstration models (see Fig. 42) were also made to assist in the presentation of the concepts. In both sessions first the intervention system was outlined and then the concepts were demonstrated individually with discussions in between. The focus groups consisted of:

<p><b>FG01: Professional Beekeepers (see Fig. 43 &amp; 44)</b>          Randburg, Johannesburg - 9<sup>th</sup> September 2015          Appendix I</p> <ul style="list-style-type: none"> <li>○ P01: Tom Cain</li> <li>○ P02: Manfred Leitner</li> <li>○ P03: Paul Edwards</li> </ul>	<p><b>UF02: Urban Farmers (see Fig. 46 &amp; 47)</b>          Soweto, Johannesburg - 11<sup>th</sup> September 2015          Appendix J</p> <ul style="list-style-type: none"> <li>○ P01: Mpho Khoza</li> <li>○ P02: Lucky Gare</li> <li>○ P03: Israel Rakoula</li> <li>○ P04: Themba Khoza</li> <li>○ P05: Sibongiseni Mngomezulu</li> </ul>
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At this stage a brand (see Fig. 45) was also developed with the intention of promoting the intervention and linking the products as one cohesive system. The name 'Beegin' refers to beekeeping as well as the initiation of a new offering for UA. The logo forms an unfinished hexagon, intended to represent a honey-comb cell as well as an arrow indicative of starting and progress.

### 5.2.1 Focus Group 1

The First concept was received well. The participants were quick to point out that internal covers should be used to prevent the lid from being sealed to the chambers (23:14). Raised entrances appeared to be a controversial idea, with the benefit of keeping bees away from the floor argued against the ability for the bees to easily carry fallen debris out of a lower entrance. It was pointed out that top or alternating entrances are only used in colder climates, as P03 stated (35:26) in SA "the bottom entrance is better quite frankly, because they (bees) clear all their rubbish out there" (33:05). Alternatively it was argued that although Varroa mites are manageable, the pests transmit diseases that cause more serious damage to colonies and a raised entrance may help (P02 18:02).

The second concept delivered mixed responses. The participants (P02 & P03 1:02:40) stated that although in principle the bees would confine the brood to the mid-section, in reality the bees would arrange the brood at the bottom of the hive. However the participants pointed out that a central entrance would reduce the distance that



Figure 45: Beekeeping product branding, logo interpretation, 2015 (designed by author).



Figure 46: Urban farmers focus group, design demonstration, 2015 (photographed by author).



Figure 47: Urban farmers focus group, participants creating a simple hive stand, 2015 (photographed by author).

foraging bees have to travel inside the hive to reach edge comb. P03 suggested (1:07:14) that a feature that transformed the hive from frame to top-bar compatible would be more important than the extra row of small frames that had been included in the design. The participants agreed that viewing windows and Varroa screens were typically unpractical as they were damaged easily.

The third concept led to a number of discussions about the value of simplification to the proposed intervention. The use of medium sized frames was dismissed as they were no longer manufactured in SA (1:26:46). Instead it was highlighted that many beekeepers use only brood chambers to reduce wasted space in the hive (1:11:26). Another consideration was that in P03's experience (1:27:30) multiple honey-supers force bees to adopt a stop-start comb building pattern: reducing productivity. The stackable cardboard catch-hive design was favoured by the participants, although they were adamant that it should also accommodate Hoffman frames (1:28:35). Commenting on the use of bars to support the frames the participants had found that in their experience bees were less prone to building burr-comb on the edges of frames where the bee-space had been substituted for a larger gap (P02 & P03 31:13). This was also stated by P03 (29:31) and P02 (30:30) to reduce the amount of damage to the thin chamber edges when loosening frames with a hive-tool. P03 pointed out that the top-bars would need to be designed with spacers for vertical passage of the bees (2:00:00). With regard to insulation and internal humidity the beekeepers agreed that having extra ventilation via the shuttering pin holes in the concrete hive would be a good idea, allowing the bees to seal and open them naturally (P03 51:35). According to P02 (22:45) "overheating is more of a problem" and the design should focus on cooling.

The participants unanimously agreed with the intervention system of a staggered introduction to beekeeping and the suitability of the materials (P01, P02 & P03 57:50). The participants indicated that private harvesting would be a more viable option than cooperative beekeeping as the farmers would not have enough hives to make the venture attractive for beekeepers (P02 & P03 1:07:35). The beekeepers noted that a separate floor was used for cleaning mostly, with swarm-cell inspections forming part of regular brood frame inspection (P02 2:00:30). In their experience natural hive splits would only occur in hives that were left in remote locations and not inspected regularly (P02 2:01:30). When presented with the chain protection method the general consensus was that the chambers could be forced apart horizontally unless an internal join was used (P02 2:05:30).

### 5.2.2 Focus Group 2

The participants unanimously agreed with the intervention system, indicating that they would prefer a self-reliant model, harvesting the entire comb and collecting both wax and honey through low-tech methods (2:34). The participants queried where to acquire a swarm of bees, where to buy equipment, how to harvest the honey, when

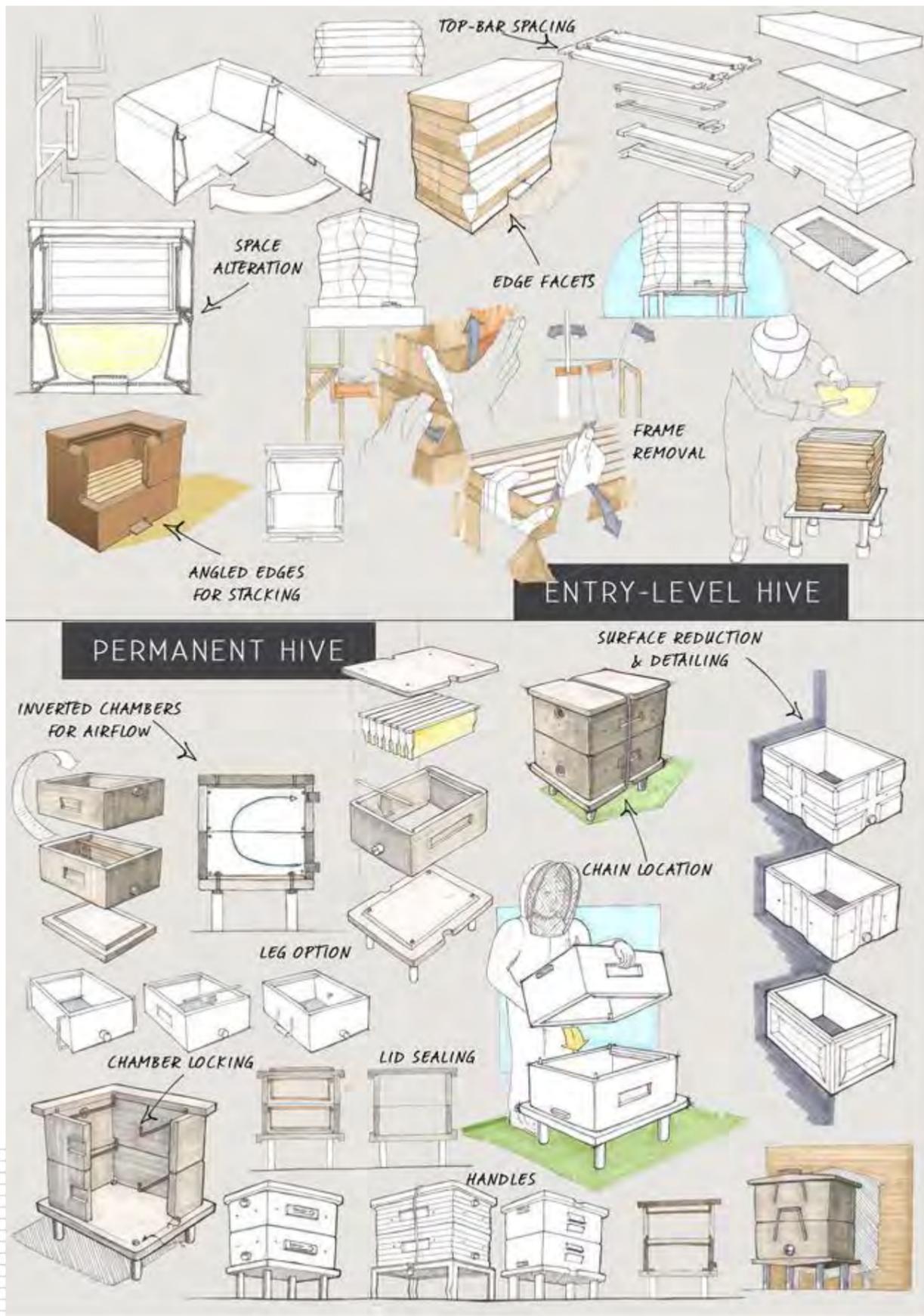


Figure 48: Refinement sketches of the cardboard (top) and concrete (bottom) hives, 2015 (illustrations by author).

to harvest and how the hives functioned. They were also concerned with public safety, site location and municipal regulations, going on to suggest that a beginner's manual should be included with the entry-level hive.

The Langstroth system demonstrated appeal to the participants as the concrete honey-supers would be lighter to move during inspections and buying additional supers would be slightly cheaper. The participants pointed out that chaining the hives closed would be more valuable for protecting people than the contents, as theft would be deterred by community vigilance (18:50). It was stated by P05 that vandalism may be a problem, however through education the public could be made aware of the value of bees (25:03). P05 stated that although he would like to choose the biggest hive the cost was too great (47:37). P04 agreed that in order to build their confidence they should start with a small, beginner hive that was better suited to their environment, demonstrating that they could easily make a stand with materials found on their farms (see Fig. 46; 48:00). The participants were interested in the possibility of manufacturing the cardboard hives themselves as a DIY option (59:46).

### 5.3 Findings: Using the Feedback to Select a Direction

From the feedback it was apparent that the third concept was the most suitable, shown largely by the ability for participants to easily relate the beekeeping system to the intervention framework. The impression was created that concept one and two had catered more to conventional practices with complications arising where they had been modified. Whereas the third concept was understood to embody the central themes, suit the materials and simplify the system appropriately.

### 5.4 Concept Refinement

The simplicity and low-cost that could be achieved by having one chamber size was a key attribute, with the provision that the chambers were brood-size. Although the third concept used the VTB system the feedback determined that the top-bars would only be necessary initially and that frames should be a key feature of the permanent hive. The frames would not require wire supports, bringing their cost down substantially and although still costing about R18 each (see Appx. L) they could be added once the apiary begins to generate a profit. The cardboard as a material would lend itself to post production alterations required to swap from top-bar to frame compatibility as well as the possibility of including printed illustrations and guidelines for beginners at little added cost. The feedback indicated that the locking system for the concrete hive would have to be refined, as well as the exposure of steel components. Where the floor of the hives was sealed to the brood chamber it was evident that the entrance should be at floor level, whereas a separate, cleanable floor would allow for a raised entrance. Through hand sketching (see Fig. 48) and prototyping the design was refined in line with the findings while referring to the central themes.

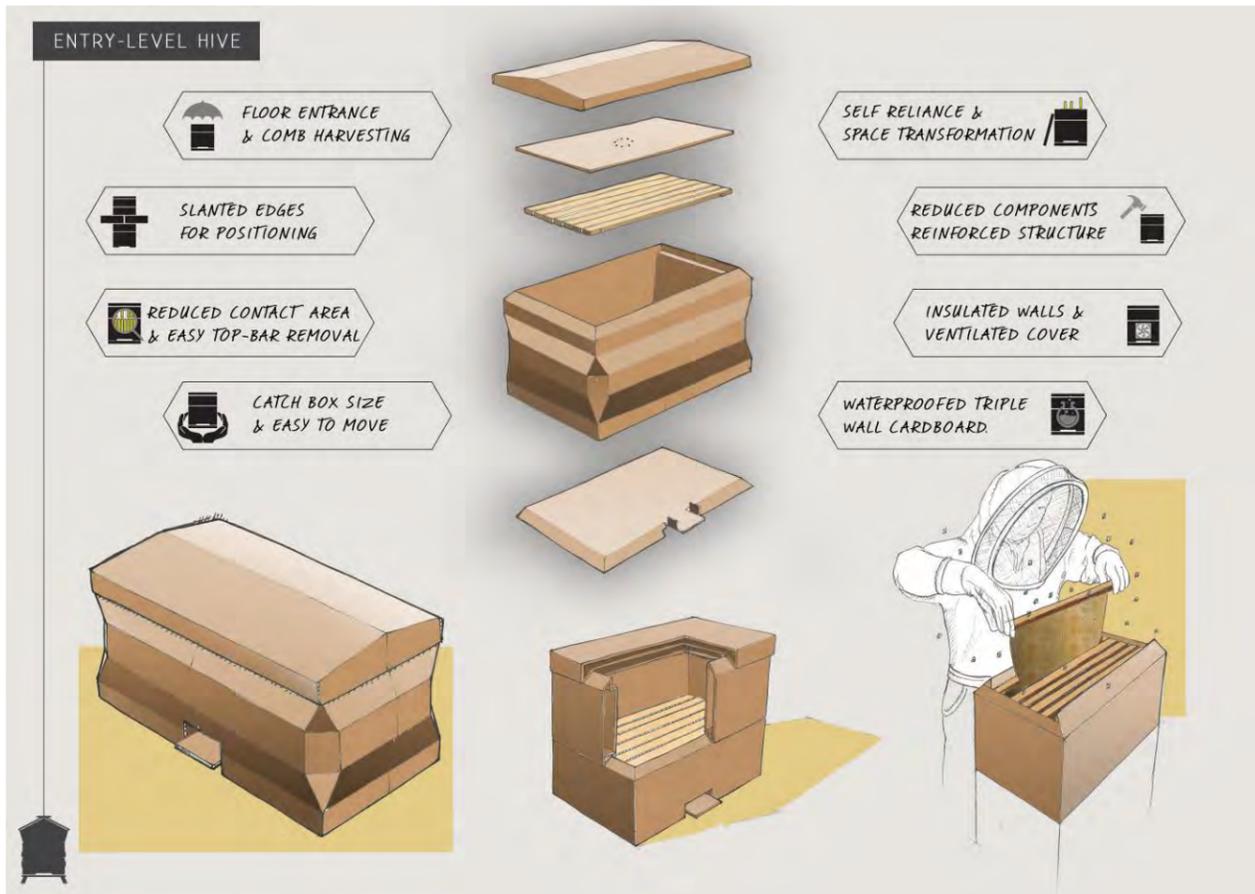


Figure 49: Final design & engineering sketches of the cardboard hive, 2015 (illustrations by author).

#### 5.4.1 Entry-level Hive

In order to simplify the cardboard hive further it was decided that the floor would be attached to the brood-chamber, with the entrance located at the floor (see Fig. 49). This required an opening to be made in the bottom edge of the chamber, cut out of chambers post-manufacture with the aid of perforations. Using internal support-bars with for top-bars was not possible as the bees would be able to build comb beneath the bars, therefore the cardboard hive was redesigned to produce with a lip on the inner walls to support the frames. The inner walls below the lip were designed with a top-bar and frame arrangement that would rely on the user to make changes to the angle of the wall for frames to fit into the chamber (see Fig. 50). Instructions for the adjustment were included in the infographics that were designed to be printed on the parts (see Appx. K). As the edges of the hive would be at risk of being damaged by the hive tool during frame removal, different methods for loosening the top-bars were explored. It was found that by drilling a hole into the top-bar a rod could be inserted from the top and used as a lever to loosen and lift the top-bar without using the chamber edge as a pivot (see Fig. 50). Small screws were added to the sides of the top-bars (see Fig. 48) as the simplest method for spacing the bars.

Although the cardboard chambers would be lightweight the risk of dropping them during handling remained because of the use of gloves during inspection. Handles could not be added to the outer surface without risking water penetration. Instead a method of creasing and folding the chambers (see Fig. 51) was used to create facets on the corners and provide added grip. The facets would also provide added diffusion from direct sunlight or sound. Adding an inner cover to the cardboard hive below the lid provided an opportunity to support airflow. The lid could be pitched to create an open space that the bees were restricted from by the inner cover, with air flowing through ventilation holes on the inner cover and out the edges of the lid. It was decided that the bulk of the graphics (see Appx. K) should be placed on the single parts to avoid repetition, with only public safety warnings and branding displayed on the chambers. The lid was furnished with site guidelines, the inner cover with inspection directions and the inner walls with directions for changing from top-bar to frame compatibility.

#### 5.4.2 Permanent Hive

Moulding entrances into every chamber of the concrete hive remained the most efficient method of generating airflow as the upper chambers could be inverted to create top vents and control the entrance height. The upper entrances could then be closed with mesh to stop pests while allowing air-flow. The entrance was created from a section of steel tube with the intention that a cap could be used to create the mesh seal. It was found that the frame support-bars could be used to locate and secure the parts from the inside of the chambers. The chambers were designed with four slots in each edge to hold the ends of the two support-bars (see Fig. 53). The bars could be bent at each end to protrude upwards from the housing slot and into the vacant slots in the chambers above, with slots in the lid/base to secure the top and bottom pins.

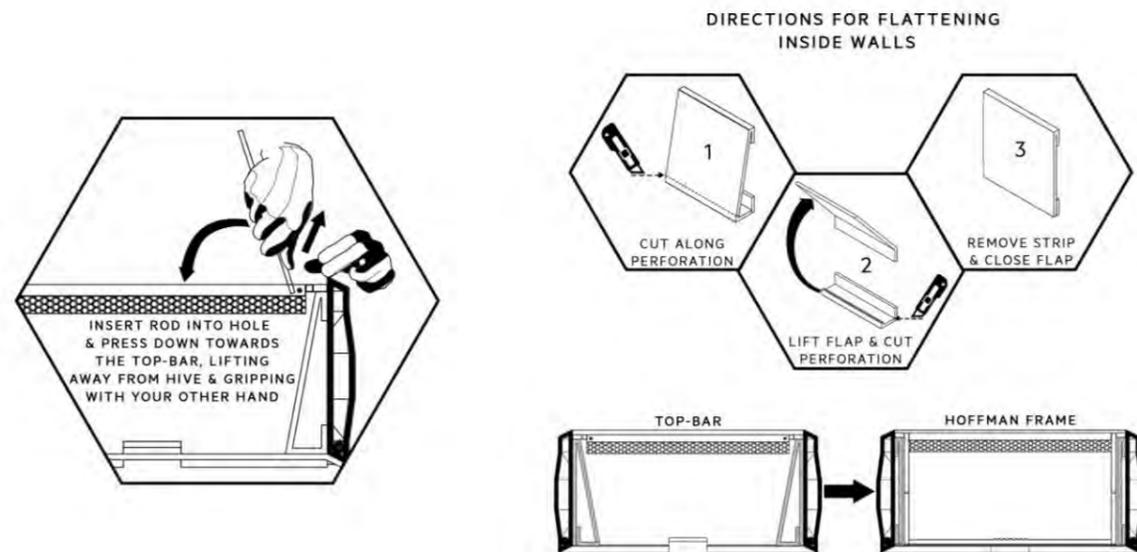


Figure 50: Directions for entry-level hive, 2015 (produced by author).

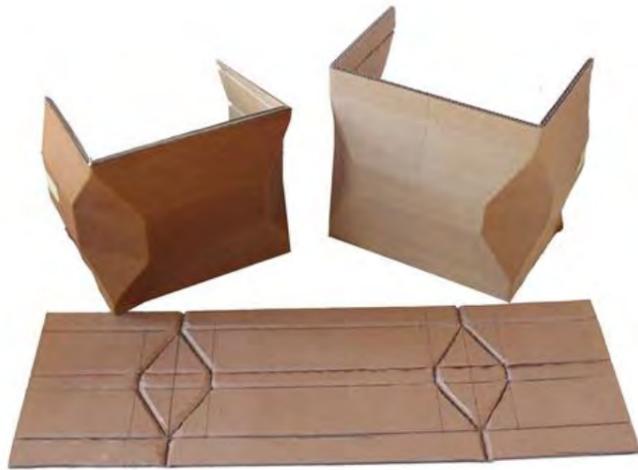


Figure 51: Cardboard corner facet creasing and folding technique, 2015 (produced by author).



Figure 52: Steel bar bending with table-vice and a hammer, 2015 (produced by author).

The lid/base was designed to extend over the edges of the chambers for rain protection and thus became easy to grip and lift, although the chambers still required handles. To create handles a number of options were explored (see Fig. 48) and it was decided that ideally the handle should comprise of a bar that could be clasped in the hand rather than a thin lip gripped by the fingers. The handle could not be fastened perpendicularly to the side of the chambers as the bending force would damage the concrete. Instead the handles were designed to bend upwards along the side of the chambers, evenly distributing the force along the sections that pierced the wall of the chambers. The handles were designed to be removable for safe keeping, meaning users would only need one set for multiple hives. Chamfers were added to the outer edges of the chambers to reduce the risk of chipping and recessed facets were added to exterior surfaces of the chambers to reduce the overall weight and create an aesthetic link to the entry-level hive. Facets were also added to the lid/base to complete the visual aesthetic and locate the security chain securely at the centre of the hive.

Originally four thin legs were designed to be fastened to the base, ideal for users to implement simple oil wells made from tin-cans. The complexity and cost of manufacturing the legs resulted in the design being changed to use the same cheap steel rod (see Appx. L) used to make the handles and frame support-bars. The stand was designed to still have four main legs all connected as a single frame to ensure maximum strength. The stand would not be fastened to the base but locked to each end of the security chain. Four small feet were added to the moulding of the lid/base to prevent the stand from bending outwards along the pitched surface. The feet were also designed to support the hive if a stand was not used and the hive was placed on a level surface. The stand, support-bars and handles were bent by hand focusing on low-tech manufacturing options (see Fig. 52)

### 5.5 Technical Refinement

To design successful products from the chosen materials research and experimentation was conducted to understand the technical requirements for manufacturing with concrete and cardboard. Appendix L provides a detailed report of the manufacturing processes, testing and costing, with the findings summarised here.

The main concerns surrounding the cardboard hive were strength and durability. It was found that triple-wall cardboard provided the most strength and could be coated with the wax-based sealant 'Waxsol' (used on wooden hives) for cost effective waterproofing. The thick, treated cardboard created ridged prototypes that withstood durability and weathering tests, resulting in only two design alterations. It was found that creating a lip fold from the inner walls of the chambers produced assembly complications and reduced the overall strength of the chambers. Instead a lip was created by adding a cardboard insert to each side of the chamber. The insert was designed to initially create top-bar friendly chamber space, although perforations would allow the user to easily

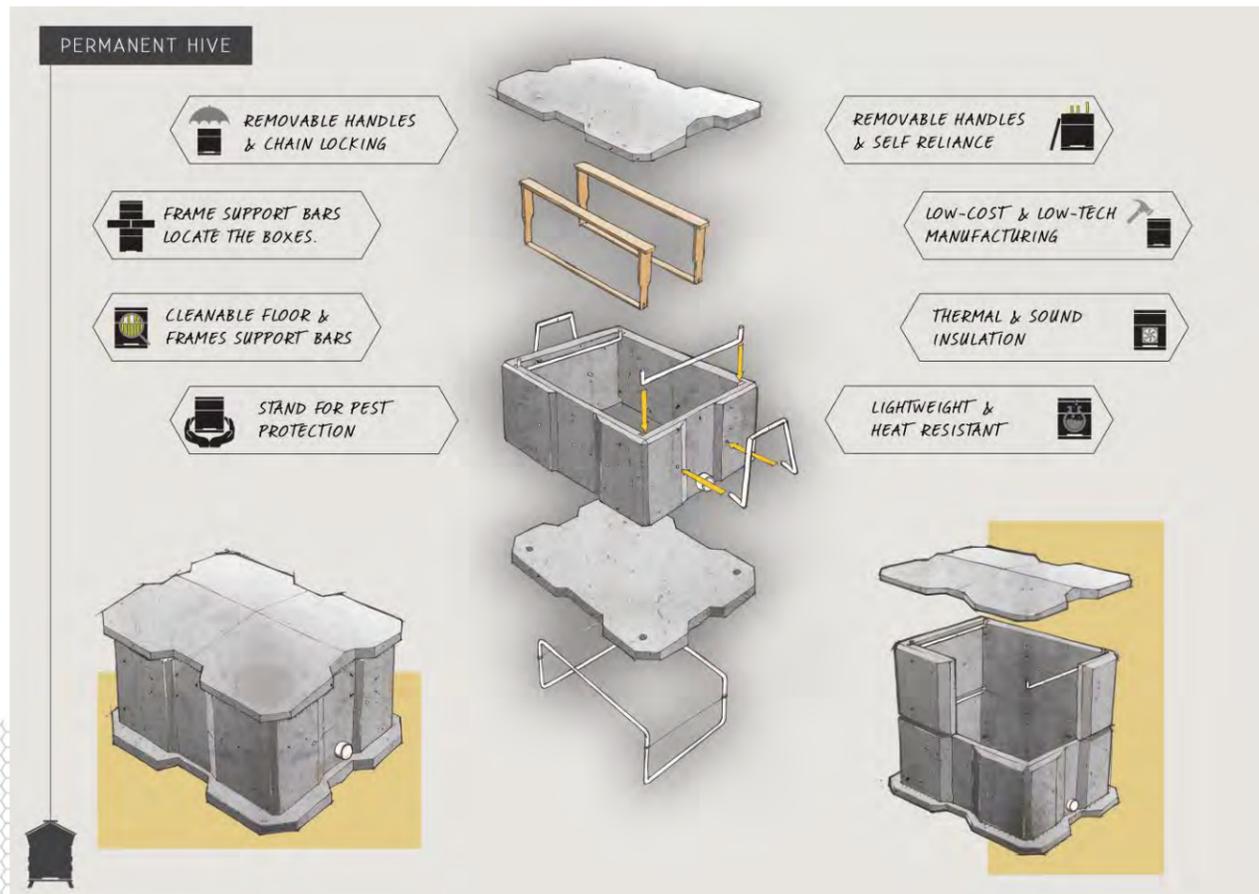


Figure 53: Final design & engineering sketches of concrete hive, 2015 (illustrations by author).

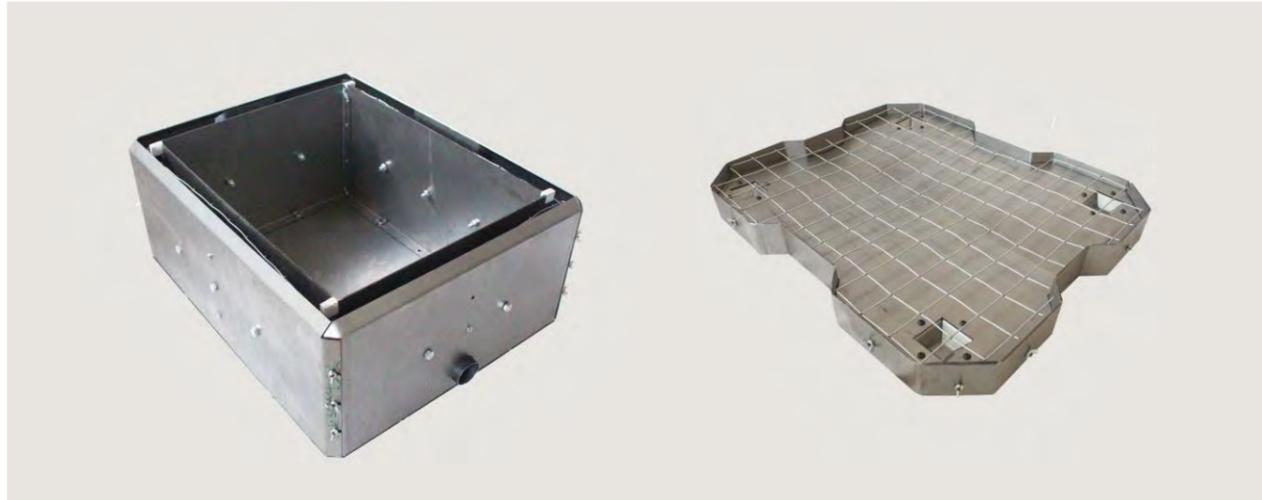


Figure 54: Steel shutter moulds for concrete chamber and lid/base part, 2015 (designed by author).

Figure 55: Bees building comb onto top-bar during testing of the entry-level hive, 2015 (photographed by author).



Figure 56: Bees using raised entrance of the permanent hive during testing, 2015 (photographed by author).



remove a strip from the insert to create space for Hoffman frames. The slanted roof of the cardboard hive proved to be ineffective in clearing water and was instead pitched to match the concrete hive (see Fig. 49).

The main concerns for the concrete hive were strength and weight. It was found that steel mesh reinforced concrete of 1 part cement, 3 parts perlite (lightweight aggregate), 1.5 parts water and 0.0025 parts reinforcement fibre would produce the desired strength-to-weight ratio. The resultant weight was 10.6kg (25kg with honey filled frames) for the chamber part and 9kg for the lid/base. The lightweight aggregate would provide increased thermal and audio insulation, with the additional benefit of increasing the temperature threshold of the concrete to well above that required for AFD burn treatments. Shuttering proved to be a suitable moulding method, however wood did not withstand repetitive demoulding and galvanised sheet metal was selected for the final mould (see Fig. 54). The mould was designed as the third product outcome for the intervention, with community driven manufacture in mind, or to be sold to organisations or beekeepers for onsite hive production. Providing a balance of strength and simple manufacturing, 8mm steel rod was chosen for the handles, support-bars and stand. Together with the tube used to make the entrance the materials could all be sourced in Johannesburg.

## 5.6 Testing

### 5.6.1 Key Informant Feedback

After producing working prototypes Tom Cain (expert beekeeper) was consulted as a Key Informant (see Appx. M). Satisfied with the design changes and quality of the prototypes Cain verified that the hives were fit to house bees. Cain also tested the usability of the hives by performing mock inspections. The weight of the concrete parts did not create much difficulty and Cain was easily able to move the components. The lid was noted to be difficult to reposition onto the top support-bars and to resolve these issues in the final design the lid/base slots were widened.

### 5.6.2 Field Experimentation

A colony of bees was introduced into a prototype of each hive and monitored over a four week period. The colonies performed well exhibiting no signs of distress. Comb was built in the intended manner (see Fig. 55) and the hives did not deteriorate as a result of the bee's activity or from regular inspection. Using a digital air-thermometer the internal temperature of each hive was measured at different times throughout the day. The temperature was moderated well inside the hives during cold and hot exterior climates. Rain was not observed to create internal condensation issues although drip marks were seen running inwards under the lid. It appeared that the drips would stop at the edge of the chamber, although if contact was not achieved by the two parts the water may have penetrated the hive. To prevent this at the lid/base join a small groove was cut into the flat surface to curb the inward flow of water droplets. The bees were observed to use the main entrances on the permanent hive, demonstrating signs of building propolis structures to reduce the size of the openings (see Fig. 56).



Figure 57: Final demonstration poster of the entry-level hive, 2015 (produced by author).

## CHAPTER 6: CONCLUSION

### 6.1 Closing Statements

#### 6.1.1 Summary of the Outcomes

The lack of appropriate and accessible technology has prevented beekeeping from being adopted by local urban farmers. The beekeeping industry also operates through exclusionary practices and technologies, limiting dissemination of skills and availability of technology within communities that stand to benefit greatly. In order to provide such an opportunity and answer the central research question, 'how can a beehive be designed to assist urban farmers, promote apiculture and help ensure the ongoing survival of the honey bee?', this study developed a holistic approach to the production of beekeeping equipment and an initiation process for novices in low income communities. Using the study's central themes to assess the success of the outcome the following insights can be gleaned (see Fig. 57 & 58):

**Protection:** Compared with standard hives the permanent hive is designed to be better protected from vandalism and theft, however with the right tools the hive could potentially be broken or stolen. The entry-level hive instead protects the owner from substantial property loss through its low cost. The performance against diseases and pests could not be determined from the initial testing, although the materials used as well as the design of the components should make these problems easier to manage. The solution proposes an amendment to current beekeeping practices that causes the spread of pests and diseases: offering farmers an alternative to migratory pollination.

**Adjustability:** The size of both hives can be manipulated in differing increments that suit their stage of use. The transition from top-bars to Hoffman frames with the entry-level hive provides opportunities for low-income beginners not otherwise available. The use of only brood-size chambers and standardised components reduces manufacturing requirements substantially, although the effect this has on productivity could not be measured conclusively.

**Inspection:** The difficulties associated with handling top-bar comb were minimised where possible, although a certain degree of skill is still required from the beekeeper. The access to beekeeping skills presents a potential problem, although once a network of beekeepers has been established within the local UA community the skills should become transferable. The designs minimise areas where bees typically seal components together with propolis and offer easier comb removal.

**Sites:** Setting up a successful apiary relies largely on the user. The basic instructions supplied with the entry-level hive will assist beginners and it is for them to choose the most appropriate methods for stands, public protection and positioning based on their specific context.

**Harvesting:** Although suitable systems for harvesting were selected they were not able to be tested and issues surrounding access to harvesting equipment still exist. The success of the intervention relies upon

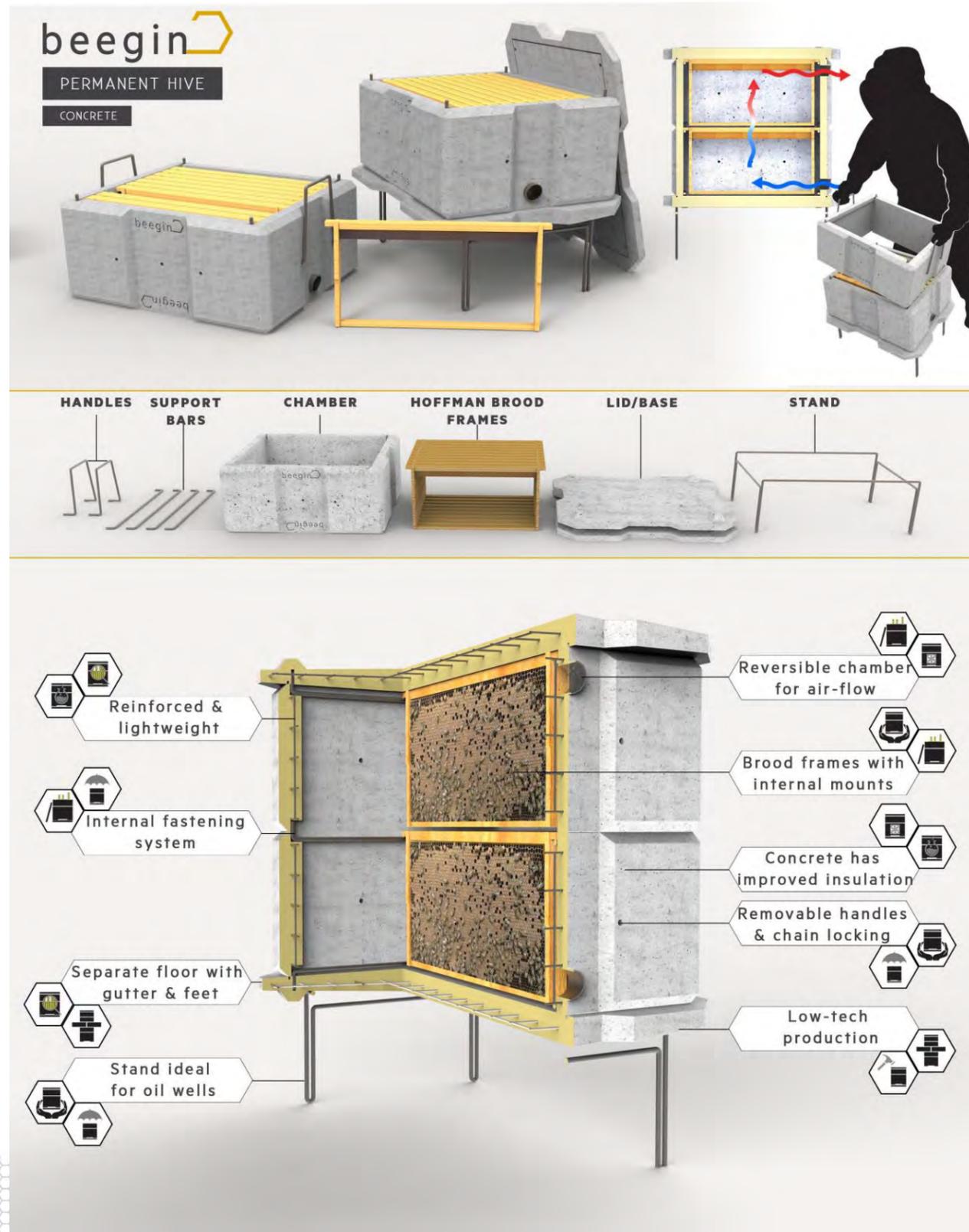


Figure 58: Final demonstration poster of the permanent hive, 2015 (produced by author).

users being able to generate enough harvested product from the entry-level hive to upgrade their apiary, focusing on creating self-reliance within the intervention.

**Making:** The final production cost of the hives was substantially lower than that of existing products (see Appx. L), with improved access to materials and simplified manufacturing approaches. The permanent hive lends itself to community centred manufacture, however the entry-level hive detracts from the value of such an economic endeavour, serving instead to reduce the cost and improve accessibility through mass manufacture.

**Thermoreg.:** The airflow features along with the moderate local climate limit the potential temperature difficulties, although different sites will affect the performance of the hives. The chosen materials should theoretically outperform wood in this regard. The airflow systems designed for each hive should also protect the colonies from excessive heat even when kept in direct sunlight.

**Material:** Although the materials are not natural they will require less maintenance and are more durable than existing wooden and cardboard hives: requiring less maintenance. Problems such as weight, durability and strength were overcome, with the materials providing unforeseen benefits. Initial results were favourable however the performance of the materials will require further testing.

It is recommended that to assess a technology's appropriateness its technical, economic, environmental and social performance must be measured (Sianipar, Yudoko, Dowaki & Adhiutama 2013:3418). The initial testing and informant feedback suggested that the solutions were technically successful, however the time frame of the study did not allow the performance of the intervention system to be tested with the end-users. The time frame, season and colony size also affected the results of field experimentation. The design process of iterations continued after the tests had begun affecting the accuracy of the results in relation to the final outcome. The results do demonstrate that further testing and implementation can be done without changing the final design.

The products developed through this study have the potential to create valuable skills and create additional income in the burgeoning local urban agriculture industry. The success of the intervention will largely be determined by the productivity of the end-users, relying on their motivation to improve their circumstances. The urban farmers specific to this study had already demonstrated motivation and productivity through their agricultural entrepreneurship. The interest in beekeeping demonstrated by the participants was an indication that the intervention would be received well. The focus of this study was to produce an accessible approach to beekeeping for local urban farmers and the solution provides an unprecedented method of achieving this (see Fig. 59). The outcome also provides 'Capabilities' for socio-economic development through community driven manufacture of the permanent hive and the creation of local beekeeping product businesses within the communities (Campbell 2015:8).

# beegin

The staggered initiation process starts with users purchasing an entry-level hive and building it up until they are able to harvest enough honey and wax to fund their investment in frames and eventually a permanent hive. The process should be able to take place over one year if the environment is conducive to creating a strong colony and the user takes to beekeeping. The entry-level hive can then be used to repeat the process again until the user has an effective apiary of about 3-4 permanent beehives.



Figure 59: Final demonstration poster of the beekeeping system, 2015 (produced by author).



Figure 60: Final prototype of the entry-level hive, 2015 (produced by author).

ATD is an indirect method of solving the needs of marginalised communities by providing new opportunities for socioeconomic development. The study demonstrated the importance of Industrial Design as applied to finding appropriate and accessible means to provide entrepreneurial opportunities through the HCD approach. The rigorous design research methods, innovative use of materials and utilisation of expert knowledge also lead to an improved beehive design, the value of which extends beyond the intended user and could benefit the entire beekeeping industry. The discourse stimulates discussion that through HCD and ATD methodologies Industrial Design has the potential to improve entire systems and benefit multiple stakeholders.

### 6.1.2 Recommendations for Further Study

The participation of experienced experts provided a multitude of insights throughout the research, whereas the end-users lacked the technical understanding to contribute equally to the technology development. The second group was mainly used to develop a contextual understanding and measure responses that lead to the development of a suitable intervention framework. The implementation was left open to interpretation to a certain degree, providing the opportunity for users to uncover issues and possibilities. During future implementation of the intervention the users will become experts in local UA centred beekeeping and their participation in refining the technology would increase substantially.



Figure 61: Final prototype of the permanent hive, 2015 (produced by author).

Extensive testing of both the performance of the hives would need to be conducted to determine the success of the outcomes. The temperature and humidity of the two hives, a control hive and the exterior environment should be measured once monthly, four times per day, over one year to assess their performance in different seasons. To increase the accuracy these tests should be conducted in multiple sites with different colonies with the productivity and wellbeing of the colonies being assessed simultaneously. This research would produce quantitative data that would serve to verify the qualitative data used to inform this study and as such the research methodology should be revised going forward.

Although the estimated retail prices of the products are quite high the cost could be subsidised by organisational involvement or community driven production. In line with the ARC's goals to create 5000 small scale beekeepers and develop the apiculture industry in SA the organisation could be approached for involvement in the project. The beekeeping organisation SABIO could also be approached to network with expert beekeepers that could participate in training and facilitation during the intervention. The intervention should undertake a holistic approach to the implementation phase by facilitating community centred manufacture of the products as well as extensive urban farmer end-user testing.

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**Appendix A**

Diseases and Pests Affecting Honeybees				
Type	Name	Cause	Symptoms	Control
Microbial Disease	American Foulbrood	Spore-forming bacteria that only affects bee brood. Transferred by migrating worker bees that visit other colonies. Also found in commercially available honey.	Isolated capped cells from which brood has not emerged. Darker caps slightly indented. Decaying brood can be screened using the 'Stretch Test'.	Destroy the hives and bees through burning. Bury the remains underground and do not use the same area again for 50 years. Plastic hives must be cleaned with sodium hydroxide.
	European Foulbrood	Non-spore forming bacterium transmitted similarly to AFD.	Infected larvae die at a younger stage, often before capping has taken place. Decayed larvae has a sour odour.	Feed bees to stimulate colony strength and natural hygiene. Remove infected brood. Replace the queen.
	Chalkbrood	Fungal spore forming disease. Larvae are infected around days 3-4.	Initially the dead larvae swell to fill the cell and are covered in white fungus. The larvae then shrink and harden turning white.	Same methods as per EFD to stimulate bee's natural hygiene methods. An open hive floor can help remove falling larvae.
	Sacbrood	Viral disease transmitted by nurse bees through food.	Infected larvae do not reach pupation stage, remaining stretched out in the cell on day 4. The larvae appears to have a skin containing white liquid, resembling a sack.	Remove infected brood. Stimulate hygiene and colony strength.
	Nosema	Spore forming viral infection that enters active bees through food.	Infected bees life spans shorten measurably. Abdomens appear swollen. Movements are lethargic and bees can be seen shivering.	Colonies should receive adequate ventilation and protection from cold and humidity. Combs should be swapped out once every two years. Hive equipment should be decontaminated through heat.
Parasites	Varroa mite	The mites are spread in the same manner as diseases. They are found in brood cells, on combs and clinging to bees. The mites weaken the bees and make them more susceptible to disease.	The mites gestate inside brood cells and feed on the bee's blood. They are visible with the naked eye, are small brown and pin-head sized.	Chemical fumigation of the hive. Manipulating the hive to control brood configuration and draw mites into cells that can be destroyed. Applying a mesh floor that expels falling mites from the hive.
Insects	Small hive beetle	The beetles thrive inside bee colonies. Laying eggs in fissures and crevices that bees cannot access. The larvae leave the hive to pupate in the ground near the hive. The beetle can fly and moves very quickly.	The beetles are dark brown and about 5mm in size. The beetle's larvae infest brood and honeycomb. Destroying the capping and spoiling the honey. They hide in dark areas of the hive.	The apiary site should be kept clean and the hives should minimize areas for the beetles to hide and lay eggs.
	Ants	Ant attack hives in mass to take honey, brood and the bees themselves.	The ants agitate the bees and eventually cause them to abscond from the hive.	Keep the apiary site clean, search for ant nests and destroy by burning. Supporting the hive on posts that have moats of water or oil.
	Wasps & Hornets	Wasps and hornets feed on honey and brood. They are roughly the same size as the bees so they are able to enter and manoeuvre inside a hive with ease. Generally they are stronger than bees.	Attacks occur generally when colonies are weak or small.	Eradicating nearby nests is the most effective solution. Killing wasps that enter the apiary site is also effective. Beekeepers will often temporarily narrow the entrance of the hive if wasps are sited.

	Wax moth	The moths enter hives at night to lay eggs inside cells or in crevices. The larvae feed on honey and pollen and burrow into the comb, protecting themselves from the bees with a web. A moths can lay up to 150 eggs and within 10-15 days entire combs can be spoilt.	Bees are often unable to leave their cells when they mature as they are tied up by the silk strands and webbing.	Fumigation is the most assured solution. However preventative methods include adjusting the hive size to suit the colony. Keeping the colony free of unnecessary empty comb. Limiting the crevices and cracks in the hive.
Vertebrates	Amphibians & Reptiles	Frogs, lizards and toads feed are known predators of bees.	Predator's droppings are found around the hive.	The hive entrance should be at least 40cm from the ground. Keep the apiary site clean and clear of dense vegetation.
	Honey Badgers	The honey badger is a notorious enemy of the beekeeper. They destroy hives in order to feed on brood and honey.		Fencing off the apiary site, placing hives on high pole-stands and strapping hive boxes/lids down are all acceptable solutions. Killing honey-badgers is not to be done under any circumstance.
1	FAO. 1987. Honey bee diseases and pests: a practical guide. <i>Agricultural Services Bulletin</i> No. 68(5).			
2	Begg, K. 2001. Report on the conflict between beekeepers and honey badgers <i>Mellivora capensis</i> , with reference to their conservation status and distribution in South Africa. <i>Endangered Wildlife Trust's Carnivore Conservation Group</i> .			

**Appendix B**

**Analysis of Contemporary Beehives Design**

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**CONVENTIONAL HIVES**

The Langstroth hive is the most widely used hive in modern apiculture, representing over a century of development and refinement (Johannsmeier 2001:58). The central innovation is the frame-design (see Figs 1 & 2) that uses biomimicry to ensure that the bees build comb in an easily manageable and extractable manner. Preferred by commercial beekeepers for its relatively low cost, portability, standardised parts and easy harvesting the Langstroth hive is an intensive agriculture tool. The disadvantages are that the hives are difficult to work with, use industrial comb structures and are largely ineffective at preventing CCD and other issues.

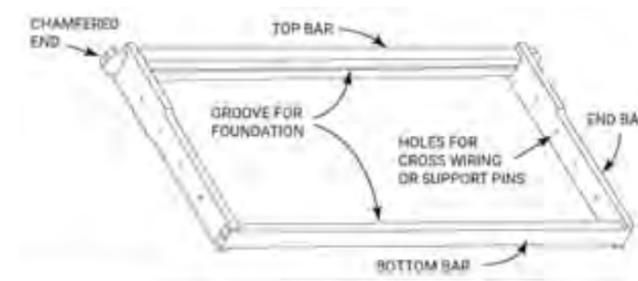


Figure 1: Designer unknown, illustration of Hoffman Frame components, 1889, (Beesource 2015:sp)



Figure 2: Photographer unknown, Hoffman Frame with a full wax foundation sheet, 2015, (Beesource 2015:sp).

The Langstroth hive (see Fig. 3) is the most commonly used hive, originally designed by Rev. L. L. Langstroth in 1852 (Stubbs 2012:sp). Rev. Langstroth discovered a system of ensuring that the bees build their comb onto separate parallel frames that can be removed and examined one at a time – minimizing the disturbance to the colony (Stubbs 2012:sp). The frames were designed based on the natural spatial measurement between the centres of two parallel combs built by bees. The Langstroth hive uses frames based on the Italian Bee (*Apis mellifera Ligustica*) that has a comb spacing of 35mm (Johannsmeier 2001:60). Inside the hive there are gaps left between the frames edges and the adjacent surfaces. Referred to as the “bee-space” the gap must be larger than 6.35 mm to prevent the bees from sealing it with propolis and smaller than 9.5 mm to prevent them from building comb (Stubbs 2012:sp; Johannsmeier 2001:61).

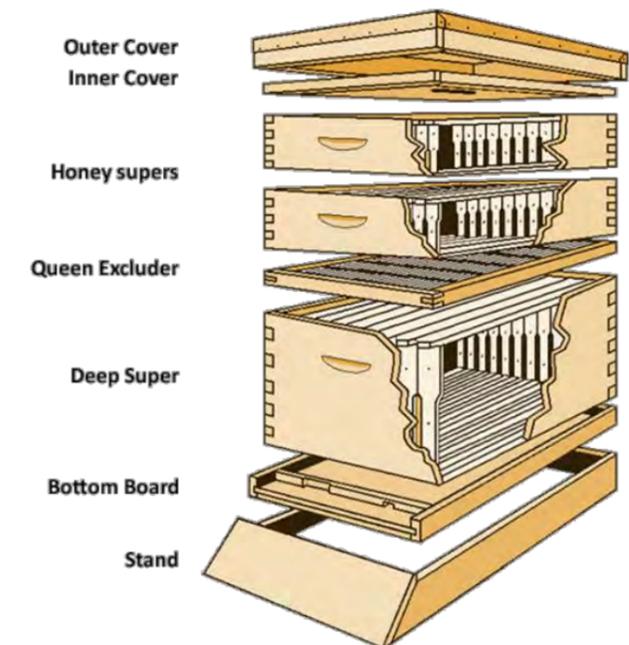


Figure 3: Rev. L. L. Langstroth (designer), illustration of individual components that form the Langstroth beehive, 1852, (UBC 2012:sp).

The Hoffman frames (see Fig.s 1 &2) are spaced by the width of the 'shoulders'; two side-bars that connect the narrower top and bottom bars (Stubbs 2012:sp). The 'shoulders' create space for the bees to pass through and support the frames when gripped together (Stubbs 2012:sp). The frames can be furnished with a foundation sheet – a flat sheet of bees-wax manufactured with hexagonal indentations to stimulate the bee's production of comb-cells. The hexagonal indentations are based on the measurements of the bees cells with both drone and worker cell size sheets available (Johannsmeier 2001:66). Foundation sheets force bees to build their comb onto the frames in the ideal formation, however the bees then have to move around the entire frame when they want to reach the other side slowing their initial process of comb building (Johannsmeier 2001:65). Foundation comb sheets are also expensive, costing R17 each, and if they are not certified as organic it can affect the honey (Stubbs 2012:sp). Beekeepers often use starter strips – foundation cut into roughly 2 cm lengths, positioned at the top of the frame. Alternatively a wooden ridge coated in beeswax has been proven effective in replacing the starter strip all together (Stubbs 2012:sp). Plastic combs are also available and are beneficial as they do not break during extraction and cannot be affected by wax moth (Stubbs 2012:sp). However bees will only use them in a strong nectar flow and refuse to adopt them in the brood chamber (Johannsmeier 2001:66). Plastic frames are also highly expensive and studies have shown that using plastic inside hives can impact the health of the bees.

The frames are threaded with a thin wire that crosses horizontally down the centre in three or four evenly spaced places (see Fig. 2). The wire supports the comb, preventing it from falling out of the frame during inspection and extraction (Johannsmeier 2001:160). To harvest honey from hives beekeepers will remove frames that are fully stocked and capped and replace them with empty or harvested frames. The honey laden frame will be taken to a processing room where the 'wax-cappings' are removed and the honey is extracted by spinning the frame in a centrifugal drum extractor. Returning frames with empty comb to hives means that the bees will not have to rebuild new comb and can immediately start refilling the cells. The wax may also be cut from the frame and harvested for selling whole as comb honey is also valuable for selling in its unprocessed form. Frames without wire supports and thin starter strips are used in this instance (Johannsmeier 2001:160).

Frames are manufactured with different 'frame-depths': a deep body frame (232 mm), a medium super frame (159 mm) and a shallow super frame (137 mm). The deep body frame fits into the deep super, also called a brood chamber. Ten frames are suspended in this chamber and provide space for the bees to build brood comb. For strong colonies of Italian bees two brood chambers are sometimes required, however the smaller African bee never requires more than one chamber for the brood to be laid and hatched at a sustainable rate (Johannsmeier 2001:59). The chambers are made from four wooden walls with a lip to support the frames. Super frames fit into shorter chambers that are stacked above the brood chamber. A mesh screen called a 'queen excluder' can be placed between the brood chamber and the first super to prevent the queen from entering the supers and laying eggs. Only the smaller worker bees are able to pass through 4,0 to 4,2 mm gaps in the screen and as a result the

supers will only be filled with honey stores (Johannsmeier 2001:61). The supers are shorter to allow beekeepers to harvest honey more regularly. The size also makes handling easier and the extraction equipment can be smaller.

A bottom board seals the base of the brood chamber. This board extends outwards at the front of the hive by 50mm to form the 'alighting platform' where the foraging worker bees land and take off (Johannsmeier 2001:59). The board has a rim that meets the edges of the brood chamber on three sides with the side facing the platform left open. The board will usually have a deep side (22 mm) and a shallow side (9.5 mm), where one side provides more floor space and a larger entrance (Johannsmeier 2001:59). This can be alternated for cold and warm seasons, however beekeepers generally prefer to use an 'entrance reducer' – a strip of wood that closes the opening leaving a smaller gap (10-13 x 80 mm) (Stubbs 2012:sp). It is important that the floor can be separated from the brood chamber so that it can be cleaned out, however migratory beekeepers fix the floor to the brood chamber and rely on the bees natural cleaning activities (Johannsmeier 2001:59). The bottom board of the Langstroth hive is often fitted with a screen at the floor section of the hive so that falling *Varroa* mites will be removed from the hive (Stubbs 2012:sp). In the warm season the screen also helps ventilate the hive.

The top super is covered by an inner lid, that also has a lip to create the 'bee space' between it and the tops of the super frames (Johannsmeier 2001:60). There are three different outer lid types. A telescopic outer lid has a wider rim that fits over the inner lid and top super on all four sides and is usually covered in plastic, steel or aluminium on the exposed surface. A migratory lid is the same size as the supers, with a ventilation space (40mm) and gauze covered vents on the sides. This lid makes it easier to load the hives into a vehicle and provides necessary ventilation when the hive entrances are sealed during transport (Johannsmeier 2001:60). A slide-cover lid has two parallel lips that extend over the inner lid and top super and is preferred to the telescopic lid for easier removal (Johannsmeier 2001:60). The hive rests on a stand that can take any form as long as it is level and sturdy. It is advised that the stand be at least 500 mm from the floor to make working on the hive easier and to protect the brood from pests and frost. The hives are generally constructed from S.A. pine timber (*Pinus patula*) 20-22 mm thick (Johannsmeier 2001:61). The wood is treated with waksol and left to air for at least one month, where upon the outside can be painted (Johannsmeier 2001:62).

In the 2008 *Survey of Beekeeping in South Africa* Langstroth hives were shown to be used mainly in the commercial sector, while smallholder beekeepers preferred the Horizontal Top-Bar (HTB) hive, Figure 4 (Conradie & Nortje 2008:2). Johansmeier (2001:68) describes HTB hives as being "especially suitable for small-scale farmers and novice beekeepers with limited resources". HTB hives range from very basic traditional versions to modern commercial designs, however the fundamental principle remains the same: a container with an open top, is fitted with wooden bars that can be removed and replaced separately. Since the HTB hive was introduced into Africa in the mid-nineties it has been widely adopted with Kenyan, Tanzanian and South African variations. Like the Hoffman frames the bars are also based on the natural spatial measurements of comb, however the width has

been reduced to 32 mm to suit the smaller African bee (Johannsmeier 2001:68). This change has eliminated the problem of ‘burr-comb’ experienced with Langstroth hives, where African bees will often build parallel combs incrementally closer and fuse a set of frames at one end of the chamber (Stubbs 2012:sp).

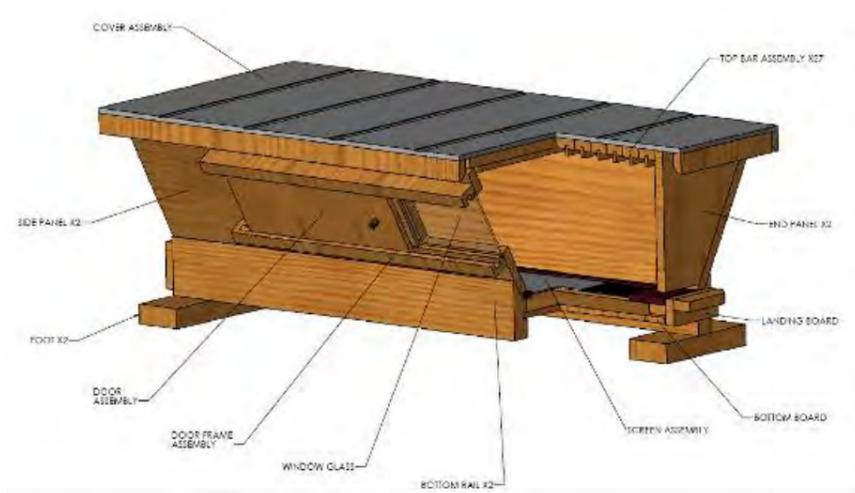


Figure 4: Illustrator unknown, Kenyan Top-Bar Hive components, 2012, (Chandler 2009:40).

The bars are cut to the same length as Langstroth hive frames and finished with either a groove for starter strips or a wooden guide ridge (Johannsmeier 2001:68). The chamber is rectangular with the entrance positioned on one of the shorter sides. The bees build comb onto the bars, however because it is not supported on the sides or bottom it is fragile and must be handled delicately (Johannsmeier 2001:68). Modern HTB hives also use queen excluders that divide the inside space into a brood compartment and honey stores. Due to the fragility of the comb it cannot be kept intact during the honey extraction process. Beekeepers cut the entire honey comb from the bar, separating the honey and wax with gravity, press and sieve methods (Johannsmeier 2001:69).

HTB hives must be covered with a board for rain protection and are usually placed on a stand or built with legs. The most successful HTB hive is the Kenyan variation that uses sloping sides to prevent the bees from attaching the comb to the sides (Johannsmeier 2001:68). The bees build the comb in an arc formation that does not naturally require them to fuse it to the sides as it is strong enough to support itself. The HTB hives are positioned at an easy height to work with, uses natural comb structures and can be made very cheaply. However they are also difficult to move, make harvesting difficult, have no standardisation in parts, cannot be expanded and offer less effective ventilation (Kritsky 2010:12).

In the early 1900’s a French Monk named Abbe Emile Warre wrote a book titled *Beekeeping for All* that documented his design of the “People’s Hive” which has since been named the ‘Warre Hive’ (1942:38). The book documents Warre’s findings from over 350 experiments with different hives and techniques, leading to the development of the Warre Hive shown in Figure 5. Warre’s intention was to develop a hive that would be less expensive, require less work, sustain the colony more effectively and produce enough honey to support the average beekeeper and their family (Warre 1942:25). Warre hives are also called ‘Vertical Top-Bar Hives’ as they

use top-bars instead of frames in order to bring down the cost (Chandler 2009:40). Warre (1942:147) also believed that frames typically lead to the spread of diseases and pests by using the same foundation repeatedly.

The hive uses no queen excluder, making use of the bee’s natural tendencies to separate the brood and honey comb during heavy nectar flows. Additional boxes are added to the bottom of the hive (undersupered) as Warre observed that wild bees tend to build comb downwards (Warre 1942:147). By moving the brood when new supers are added in spring the comb is replaced annually, ensuring that the hive does not contain old wax that is potentially contaminated (Kritsky 2010:72). The roof of the Warre hive is sloped for rainwater run-off and has a gap beneath it to diffuse direct sunlight radiation (Warre 1942:91). The roof frame is hollow and fits on top of a ‘Quilt’ box that has a fine mesh cover at its base and is filled with wood shavings or straw to help regulate the temperature and humidity within the hive (Warre 1942:91).

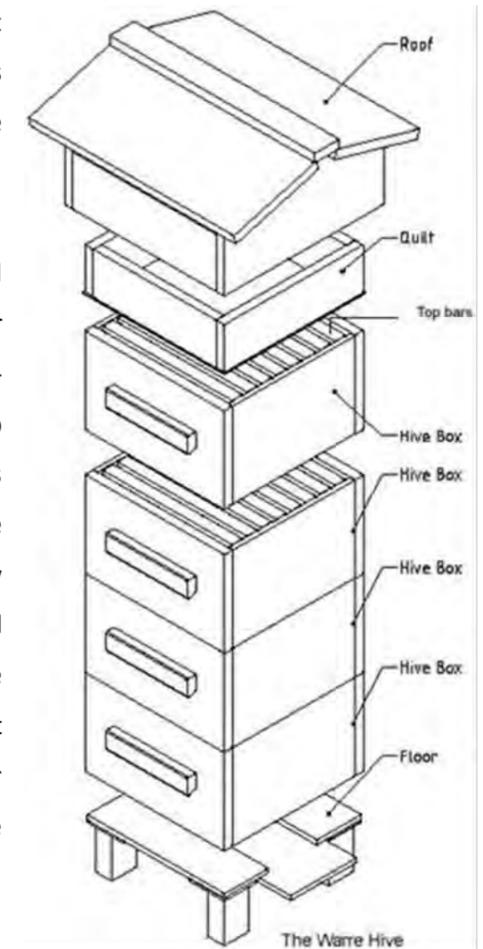


Figure 5: Abbe Warre (designer), Warre Beehive component illustration, 1942, (Warre 1942).

The floor of the hive features a simple entrance way that also forms the alighting platform, with legs fixed to the underside. By keeping the floor separate and flat it could be more regularly and easily cleaned out (Warre 1942:88). Warre also explains that during winter the combs could be oriented parallel to the entrance by rotating the hive on the floor in order to slow the air flowing in over the brood, made possible by the square chambers. In summer the comb would then be faced perpendicularly to the entrance allowing the air to flow through more rapidly (Warre 1942:88). To harvest honey from a Warre hive supers containing honey are removed starting from the top. When a super containing brood is discovered it is left along with all the boxes below it. This practice ensure that the colony will have an abundance of honey stores for winter months and will emerge from overwintering strong and productive (Warre 1942:114). The honey and wax is then harvested from the collected supers that are cleaned and prepared for implementation the following spring.

## TRADITIONAL HIVES

In a study on the effects of beehives on honey production it was shown that new hives produce more honey when compared to traditional hives (Vural & Karaman 2009:226). However traditional hives were also described as being more appropriate in terms of cost, manufacture and availability of materials in developing countries (Vural & Karaman 2009:226). Traditional hives do not use frames and are generally hollow chambers that can be opened to remove honeycomb. In Africa these hives are traditionally made from clay-pots, tree-bark, logs or wicker baskets coated in mud and dung (Johannsmeier 2001:69).

## MODIFIED HIVES

Thermoregulation refers to the system bees use to moderate the internal temperature and humidity of hives. The ideal temperature inside the hive ranges from 33-36 °C, and is naturally achieved by the bees cooling or heating activities (Johannsmeier 2001:28). In a study on the effects of hive modifications that aid thermoregulation in harsh climates by Hossam Abou-Shaara, Ahmed Al-Ghamdi and Abdelsalam Mohamed (2013:45) it was found that insulated hives outperformed those with electronic regulation devices or no modifications. Similarly participatory technology development and research projects in Ethiopia by both the International Livestock Research Institute (ILRI) and the Institute for Sustainable Development (ISD) showed that insulated hives are favourable for small-scale farmers (Araya, GebreMichael, GebreAmlak & Waters-Beyer 2007:29; Girma, Ballo, Tegegne, Alemayehu & Belayhun 2008:2).

The Sun Hive (see Fig. 6) was produced by the Natural Beekeeping Trust (NBT) who based the design on the natural formation of comb structure in feral colonies (Bradley 2013:sp). Intended to maximise colony health and promote beekeeping for pollination the Sun Hive is an 'apicentric' design (NBT 2015:sp). The hive is manufactured from a wooden sub-frame with a woven straw basket covering similar to traditional Skep hives from Europe (Bradley 2013:sp). Queen excluders are not used, which allows the colony to position the brood based on their own criteria, which the NBT claims improves the overall colony health (NBT 2015:sp). The egg-shaped hive separates at the centre where the top and bottom baskets are joined to a supporting board. Although the curved wooden frames that the comb is built onto allow for each comb to be removed individually the size and weight of the comb would make this a difficult operation. The straw also lends itself to concealing pests and bacteria such as wax moth. The housing structure that both covers the hive and holds the support board is large and expensive. The NBT claim that the cap built into the top cover can be removed to attach a honey super during heavy honey flows, however the design of the honey super is not specified (NBT 2015:sp; Bradley 2013:sp). Although the design echoes Warre's consideration that a round hive would be more natural, his reasons for returning to a square design remain relevant; the construction of round hives is more difficult and costly (Warre 1942:91).

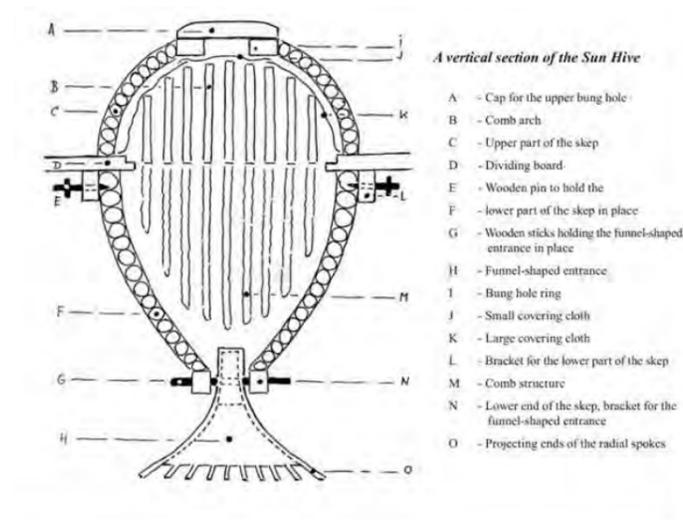


Figure 6: NBT (designers), Sun Hive components illustration, (NBT 2015:sp).

The Flow hive (see Fig. 7) is a Langstroth based hive design that offers a more efficient method for harvesting honey (HoneyFlow 2015:sp). According to its inventors, Stuart and his son Cedar Anderson the hive does not have to be opened to extract the honey, reducing stress on the bees and the work required by the beekeeper (HoneyFlow 2015:sp). As a result the hive has garnered massive interest from hobbyists worldwide, raising over R150-million in a start-up campaign on the crowd-funding website Indiegogo (2015:sp). However concerns have been raised by professional beekeepers surrounding the use of plastic and potential for over-harvesting and limited colony inspections (Bradley 2015:sp).



Figure 7: Stuart Anderson & Cedar Anderson (designers), the complete Flow hive, 2015, (HoneyFlow 2015:sp).



Figure 8: Stuart Anderson & Cedar Anderson (designers), the Flow hive: honey on tap, 2015, (HoneyFlow 2015:sp).

The Flow Frames (see Fig. 8) are plastic foundations of complete cells that are formed by vertical strips of half-cell forms that are aligned on a backing board. They work by splitting the comb cells of capped honeycomb to create vertical channels for honey to drain from (see Fig. 8; HoneyFlow 2015:sp). The cells can then be reformed allowing the bees to replenish the empty cells. The end caps are largely left intact during extraction and the bees are undisturbed. Although the Flow products are marketed to customers worldwide the bee-space and cell sizes are based on the Italian Bee and will most likely create problems for beekeepers in Africa, Asia and America (Bradley 2015:sp). While in cold climates honey often crystallises in the comb and must be heated during extraction.

Professional beekeepers argue that the use of plastic in hives generally leads to problems with condensation and electrostatic discharge (Hauk 2002:25). Jonathan Powell (2015:sp), a partner with the NBT, wrote in his blog that bees use wax comb, that has a resonant frequency of 230-270 Hz, to communicate through vibrations keeping the wax at the ideal temperature to facilitate these vibrations. Adding that worker bees are also able to ascertain information about the history of the colony from wax composition and the structure of combs (Powell 2015:sp). If the combs are not inspected before draining there is the possibility that unripe honey may be harvested through the Flow extraction method. Uncapped cells containing moisture form natural yeast in the honey and lead to fermentation that can spoil the harvested honey (Johannsmeier 2001:112).



Figure 9: Mark Collins (designer), BeePak composite flat-pack beehive assembled, exploded and section views, 2014, (BeePak 2015:sp).

The South African designed BeePak hive (see Fig. 9) is also based on the Langstroth hive and is manufactured from a durable plastic-composite and aluminium, with the benefit of easily disassembling for transport and cleaning (BeePak 2015:sp). The BeePak is both larger and lighter than the Langstroth hive and uses plastic frames (BeePak 2015:sp). Although BeePak claim the hive would be ideal for low-income, rural communities it costs four times that of a Langstroth hive (BeeWare 2015:sp). The plastic body of the hive is insulated to help regulate the internal temperature, however beekeepers are still concerned by the humidity that has been observed in hives with plastic lids (Hauk 2002:25). The possibility that the internal air quality is affected by estrogenic and carcinogenic chemicals released by plastic has also been raised by melitologists (Bradley 2015:sp). BeePak claim that plastic hives are more sterile and make bacteria outbreaks more easy to control by simply sterilising the hive components rather than burning (BeePak 2015:sp). However the chemicals required for sterilisation are dangerous and expensive.

## LOCAL INNOVATION

Due to problems with theft and vandalism commercial beekeepers in Carletonville have started manufacturing concrete beehives. With over 3000 hives located across the North West, Free State and Gauteng provinces the beekeepers are only able to inspect their apiary sites once a month. Currently working on a 30% loss annually they have made numerous attempts to protect their hives, to no avail. The wooden hives Langstroth hives that they use are easily loaded into vehicles and stolen; dismantled and robbed; or destroyed by fires, floods, wildlife and vandals. The pile of destroyed hives shown in Figure 12 represents one months' worth of hives destroyed at their various apiaries. Compounded by the current bee mortality rates they have decided to take matters into their own hands and manufacture virtually indestructible concrete hives.



Figure 10: Concrete hives at commercial beekeeper's farm in Carletonville, 2015, (photographed by author).



Figure 11: Concrete hive manufacturing at commercial beekeeper's farm in Carletonville, 2015, (photographed by author).



Figure 12: Vandalised hive components at commercial beekeeper's farm in Carletonville, 2015, (photographed by author).



Figure 13: Concrete hives at commercial beekeeper's farm in Carletonville, 2015, (photographed by author).

The concrete hives comprise of three parts: a brood chamber, honey super and a lid. The concrete is shuttered in moulds and reinforced with steel mesh (see Fig. 10). The brood chamber is sealed at the bottom with the hive entrances located on one of its top rims. The components are simple boxes with no embellishments and flat surfaces. The frames rest on top of one another inside the hive boxes, held upright with a tight fit (see Fig. 13). The interior walls of the boxes are coated in bees-wax to make the environment more hospitable for colonies.

The three components are joined through the centre by a threaded steel bar that is locked above the lid with a plumbing cap. The beekeepers believe that the weight of the hive will prevent people from thieves the hives, and if they want to get to the honey they will need to have specialised tools. The hives will also be safe from fires, flooding and harsh weather conditions. A completed hive had been housing a colony of bees for a month and was showing good signs of activity indicative of successful adoption. According the beekeepers the hives were costing about R250 each, weighing in at roughly 150 kilograms. Their intention was to install the hives as permanent features at their apiary sites, harvesting the frames separately.

## PRICING

HIVE	PRICE	SOURCE
Langstroth	R950	BeeWare 2015
Warre	R2700	BeeThinking 2015
Horizontal Top-Bar	DIY - R400 Materials	Beequip 2015
BeePak	R3350	BeePak 2015
Sun Hive	R3864	NBT 2015
Flow Hive	R3235-R8336	Flow™ Hive Shop 2015
Hoffman Frame	R11.10 (assembled)	Beequip 2015

Figure 14: Comparative table of the prices of modern beehives, (compiled by author).

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**Appendix C**

**CONSENT FORM**

I .....hereby agree to participate in social research and the development of prototypes and final models of appropriate apiary technology for urban farmers.

- I understand that I am participating freely and that I am not being forced in any way to do so.
- I also understand that I can stop participating at any point should I not want to continue and that this decision will not in any way affect me negatively.
- I understand that this is a research project whose purpose is not necessarily to benefit me personally in the immediate or short term.
- By signing this consent, I acknowledge that I have read the project information form.
- I hereby agree to the voice and/or video-recording of my participation in the study.
- I understand that the information that I provide will be stored electronically and will be used for research purposes now or at a later stage.

Signature of participant:..... Date:.....

**Anonymity (fill in only if anonymity is requested)**

I hereby request that my identity be kept confidential in the communications emanating from this project.

Signature of participant:..... Date:.....

Recording Of Details for Future Communication

Names and contact details for future correspondence.

Name and Surname	Telephone Number	Email Address	Postal Address

## Appendix D

### B-TECH MINOR DISSERTATION PROJECT:

#### An Improved Beehive Design to Support Local Urban Agriculture

##### Project Information Form

##### Background:

An improved beehive design to support local urban agriculture is a minor-dissertation project that has been undertaken by myself, Ivan Brown, an Industrial Design student at the University of Johannesburg (UJ). As someone relevant to the aims and objectives of this social research and design project I would like to interview you. I will explain what the implications of your participation in this project are, and this form is intended to capture your informed consent. You should understand completely the implications of your participation in this project. This should be done to your satisfaction and should you have any questions in this regard please notify me or my project supervisor that you are not completely informed or comfortable with the explanations given. Please do allow me the opportunity to explain the project to you until you are satisfied.

##### No obligation of participation:

Please also note that you are under no obligation to participate in this project. You may also change your mind about participating at any time during the project. You will not be penalized or disadvantaged in any way should you decide to discontinue your participation. However, I hope that through your participation I will be able to address some of the concerns that beekeepers and urban farmers/gardeners have, and this may well improve upon their interests and conditions.

##### Intellectual Property:

This project is dependent on funding, which will be obtained from the National Research Foundation (NRF). Therefore intellectual property rights will be dealt with in accordance with the Intellectual Property Rights from the Publicly Financed Research and Development Act No 51 of 2008. Any intellectual property that belongs to any of the participants in this research (background intellectual property) will at all times remain vested with that participant. The intellectual property of the research findings and information, as well as the content of the final publications of the social research belongs to the University of Johannesburg. I acknowledge however your participation in this project and I will acknowledge your participation (to an extent that is appropriate) in the dissemination of findings and presentation of final findings should you wish so.

##### Commercialisation:

The research reported on here is done for educational purposes, although I cannot exclude the possibility that this might have commercial applications. In the event of commercialisation an agreement will be concluded with you that will stipulate the terms and conditions of the negotiations between UJ and yourself.

##### Confidentiality:

You have the opportunity to request that no identifying information be made available by this project. I may record information that may identify you in written, oral and visual form. Should you request so, no identifying information will be made available through the communication and educational materials emanating from this project. Information that may identify you will be protected and kept in an access controlled room unavailable to others. These records can only be reviewed by others with the express consent of myself or the project supervisors. This material may also be reviewed by their superiors.

##### General:

Should you want to be included in future communication emanating from this project, please do include your name and contact details in the form provided so I can record that. I do not foresee any risk or harm from participating in this project, however UJ, the project supervisors and Ivan Brown will at all times be indemnified against any loss, injury or damage encountered due to the participation by yourself in this project. The risks associated with participating in this project are no greater than you would encounter in your daily business.

##### Communication:

Should you have any complaints about any ethical aspect of participating in this research, or if you feel that you have been harmed in any way by participating in this study please contact the Department of Industrial Design at the following numbers and addresses:

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**Appendix E**  
**UF01**

<p>1 Sunday 19<sup>th</sup> April</p> <p>2 Bertrams Inner City Farm: A Bambanani Food Project</p> <p>3 Transcription of interview between Amon Maluleke 4 (Head of Agricultural Operations and Project 5 Manager) and Ivan Brown (Industrial Design Student, 6 UJ).</p> <p>7 We met at 11am, by the cricket pitch. We discussed 8 the reasons for the interview and my research 9 problem. I informed him of the ethics, had him sign 10 a consent form and began recording the 11 conversation. We walked around the farm while 12 talking and he showed me his proposed location for 13 an apiary.</p> <p>14 AMON: You're from, uh, UJ?</p> <p>15 IVAN: Yeah, I'm studying industrial design.</p> <p>16 AMON: Okay.</p> <p>17 IVAN: Same department that Angus is from.</p> <p>18 AMON: Okay.</p> <p>19 IVAN: I'm doing my B-tech degree year.</p> <p>20 AMON: Okay, it's like a, like a degree?</p> <p>21 IVAN: Yeah, it's like a, like an honours degree. So 22 it's...</p> <p>23 AMON: Okay, alright.</p> <p>24 IVAN: So it's post-graduate.</p> <p>25 AMON: Okay.</p> <p>26 IVAN: Um, and then this year we have to, um, a final 27 dissertation project, so we could choose what we 28 wanted to do; what product we wanted to design. 29 Um, so I chose to do, um, a product for social 30 development.</p> <p>31 AMON: Okay.</p> <p>32 IVAN: Which means I am following in Angus's field of 33 Urban Agriculture. I think my project is going to be</p>	<p>34 a, finding a solution for a bee-hive that can be 35 implemented in urban agricultural environments 36 that will be easy enough and safe enough for people 37 to use. So that's my focus, Bee-keeping.</p> <p>38 AMON: Okay, that's the initiative we are looking for. 39 I think, uh, in, um, when we were having, um uh, 40 conversations with some stake holders in jubulani, I 41 think it was earlier this month, we did mention the 42 idea for like a, to add over and above what we have, 43 we would like to add a bee-hive. So you can advise 44 us.</p> <p>45 IVAN: Okay, so you've already been talking about it.</p> <p>46 AMON: yes, I think it's on the pipeline because we 47 are looking at, umm, the bees are dying every day 48 because of the chemicals... or whatever</p> <p>49 IVAN: Ya. Because of the...</p> <p>50 AMON: Which means without the bees which means 51 our business is going to die.</p> <p>52 IVAN: Because there's no pollination?</p> <p>53 AMON: There will be no pollination, uh, pollination, 54 uh, so we will be looking at introducing maybe two 55 or whatever bee-hive according to your spec and 56 then we are, from your advice.</p> <p>57 IVAN: Yes?</p> <p>58 AMON: Because I think, err, Dr Malan did mention 59 that he would talk to the department.</p> <p>60 IVAN: Okay, yes, yes, he is also lecturing me as well.</p> <p>61 AMON: Okay.</p> <p>62 IVAN: um, so he knows what I'm working on.</p> <p>63 AMON: Before I came, so that I can get an idea, so 64 what is the requirements for a bee-hive?</p> <p>65 IVAN: Well... um, I've spoken to a few bee-keepers 66 and experts and they say the requirements are that 67 they do need a water source-</p> <p>68 AMON: Okay.</p>	<p>69 IVAN: and they need to, I think the laws are, that 70 they need to be about at least 5 meters away from a 71 building or house that, that people live in.</p> <p>72 AMON: Okay.</p> <p>73 IVAN. Other than that they just require food; nectar 74 and pollen.</p> <p>75 AMON: Which means to ask, uh, does it have any 76 effect on like workers, you know like it is there.</p> <p>77 IVAN: Well, bees can sting you, and some people are 78 allergic to bees. So, um, but there aren't laws about 79 testing people for allergies. You need some 80 education in bee-keeping, it just about letting 81 people know that there are bees around, you know.</p> <p>82 AMON: Because we are looking at introducing them 83 somewhere.</p> <p>84 IVAN: Yeah.</p> <p>85 AMON: Let me show you. So that it means we are 86 having sittings and showing people our food and 87 teaching them about healthy eating.</p> <p>88 IVAN: Where you serve food that you have grown 89 here.</p> <p>90 AMON: Yes, and then also we want to introduce this 91 herbal tea, then-</p> <p>92 IVAN: Okay.</p> <p>93 AMON: to sweeten it we are looking at these bees 94 and honey. Natural honey, which means we want to 95 promote natural diversity.</p> <p>96 IVAN: Yeah.</p> <p>97 AMON: Without using sugars, you can use natural 98 like-</p> <p>99 IVAN: Honey.</p> <p>100 AMON: yes, in terms of honey.</p> <p>101 IVAN: okay.</p>	<p>102 AMON: Because we want to promote healthy 103 lifestyles.</p> <p>104 IVAN: So you grow, um, you grow organic vegetables 105 and herbs?</p> <p>106 AMON: Yes, naturally grown, yes.</p> <p>107 IVAN: Okay.</p> <p>108 AMON: So you see this, um tunnel-</p> <p>109 IVAN: Yes.</p> <p>110 AMON: We are looking at having an amount, or at 111 least one or even being two or three.</p> <p>112 IVAN: Yes.</p> <p>113 AMON: Then at least it can help us in the pollination 114 and whatever as time goes on.</p> <p>115 IVAN: Yeah.</p> <p>116 AMON: So at least, uh, I will rely to you to, too.</p> <p>117 IVAN: Well I can advise you.</p> <p>118 AMON: and then advise us, and then what is it that 119 to do, if I ever need to be in the place to got bees.</p> <p>120 IVAN: Yes, well there certain things, there's, I mean 121 there's a lot of different things-</p> <p>122 AMON: Yes.</p> <p>123 IVAN: that apply, but there's like, certain things, like 124 if you put it under a trees its better if the trees are 125 deciduous, so that in the winter the loose their 126 leaves and the hive will get more sunlight.</p> <p>127 AMON: Okay.</p> <p>128 IVAN: and then in the summer it gets more shade, 129 because they like to have regulated temperature in 130 the hive.</p> <p>131 AMON: Yeah, it is those advice which we will need.</p> <p>132 IVAN: Yeah.</p>
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133 AMON: If it needs to share the tree so that it can  
134 have those particular things, so we will, we will, err,  
135 adhere to whatever the rules are.

136 IVAN: So when-

137 AMON: Because we want actually to diversify in each  
138 and every aspect like as the, uh, Industrial, uh err,  
139 Designers will like to have all kinds of, err,  
140 gardening, err, designs; can be vertical gardening,  
141 can be container gardening, and all particular  
142 aspects because what we are envisaging, uh, in a  
143 year or two or three want this to be a centre of  
144 excellence. Whereby we are looking at replicating it  
145 all over the country. So those who would like to do  
146 similar projects like this one, and we can tell them  
147 the challenges they will face, because the garden  
148 itself have taught us so many things. Like I have been  
149 here since it was six months old and then-

150 IVAN: And how long ago was that?

151 AMON: So now I have got seven years that I have been  
152 in the project.

153 IVAN: Okay.

154 AMON: It was initially in September 2006. So in March  
155 I was walking around just relaxing during my off day  
156 as a security guard, back then, then I saw ladies  
157 digging, here and then I said oh, there's something  
158 that I left at home. Let me at this day get inside and  
159 ask how can I be of help to them or can I participate.

160 IVAN: So you had experience from home?

161 AMON: Ya, ya, err, back from rural areas where I was  
162 born in Venda then, uh, subsistence farming is still a  
163 norm.

164 IVAN: Yeah.

165 AMON: and I think it will still be a norm as time goes,  
166 uh, as it goes. Because, err, we grew up with, uh, a  
167 herd of cattle and then ploughing some field milking  
168 some cows or whatever.

169 IVAN: Yeah.

170 AMON: Those have learnt previous to going to school  
171 in nineteen-seventy-eight. When, when I go to school  
172 I knew how to plough in the field and whatever.  
173 Looking after the cattle.

174 IVAN: But then you had-

175 AMON: So I was exposed to, err, it was part in passing  
176 of my school fund, because my father have to sell  
177 maybe two cows each and every year in January-

178 IVAN: Yeah.

179 AMON: to, to buy us books, to buy we uniform, to  
180 buy us everything which is needed to pay school  
181 fees. We didn't have even a single year whereby we  
182 were told to go home and, and collect some school  
183 funds, because he used to. And then we were not  
184 sent home for that you don't have a uniform, we had  
185 a whole set of, of uniforms, we had book which other  
186 families couldn't afford. Because in my time we used  
187 to buy books and then the text books, we used to  
188 have all those, those kinds of things.

189 IVAN: Because you had food.

190 AMON: Because of the land and whatever. Ya. So you  
191 have to look after those particular things, if they are  
192 not there let's take one cow is missing you can miss  
193 one week or two weeks till you get it. Cause you  
194 know it is a source of your, uh, your, err, your  
195 supplement.

196 IVAN: Your education?

197 AMON: The reason why you have to go to school.  
198 Even though we didn't understand by that time. Uh,  
199 I, err, when I grow up I tend to realize that my father  
200 loved us so much that some of our peers didn't make  
201 it even to standard five.

202 IVAN: Okay.

203 AMON: Ya because we, uh, he sees how important  
204 the standards are. So at least each and every one  
205 who, who, who worked hard to reach matric in my  
206 family. And they have reached, ya.

207 IVAN: So it taught you the value of and food?

208 AMON: Farming, and then yes. And then when I came  
209 here and participating, then it made me to, to  
210 rethink and say, uh, this, err, this farming has loved  
211 me so much that it have followed me back from  
212 Limpopo. Seven years working in the town-houses  
213 cleaning and working security and whatever. When I  
214 came here after retrenchment then I thought it have  
215 worked for seven years to follow me then it have  
216 found me. Even though I didn't believe much in it  
217 because I was not what have learnt from here. For  
218 you to participate in, so along the way it was  
219 teaching me, and then it have, uh, whispered in my  
220 ear that, uh, for you to make it in this you have to,  
221 uh err, to add something, uh, like study further and  
222 whatever. So, answering that question I umm,  
223 twenty years, uh 2007, and then four years down the  
224 line I have seen that there is a gap. Which needs to  
225 be closed because we don't know what is  
226 administration how to it is record keeping and  
227 whatever. And then things are changing day in day  
228 out. So I decided while sitting, uh, at the, uh, other  
229 farm for cricket, uh where we farm cricket talent.  
230 So, uh, I decided that let me do something. So I  
231 decided to register a skills diploma in Farming  
232 Management. Because I went to Unisa, wanting to do  
233 Agricultural Management. For there the subjects I  
234 did at school doesn't allow me to do that, because it  
235 requires someone with physical science and maths.  
236 And I didn't do that, I did Geography, Biology and  
237 Agriculture at school, they don't balance. So, uh,  
238 while I was doing the shopping, window shopping,  
239 then I came across a college called Oxbridge  
240 Academy, so those, uh, offer a Farming Management  
241 Diploma. 'Oh', I said, 'whoa, let me take this chance'  
242 and then I took that chance, 2011, the whole of 2011  
243 until 2012. So, uh, in that course, uh, I, uh I did make  
244 it five distinctions, 3 B's and one C. But I got a cum-  
245 lade when I qualified for that.

246 IVAN: Wow.

247 AMON: So it, it, stimulated my interest because  
248 though it didn't have an advanced course for it, um,  
249 then I decided that, 'oh the administration side is  
250 lacking'.

251 IVAN: Okay.

252 AMON: and then let me do something about it so I  
253 registered for business administration of which I am

254 currently doing higher certificate. So in the quest of  
255 knowing much of this particular industry I did again  
256 go and knock at the door at Unisa again and say I  
257 want to do Horticulture. So I found that the fees is  
258 up, so they are left with Ornamental Horticulture.  
259 So the requirements I have to bridge you see. I have  
260 to do English for academic, and um, English for  
261 whatever, as a bridging, and then two of the subject  
262 which is related to, to, an, to Ornamental  
263 Horticulture. So in that I struggled with Science. I  
264 wrote, uh, two, two times. They never accredited  
265 me so I tried last semester to do ICT for development  
266 with no background it stabbed me again - laughs -.  
267 So for me to bridge and then do the National Diploma  
268 in Ornamental Horticulture, then, uh, yes I still need  
269 to have more resources.

270 IVAN: Okay.

271 AMON: For ICT is that I was not having the sources, I  
272 was not having access to WIFI, because you have to  
273 do an online sort of thing and then learning  
274 technology and then doing and online. You need  
275 somebody who has at least a background. So I'm, I'm  
276 trying now to, to learn. Then when I go back I think  
277 I will get it with, um, with high marks ya. Because  
278 it's only submitting those particular things. It is only  
279 submitting those particular things no exams, in its,  
280 ya. So let's, let's talk about what we are doing in  
281 this particular conversation ya.

282 IVAN: Okay, um, I just need to ask a few questions  
283 about the farm itself.

284 AMON: Okay.

285 IVAN: Um, how big is the, the farming area?

286 AMON: It's plus or minus a hectare.

287 IVAN: Okay, and what, what do farm mostly?

288 AMON: Uh, it depend to the season. Like now its  
289 winter and then it's very cold, here in Joburg. We,  
290 we venture into the Brassica family. Uh, you're  
291 vegetable, like Brassica means cauliflower, um,  
292 kale, uh, broccoli and then ya, ya, those family.

293 IVAN: Okay.

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294 AMON: Because other things like spinach it grows, uh 334 You see which means you don't have business during 375 AMON: Or we go and do the, we during the day and 411 AMON: So I would make sure that the flowers are  
295 very slow, it doesn't give you big leaves, uh, but 335 that period. But if we can be able to grow like 376 then we make the fire and we kill it. 412 always here. And then, uh, for them to give me the  
296 solution to that is on the way. Very soon it can be a 336 spinach, spinach is cut and grow. Every week you will 377 IVAN: Chase them away. 413 best honey.  
297 way, for it can be another week and I can be signing 337 be harvesting something which means there is cash 378 AMON: Instead, of, uh, having more then we find 414 IVAN: Well, yeah.  
298 an enterprise development through service the 338 flow. Better cash flow, then that you have to put the 379 that we have killed a lot of, of bees. 415 AMON: Which I can sell to the people instead of  
299 company I'm still working at which I worked for the 339 input that you put in is sometimes you don't get out 380 IVAN: And then the next year? 416 them, uh, relying to those which have been  
300 past seven years. 340 of that, cause they are having serious actually when 381 AMON: The next year you find they are gone. So 417 packaged far away from where they don't know.  
301 IVAN: Okay. 341 we group them into categories of uh, uh, categories 382 that's the concern now I want to pay back my sins. 418 Because part of what we are doing is to promote that  
302 AMON: so they will be putting like interest in like 342 of, of, of plants. 383 IVAN: Okay. 419 people, uh, will, err, that would call  
303 hot-houses. Which will add six, over and above our 343 IVAN: Okay, alright. And so during the summer you 384 AMON: Which I did maybe making fire and then, um, 420 Food Sovereignty. Because they must know that  
304 two, which means we will be having eight all in all. 344 can grow tomatoes? 385 uh. I want to get an innovative way of getting honey, 421 sometimes they come and see a bee hive, because  
305 IVAN: So you will have eight hot-house for? 345 AMON: At least during the summer you diversify, you 386 instead I mustn't get honey by killing. I must get 422 we, err, so many people are using the honey. They  
306 AMON: Because we want at least to grow things like 346 grow tomatoes, green peppers, yellow pepper, red 387 honey in a way that it can sustain, uh, year in year 423 don't know where the honey, uh, the honey is made.  
307 tomatoes, brinjal, green pepper and then all those 347 pepper, and all those things. And then you have got 388 out, and then the coming generation also get the 424 So at least here they can explore. They can know,  
308 food bearing plants because it's hard to grow then in 348 three months, actually here in the urban area you 389 pollination. Because if I however join the army of 425 uh, and when we, we, we get the honey maybe some  
309 winter here. 349 have three months to grow and then two months to 390 those who, who are having their firearms killing the 426 of our customers will be seeing what we are doing in  
310 IVAN: Okay. 350 sell and then two months to sell, and then seven 391 bees which agriculture cannot sustain itself without 427 an innovative way that they mustn't become so  
311 AMON: But back at Limpopo you can grow them all 351 months down the line... you got nothing.. So you can 392 be doing justice. Also when I say I'm growing things 428 aggressive and sting each and every one.  
312 year round. 352 imagine that if you got only five months not half of 393 naturally which means I may be writing that on the 429 IVAN: Okay.  
313 IVAN: Cause the climate is moderate. 353 what, because the six months it's where you get, err, 394 book but not practicing it. So I want to practice what 430 AMON: If however we have been taught how, to, to  
314 AMON: The climate is moderate ya. We want at least 354 not sufficient. Then at least seven months down the 395 I'm preaching. 431 look after, the, the language of the, of the bees and  
315 for business to sustain because we are still at the 355 line you don't have anything to do, then you get you 396 IVAN: Okay. 432 then whatever, then we, we think that that this can  
316 imaging even though we got seven years down the 356 are looking at sustaining the, uh, the, the, the, the, 397 IVAN: Okay. 433 be part of whatever we are looking at and then part  
317 line with no resources then we are still in imaging 357 the business. 398 AMON: And then at the end of the day I mustn't say 434 of, of, of our future plan is that we must have a  
318 because if I however can get that I think now 358 IVAN: Okay. In terms of the bees. Do you have any 399 'maybe the bees will come'. I must know that I have 435 kiddies garden. Kids must know where everything is,  
319 will graduate not to be in the imaging we'll be 359 experience in bees, um, did you know anyone in 400 got the beehive inside my, my farm which they can 436 uh, uh, err.  
320 sustaining our self. Because if you combine all the 360 Venda that had bees? 401 multiply and multiply. And then I would make sure 437 IVAN: Coming from.  
321 leafy vegetables and the food bearing plants then 361 AMON: Not actually, we, we, err grew up, uh getting 402 the flowers perhaps which can make, uh, make the 438 AMON: They mustn't be like a modern man who  
322 you get more money to sustain. Which you can be 362 the honey from the bees naturally. 403 best quality bee. Like what I've read about the herbs 439 believes that, uh, the solution is in the super market.  
323 able to hire other labour and then do other things 363 IVAN: Stealing it. 404 like lavender. If you grow them near the hives then 440 As part of it as an Urban Farmers we have got a lot  
324 which you would like to at least promote urban 364 AMON: No, no, from in the vegetation. 405 you have the best quality, uh- 441 of things to teach. Actually these, err, particular  
325 farming. 365 IVAN: Yes. 406 IVAN: Honey. 442 project can form part of eco-tourism whereby  
326 IVAN: So the Brassica family is the leafy, the leaf 366 AMON: That's something which now from May we 407 AMON: Whatever, so that is the little knowledge 443 teaching people part of the importance of growing  
327 plants 367 start to go and then looking for the, the hives and 408 which I have about them. 444 they're vegetables and harvesting and knowing  
328 AMON: Ya, well the Brassica family one challenge 368 enjoying the honey. So maybe we for a part of it is 409 IVAN: And if you grow sunflowers then you get big 445 where they're vegetables come from. That's the part  
329 they have is, uh, except the kale the kale is a cut 369 for a business, part of it is to remind me of my 410 quantities of honey. 446 of education which we need to, to, to mobilize. And  
330 and grow, but the rest cut once and then they are 370 upbringing. I don't have any, any knowledge ya. We 411 AMON: And if you grow sunflowers then you get big 447 then part of it we must, uh, we must, uh err, tell  
331 finished, and then you have to wait, for 371 used to go and then to sometimes to go late at night 412 AMON: And if you grow sunflowers then you get big 448 them the importance of knowing where their  
332 a cabbage you have to wait 120 to 150 days, which 372 when they are sleeping its better they don't sting you 413 AMON: And if you grow sunflowers then you get big 449 vegetables come from in terms of nutrition that is  
333 is five months. And then for broccoli is four months. 373 much. 414 AMON: And if you grow sunflowers then you get big 450 health. We are promoting health at the same time.  
374 IVAN: Okay. 415 AMON: And if you grow sunflowers then you get big 451 When we working with them around here. Us health  
416 AMON: And if you grow sunflowers then you get big 452 wise because they are working and exploring and  
417 AMON: And if you grow sunflowers then you get big 453 getting some, uh, uh fragrance from different  
418 AMON: And if you grow sunflowers then you get big 454 whatever. Which according to the Homeotherapists

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455 is a, is a therapy on its own. And then part of it is 500 at the early age that's why even now it's not a 540 which you can get anywhere in the whatever. And 584 have got money and then use the people. So we want  
456 income generation, then if however people are 501 problem to me even if I'm in the urban area. 541 then practising organic or natural growing or 'natural 585 this actually, actually it's a, it's a, voice of the  
457 seeing that we are sustaining ourselves with this 502 IVAN: Yeah. 542 growing' because we cannot say we are organic 586 voiceless. It's also a message to them African  
458 particular project then those that who got bigger 503 AMON: In the city of gold. 543 because we haven't been certified but we are using 587 because most of us Africans, 70% of us have grown in  
459 learn. Those who got bigger years they can, uh, 504 IVAN: Well for me as well, I grew up on a farm in 544 the principles of organics, ya. So - 588 the rural areas, of which the way I have upbringing is  
460 source it to other people who are unemployed; have 505 Magaliesburg as well and we did subsistence farming. 545 IVAN: It take, it takes a period of time to be 589 the way they have been upbringing. My generation I  
461 got, a, a, a zeal to do this. And then, and then at the 506 We would always get our eggs from our chickens and 546 certified. 590 don't talk about this generation from the nineties  
462 same time they can get the surplus and their goods 507 our milk from our cow, and our, our, fruits from the 547 AMON: It takes a period of time and then, uh, but 591 upwards. But the generations from the sixties,  
463 and whatever. If however they need be they can go 508 trees. 548 it's good that we are looking after the soil. Ya, the 592 seventies, eighties, the uh, err, the last generation  
464 to the hospices and donate those particular 509 AMON: So if however you can talk to your fellow 549 input, input and labour, ya that's the main expense. 593 which was little bit exposed those where the  
465 vegetables. To those old age homes and whatever. 510 students there and ask them where does, uh, did you 550 IVAN: Okay. 594 eighties. So for those people they are, they are, the,  
466 Then that would be a, uh, err, fighting hunger at the 511 ever in your life see err, a pumpkin, err uh, tree. But 551 AMON: Which is higher than what we are 595 they have, have got a knowhow. Some knows more  
467 same time and then promoting entrepreneurship. 512 did you ever in your life see a, uh, potato tree, he 552 anticipating. For the past seven years I haven't ever 596 than what I know and then some that knows more  
468 And then we need also agriculturists. If you are doing 513 haven't. So actually we want the children not to be 553 get a reward from what, all my hard work. So it 597 than what even the person with the PHD can do  
469 it in your back yard you got children, they will, 514 cumbersome with knowledge. They must know 554 needs not, uh, uh, sissy's heart. It need a big heart 598 because the PHDs, most of the people have got  
470 children like to get dirty. And then they will come 515 where, uh, what is uh, uh, a spinach, uh, seeing it, 555 to accommodate this particular initiative. And also 599 theoretical more theoretical knowledge, but then  
471 and join us and we will teach them and then they 516 uh, in the ground. Not in the super market being 556 in, in the reality, uh, to for a business to sustain you 600 when they go to do practical's I can't, I can't, err,  
472 grow up contributing to the table. What they eat. So 517 shelved. 557 need five years to model if you got resources. To, to, 601 recognize that you are lazy, I can recognize that you  
473 in that we will be growing a future leaders who will 518 IVAN: Alright. Um, I also just wanted to ask in terms 558 to be able to, to get, uh the return. 602 are have been good, even though he was not good.  
474 know that we have to contribute, no matter in 519 of selling the vegetables? It goes to Bamabanani, 559 IVAN: Yeah. Well that's why I'm interested in looking 603 So there are people who can do this particular  
475 whatever it can be a little contribution. One day 520 Bamabanani is the retailer or farm? 560 at the bees because the honey is quite a valuable 604 garden in, in the close eyes. So we are looking at  
476 when they harvest here the spinach that your child 521 AMON: Bamabanani is the name of our co-operative. 561 resource and the bees produce it by getting pollen 605 that particular talent, with this particular initiative,  
477 have grown she will feel that 'Oh I have contributed' 522 Uh, then what we sell actually goes to the, uh, the 562 and nectar from plants that you already growing. As 606 that's, the reason why that today we are still  
478 and that make her to grow inside. And then 523 bank account and sometimes it goes back to the soil. 563 well as the wax, people buy the wax to buy beeswax 607 continuing growing vegetable inside the city.  
479 tomorrow then maybe, cause the agriculturalists are 524 Like currently as we are building the co-operative 564 candles and health, medical products. So it's 608 IVAN: Yeah, alright. Do you ever have problems with  
480 lacking. Cause currently in the whole of Africa we 525 then everything that we get goes to the garden. 565 valuable in both areas. 609 thieves, I mean in terms of people firstly?  
481 are sitting in a time bomb. The oldest farmers who 526 Iva: Okay. 566 AMON: Now at least you have explored something. 610 AMON: Actually maybe we grow too much that we  
482 are doing like, uh, err commercial are like sixty 527 AMON: The cash flow is not that good because, uh, 567 That wax, eh, uh then why can't we if however we 611 don't see that there is something which is been  
483 something years old we need 10 million farmers in 528 the maintenance of the garden is expensive. So we 568 know how to make a candle, then it can be another 612 stolen. But, uh, to answer that question yes, we got  
484 10 years. So to get that particular number we have 529 make sure that the garden, uh, the garden gets more 569 everybody must have in this pie they must have 613 twenty-four hour security but he's not guarding our  
485 to start from the, uh, the back yard. 530 attention so that we can get, uh, more, more 570 unemployment will be a history. And then as we are 614 vegetables, but is part of the premises which is here.  
486 IVAN: So form the young generation. 531 sponsors to come on board. Like service when it 571 looking at replicating it all over South Africa for 615 Looking after here.  
487 AMON. Ya the young generation. That's why we are 532 comes, uh, when it comes is because there is rats in 572 Africa. Because why we are looking at all over south 616 IVAN: Okay. It's just because there are, with  
488 looking at partnering with another organisation that 533 the garden so that image mustn't die. 573 Africa and for Africa, if we can look at our, our city 617 beekeepers they often find people will steal, the,  
489 came and approached and I liked the idea that they 534 IVAN. What is the biggest expense? Is it water? 574 Johannesburg its, uh, full of every nationality who 618 the, the honey. Because it's quite a valuable thing  
490 want to open a kiddies club, uh, every Monday they 535 AMON: Water and, uh, uh, water we are covered, 575 came here at the same, err, the same mind set which 619 once it is full then, you know. SO they have to look,  
491 call and meet free every Monday. And in that at least 536 because the city is on our side. Like, the biggest 576 we have been doomed as we grow that when you go 620 to try and look after them.  
492 we will like to, to get the way how we can work with 537 expense is labour and fertiliser, and, uh seeds. To 577 to the urban area you will find a job. Today we got, 621 AMON: So I tell you whenever we have got those  
493 them. Maybe it can also attract the children around, 538 get heirloom seeds is not cheap and you have to 578 we have been doomed as we grow that when you go 622 because, uh, its uh, some of the things which maybe  
494 and then we, we, we, we get children to play with 539 source them from some other people unlike those 579 to the urban area you will find a job. Today we got, 623 we have to look then you make not to, to open eyes  
495 and then part of what we are playing with will be 580 uh, we got a lot of people who are sleeping on the 580 uh, we got a lot of people who are sleeping on the 624 ya, because, you are, you, you are quite right. One  
496 part of teaching. 581 street because there is a competition to get the job. 625 of my friends who's got a farm in Limpopo, uh,  
497 IVAN: Yeah. 582 So, err, a, today people are just accepting whatever 626 people from Germany introduced the bee farming in  
498 AMON: Because even myself like I have mentioned 583 they can be given with those fat cats, uh, cats who 627 his farm but all the boxes were stolen.

**Appendix E**  
**UF01**

628 IVAN: Yeah. Well that's where I come in. Maybe I can  
629 design a solution, you know, so that it can be safe  
630 regardless. You don't need more people to watch it,  
631 or. But also I wanted to ask, um, and thieves in terms  
632 of animals and pests and things eating the  
633 vegetables?

634 AMON: uh pests is not much a problem because we  
635 are...

636 IVAN: Mice?

637 AMON: There, there, there are only mice yes. That's  
638 the problem actually, uh, we are looking at  
639 whatever, because also serviced has got pest  
640 management as part of the talking we have is that,  
641 uh, how can we get rid of the mice. Because they  
642 have got a lot of some diseases and whatever and  
643 other people if they can see that there is mice then,  
644 then they won't come buy here. So it's another thing  
645 which we are looking at getting a solution. In terms  
646 of pests we use companion planting, whereby some  
647 insects help each other to, to repel. So minimum  
648 spraying which we do.

649 IVAN: Yeah, and ants? Do you have?

650 AMON: Ants I haven't seen because most ants what  
651 they've realised is that when the soil is acidic is  
652 where you get a lot of ants of which maybe our soil  
653 is so fertile that, we, err, it doesn't attract more  
654 ants, but also we cannot say they are not there  
655 because it's a big place I can't scout every row.

656 IVAN: Okay.

657 AMON: Yeah, I haven't come across much. But which  
658 I come across ever time is the mice - laughs -ya.

659 IVAN: Alright. Hmm, I've asked quite a lot of the  
660 questions already...

661 AMON: You are more than welcome, you got me  
662 today.

663 IVAN: I think I have asked pretty much everything,  
664 uh, I needed to know and uh, you've given me a lot  
665 of extra information as well.

666 AMON: Ok, no problem you are more than welcome  
667 any time you want to. And then I will, uh, it's a plea  
668 to me that when you think of that bee hive, eh, when  
669 you design those, uh, let us explore together and  
670 then I got a youth who are doing plant production  
671 level three of which they are finishing next month.  
672 Maybe, we can engage them in helping in the design  
673 and then maybe some we can catch from then and  
674 then, then we, we create something.

675 IVAN: Okay, that would be cool as focus group too.

676 AMON: Then you got, I, I'm assuring you that we got  
677 a group which if you need, uh, extra hands and also  
678 passing this knowledge to they are there. As long as  
679 you do it not, uh, later than end of, eh, end of May.

680 IVAN: Okay.

681 AMON: Because end of May I won't have anything to,  
682 to give them, uh, as a source of staple, because  
683 currently AgriCity has given them 1000 as a source of  
684 staple. They, they attend class for three, three hours  
685 and come and do projects for three hours.

686 IVAN: How old are they?

687 AMON: uh, um most they, they are in the youth age  
688 only three have, they are above thirty-five. The rest  
689 they are bellow thirty-five.

690 IVAN: Okay.

691 AMON: And of which, my, my, my question now is  
692 where are they going from here cause I have kept  
693 them for, for eight months here, I've accommodated  
694 them for eight months. So the question is are they  
695 also going again and then uh, add number of  
696 unemployed and unskilled people? Actually they are  
697 skilled now because the, the level they are learning  
698 now is, uh, is which they can be able to start. It's  
699 only that they need my, my, my mentorship, or other  
700 peoples mentorship for them to be strong because  
701 all what is needed can be food handling, can be  
702 whatever.

703 IVAN: But there's, there's opportunities like you say  
704 that there's only old people in farming and above  
705 sixty-five.

706 AMON: So, so to keep them and then motivated them  
707 is to show because, eh, according to the study  
708 conducted, uh, in Ghana when they had a youth  
709 summit, uh, they say if there, they, for us to attract  
710 youth, it's when we introduce technology like what  
711 you want to do, to design a beehive in a way that  
712 even if a person want to steal then he cannot steal.  
713 And then introducing the hot house, whereby  
714 technology have to work. Maybe we can operate it  
715 in, uh, in an electronic way and then at least that  
716 makes the use to, to have a dream.

717 IVAN: Yeah, they see it, they see it progressing as  
718 opposed to just farming where it's stayed the same  
719 for thousands of years.

720 AMON: yes, and then give similar which is there by  
721 intensive. Because in the hot houses we can turn it  
722 to be, we can, can lay the plastic, and then there is  
723 no more hard work, it's just monitoring and scouting  
724 and whatever. For those, uh, whom I'm mentioning  
725 I've taught them every, every aspect of, uh, from  
726 when you identify a plan, a place for farming, plant  
727 propagation. Currently they are doing, uh, the last  
728 level. How to, uh, because they have identified a  
729 farm, then they will learn plant propagation then  
730 now it's the end product, that how to handle it.  
731 What is the requirements, required for you to, to, to  
732 do those particular things. And then part of it is  
733 unlike when I do my certificate in horticulture.  
734 Cause only related to horticulture, and then these,  
735 they have been exposed to marketing, human  
736 resource, and then all those particular management  
737 things.

738 IVAN: Okay.

739 AMON: I know they cannot master it all at once but  
740 as they, they are with us working with them, then,  
741 uh, maybe I can get a reliever one day. Who can  
742 relieve me, and say go home and say we will do the  
743 work.

744 IVAN: Yeah, and apprentice.

745 AMON: Ya, so at least I will go home, and uh, when I  
746 die, when change my address to the other one I won't  
747 turn and toss.

748 IVAN: You know that there is someone looking after  
749 your interests.

750 AMON: Ya, that there is someone who has taken the  
751 baton. Because this baton was uh, given to me from  
752 the other generation who didn't have, uh, uh, a  
753 sophisticated education. That was the knowledge  
754 which was passed from generation to generation  
755 which was not recorded anywhere, so actually, uh,  
756 for me I want to pass this baton to those who have  
757 got something, who have got, who, who have got,  
758 uh, some skills and whatever and then they have got  
759 a background of current educational system which I  
760 want them to pass top my children. Because they are  
761 still growing, yeah, and when they are grown they  
762 must find people who will guide them like I have  
763 guided them.

764 AMON: You mentioned AgriCity as sponsoring these,  
765 these youths that you were training. Do they sponsor  
766 a lot of educational?

767 AMON: Yeah, each and every year they open doors,  
768 uh, for, for application to the service providers that  
769 we are accredited, of which even us, as well money,  
770 we are looking at even this year when they open  
771 there window we will apply we are looking at the  
772 way how we can be the service provider. Uh, then  
773 these as, we are, we will call it we want to create a  
774 centre of excellence.

775 IVAN: Okay.

776 AMON: Because in part of the, uh.

777 IVAN: And then you will be able to certify the people  
778 that, that have been trained here.

779 AMON: We want to conduct formal and informal, uh,  
780 training to the, to the people, to everyone who  
781 wants to learn, cause part of the infrastructure that  
782 serviced will put, it will put office work, and uh, a  
783 container which is a place where we will, uh, we will  
784 be conducting our, uh, training and everything.  
785 Currently we will be relying to those who are  
786 accredited by AgriCity, by we are looking at the way  
787 how we can be able to. And then if we diversify and  
788 help bee farming then the second dream will also be  
789 Aqua-culture.

**Appendix E**  
**UF02**

<p>1 Saturday 1<sup>st</sup> August</p> <p>2 Soweto UJ Campus: Izindaba Zokudla Farmers School</p> <p>3 Transcription P002 of interview of Edward E. Maake 4 (Urban Farmer) by Ivan Brown (Industrial Design 5 Student, UJ).</p> <p>6 We met at 13h00, outside the lecture halls during 7 the lunch break. We discussed the reasons for the 8 interview and my research problem. I informed him 9 of the ethics, had him sign a consent form and began 10 recording the conversation. I had just presented my 11 project to the farmers and EDWARD approached me 12 out of interest in the study.</p> <p>13 IVAN: Um, so EDWARD you were saying that you, you 14 farm.</p> <p>15 EDWARD: Yes.</p> <p>16 IVAN: Where is your farm?</p> <p>17 EDWARD: Uh, its in Soweto, uh, the primary school 18 is called Inshaneen, uhh, what we doing there is uh, 19 we realised that we, we have bees around the school 20 cause uh, when our Chinese spinach started, uh, 21 whats this.. Blossoming uh, the bees would come 22 around. And we have around four places, different 23 areas around our vegetables, so the bees would be 24 all over the garden. They never, never any day has 25 anybody been stinged, but myself only when I went 26 to harvest and then the flowers on my ear I didn't 27 see the bee.</p> <p>28 IVAN: When you were harvesting the plants?</p> <p>29 EDWARD: Yes, while I was harvesting. SO it could 30 have been the fact that I started while It was busy 31 with its pollination.</p> <p>32 IVAN: Yeah.</p> <p>33 EDWARD: So.. But we've never had problems.</p> <p>34 IVAN: Okay.</p> <p>35 EDWARD: Ya, right.</p> <p>36 IVAN: And-</p>	<p>37 EDWARD: They, They, They, We work there while 38 they are around.</p> <p>39 IVAN: Ya.</p> <p>40 EDWARD: And I was only stung once while I was 41 harvesting.</p> <p>42 IVAN: Okay, and you know where the hive is?</p> <p>43 EDWARD: We have never seen the hive but we 44 believe they are still there.</p> <p>45 IVAN: Okay.</p> <p>46 EDWARD: See, we usually leave around 3, but still 47 the bees will be there, and we've never really got 48 the <span style="color: red;">time</span> to say let's sit and see where they go after 49 they've done there you know.</p> <p>50 IVAN: Okay. What err crops do you mostly grow?</p> <p>51 EDWARD: Uh, we grow vegetable crops, but now 52 we've started with strawberries. Uh we also have 53 granit. I don't know what they call it..</p> <p>54 IVAN: Granadilla? No that's a tree.</p> <p>55 EDWARD: No. It's a fruit that has many seeds inside. 56 Uh, it, it..</p> <p>57 IVAN: Pomegranate.</p> <p>58 EDWARD: P, Pomegranate. Thank you.</p> <p>59 IVAN: Okay.</p> <p>60 EDWARD: We have been doing but we haven't 61 planted it yet. Uh, but the strawberries we have. So 62 also the only fruits that we have currently that are 63 planted. And then we also have apple trees but they 64 are not yet there. We still, you know what this thing, 65 uh, this past, uh black plastic bags, I did them at 66 home.</p> <p>67 IVAN: Okay.</p> <p>68 EDWARD: So we gonna bring them out afterwards, 69 while the trees have grown. Cause we have to take</p>	<p>70 them, care of them regularly you know, feed them 71 the right nutritions.</p> <p>72 IVAN: Okay, how big is the farm?</p> <p>73 EDWARD: Its huge, its about 100m long and 35m 74 wide.</p> <p>75 IVAN: Okay.</p> <p>76 EDWARD: But we've also uh, proposed another space 77 which is much bigger than that.</p> <p>78 IVAN: Okay.</p> <p>79 EDWARD: It's about acre, uh, maybe a hectare and a 80 half also.</p> <p>81 IVAN: Alright.</p> <p>82 EDWARD: Uh the one that we've currently proposed 83 ya. So we only waiting for the director of education 84 to approve our proposal.</p> <p>85 IVAN: Okay.</p> <p>86 EDWARD: Ya.</p> <p>87 IVAN: So it's a collaboration between..</p> <p>88 EDWARD: Uhh, no its one co-operative-</p> <p>89 IVAN: Okay.</p> <p>90 EDWARD: But we've, uh, we've applied for two 91 spaces because we need to. We need to do all the 92 vegetables. We don't want to do specific, you know. 93 We wanna try everything so that we can know what, 94 what we are best at.</p> <p>95 IVAN: Okay.</p> <p>96 EDWARD: Ya, cause we only started last year in 97 August and so far we have Chinese spinach, we have 98 spring onions, we have got strawberries, uhh we 99 have swiss chard spinach, we have beetroots, we 100 have cabbages.. Kale, you know kale?</p> <p>101 IVAN: Yeah. Kales a friend of the bees.</p>	<p>102 EDWARD: Ya, kale. We have lettuce, but not the 103 commander lettuce. This other one it looks like a 104 butter lettuce.</p> <p>105 IVAN: Okay.</p> <p>106 EDWARD: Ya but its another one, there are three 107 types of lettuce.</p> <p>108 IVAN: Oh?</p> <p>109 EDWARD: Ya, it's commander lettuce, butter lettuce 110 and this one that we have.</p> <p>111 IVAN: And</p> <p>112 EDWARD: And then.. ya theres a whole lot of 113 vegetables there but then we still have more seeds 114 to plant, then we still have seedling like Chinese 115 spinach. Its seedlings are already here. We've been 116 transplanting them during the week. Then we have 117 seedling of this. Whats this... Tape, uh, ama. Is it 118 amarenthus?</p> <p>119 IVAN: Yeah, yeah.</p> <p>120 EDWARD: Ya tape. Its amarenthus, we also have that 121 but its only seedlings.</p> <p>122 IVAN: And is it all open, or do you use tunnels?</p> <p>123 EDWARD: Its open. We don't have tunnels. We don't 124 have because uh, we haven't done anything like a 125 proposal or I haven't asked any department for 126 anything.</p> <p>127 IVAN: Okay.</p> <p>128 EDWARD: So we only got a certificate in may but we 129 registered last year, so the certificate came late. Uh 130 so I think that but I think we can have...</p> <p>131 IVAN: But it's in the plans?</p> <p>132 EDWARD: Ya, but now we have that certificate we've 133 also done a basic clearance. We also want to do a 134 whole lot of things like our business plan, a proper 135 one you know and do a funding proposal that's 136 proper. Because we don't wanna try something and 137 then fail because we didn't do things the right way.</p>
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**Appendix E**  
**UF02**

138	IVAN: Okay.	170	IVAN: A lot of the time it's not even the, the, the	202	EDWARD: Um, no. But where I come from in	235	IVAN: Alright, and um, in terms of uh, materials and
		171	pollen it's also the nectar in the plants.	203	Limpopo, we had bees at my house. They used to live	236	things, do you ever make things on the farm? And
139	EDWARD: Ya.			204	in the ceiling.	237	build things?
		172	EDWARD: The nectar, ya.				
140	IVAN: It's the same for bees. You have to get a			205	IVAN: Oh okay.	238	EDWARD: Ya what we've done now, what we've built
141	certificate for the hive and the person that manages	173	IVAN: And the flowers. It doesn't necessarily need to			239	for ourselves is these nets. They are not huge nets
142	the hive.	174	be flowering. But there will still be pollen and nectar	206	EDWARD: So there was no problem with them. We	240	they are just for the, for the, like lets if theres a
		175	on the plants, on the plants.	207	never took them out. I don't know now because that	241	base, a base maybe about eight meters long and, uh,
143	EDWARD: Alright.			208	thing might have had an impact on the ceiling itself.	242	a meter wide, or two and then we build a net for
		176	EDWARD: Ya true, on the plants themselves. So ya.			243	there.
144	IVAN: But it's easy and it's free. Its just to run and	177	That's what we realised. So, uh, we were interested	209	IVAN: Okay.		
145	organise it.	178	before but we never knew what to do.			244	IVAN: Okay.
				210	EDWARD: Because that thing after a long time, uhh		
146	EDWARD: Okay it's not like, it's not like the fishing	179	IVAN: Ya.	211	a long there will eventually collapse.	245	EDWARD: For that specific space, Because we
147	one.					246	haven't a lot, uh, we don't, uh, we don't make a lot
		180	EDWARD: Uh, and then once we had googled all of	212	IVAN: Yeah.	247	of profit you know. Uh, what we make around there
148	IVAN: No.	181	them come from UK or either America or something.			248	about 107 bucks, and we are 7 in a co-operative, so
				213	EDWARD: By the ceiling. So I don't know if they've	249	all the money goes into our account. We don't have
149	EDWARD: Because the fishing one I know its	182	IVAN: Ya, that's it.	214	taken them out or not but ya. Bees have.	250	a bank account. We just have uh, a lady whose a
150	expensive.					251	chairperson she, she holds the money for us, until we
		183	EDWARD: I haven't seen a lot of them in South	215	IVAN: So you're not, you're not, you're not scared of	252	can get a bank account and everything. And we don't
151	IVAN: No this is free. It's just to keep track of where	184	Africa. So, ya that was one also in Cape Town.	216	bees.	253	wanna open a bank account whilst the bank account
152	all the bees are.					254	will also need a whole lot of cash you know, because
		185	IVAN: Yeah.	217	EDWARD: I'm not scared of bees. I've always loved	255	it takes around 400 bucks to open one and then you
153	EDWARD: Ya.			218	bees, when I was a little boy I used to catch them.	256	have to maintain it with atleast 200 a month. So its
		186	EDWARD: Which I saw, or in Joburg there's one in	219	Ya, close them in a bottle, uh punch the holes there	257	difficult to maintain that bank account because
154	IVAN: Um, so you would be interested in keeping	187	the city, but its all at the top floor, its on the flats,	220	at the top and put those little flowers, you know.	258	there will be extra charges if you don't you know.
155	bees?	188	and its at the top floor.				
				221	IVAN: Yeah.	259	IVAN: Okay.
156	EDWARD: Yes we are, we are interested because as	189	IVAN: Okay.				
157	we were listening to your, uh, to your, eh, delivery			222	EDWARD: Those ones that on these fence trees.	260	EDWARD: So ya, we have, we've told ourselves after
158	there, you know your, uh.	190	EDWARD: So ya you know those guys we don't even,			261	doing all the things that we need to do like our
		191	they don't even have a address there they just show	223	IVAN: Okay.	262	business plans or the proposals, uh, with a
159	IVAN: Presentation.	192	the people the picture and what kind of beehives			263	consultant, and then uh, our BBE certificates and all,
		193	they have.	224	EDWARD: You know the fence trees. The bees used	264	because we've done the test clearance, we've done
160	EDWARD: Yeah. Presentation, I'm sorry. Uh, we were			225	to like those fence trees. The ones which has wide	265	the certificate, it's done. Uh, just those little minor
161	speaking amongst ourselves that we really need bees	194	IVAN: Yeah.	226	petals.	266	things that we need before you can open an account
162	there because, uh most of our plants may not have					267	and run your business properly. We're still just
163	flowers but those which have, they need pollination.	195	EDWARD: So ya.	227	IVAN: Yeah the ones that, the creepers that grow on	268	saving our money by ourselves now. Ya.
				228	the fences.		
164	IVAN: Yeah.	196	IVAN: Aand.			269	IVAN: Okay.
				229	EDWARD: Ya, ya, ya. So I used to put those flowers		
165	EDWARD: And with bees we've seen that this Chinese	197	EDWARD: That's the problem that I've had. To get	230	and then the bee would live only for a day or two	270	EDWARD: So we, what we have built there is just that
166	spinach is growing very well since the bees have	198	someone who really works with bees and that is	231	and then the next day no longer, its gone.	271	and then we've tried to build theres that thing, uh,
167	been around.	199	willing to engage with us.			272	whats this, uh a small, uh net which you use wire like
				232	IVAN: Okay.	273	I can show you.
168	IVAN: Yeah.	200	IVAN: Yeah, and um, so you have no experience in				
		201	keeping bees as of yet.	233	EDWARD: So ya. I used, uh, I loved bees from my, my	274	IVAN: Oh okay, and then they, the, the plants will
169	EDWARD: Um.			234	childhood, ya.	275	grow up, alright. With support.

**Appendix E**  
**UF02**

<p>276 EDWARD: Yes the supports.</p> <p>277 IVAN: Okay, so you're using wood and...</p> <p>278 EDWARD: Wood and this wires that you hang your clothes on, we just combine them.</p> <p>280 IVAN: Oh clothes hangers. And the materials you find?</p> <p>282 EDWARD: Ya some of it we find in the streets, some of it we ask from those guys who sell veges.</p> <p>284 IVAN: Okay.</p> <p>285 EDWARD: Ya, and then some of them we take from those guys who do constructions on the road. Because they also have nets that they keep on the streets.</p> <p>289 IVAN: Yeah, yeah, yeah. Okay so it's whatever you can find?</p> <p>291 EDWARD: Ya whatever we can find cause with this cash we have now we don't wanna use it for anything on the farm until we have the proper papers and know how to keep your invoices and stuff like that, bookkeeping as well.</p> <p>296 IVAN: Okay. Alright, so you say there's seven of you?</p> <p>297 EDWARD: Ya there's seven of us. There's one he's coming. It's four guys and three ladies. Ya.</p> <p>299 IVAN: Okay.</p> <p>300 EDWARD: It started off with ten, but these three other guys got jobs somewhere else. The other one got a job at school, an administrator there, and the other one just got a job in, at retail stores you know. And then we asked them 'are they going to come back?' And they didn't so we asked them to give us their resignation letters so that we can aim to move on.</p> <p>308 IVAN: Okay.</p> <p>309 EDWARD: Because it's hard to get fundings while people are appearing on the certificate, but they're not there.</p>	<p>312 IVAN: They're not there full time.</p> <p>313 EDWARD: When they gave you that funding they have to get sure of that.</p> <p>315 IVAN: So, so, you, you're working on the farm full time?</p> <p>317 EDWARD: Ya we are working on the farm full time.</p> <p>318 IVAN: Okay.</p> <p>319 EDWARD: We are working on the farm full time. Even though we don't go there everyday. But we try to make it five days a week atleast, even on weekends if we couldn't make it during the week because some days have been cold.</p> <p>324 IVAN: Ya even in winter.</p> <p>325 EDWARD: Ya so we would skip those days but then go on weekends you know, if it's okay.</p> <p>327 IVAN: Alright, um, let me just make sure I've asked all the questions I needed to. Oh um, is there, is the farm quite secure? Like in terms of crime? And people stealing plants?</p> <p>331 EDWARD: Ya I would say its secure because it has a fence and it's, it's, it's a fence like that one (points to palisade fencing) but it's huge, it's like, it's high up, so it's about this size (indicates a 2.5m height) uh, its in a school yard so there are securities there at the school and at night and at day security.</p> <p>337 IVAN: Okay. So it's not, it's not a big problem. And, um, are you growing organically?</p> <p>339 EDWARD: Yes.</p> <p>340 IVAN: Not using pesticides?</p> <p>341 EDWARD: Uh, pesticides yes, we maybe, we started to maybe use a cigarette butts, cigarette butts, ya and whats it, dishwashing liquid.</p> <p>344 IVAN: Okay. But, your own, your own, your own recipe.</p>	<p>346 EDWARD: Ya, so ya, because we only used it once and only on one bay jut to try it out, so we started to see its not that much effective, or we didn't use it well, but whatever we've been using now its organic.</p> <p>351 IVAN: Yeah.</p> <p>352 EDWARD: Everything else is organic. The compost is organic, the manure is organic.</p> <p>354 IVAN: The cigarette butts are for the nicotine?</p> <p>355 EDWARD: Ya, we only used them on kale, because of those Aphids, you know Aphids?</p> <p>357 IVAN: Okay.</p> <p>358 EDWARD: Ya, so it didn't work properly, or we didn't use it correctly. But we don't want that cause we're going organic now. So wherever we've been taught today like making your own pesticide with chillis and, uh, whats that thing, garlic, cloves and onions, and Epson salt.</p> <p>364 IVAN: Garlic and onions. Okay.</p> <p>365 EDWARD: That we can use. Ya</p> <p>366 IVAN: Ya. Cause the, the pesticides and insecticides are a big problem for the bees at the moment.</p> <p>368 EDWARD: Oh they are?</p> <p>369 IVAN: That's why I think it's more important for people that are doing organic farming and permaculture to, to be the ones that are getting bees. Whereas the big farms are the problem at the moment.</p> <p>374 EDWARD: It makes sense ya.</p> <p>375 IVAN: Alright, um so going forward uh, I'm gonna use these interviews to um, to evaluate how I'm going to design the, the beehive, to make it more usable, or more appropriate for the farmers in Joburg. But then um, so I'll, I'll come up with a few designs and then I'll need to show them to the people that I've interviewed so I'll contact you and then probably we can make a meeting time, or maybe I could come to</p>	<p>383 the farm and interview you all together and then I could get input from everyone.</p> <p>385 EDWARD: Yeah, exactly. We also, it also will be visible to you that what kind of environment is it for the bees, you will know what we're talking about.</p> <p>388 IVAN: Yeah. Okay.</p> <p>389 EDWARD: Ya, because currently we do have bees there and then they, you know they do not disturb us. Those are just run around bees. Ya but we don't even know where their hive is, that's what is asked.</p> <p>393 IVAN: Okay. Ya that's enough for the interview.</p>
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**Appendix E**  
**UF03**

<p>1 Saturday 1<sup>st</sup> August</p> <p>2 Soweto UJ Campus: Izindaba Zokudla Farmers School</p> <p>3 Transcription of interview of Herbert Moghale</p> <p>4 (Urban Farmer) by Ivan Brown (Industrial Design</p> <p>5 Student, UJ).</p> <p>6 We met at 13h15, outside the lecture halls during</p> <p>7 the lunch break. We discussed the reasons for the</p> <p>8 interview and my research problem. I informed him</p> <p>9 of the ethics, had him sign a consent form and began</p> <p>10 recording the conversation. I had just presented my</p> <p>11 project to the farmers and Edward approached me</p> <p>12 out of interest in the study.</p> <p>13 IVAN: Sorry what was your name?</p> <p>14 HERBERT: Um my name is HERBERT Mogale.</p> <p>15 IVAN: HERBERT.</p> <p>16 HERBERT: Ya.</p> <p>17 IVAN: And you're also a farmer?</p> <p>18 HERBERT: I'm also a farmer.</p> <p>19 IVAN: Where is your farm?</p> <p>20 HERBERT: Um, currently im working at a school yard.</p> <p>21 IVAN: Okay.</p> <p>22 HERBERT: I'm at a school, ya it's in Soweto. And, uh,</p> <p>23 it's about a half a hectare. And we cropping, uh,</p> <p>24 veg, uh, vegetables.</p> <p>25 IVAN: Okay, and you're interested in beekeeping.</p> <p>26 HERBERT: Yeah, it was my dream.</p> <p>27 IVAN: Your dream?</p> <p>28 HERBERT: Um, I actually have missed the</p> <p>29 opportunity when the department of, uh, agriculture</p> <p>30 was giving out bees. Because I didn't have, uh, a, uh,</p> <p>31 space, a confined space so I was, uh, lost out.</p> <p>32 IVAN: They were giving out bees to farmers here?</p>	<p>33 HERBERT: Farmers, sometimes, it's about five,</p> <p>34 seven years back.</p> <p>35 IVAN: Okay.</p> <p>36 HERBERT: Ya. So I'm interested so much in bees.</p> <p>37 IVAN: Okay.</p> <p>38 HERBERT: Ya.</p> <p>39 IVAN: So do you have friends that have, that got</p> <p>40 hives during that time?</p> <p>41 HERBERT: I think I have got one, but he moved away,</p> <p>42 he got a farm and he, uh...</p> <p>43 IVAN: Took the bees away.</p> <p>44 HERBERT: He took the bees away.</p> <p>45 IVAN: Okay.</p> <p>46 HERBERT: But it was interesting because, uh,</p> <p>47 smoking and all those things, what was it was called?</p> <p>48 IVAN: In the suit.</p> <p>49 HERBERT: (Laughs) Ya.</p> <p>50 IVAN: So you're interested in how it all works and</p> <p>51 learning about it.</p> <p>52 HERBERT: Yeah, that I'm interested so much.</p> <p>53 IVAN: Okay.</p> <p>54 HERBERT: Ya.</p> <p>55 IVAN: So for you it's more the interest then it's the,</p> <p>56 trying to get more crops, more crop yield, or would</p> <p>57 you say it's both? You want to make, make some</p> <p>58 more money as well?</p> <p>59 HERBERT: I think, I think it is out of interest.</p> <p>60 Remember the interesting it's a foundation, you</p> <p>61 develop that into a business.</p> <p>62 IVAN: Okay.</p>	<p>63 HERBERT: For instance the current job that I'm doing</p> <p>64 I'm specialising in it. It was like a interest now it</p> <p>65 becomes money making, uh, route measuring and</p> <p>66 I'm one of the third, you know, highly qualified in</p> <p>67 the South Africa. So by, by, by learning and, you</p> <p>68 know, it brings more of attention to, to the project</p> <p>69 and eventually grow, grow, grow until we make</p> <p>70 money.</p> <p>71 IVAN: But you have to be passionate about it is what</p> <p>72 you're saying?</p> <p>73 HERBERT: Passion, that's what I'm saying.</p> <p>74 IVAN: Okay.</p> <p>75 HERBERT: Once you have passion then you can look</p> <p>76 after that.</p> <p>77 IVAN: And you're not afraid of bees?</p> <p>78 HERBERT: No, no, no.</p> <p>79 IVAN: Have you been stung before?</p> <p>80 HERBERT: eh, I've, I've been, I've been, I've worn</p> <p>81 the suit and I was into...</p> <p>82 IVAN: Okay</p> <p>83 HERBERT: Yes.</p> <p>84 IVAN: So you had a bit of experience?</p> <p>85 HERBERT: (Laughs).</p> <p>86 IVAN: Okay. So when you, when you wore the suit did</p> <p>87 you do the inspections and open the hive?</p> <p>88 HERBERT: I did the inspection of the, the...</p> <p>89 IVAN: The frames.</p> <p>90 HERBERT: The frames. Ya.</p> <p>91 IVAN: Okay, and do you know anything about the, the</p> <p>92 harvesting of the honey and separating it from the</p> <p>93 wax.</p>	<p>94 HERBERT: No, not necessarily, I, I didn't have an</p> <p>95 opportunity for that.</p> <p>96 IVAN: Okay.</p> <p>97 HERBERT: Ya.</p> <p>98 IVAN: Alright, and, so, um, your farm, you would</p> <p>99 want to keep the bees on your farm that you have</p> <p>100 now?</p> <p>101 HERBERT: Totally, I think I want to keep that.</p> <p>102 IVAN: Alright. And how many, how many hive do you</p> <p>103 think you could have on that, that farm?</p> <p>104 HERBERT: For a start you will need, you'll need to</p> <p>105 have at least four to six.</p> <p>106 IVAN: Okay.</p> <p>107 HERBERT: And then till if there, you know, you know</p> <p>108 you are able to cope with that, you can look at the</p> <p>109 place and, and you can have more.</p> <p>110 IVAN: Get more.</p> <p>111 HERBERT: More ya.</p> <p>112 IVAN: Okay, so you wanna grow it into a, a big</p> <p>113 business.</p> <p>114 HERBERT: Yes, sort of keeping that I want to grow it</p> <p>115 to, uh, to a, a bigger business per say.</p> <p>116 IVAN: Okay.</p> <p>117 HERBERT: Ya.</p> <p>118 IVAN: And do you have access to materials or</p> <p>119 machinery and tools?</p> <p>120 HERBERT: Yes, I think we have access to that.</p> <p>121 IVAN: Through the agricultural research and?</p> <p>122 HERBERT: I think through the, the, the, the, uh</p> <p>123 experiences and expertise or contacts.</p> <p>124 HERBERT: Ya. We can be able to access those.</p>
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**Appendix E**  
**UF04**

1 Saturday 1<sup>st</sup> August

2 Soweto UJ Campus: Izindaba Zokudla Farmers School

3 Transcription of interview of Sibongisiwe  
4 Mngomezulu (Urban Farmer) by Ivan Brown  
5 (Industrial Design Student, UJ).

6 We met at 13h30, outside the lecture halls during  
7 the lunch break. We discussed the reasons for the  
8 interview and my research problem. I informed him  
9 of the ethics, had him sign a consent form and began  
10 recording the conversation. I had just presented my  
11 project to the farmers and Edward approached me  
12 out of interest in the study.

13 IVAN: Alright so you're farming here in Soweto.

14 SIBONGISIWE: Yes.

15 IVAN: How big is your farm?

16 SIBONGISIWE: Um, we are in a school, um, so I think  
17 maybe I can say...

18 IVAN: You're also in a school.

19 SIBONGISIWE: One hectare, ya, let me say one  
20 hectare, in a school yard.

21 IVAN: Is it-

22 SIBONGISIWE: It's just there's a space by the other  
23 other side, its one and a half hectares, ya.

24 IVAN: Okay, and how many of you, is it just you three  
25 that work on the farm? (Points to group).

26 SIBONGISIWE: For me ya I'm working on a separate  
27 project and the brothers also working on a separate  
28 project.

29 IVAN: Okay.

30 SIBONGISIWE: But I'm also having a, a, a wetland  
31 where I'm planting so there's no fence and stuff, but  
32 it's just near a wetland whereby if it can atleast be  
33 fenced then it can..

34 IVAN: Yeah.

35 SIBONGISIWE: The beehive can start working there.

36 IVAN: Ya, cause, um, it needs to be secure so people  
37 don't steal it.

38 SIBONGISIWE: Yes.

39 IVAN: Okay, and the, the school is it a primary  
40 school?

41 SIBONGISIWE: Okay the school we're working at is  
42 already closed now, it's actually used as a sp, a  
43 space for projects.

44 IVAN: Okay.

45 SIBONGISIWE: For people that working on a  
46 carpentry, welding and stuff like that so people hire  
47 classes to, to do their projects and then they pay  
48 rent to the school.

49 IVAN: Okay.

50 SIBONGISIWE: So we also, we're entered through the  
51 garden side, you know like this big community  
52 project.

53 IVAN: Okay.

54 SIBONGISIWE: So ya.

55 IVAN: So there's no children, not, not a lot of  
56 children?

57 SIBONGISIWE: The problem is that theres no fencing,  
58 like on the other part of the school theres no  
59 fencing, so we just have a problem of that. But  
60 children they do come because there are still those  
61 that have a play-

62 IVAN: Ya.

63 SIBONGISIWE: You know like, a playing-

64 IVAN: A jungle gym.

65 SIBONGISIWE: Play area, like that, so children do  
66 come and they play around.

67 IVAN: Okay, and why are you interested in  
68 beekeeping? Have you thought of it before?

69 SIBONGISIWE: We have, we have, uh, actually me  
70 and my partners they have, we used to talk about it  
71 you know, and we also, also saw one at the projects  
72 in this living land program. So yeah, I think that its  
73 something beneficial like maybe just to avoid sugar  
74 and use natural honey.

75 IVAN: And to, to earn some money? Would you want  
76 to sell it or just use it yourself?

77 SIBONGISIWE: Ya well for using ourself is good but  
78 also for business I think its very important.

79 IVAN: Ya?

80 SIBONGISIWE: To grow. Ya and, and, and-

81 IVAN: Okay.

82 SIBONGISIWE: And sell it also.

83 IVAN: Alright, and what kind of foods do you grow on  
84 the farm?

85 SIBONGISIWE: So far we have vegetables, uh, we  
86 have spinach, cabbage, onions, lettuce and stuff like  
87 that. And I was just saying inside that we also  
88 growing avocado trees you know like-

89 IVAN: Ya.

90 SIBONGISIWE: Ya, so we just need space, a protected  
91 space where we can planting them and have aan  
92 orchard whereby we know that our trees are growing  
93 somewhere.

94 IVAN: So you're looking for the place, for the orchard  
95 now, or you've already started?

96 SIBONGISIWE: We're looking for, for, for a proper  
97 place.

98 IVAN: Okay.

99 SIBONGISIWE: Yes, for planting those trees.

100 IVAN: Okay, and then you want to incorporate the  
101 bees into that hopefully? Into that project?

102 SIBONGISIWE: Ya, well I think it's different projects.

103 IVAN: Yeah.

104 SIBONGISIWE: I would say, you know, but since we  
105 have already said that they also need plants-

106 IVAN: Yeah.

107 SIBONGISIWE: what grow around there. I think ya it  
108 can work together.

109 IVAN: And avocados are a big one for the bees.

110 SIBONGISIWE: Serious?

111 IVAN: Ya, its avocados and almonds. Are good, good  
112 trees.

113 SIBONGISIWE: So we're not, we're not, I think they  
114 can work together also.

115 IVAN: Okay. And, um, at the, the community centre  
116 are resources like tools and materilas.

117 SIBONGISIWE: Yes, we're working with the  
118 department of agriculture there so they have already  
119 provided tools like rakes and shovels and stuff like  
120 that.

121 IVAN: Okay, gardening tools, and then are there, um,  
122 like, uh carpentry tools or

123 SIBONGISIWE: Carpentry?

124 IVAN: Like saws and, uh, hammers and nails?

125 SIBONGISIWE: No, no, not, not a lot of things, just  
126 garden tools strictly, other ones we haven't yet got  
127 them.

128 IVAN: Alright. Okay, and um, thank you, let me just  
129 check my questions. Okay I think that's fine for now.

**Appendix E**  
**UF05**

1 Saturday 1 <sup>st</sup> August	37 THEMBA: On a higher hemisphere.	70 beehives now, for young children in nursery schools	104 THEMBA: Um, it maybe starts, you see where Hector
2 Soweto UJ Campus: Izindaba Zokudla Farmers School	38 IVAN: Yeah.	71 and primary schools. Cause the bees have a, a	105 Peterson memorial is? (points to memorial about
3 Transcription of interview of Themba Khoza (Urban	39 THEMBA: Isn, isn't that going to be a problem is that,	72 society inside the hive. They have the queen and the	106 500m away).
4 Farmer) by Ivan Brown (Industrial Design Student,	40 or is that going to be a problem?	73 workers and the drones and they all have jobs, and	107 IVAN: Okay.
5 UJ).	41 IVAN: Well how close is your farm to the building?	74 they, they, they build comb and they make honey	108 THEMBA: It can start there and maybe end here
6 We met at 13h45, outside the lecture halls during	42 THEMBA: Ah we can say maybe the building is here	75 and its an interesting thing to learn about for the-	109 (indicates where we are sitting).
7 the lunch break. We discussed the reasons for the	43 (where we were sitting) and then maybe that's from	76 THEMBA: Cause I've seen the bees, with the movie	110 IVAN: Wow, okay so its quite big.
8 interview and my research problem. I informed him	44 where the, the, the, the, the, foundation of that	77 of bees, the queen.	111 THEMBA: Ya cause, cause we just started but now we
9 of the ethics, had him sign a consent form and began	45 stoep starts (points to concrete ledge 5m away).	78 IVAN: The bee movie?	112 are going on our first month. But now we still
10 recording the conversation. I had just presented my	46 IVAN: Okay.	79 THEMBA: Ya the bee movie. Ya that's why, that's	113 working on that side, we haven't reached this side
11 project to the farmers and Edward approached me	47 THEMBA: That where we start planting.	80 why I, I got interested when you spoke about bees	114 yet (indicates to the other half of the hypothetical
12 out of interest in the study.	48 IVAN: Okay so its about five meters. Alright, and the	81 cause in Soweto theres no one whose expe, who has	115 space).
13 IVAN: Uh, can you just put your telephone number	49 children, do they use that area as well?	82 the experience of working with bees so I think if you	116 IVAN: Okay.
14 there, um so that I can get hold of you. And your	50 THEMBA: They normally don't come that side, but	83 can come and start helping us or assisting us in	117 THEMBA: So we still working in progress situation,
15 email address.	51 you know how kids are.	84 bringing that, what do you call it... beehive?	118 but we are still gonna come to theis side.
16 THEMBA: My email address is currently not working	52 IVAN: Yeah.	85 IVAN: Beehive.	119 IVAN: So you have a lot of space on the farm
17 but I can write my postal address.	53 THEMBA: Ya, so, ya.	86 THEMBA: Ya the beehive. It will be the first of its	120 inbetween the building and so..
18 IVAN: Okay. Okay.	54 IVAN: Well one of the things is its all about education	87 kind in Soweto I think.	121 THEMBA: Ya, no so the building is only on this side,
19 THEMBA: Oh please don't mind my handwriting	55 and if you can teach the children about the bees at	88 IVAN: Yeah.	122 that whole space is behind the whole building.
20 please. 1852. I hope you can see here.	56 an early age.	89 THEMBA: So it will be a good thing and the greatest	123 IVAN: So you could put the hives quite far from the
21 IVAN: 1852.	57 THEMBA: Cause even, cause even now most of the	90 thing that can happen.	124 building on the, on the farm?
22 THEMBA: Ya (laughs).	58 times, cause on Monday, Wednesday and sometimes	91 IVAN: Well I think it should be very educational as	125 THEMBA: It can be in between or ya.
23 IVAN: Okay. That's yours.	59 even on Friday we invite kids to come and assist us.	92 well, it should, the hive should be designed to	126 IVAN: Or at the, at the end?
24 THEMBA: Shall I start from the beginning?	60 IVAN: Yeah?	93 instruct and demonstrate the bees a lot. Because the	127 THEMBA: Ya.
25 IVAN: Ok so THEMBA and Gift, so you say you have a	61 THEMBA: Maybe for an hour, and lunch time fifteen	94 hives that exist at the moment that I showed, they,	128 IVAN: And surrounding the, the other sides of the
26 farm?	62 minutes after school.	95 they very complicated and the beekeepers know how	129 farm? Are there...
27 THEMBA: We have a farm in Soweto, which, which is	63 IVAN: Yeah.	96 to use them but have techniques and...	130 THEMBA: There's like a fence, not a huge one, but a
28 in, based in Middlelands in Zonty. Uh, currently what	64 THEMBA: So we can maybe teach them how bees	97 THEMBA: On how to build it.	131 fence rounding the school.
29 we have currently now is, is a back space behind a	65 live, how they interact with people who... that stuff.	98 IVAN: Yeah, but it's, it can be a lot simpler.	132 IVAN: Okay, so it's...
30 school. So we want to know whether the bees are,	66 IVAN: Yeah, well if, at the end of the day it will be	99 THEMBA: But you can make it simpler.	133 THEMBA: To protect the kids from coming into our
31 are, are the bees going to be a problem because we	67 up to the school, wether or not they will allow the	100 IVAN: Yeah, so that's the goal and cheaper.	134 garden there's another fence separating the building
32 we have kids. It's a primary school so we, we, isn't	68 bees, and they'll, they'll base it on the safety of the	101 THEMBA: (laughs) Ya.	135 as well as our garden.
33 it going to be a problem if kids go that side. Cause I	69 children. But ther are a lot of schools that use	102 IVAN: Cause those hives are thousands of rands and,	
34 heard you speaking about it. You create a wall		103 so, so the farm you have, um how big is it?	
35 whereby the bees will just-			
36 IVAN: Fly over..			

Appendix E  
UF05

136 IVAN: Okay, and then on the other sides of the fences  
137 are there other houses and things? And buildings?  
138 THEMBA: There's another school that side, but  
139 there's maybe we can say fifteen or twenty meters  
140 wide and then after the school there's a, there's a  
141 gate and then houses are not that far from the school  
142 but I don't think that will be a problem because,  
143 because you said that if maybe the bees can go and  
144 farm, farm, farm then they can come back there.  
145 IVAN: Yeah.  
146 THEMBA: So I don't think that will be a problem.  
147 IVAN: But it's, it's mostly the, the immediate  
148 surroundings of the hive, where the bees are flying  
149 quite low and then afterwards they fly quite...  
150 IVAN: Do you also have, whatsapp, cause we have,  
151 have pictures, I think maybe I can send you pictures  
152 tomorrow.  
153 IVAN: Yeah, send me pictures on whatsapp, my  
154 numbers on there (points to project information  
155 sheet).  
156 THEMBA: We can use those numbers for whatsapp as  
157 well?  
158 IVAN: Yeah, yeah my phone number (points to phone  
159 number). Um, and then I just wanted to ask uh, so  
160 have you ever considered keeping bees before?  
161 Before today?  
162 THEMBA: No we've never cause, I saw, I saw, I saw a  
163 show on, on SABC 1, I think it was hundred percent  
164 youth where the lady was keeping bees in, in his  
165 farm. That thing. That's where I got the  
166 understanding of how bees live and how they  
167 interact with people and plants and stuff. That's  
168 where I think I, I, I had an idea of how bees live and  
169 how I can actually bring them. But I never had a clue  
170 of me bringing them to that farm of mine, to that  
171 piece of land, I think ya.  
172 IVAN: Okay.  
173 THEMBA: Ya I think that has been an issue for me.

174 IVAN: And um, on your farm do you have materials  
175 and building supplies and things? Do you ever build  
176 anything?  
177 THEMBA: No only what we have is, oh what structure  
178 of building are you referring to?  
179 IVAN: Uh, just uh, wood, wooden structures.  
180 THEMBA: Ya wooden tools we do have, steel tools we  
181 do have and then other tools that we do have is  
182 spades, wheel barrows, hose pipes those are the  
183 tools that we currently have.  
184 IVAN: Okay.  
185 THEMBA: Besides the tractor ya.  
186 IVAN: Alright, that's cool for now.  
187 THEMBA: I will send you those pictures on Monday.  
188

**Appendix E  
BK01**

<p>1 Wednesday 5<sup>th</sup> August</p> <p>2 39b Rustenburg Road, Melville Johannesburg.</p> <p>3 Transcription of interview of Scarlet Dymond and 4 Donovan Dymond (Urban Beekeepers) by Ivan Brown 5 (Industrial Design Student, UJ).</p> <p>6 I was referred to Sam and Donovan by another 7 beekeeper. They keep beehives on their property in 8 an intra-urban environment.</p> <p>9 We met at 18h00, at Sam and Donovan's home in 10 Melville. Sam showed me their bee hives while we 11 waited for Donovan to arrive. We discussed the 12 reasons for the interview and my research problem. 13 I informed them of the project details and ethics, 14 had them sign consent forms and began recording 15 the conversation.</p> <p>16 SAM: Okay.</p> <p>17 IVAN: Cool. So the first few questions are just about 18 um, how long you've been beekeeping for and how 19 you got into it?</p> <p>20 SAM: Oh okay, we had a large property with a bee- 21 pest problem and I felt it would be a good idea to 22 keep bees in a way to also repel um, other bees. 23 Which worked we never had a bee infestation after 24 that, so that was four years ago.</p> <p>25 IVAN: So the bees were living in your walls or...</p> <p>26 SAM: Ya they were living under the ceiling and 27 getting into the roof and coming into the house.</p> <p>28 IVAN: And then by keeping bees in hives they, they 29 kind of repelled them from getting into, or coming 30 and moving into the house.</p> <p>31 SAM: Ya, its, after we had bees we never had a bee 32 problem after that so the, I do believe that there is 33 a radius of, I'm not sure, a couple hundred meters 34 or so that a bee will not move into an area (a swarm 35 will not settle within close proximity of another 36 existing colony).</p> <p>37 IVAN: Mhm, in other words its domain is protected.</p>	<p>38 SAM: Ya.</p> <p>39 IVAN: Okay.</p> <p>40 SAM: Cause we've never had a bee problem here, 41 we've had those bees (the hives that we looked at 42 earlier) for a year, cause we moved, after three 43 years (of keeping bees) we moved to this place and 44 we've never had a bee problem here. There are, in 45 summer you see bees all over (swarming) but they 46 don't nest in a cavity in our house or in a cavity in a 47 tree.</p> <p>48 IVAN: Mhm, ya theres a big Aloe uh, park down the 49 road here.</p> <p>50 SAM: Yes.</p> <p>51 IVAN: Theres like thousands of Aloes in it, so I can 52 imagine theres quite a lot of bees around here.</p> <p>53 SAM: Yes, ya but we've been lucky they haven't been 54 a pest and they haven't...</p> <p>55 IVAN: Ya.</p> <p>56 SAM: Nested anywhere.</p> <p>57 IVAN: Alright and how long have been keeping them 58 for?</p> <p>59 SAM: Four years.</p> <p>60 IVAN: Okay, and you have two hives?</p> <p>61 SAM: Correct.</p> <p>62 IVAN: And they're Lang, Langstroth hives?</p> <p>63 SAM: They are. And so the routine is I call a bee guy, 64 Stuart the bee guy, he's my bee helper. He comes 65 uh, usually three times a year, we do a bee 66 inspection in winter where we shut down, no, ya you 67 shut down the hive sort of after Easter, you take off 68 the supers, so we have one super, one brood box. 69 And he's due to come now sort of August-September, 70 he'll put another brood b uh, another super on. SO 71 we'll have to supers and one brood box, then he'll 72 come in October-November take away one super full 73 of honey cause that's the nectar flow.</p>	<p>74 IVAN: Ya.</p> <p>75 SAM: And, ya. So the he comes again in about 76 February because there's another small flow usually 77 in about February. So I suppose its usually about 78 probably (dogs barking) four times a year I think.</p> <p>79 IVAN: Okay. (dogs barking)</p> <p>80 SAM: Ya he does it cause it's heavy, I mean you can't 81 actually lift the, I can't physically lift the super with 82 the honey.</p> <p>83 IVAN: With all the honey and ya.</p> <p>84 SAM: Its heavy, it weighs a ton.</p> <p>85 IVAN: It can be up to like 40 kilograms.</p> <p>86 SAM: Ya I mean you've got ten frames and each 87 frame weighs one or two kilos, so that's twenty kilos 88 plus the box so if you trip over you know I mean its... 89 you get attacked by the bees obviously.</p> <p>90 IVAN: Yeah.</p> <p>91 SAM: And that's the end of your frames and you box.</p> <p>92 IVAN: It's all about a delicate hand. Sort of very 93 gentle movements.</p> <p>94 SAM: Oh, ya, ya, ya. You mustn't bang the hive, you 95 know when you take the, remove those you can't 96 bang it obviously they don't like that. You have to 97 try, the thing is you just need to be quite confident 98 and quick with it. You mustn't be nervous and 99 unsure, you know the bees don't get too worked up 100 if you're pretty quick and you know what you're 101 doing you know.</p> <p>102 IVAN: Okay.</p> <p>103 SAM: You take the lid off and you picking it up and 104 put it down and then you take the hive off check the 105 frames or whatever. You know if you're checking 106 that their okay.</p> <p>107 DONOVAN: Hi.</p> <p>108 SAM: Howsit. Uh this is IVAN, and IVAN DONOVAN.</p>	<p>109 IVAN: Hi.</p> <p>110 DONOVAN: He's too tall.</p> <p>111 SAM: Oh I know. Howsit?</p> <p>112 DONOVAN: Howsit? You're interested in bees?</p> <p>113 IVAN: Good. Ya. We're just doing an interview.</p> <p>114 SAM: You can join the interview (laughs).</p> <p>115 DONOVAN: Okay I can join the interview.</p> <p>116 IVAN: Ya two points of view are better than one.</p> <p>117 SAM: Better than one (laughs).</p> <p>118 DONOVAN: Just going to grab something to drink.</p> <p>119 IVAN: Alright so, so this guy comes and takes the 120 honey and he then he'll process it himself?</p> <p>121 SAM: Yeah, he'll process it and I go the next day and 122 fetch it, in a huge bucket actually, ya a big plastic 123 bucket.</p> <p>124 IVAN: And he gives you the honey?</p> <p>125 SAM: Yeah, well I pay him, ya he gi-(laughs) gives me 126 back my honey and ya, so he also swaps out the 127 hives, so he'll bring an empty uh, super.</p> <p>128 IVAN: Yeah.</p> <p>129 SAM: And then uh, with co, with comb ya. So we, he 130 takes those. Cause when I bought it I bought it with 131 two supers and he just swaps them out.</p> <p>132 IVAN: Okay and he doesn't keep any of the honey 133 himself.</p> <p>134 SAM: No, but I pay him, we pay him about 350 (rand) 135 a visit, depend, 350 a visit and then if he does more 136 than one thing its 600 bucks in total.</p> <p>137 IVAN: Okay.</p>
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138 SAM: So we, paying him costs me about 1200 rand	172 IVAN: Yeah.	202 IVAN: Ya, and the ants just come in with force,	233 DONOVAN: So the bugs then couldn't fly and got
139 every year just to come and check on the boxes and		203 thousands of them.	234 stuck in the oil and eventually it was enough for a
140 swap them out and process honey and stuff.	173 SAM: I've never done that.		235 bridge for the ants, ya.
		204 SAM: Ya they just steal all their honey and that's	
141 IVAN: Alright, that's interesting.	174 DONOVAN: Ya I've never herded bees before	205 terrible.	236 IVAN: The ants could walk across the bugs.
	175 (laughs).		
142 DONOVAN: (sits down and groans).		206 IVAN: So there's just the small well of water at the	237 DONOVAN: So I just sort of put old engine oil in and
	176 SAM: Yeah.	207 bottom?	238 sort of irrigated it. You know. Sort of flooded it.
143 SAM: Ya otherwise I've gotta buy all that gear and			239 Although I haven't had a close look to see whats
144 store it you know, which is a pain.	177 IVAN: Herding them, ya.	208 SAM: Oil.	240 happening now.
145 IVAN: Ya. For the processing and the spinners are	178 IVAN: Um, alright cool and so you've made a few	209 DONOVAN: Oil.	241 SAM: Ya I see that theres, but I must top it up though.
146 very expensive or not?	179 modifications to the hives I saw. The polystyrene on		242 I just checked yesterday cause I, yesterday was the
	180 the top?	210 IVAN: Engine oil?	243 first day I'd seen ants there and they were, jees-e-
147 SAM: Their not really-			244 em, they were like all over the hive you know.
	181 SAM: Yeah, we put the polystyrene on the top and	211 DONOVAN: Old engine oil.	
148 IVAN: They take up a lot of room.	182 we put um, we put that frame with the shade cloth		245 IVAN: Yeah?
	183 to make shade.	212 IVAN: Okay. And how often do you have to replace	
149 SAM: fifteen-hudred (rand) and they take up a lot of		213 it, or do you ever?	246 SAM: So I put in a cup full yesterday just to um stop
150 room. Of course you gotta clean it cause the bees if	184 IVAN: Okay.		247 them, so I'll top it up again tomorrow-
151 they smell honey there, they come and be a pest.		214 DONOVAN: I did that about a year ago and it looks	
	185 SAM: We put the stand underneath with the um, well	215 like we need to do it again.	248 DONOVAN: Ya.
152 IVAN: Ya it must be in a sealed room.	186 in the um, centre to stop ants. Cause the ants are		
	187 really a big problem.	216 SAM: Ya, just to top it up.	249 SAM: With the engine oil. Dirty old engine oil.
153 DONOVAN: Yes.			
	188 IVAN: Are they a big problem just here or were they-	217 IVAN: Alright, and you don't find the ants kind of	250 IVAN: Alright.
154 SAM: Yes. So he was trying a little experiment (points		218 making bridges across it?	
155 to DONOVAN) you can get some honey in a little pan	189 SAM: Oh, I think this area because it's very rocky.		251 SAM: Ya, we, otherwise you just put that ant poison
156 and heat it up and see how many bees arrive, you		219 SAM: No.	252 powder, which is not wonderful.
157 can't actually believe it.	190 IVAN: Yeah.		
		220 IVAN: Cause I've heard-	253 IVAN: Was that the powder that I saw around the
158 IVAN: As it starts to evaporate.	191 SAM: Uh we never had an ant problem before.		254 hives.
		221 DONOVAN: And I tell you, when I first put the oil in	
159 SAM: Ya just the smell and they'll, just you kitchen	192 IVAN: OK.	222 it was like, the ants used to, you know they were	255 SAM: Yes cause I noticed the hives yesterday for the
160 will be full of hon uh, bees in about ten minutes.		223 going in and out of the hive all the time and on that	256 first time since you put that oil in you know.
	193 SAM: At the old house. Which was very sandy, but	224 like square ring the, the, the oil, the well for the oil.	
161 IVAN: Ya? That's a good way for attracting hives, I	194 here where its rocky, you just can't believe.	225 I mean they were standing on their back legs.	257 DONOVAN: Ya but that, if it rains the stuff goes away
162 mean swarms.			258 and the ants, and the ants are very gung-ho for
	195 DONOVAN: It really messes them up.	226 SAM: Ah it was like Modor, you know.	259 honey hey.
163 SAM: Uh stray bees ya (laughs). Cause a swarm like,			
164 swarming seasons gonna be what in about four	196 IVAN: Ya.	227 DONOVAN: It was like really quite a weird scene hey.	260 IVAN: Ya.
165 weeks. SO you gonna have all those swarms buzzing			
166 around. We have a lot, I mean they just arrive and	197 DONOVAN: They, they get disorientated and this	228 IVAN: Ya.	261 SAM: Mhm.
167 its just (buzzing sound).	198 that.		
		229 DONOVAN: And then of course we didn't have old	262 DONOVAN: And they'll make a plan to try and get the
168 IVAN: Ya.	199 SAM: Aggressive.	230 engine oil so we put sunlight oil in, and that	263 honey.
		231 attracted bugs.	
169 SAM: So if you can catch them, you know you can	200 DONOVAN: They get aggressive. They just, ants and		264 IVAN: Ya, ya in a few of the wells that I've seen
170 even use those spin things, those bits of wood on	201 bees don't mix hey.	232 IVAN: Oh no.	265 people using with just water the ants have kind of
171 string. Get them into a cardboard box.			

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266 made a bridge across with other dead ants, walking  
267 across their fallen friends.

268 DONOVAN: They, I tell you they if you had seen the  
269 ants in the oil.

270 SAM: Oh god it was ridiculous.

271 DONOVAN: It was like a scene out of lord of the rings,  
272 really hectic hey. Ya.

273 IVAN: Okay, um have you ever tried any othe hives  
274 or is it you've always used the Langstroth.

275 SAM: I use that one because Stuart works with  
276 Manfred who, who is, is he Austrian?

277 DONOVAN: Yes.

278 SAM: He's been keeping bees for a million years and  
279 that's his hive, standard hive.

280 IVAN: Okay.

281 SAM: And he's the guy who supplies me with the  
282 supers and brood boxes and frames and whatever so  
283 it doesn't make sense to try a different um, size.

284 IVAN: Okay, alright um.

285 DONOVAN: There's a bee meeting tonight isn't  
286 there?

287 SAM: Tomorrow. Ya.

288 DONOVAN: Is it tomorrow night in Bryanston?

289 SAM: Ya. Look on that thing it's the Bryanston  
290 Country Club.

291 DONOVAN: Bryanston Sports Club.

292 SAM: Is it the Sports Club?

293 DONOVAN: Ya.

294 SAM: It's the Country Club. They sport there, they  
295 play tennis and drink, yeah.

296 DONOVAN: Oh ok I thought it was just the Bryanston  
297 Sports Club. Ya it's quite, it's interesting to go cause  
298 you know you've got guys that have got like 700 hives  
299 you know they, they, it's a business.

300 IVAN: Yeah.

301 DONOVAN: And they scoop what is it, about eight  
302 tons a year?

303 SAM: Ya it's crazy.

304 DONOVAN: Or what is Keagan getting? Is it about 10,  
305 11 tons of honey a year.

306 IVAN: Shees.

307 DONOVAN: But that is like 700 hives hey. Um, it's a  
308 lot of work I mean they're-

309 IVAN: Yeah, they're, they're uh, migratory  
310 beekeepers, where they move around, take, take  
311 their hives to the, the farms.

312 DONOVAN: Well not, they've got generally areas  
313 where they keep them and then you know they will  
314 also do the pollination thing, so they will actually  
315 take a whole lot of them. But I think the majority of  
316 their hives are sort of all over the place. And then  
317 you expose yourself to a hell of a lot of problems,  
318 badgers and theft.

319 IVAN: Okay, cause.

320 DONOVAN: Cause where hives used to be painted  
321 white, because the bees like white hives, they now  
322 paint them brown and whatever because the Af's  
323 (Africans) see them in the veld and they see the  
324 white hives and they go and they just smash the  
325 hives and take the honey.

326 IVAN: Take the honey. Ya.

327 DONOVAN: It's like such a fruitless exercise.

328 IVAN: So they're camouflaging them to-

329 DONOVAN: So there's a lot of theft. Big, big problem.

330 SAM: Ya, in KZN you can't have hives anymore  
331 because they just get stolen.

332 DONOVAN: Ya theres that couple that had 37 hives  
333 or something, old, elderly, you know old couple.

334 SAM: Not like us (laughs).

335 DONOVAN: (laughs) not like us, older and they got  
336 held up and mugged and the people stole their hives,  
337 they had 37 hives.

338 IVAN: They got held up for their hives? Shees.

339 DONOVAN: Ya, the people got robbed and they took  
340 all the hives.

341 IVAN: That's crazy.

342 DONOVAN: And I think you'll see more, you know,  
343 it's like cars and hijacking, I think you'll see more,  
344 you know as the wonderful economy of this country  
345 goes down it'll be a bigger problem you know.  
346 Especially with the guys that have got you know,  
347 here having two hives in the back yard, fine. But you  
348 know anybody, like let's say you've got a small  
349 holding and you know, because you want to keep it  
350 out of the way you generally got your hives sort of  
351 the other end of you ten acre plot or whatever. But  
352 they all you know whatever they good people.

353 IVAN: Yeah.

354 DONOVAN: It's lousy but you know and then they,  
355 they just smash them that's the thing.

356 IVAN: Yeah it's-

357 DONOVAN: Take the honey and smash the hives.

358 IVAN: Yeah it's strange that they don't take the hives  
359 themselves as well cause they worth quite a lot of  
360 money.

361 SAM: Mhm some of them do.

362 DONOVAN: Ya they'll pick up the whole hive and take  
363 it. I think that thirty there where they took all those  
364 peoples hives they just took the whole hives and  
365 obviously they had planned for it you know. But

366 generally it's just smash the honey, smash the hives  
367 grab the honey and run. You know.

368 IVAN: Ya.

369 DONOVAN: What a mess.

370 IVAN: Shees it's terrible. Um, I must ask, do you have  
371 any other friends in Johannesburg that keep hives,  
372 in kind of their back yards?

373 SAM: Ya only people I know from the bee club, like  
374 Manfreds got like twenty.

375 DONOVAN: Ya, or what's his name down the road  
376 here.

377 SAM: He hasn't got any in his actual garden. Um.

378 DONOVAN: His bee hotel man.

379 SAM: Oh Paul.

380 DONOVAN: Paul.

381 SAM: Pauls bee hotel. His got, oh he must have.

382 DONOVAN: Ya his got hives in his hotel, ya. So his in  
383 his back yard got hives.

384 IVAN: And it's a hotel?

385 DONOVAN: No, he's got, cause he built a fancy thing  
386 for his hives you know.

387 IVAN: Okay.

388 SAM: His the joke of the bee community.

389 DONOVAN: They joke about Pauls Bee Hotel.

390 IVAN: Oh a luxury apiary.

391 SAM: Well he built a cement plinth, cause of the  
392 ants, and then he put poles with a sh, uh, tin roof.

393 DONOVAN: Ya a proper roof on it.

394 SAM: Ya cause they quite inventive the bee people,  
395 they always coming up with gadgets and things.

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396 IVAN: Ya it's fascinating.

397 DONOVAN: Ya there's quite a push for people to keep  
398 bees in, in suburbia you know. Um, and people have  
399 started keeping hives on top of rooves and on top of  
400 shopping, you know little like shops and flats.

401 IVAN: Where there's quite a big r, space.

402 DONOVAN: Ya there's quite a push actually, they,  
403 they, they. You go to the bee meetings and they  
404 actually kind of like encourage it-

405 IVAN: Yeah.

406 DONOVAN: I don't know, I think it's uh, you know, I,  
407 I think with bees uh, cause they the experts seeing  
408 how they're in touch with Department of Agriculture  
409 which doesn't exist anymore, but you know all the  
410 people that used to kind of you know, it used to be  
411 quit a, a wonderful thing. Um, you know they kind  
412 of like encourage and, and I think the idea is to get  
413 a lot more independent hives out there.

414 IVAN: Yeah, wel the, the project I'm doing, I'm doing  
415 my dissertation on a hive design but it's um, my  
416 lecturer his doing his doctorate in urban agriculture  
417 and they've got a project running in Soweto and in  
418 Johannesburg where their training and they're  
419 training people in the marginalised communities um,  
420 with skills to develop urban agriculture and um, they  
421 all have allotments of land, most of it in school yard  
422 and public, I mean um, government allotments of  
423 land and then they set up small farms and they train  
424 them in permaculture and horticulture. But then our  
425 department, we develop projects on um, the  
426 technologies and things like water pumps and  
427 mulchers to help them. Um, and also making them  
428 more accessible so either cheaper or easier to make  
429 themselves, and training them, or easier to, for  
430 them to use and figure out. SO they were pretty keen  
431 on getting a beehive going.

432 DONOVAN: Look you know if you look at  
433 Johannesburg hey, we're the biggest manmade  
434 forest in the world.

435 IVAN: Mhm.

436 DONOVAN: Um, and if people don't keep bees where  
437 do the bees go? You know, the bees what will only  
438 fly two and a half k's or three and a half k's.

439 SAM: Um, they can go, ya a couple of k's.

440 DONOVAN: Like they'll go further for water.

441 SAM: But there, I mean there've been a lot of  
442 projects on um, developing like yours, like yours you  
443 know, maybe not in an urban environment but  
444 there've been quite a few ventures in the past. And  
445 then they all seem to fizzle out and I'm not quite  
446 sure why.

447 DONOVAN: Ya, so, so the bees you know they, they  
448 haven't got any, they not structured so they get into  
449 people's rooves, they get into the top of robot poles  
450 (traffic lights) you know they're there with  
451 everything else and it's a hiding to nowhere because  
452 uh, the honeys not harvested and at the end of the  
453 day the landlord or whoever just says poison them,  
454 you know, kill the bees.

455 IVAN: Yeah.

456 DONOVAN: So I think they, you know, they seeking  
457 out, they...

458 IVAN: They're an important part of the-

459 DONOVAN: Cause bees are not dangerous, I mean.

460 SAM: They're flipping dangerous man, what do you  
461 mean they're not dangerous?

462 DONOVAN: Well because they're everywhere to start  
463 off with so instead them being in a, in a telephone  
464 pole and then a car hits the telephone pole you know  
465 then you've got a swarm of bees all over the place  
466 and you know you've got a problem. You know, if  
467 you've got a hive uh, and it's maintained or  
468 whatever then you know that's the way to go surely.  
469 So there's, there's a lot of encouragement, I mean  
470 living in the area of Johannesburg the, the amount  
471 of flora that there is. Um, you know it supports a  
472 huge amount of bees. So, obviously if its slightly  
473 structured it's not a bad idea.

474 IVAN: Ya the more hives there are then technically  
475 the, the less wild hives or wild swarms there'll be  
476 living in...

477 DONOVAN: They don't have happy ending you know-

478 IVAN: Ya.

479 DONOVAN: Cause they get smoked out and poisoned  
480 and whatever-

481 IVAN: Ya.

482 DONOVAN: So, and uh, I, I, I'm not sure what the  
483 public opinion is but I mean certainly from being part  
484 of the bee thing, you know it's not a dangerous thing  
485 to do providing you've got a little bit of, you know  
486 kind of...

487 IVAN: Knowledge about it.

488 DONOVAN: Ya, cause you can stop swarming, I mean  
489 there, there conditions that make the bees swarm.

490 IVAN: Ya.

491 DONOVAN: And if you don't allow those conditions to  
492 occur then its fine.

493 IVAN: Yeah, so would you say that's one of the most  
494 important things, is preventing the swarming.

495 SAM: Yeah, bee management, ya I'd say.

496 DONOVAN: Ya, cause that's what freaks the public  
497 out, that's what creates the wrong perception,  
498 that's what you know...

499 IVAN: Ya.

500 DONOVAN: All that sort of thing.

501 IVAN: But one or two bees-

502 DONOVAN: And that's not necessary. And a lot of the  
503 swarming bees are, are bees that are, I would say, I  
504 don't know you probably know more but if there's a  
505 swarm, they don't, it's not generally a hive that's  
506 swarming, it's probably a wild-

507 SAM: A swarm is just they, cause they split you know.

508 IVAN: Ya.

509 SAM: They get too big and then they split, and the  
510 young hive will go in a swarm.

511 IVAN: So it can be from a hive.

512 SAM: But they're not dangerous.

513 IVAN: If the hives become overpopulated.

514 DONOVAN: For sure.

515 SAM: Yes, ya. But they, when they swarm they're not  
516 actually dangerous, it, the dangerous bees are the  
517 bees that people drive into a tree or they open up a  
518 electrical box and they're in the box and then they  
519 go crazy. They destroy buildings and-

520 IVAN: But a swarm's kind of on it's own, on their own  
521 terms, so they, they less agitated.

522 SAM: When they looking for a new place to live? No  
523 they're usually actually quite docile. You can catch  
524 them.

525 DONOVAN: I've been caught in a hectic swarm.

526 SAM: They don't attack, they're just looking for a  
527 new home.

528 DONOVAN: Cause I, we had a big property over in  
529 Honeydew, Honey-Dew, it was called Honeydew  
530 cause the van Rensburg had a huge big honey farm  
531 there-

532 IVAN: Really?

533 DONOVAN: And that was like one plot away from us.

534 IVAN: Okay.

535 DONOVAN: And we only, we bought that property  
536 and uh, we moved on, we were there about three  
537 weeks and I just heard, it was a hell of a noise hey,  
538 I mean it's a noise hey.

539 IVAN: It's like a lawnmower...

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540 SAM: Really, it's more like a tornado.

541 DONOVAN: I mean and it's, it's just this black mass  
542 just came over the house, this swarm ya. And I was  
543 outside and they were, there's a couple of things  
544 about it. When, when you're inside a storm it's really  
545 hot ok. The bees make a lot of heat. It's hot and the  
546 second thing is when you're in, I mean when you  
547 can't see it's just black. It's noisy, I mean its really  
548 like a jumbo jet next to you hey. And uh, I just stood  
549 still I mean I thought ya let me, what else can you  
550 do?

551 SAM: (laughs)

552 DONOVAN: And I just stood still because they decide  
553 to attack you-

554 IVAN: Jump into a swimming pool.

555 SAM: No.

556 DONOVAN: Don't jump into water. Um, you know  
557 you're a gonner, so I just stood still and closed my  
558 eyes. And the heat and the noise, I mean they were,  
559 it was just this mass hey! And then they were like  
560 waaaarmm, and then they went over the house  
561 nnyaaarm, and then they came around and over  
562 the tree woraaamm. It was massive! And then a  
563 few, it was gone and It disappeared.

564 IVAN: And you didn't get stung?

565 DONOVAN: And I didn't get stung at all, ya.

566 IVAN: Wow.

567 DONOVAN: And they were taking honey out (points  
568 at SAM), and a bee came and buzzed me and then I  
569 ran away and I was waving my arms, fuck that bee  
570 nailed me.

571 SAM: (laughs).

572 DONOVAN: You don't wave your arms.

573 SAM: They, when they tryna swarm they, they not in  
574 attack mode, it's just when you disturb them they  
575 get really cross.

576 IVAN: Mhm, ya. And as long as you have the smoker  
577 going when you're inspecting the hive they're less-

578 SAM: In theory ya, no they go berserk, and actually  
579 whats interesting, you must make a note, is there's  
580 a lot of Aloes around here and apparently the pollen  
581 in the Aloes has an enzyme that makes the bees more  
582 aggressive then normal. So while those Aloes are  
583 flowering the bees are more aggressive then normal.  
584 And then they stop flowering or don't have access to  
585 them-

586 DONOVAN: Aloe also makes very nice honey.

587 SAM: (laughs)

588 DONOVAN: But the bees do get more aggressive with  
589 the Aloes.

590 IVAN: Do you think they, the bees themselves prefer  
591 the Aloe pollen-

592 DONOVAN: Ah they love it.

593 IVAN: and they, they get quite a competitive mind-  
594 set with the other bees.

595 DONOVAN: If you see there's a cactus, what's a  
596 queen of the night, a cactus?

597 SAM: It must be. It's-

598 DONOVAN: Have you ever seen a queen of the night?

599 IVAN: Mhm.

600 DONOVAN: Ya.

601 IVAN: Ya.

602 DONOVAN: Where they come up there's these big  
603 flowers-

604 SAM: Big flowers-

605 DONOVAN: very pungent, sweet smell, and the bees  
606 go absolutely berserk for them. I mean they, you  
607 can, it's so bad you can hardly see the cactus you  
608 know. And I'm talking about you know, not a little

609 thing in a pot plant. But I'm talking about a big fully  
610 grown-

611 IVAN: Fully grown one.

612 DONOVAN: Big fully grown one, ya. And they will,  
613 and I mean they just love it, they just... ya. It was  
614 just behind the house we had once and the fucken  
615 tenants chopped it down because the bees cam, you  
616 know, agh.

617 SAM: (laughs)

618 DONOVAN: And it takes that pour thing about-

619 IVAN: Twenty year old cactus..

620 DONOVAN: Ya about sixty years for it to grow that  
621 size.

622 IVAN: Shees

623 DONOVAN: And I mean when it flowers it's a  
624 magnificent thing, you know, but people destroy it.  
625 You know, oh-wa-wa bees, cut it down! It uh ya I  
626 supposed education is the thing really. I mean bees  
627 are a great thing, you know, because you know all  
628 the, the, first of all in the, the good old days honey  
629 had four different grades, you had whatever, and  
630 your choice grade was really good pure tested honey,  
631 everything. Hell then due to change of government  
632 they decided no all our honeys fantastic, there just  
633 can only be one grade of honey and that's called  
634 choice grade honey. So they import honey which is  
635 sugar water with the essensce of like two drops of  
636 essence of honey in it. I mean it's so bad that, that,  
637 that some honeys have only got like seven percent  
638 of honey in it. It's all choice grade.

639 IVAN: But it's the, the price of it's too competitive  
640 for our honey that we produce here-

641 DONOVAN: Ya.

642 SAM: Ya.

643 IVAN: Which is the problem.

644 DONOVAN: Ya, but it's all, all gets sold in the, on the  
645 shelves as choice grade honey, there's only one  
646 grade of honey.

647 IVAN: Ya.

648 DONOVAN: Which is really stupid because how do you  
649 protect real honey and whatever, so you get honey  
650 from Brazil, you get honey from Argentina, you get  
651 honey from China, you get it from all of that which  
652 is actually just rubbish.

653 IVAN: Yeah, I read that we producing about 2000 tons  
654 of honey a year and then we're importing another  
655 1800 to make up for the demand, but we could easily  
656 be producing about 5000, with hall the forage and  
657 the forna and flowers that we have, which is  
658 ridiculous.

659 SAM: Ya it's a nice hobby, our bees are very  
660 aggressive though. Cause there's a scale of  
661 aggressiveness and I think overseas bees are 2 and  
662 ours are 10. On a scale of one to ten.

663 IVAN: Ya. They say that's um, from the tradition of  
664 honey-robbing in Africa, so they've been bred to  
665 become like more protective of their hives.

666 DONOVAN: That's why you don't wear black  
667 clothing.

668 IVAN: Ya.

669 SAM: Ya, but they are, they, but they do get used to  
670 you. I mean they get used to, I mean they don't bug  
671 me, if I, like we can go out there and they're fine,  
672 they you know.

673 DONOVAN: Ya but then you get a gardener, a new  
674 gardener.

675 SAM: Oh god we had this gardener. Shame!

676 DONOVAN: And within ten seconds they get stung you  
677 know.

678 SAM: Ya but he was standing there waving his arms,  
679 and saying 'the bees are attacking me'. I said 'ya,  
680 stop do, just walk away and if you do this (waving

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681 her arms about) they'll go crazy'. And ya I don't  
682 know why...

683 DONOVAN: It's easy to see cause the beehives always  
684 got a couple of guard bees around, and when you get  
685 up and close and 'mrrrrmmmm' one will come and  
686 check you out a bit and carry on sort of pretending  
687 that he's sort of not really interested I you. And  
688 then, well, so you read the signs you see one has kind  
689 of like picked up on me and his seen me, you know  
690 and you kind of like stand there. But if you get closer  
691 you might notice like you know it comes again and  
692 gets a little bit more in your face and then goes  
693 away. You know so when you, you should read, if you  
694 see what's going on, and be in tune with it's easy not  
695 to get stung, it's actually difficult to actually get  
696 stung after a while, you know you actually have to  
697 kind of go looking for it.

698 SAM: Will your hive be used by women or men or  
699 both.

700 IVAN: Both.

701 SAM: Okay, ya.

702 IVAN: A lot of the, the farming co-ops are women  
703 and men.

704 SAM: Yes, ya. Ya cause they quite heavy to lift, the  
705 supers and things.

706 IVAN: Yeah that's one of the problems that a lot of  
707 beekeepers have said is like the weight of the hives  
708 is, or the supers.

709 SAM: Yeah, it is really heavy.

710 DONOVAN: Ya they're heavy.

711 IVAN: Ya.

712 DONOVAN: Ya but I mean I'm surprised you guys are  
713 not talking to the Southern Beekeeping Association.

714 IVAN: Umm, well I've been speaking to Hans from  
715 SABIO.

716 DONOVAN: Ya Hans.

717 SAM: Which ones Hans, oh that noisy guy.

718 IVAN: The, the older guy, he's quite, he's about..

719 SAM: He's quite..

720 DONOVAN: Yay a he's, he's quite, ya he used to be  
721 with, there's a guy called Keagan and he got offered  
722 a position in New Zealand to do major bee work,  
723 and, and bee business in New Zealand.

724 IVAN: Okay.

725 DONOVAN: And he went, him and Hans had the 700  
726 hives and were doing that sort of 11 tons per year  
727 and stuff.

728 IVAN: Ya, it's just for the research I've been tryna  
729 find people that are keeping hives in the city um,  
730 cause a lot of these guys are keeping a lot of hives  
731 but they're out on the farms and out of the city. So  
732 I'm tryna find-

733 SAM: Oh ya they are.

734 DONOVAN: But then Pauls a good guy to speak to-

735 SAM: Paul.

736 DONOVAN: cause Paul encourages people to keep  
737 hives in there.

738 SAM: Do you want his contact details

739 IVAN: Ya that would be great.

740 DONOVAN: He's a nice enough guy.

741 SAM: Ya, I'll have to send it to you. In fact you'll  
742 meet him if you go tomorrow (Southern's beekeeping  
743 meeting) you'll meet him cause he's one of the main  
744 members of the-

745 IVAN: Alright but let me, let me whatsapp him and  
746 tell him tha-

747 SAM: Oh I don't think he does whatsapp.

748 DONOVAN: While we talking about bees.

749 IVAN: Alright I'll, I'll maybe call him and tell him I'll  
750 be there.

751 SAM: I'll give you his phone number.

752 Off topic from 27:55 to 30:19.

753 SAM: And he's a main bee guy, he's got bee  
754 paraphernalia.

755 DONOVAN: Ya I think he's the, the, the treasurer of  
756 the Southern's Bee Association.

757 SAM: Ya something like that. You'll meet him  
758 tomorrow.

759 DONOVAN: Ya no their all very involved.

760 IVAN: Alright cool, um, I also wanted to ask uh, the  
761 last question, do you have any problems with  
762 neighbours ever? Having hives...

763 SAM: We once (laughs) at the old house which was a  
764 huge two acre property next doors a mirror image  
765 and they built Tuscan mansions double story. And  
766 one day the neighbour-

767 DONOVAN: Oh the electrician.

768 SAM: phoned me and said 'your bees attacked' us,  
769 and I said exsqueeze me? He said 'oh, your bees  
770 attacked us, we were putting up a light'. So I went  
771 to have a look and, his property was next our fence  
772 and the area that was the problem was on the second  
773 story right around the other side of the house and  
774 they were drilling in the wall and putting in a light.  
775 So my bees were next to a, sort of four meters wall,  
776 so there's no way those bees could see, how far away  
777 was it? Twenty meters around a cor, around a corner  
778 over a wall. So I said no they're not my bees (laughs)  
779 I don't think they were uh, I don't think, there could  
780 have been bees nesting in his roof or bees maybe  
781 even in the light fitting. But apart from that no, I  
782 mean that's, no I've never had a problem, I've  
783 never. But then I'm quite careful to site the bees.  
784 Obviously you must site them so they're not gonna  
785 be a problem.

786 IVAN: Ya.

787 SAM: Especially if you've got families living nearby  
788 or traffic, pedestrians, there are any sporting events  
789 or any kind of environment that's gonna agitate the  
790 bees, they do get agitated quite quickly especially  
791 when it's warm.

792 IVAN: Yeah.

793 SAM: But, well we got lucky, they were in a corner  
794 by a wall, so you can picture the wall was extremely  
795 high. We even had Telkom coming one day with the  
796 ladder. During the day right next to the hive and the  
797 bees didn't bug them at all so-

798 IVAN: Okay.

799 SAM: No, but I mean ya.

800 IVAN: Still be carefull. Take caution.

801 SAM: Ya.

802 IVAN: Cool.

803 DONOVAN: Ya, it's a rule of five meters, if you have  
804 one in your garden its five meters from your  
805 neighbours fence.

806 SAM: Yeah there are by-laws that govern how you  
807 must keep your bees.

808 IVAN: Ya, it's five meters from the wall and twenty-  
809 five meters from a uh, building.

810 SAM: Ok, yes so obviously we abide by that, but I  
811 mean I'm quite nervous, like we operate with  
812 caution with the bees.

813 IVAN: Okay. Um, and then the, in terms of how much  
814 honey the bees are producing um, do you ever-

815 SAM: I've got a picture.

816 IVAN: Do you ever have problems with like the  
817 amount of food available for the bees, do you ever  
818 need to feed them?

819 DONOVAN: Bryanston was lush-

820 SAM: Ya I must actually send you the picture.

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821 DONOVAN: you've got all of the, what do you call it,  
822 herbaceous borders around, so hey we got really nice  
823 honey, beautiful clear, very clear.

824 SAM: Tons.

825 DONOVAN: Beautiful honey. Lots of it. And I think  
826 from the move, cause we've only taken once here.  
827 They weren't, we got very little so we didn't take  
828 out before winter, we thought they needed it.

829 SAM: I'll send you the picture.

830 DONOVAN: You know cause a lot of the farmers, bee  
831 farmers, they will take all the honey and then give  
832 like a coca-cola bottle with a hole in it, sugar water  
833 for the bees for winter, oh no, that's not the way to  
834 go.

835 IVAN: Not so cool.

836 DONOVAN: Ya that's not so cool. You know so we  
837 didn't think there would be a lot of honey so we  
838 didn't take it.

839 IVAN: Ya.

840 DONOVAN: Rather let them get through winter.

841 IVAN: And get used to the area.

842 DONOVAN: Get through the cold and then see if we  
843 get a decent crop. I mean you know they...

844 IVAN: Alright.

845 SAM: Ya that one hive nearly died. Remember?

846 DONOVAN: Mhm.

847 IVAN: After the move? (Bryanston to Melville)

848 SAM: Ya, it didn't like the move.

849 End of interview 34:12.

Appendix E  
BK02

1 Saturday 8<sup>th</sup> August  
2 92 7<sup>th</sup> Avenue, Weltevreden Park.  
3 Transcription of interview of Tom Cain (Beekeeper)  
4 by Ivan Brown (Industrial Design Student, UJ).  
5 We met at 18h00, at Tom's house in Weltevreden  
6 Park. We discussed the reasons for the interview and  
7 my research problem. I informed him of the ethics,  
8 had him sign a consent form and began recording the  
9 conversation.  
10 TOM: Uh, it's the same throughout the world. Same  
11 here, same in the states. Slightly different in the UK,  
12 so it, it's gonna be difficult to introduce something  
13 radically different from whats already in use  
14 IVAN: Okay.  
15 TOM: Ya, um...  
16 IVAN: In terms of the, the dimensions and the size,  
17 and the, the frames?  
18 TOM: Um, I think if your stuff doesn't affect other  
19 people hives, then they're not really right. So that's  
20 why I think it's been standardised basically  
21 worldwide. Um, the same hives in Australia, New  
22 Zealand, here, USA, South America. It's the same  
23 stand, same thing. You'll see exactly the same thing  
24 all over the world.  
25 IVAN: Yeah.  
26 TOM: The UK is slightly different.  
27 IVAN: Is that due to the bee size? The size of the  
28 bees?  
29 TOM: Um, no. Not really. It, well you see it's  
30 actually easier to pick up, it's more user friendly,  
31 but for the humans rather than the bees. But  
32 otherwise it's basically very, very similar to what we  
33 use here. Ah, you might find that, ah, that's useful.  
34 I wrote that to a, in the... handy man magazine  
35 (Email copy of article written by TOM for a DIY  
36 magazine).  
37 IVAN: ok.  
38 TOM: Um, that's basically talking about beekeeping  
39 rules. But whether I... it's just for background  
40 information.  
41 IVAN: OK, thank you.  
42 TOM: I thought... they never used it but it was just  
43 research I think.  
44 IVAN: For an article?  
45 TOM: Mmm, well they asked and I gave them some  
46 information um, it was for an article that's about...  
47 beekeeping rules basically  
48 IVAN: OK.  
49 TOM: Oh I have to sign this, have you got, can I use  
50 your pen (consent form).  
51 IVAN: Yeah.  
52 TOM: (clears throat). Uh, I've done quite a lot of  
53 radio interviews, with ten different radio stations  
54 and two or three TV things, I've got a disk with the  
55 TV interview.  
56 IVAN: Recently or...?  
57 TOM: Well it was about three years ago.  
58 IVAN: okay. There's quite a lot of interest in  
59 beekeeping at the moment, in terms of the problems  
60 that are affecting the bees worldwide.  
61 TOM: Um, well ya um, me I sign here?  
62 IVAN: Ya, and...  
63 TOM: It's the seventh today isn't it?  
64 IVAN: Ya, 8<sup>th</sup> sorry.  
65 TOM: 8<sup>th</sup>.  
66 IVAN: Uh, that's anonymity, it's only if you don't  
67 want your name...  
68 TOM: Oh I don't mind.  
69 IVAN: And I have your telephone number and details  
70 so... Thank you. (papers shuffling) Uh you can keep  
71 that form it's got contact details on the back.  
72 TOM: So, uh, who do, who do you um, you report  
73 directly to these two.  
74 IVAN: Ya, to Chris Bradnum and-  
75 TOM: And uh Angus. So how far, how long have you  
76 been at UJ.  
77 IVAN: This is my fourth year. It's um, Btech is similar  
78 to an honours degree.  
79 TOM: Mhm, yeah cause I've got a grandson whose  
80 started in Pretoria University this year, but he's  
81 doing music so he has to travel there every day on  
82 the Gautrain.  
83 IVAN: Wow, I was doing an internship in Pretoria,  
84 during the, our, our mid-year break and I was taking  
85 the Gautrain. It's quite a-  
86 TOM: He gets on, well his mum and dad drive to uh,  
87 well, my daughter works in Illovo and she can't take  
88 him, his Dad works at Standard Bank and he was stay,  
89 in the building in Rosebank overlooking the station  
90 so that's working out fine, and it's quicker and  
91 better than driving there and back.  
92 IVAN: Ya.  
93 TOM: Okay.  
94 IVAN: Alright um, so how long have you been keeping  
95 bees for?  
96 TOM: Since 1966, which is like 48 years ago, 49 years  
97 ago ya.  
98 IVAN: Alright, and how did you get into it?  
99 TOM: I think it started when I was, the seed was  
100 planted in 1950 when I went to a, a school open day  
101 Quarry Bank High-school in Liverpool, where there,  
102 where there was a beehive on display, an  
103 observation hive, then there was a glass covered  
104 tunnel from the beehive through the window frame,  
105 and I was fascinated by watching the bees coming  
106 and going and running back along in, coming home  
107 with pollen on the back legs, alright, it's fascinating.  
108 Now that was 1950, fifteen years later I was then  
109 working in Manchester um, having moved from  
110 Liverpool being transferred to work there, and there  
111 a guy gave a talk, Mister RamsbotTOM, that's a good  
112 Lancaster name 'RamsbotTOM' (laughs) and he gave  
113 a talk about beekeeping and I just wanted to do this  
114 from then, and that was, that was 1965 and the  
115 following year 1966 I got my first beehive.  
116 IVAN: Did you do training courses?  
117 TOM: Yeah I went to um, they had a night school um,  
118 Rural Studies Centre in Duttering, Manchester, that's  
119 on the South side of Manchester, it was an evening  
120 thing, I can't remember if it was every week or once  
121 a month. But uh, Len Roster was a lecturer, he'll be  
122 long, he's dead now but he was good at explaining  
123 the basics of beekeeping. The good thing was they  
124 actually had beehives there cause it was a rural  
125 studies centre so it was a big old house with big  
126 garden. SO various aspects of agriculture used that  
127 place for their meetings, and uh I went there and  
128 learned the basics of beekeeping and then joined the  
129 Manchester Beekeepers Association, which was  
130 founded I think in 1898 or something and used to go  
131 to their regular monthly meetings and field days, like  
132 I've been out on one today.  
133 IVAN: Okay, and since then have you um, taught a  
134 lot of people or brought a lot of people into it?  
135 TOM: Uh, ya certainly more so here, in, so cause we  
136 came to live here in the 1980's initially for four years  
137 but then we went back to the UK, but circumstances  
138 changed so I came back here. So for the last uh, since  
139 1986 I've basically been based here and uh,  
140 increased my beekeeping activities, I had at the  
141 most ten hives in the UK but here I built up about,  
142 between 40 and 50 hives.  
143 IVAN: Wow.  
144 TOM: But I, but I do it on my own, and but that's the  
145 most that I can cope with, I don't want lots of one  
146 hive here, there and everywhere, but I've been in  
147 that situation a bit because people want a hive in  
148 their garden and want you to look after it uh, well  
149 you can do that cause you get most of the honey.

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150 IVAN: So that's what you do? You have-

151 TOM: Well most of my hives are on my own sites-

152 IVAN: Okay.

153 TOM: But I have about four which are at, single hives

154 in other people's gardens.

155 IVAN: In and around town here?

156 TOM: In and around town, suburban hives but uh, ya

157 like Old Ed's, ya various places. Usually with big

158 gardens not, not, you can't keep bees in high dense,

159 densely populated townhouse situations.

160 IVAN: Yeah.

161 TOM: Well you can but it's a bit risky, but I wouldn't

162 like to.

163 IVAN: Just to people and, and-

164 TOM: In close proximity, you need space, and bees

165 are like people in many ways cause some people are

166 good tempered and others are bad tempered it's the

167 same outlook. Some bees can be quite docile but

168 others can be quite aggressive.

169 IVAN: Mhm.

170 TOM: And you don't want aggressive bees where,

171 where people are.

172 IVAN: And, but even so the ones that you have in

173 town do you uh, try and minimise the, the kind of,

174 when you, when you um inspecting the hives do you

175 try and do it at night?

176 TOM: Well you have to choose the time of day uh,

177 where, generally I tend go in the afternoon because

178 if they are aggressive, because bees also have good

179 days and bad days and the weather conditions can

180 affect temper, the temperature of the hives, or if

181 there's a good honey flow, which is what beekeepers

182 say when the honeys coming fast, or I should say the

183 nectars coming in fast and they converting it to

184 honey. Um, then they tend to be less aggressive then

185 on a cold, windy day when there's nothing much for

186 them.

187 IVAN: Okay. And um, in terms of the sites where the

188 beehives are um, I saw one of the regulations say

189 that there should be a wall around the hives to guide

190 the bees to fly higher.

191 TOM: Yeah well that's uh, I can guarantee you that

192 the, the people that keep in suburbia generally are

193 not aware of the local rules, they vary from place to

194 place. But buy-in-large you need to be away from

195 the wall but sometimes it would be better if their

196 close to the wall cause that would force them to fly

197 high.

198 IVAN: Ya I think that the, the exact rule uh,

199 legislation is that the hive must be 1.5m away from

200 the wall, but the wall must still be around the hive

201 so that bees fly over it.

202 TOM: Oh okay well, I've seen things where it says 5m

203 away, away from the wall. So um, so they will vary

204 from municipality to municipality.

205 IVAN: Okay.

206 TOM: I can guarantee you the municipality won't

207 know what the regulations are and will have to look

208 them up. Uh, ya.

209 IVAN: But that's mostly for if a neighbour complains

210 or something.

211 TOM: Ya uh, suburban beekeeping can work but it

212 also can be problematic. Um and a lot depends on

213 the temper of that particular lot of bees and many

214 times people will not know bees have moved into

215 somewhere on the property, into a cavity or a, some,

216 some space until the gardener goes around cutting

217 the lawn and they don't like the smell of cut grass

218 (clears throat). It's not so much that, the high

219 pitched noise that they don't like either.

220 IVAN: The frequency-

221 TOM: I, I've had an experience where the guy was

222 cutting grass about a hundred meters away from

223 where I had a beehive, out in Honeydew. And he was

224 cutting the grass with a scythe and it wasn't making

225 any noise. The bees went for him.

226 IVAN: Okay, so-

227 TOM: It, it was the-

228 IVAN: It's the smell.

229 TOM: it's the smell of the cut grass, cause

230 instinctively if something, if an animal uh, breaking

231 their way through, through undergrowth uh, there's,

232 in many cases they will come across a wild bee hive

233 and perhaps trash it, whether it was a bear or

234 whatever it was, depending on what part of the

235 world. The disturbance near the hive where the

236 vegetation is disturbed, you know from the, it gives

237 off a smell then it agitates the bees.

238 IVAN: Okay, so your, the bulk of your hives are those

239 kept out of the city?

240 TOM: Ya, well the, the one site is in suburbia but it's

241 also next a, a big nature reserve and a, and the land

242 that it's on is a big piece of land uh, where the public

243 don't go, so it's private land and there's no public

244 access where the bees are. There's, there's a dead-

245 end, there's no through way.

246 IVAN: Okay.

247 TOM: So that's pretty secure, twenty hives there

248 and, and the other hives are In, are the far out in

249 Buffelspoort valley, out in that direction towards

250 Rustenburg there's a lot of fruit trees especially

251 orange trees out there so that, the orange blossom

252 flowers, the main month is October, or perhaps in

253 September, it's a bit late in October. SO you have a

254 period of six weeks where you have a good chance of

255 getting a good uh, crop from the orange blossoms uh,

256 early summer honey but I leave the bees that same

257 side. You take off the first crop of honey and then

258 you put empty supers boxes for the bees to put

259 honey in, but then later in summer you'll get totally

260 different honey from the same site.

261 IVAN: Okay.

262 TOM: Weather, weather permitting. People forget

263 that beekeeping's a branch of farming and it's

264 weather dependant.

265 IVAN: It depends on the rain and the-

266 TOM: It also depends on the rain twelve months

267 before because if there's, you get a good wet season

268 trees will put, grow quite a lot of new growth and on

269 that new growth the following year the flowers will

270 come. So what happens now, if it's raining now,

271 twelve months down the line that tree or those trees

272 in that area could produce abundant or more than

273 abundant normal number of flowers and it would be,

274 as long as the weather is good, that then as well as

275 later the bees could potentially get a heavy crop of

276 honey.

277 IVAN: okay, would you say the hives outside of the

278 city perform better than the hives inside?

279 TOM: Uh, no there, there's far more variety of

280 vegetation, mature trees, in the cities now,

281 certainly in the, if you look at Johannesburg the

282 inner suburbs are a hundred years old and there's

283 lots of huge mature trees, if you drive around

284 Houghton and places close to town there lots of

285 mature trees.

286 IVAN: Jacarandas and Bluegums.

287 TOM: Ya um, there, but it depends, cause in the

288 world in general a lot of intensive farming has done

289 away with hedgerows and they sprayed out weeds

290 that the-

291 IVAN: It's just monoculture.

292 TOM: Monoculture is good for bees, you might have

293 one crop, oilseed rape or conola, sunflowers erm,

294 onions, growers need bees to pollinate their onion

295 flowers for their, they've been growing for the seed.

296 So uh, it's a monoculture and the bees need like we

297 need, we need a variety of food, a good balanced

298 diet and if the bees don't get a balanced diet then

299 it's not good for the bee, the beehive and their more

300 susceptible probably then to diseases. If you get a, a

301 mixture of sources and pollen then usually their

302 healthier.

303 IVAN: So they almost malnourished if they base their

304 diet on one plant?

305 TOM: Well ya.

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306 IVAN: In terms of quantities, how much would you  
307 say you're getting from the hives?

308 TOM: Well it varies from year to year, I mean as I've  
309 said beekeeping's a branch of farming, it depends on  
310 the weather, and the rainfall, and if the flowers of  
311 where the bees are working are open you don't need  
312 heavy rain every day, you need nice sunny weather,  
313 not too windy um, so that the nectar is, is in the  
314 flowers and the bees can collect it. So uh, a good,  
315 strong hive you should be able to get two supers of  
316 honey. A super will hold perhaps twelve kilos of  
317 honey. So two supers, you're looking at getting  
318 twenty-five kilos from one hive.

319 IVAN: Per year?

320 TOM: Well, per year, that depends. Well honeys  
321 now, I sell my honey for R55 a kilo at the present  
322 time so it uh, it's a useful income and you can  
323 quickly pay for the initial outlay of buying a beehive  
324 and more frames and things that you need for the  
325 hive, and you gotta have the gear and equipment so  
326 you can carry on your beekeeping and-

327 IVAN: and grow the business.

328 TOM: Ya well, I mean the, the big guys employ lots  
329 of people. People like me with up to fifty hives  
330 (R68 000 per year) can manage on their own. But  
331 once you go much beyond that you will need help.

332 IVAN: Okay and then those guys are kind of, usually  
333 migratory and move their hives around?

334 TOM: Ya, I mean virtually all the big commercial  
335 beekeepers do migratory beekeeping because they  
336 get paid, I mean their income in many cases, I mean  
337 they've told me, some of the big guys half their  
338 income is from pollination fees.

339 IVAN: Renting their hives to the farmers?

340 TOM: Ya, well the farmers are fairly specific when  
341 they want the, the hives there. Uh, because that  
342 means loading the bees up at the end of the day uh,  
343 it's a night job and you may have to drive two or  
344 three hundred kilometres from where you've loaded  
345 and then you've gotta unload them when you get

346 there which is like at midnight or something like  
347 that.

348 IVAN: Shees.

349 TOM: Uh, and then you've gotta come back home.  
350 So, there, there's that, it's a hard working life, and  
351 not many of the local people are willing to do it. But  
352 a lot do because it's a job and jobs are scarce in any  
353 place.

354 IVAN: Ya, okay, and all of your hives, are they all  
355 Langstroth hives?

356 TOM: Ya, all my hives are Langstroth hives. Um, ya  
357 there's quite a good range uh, range of beekeeping  
358 books available.

359 IVAN: I've got the Blue Book.

360 TOM: Ya, the Blue Book, I don't, the Blue Book is, is  
361 really a book for, you really need after you become  
362 a beekeeper. But the one that's better is the one  
363 that's done by the Marchands. It's a guide to  
364 beekeeping, um.

365 IVAN: I've also got Beekeeping for All, that, that's.

366 TOM: That's the best one I recommend for  
367 beekeepers to use, beekeeping in South Africa.

368 IVAN: Okay.

369 TOM: They usually have a stock of those, and I think  
370 they're a hundred and eighty or two hundred rand.  
371 This, this is written for the new beekeeper,  
372 Dominique and Jenny Marchand.

373 IVAN: Marchand.

374 TOM: They, they've got a shop in Cape Town. Well  
375 they used to have a shop in Cape Town. I don't know  
376 if their still there. So I, I've had this, see it's a  
377 honeybee foundation product, but it, it's good, it's  
378 written for new beekeepers and it's very simple to  
379 uh, illustrations of various hives, there's a bit about  
380 the history of the, the different species of honey bee  
381 and the story about how the, the bees from South  
382 Africa were taken to South America in 1956 and that  
383 resulted in the aggressive African bees-

384 IVAN: 'Killer bee'.

385 TOM: Killer bees spreading around, because I think  
386 in this book it's got a, a diagram of the, how it  
387 progressed through South America and they-

388 IVAN: Yeah, I've got a diagram from last year that  
389 shows how it's spread all the way halfway through  
390 the United States.

391 TOM: Yeah so um, well then ya this is what I  
392 recommend people to read.

393 IVAN: Okay.

394 TOM: And then they progress to the Blue Book which  
395 is wonderful. I've got a whole collection of  
396 beekeeping books, lots of them of course were  
397 related to beekeeping in, in the UK and their quite  
398 dated now, cause some of them, a lot of them were  
399 written fifteen years or longer ago, most of the  
400 authors will be dead (coughs).

401 IVAN: And would you say the consensus is just that  
402 the Langstroth is the ideal hive?

403 TOM: I don't think anything is ideal, but it's proved  
404 to be practical for beekeepers all over the world.  
405 Um, and there's been some quite drastic new  
406 beehives, this, the people splitting the things and  
407 harvesting it without having to spin it but that's very  
408 expensive and I can't see, it's a gimmick in a way, it  
409 will work but it wouldn't be practical for big  
410 commercial farms, I don't think so.

411 IVAN: Ya, there's also a few issues raised about  
412 plastic and whether or not the, the bees take to it.

413 TOM: Well they don't like plastic hives, I mean  
414 there's a guy, in fact I've got to go and see him  
415 because his wife bought him this beautiful new  
416 plastic hive uh, white thing and it all fitted together  
417 and he, they weren't beekeepers and there was a  
418 little lot of bees living in the ground and they put  
419 the hive next to it and the bees didn't go in and they  
420 wondered why, and I said 'well they won't go in,  
421 they there, they made their home here, and their  
422 not gonna move from there into your hive which has  
423 got no wax foundation, nothing in it, doesn't smell  
424 like a beehive'. I said 'no' so I took the bees out and

425 put them into a little nucleus hive, but it was a tiny  
426 little small thing, but they absconded, they didn't  
427 stay for longer than a day so I've got to go back and  
428 see them, now spring is about to, to be here and they  
429 will want me to put, what I'm going to do is take an  
430 old catch hive, put it where they want the beehive  
431 to be, and when the bees go into my catch hive I can  
432 then show them how to transfer it, the bees into that  
433 plastic hive. We'll have to get some wax foundation  
434 and all that sort of thing. But I, I'm almost, I'll be  
435 surprised if the bees make their home happily in this  
436 brand new plastic hive. The manufacturers say  
437 they're going to make millions of these things and  
438 it'll bring prosperity to local communities-

439 IVAN: But they're expensive...

440 TOM: I know, they didn't ask, they, they didn't ask  
441 the bees 'do they like plastic?' and they don't.

442 IVAN: Ya.

443 TOM: Cause I mean a guy came uh, Andy Harding, he  
444 showed us the plastic hive about two years ago at  
445 the beekeeping meeting, and I asked him about six-  
446 months ago 'how are the bees doing in the plastic?'.  
447 He says 'they don't like it, they abscond'.

448 IVAN: Okay.

449 TOM: So in theory light weight, easy to handle-

450 IVAN: Hygienic.

451 TOM: Hygienic, well it's no good if the bees don't  
452 like it.

453 IVAN: Ya, and um, in terms of other hives um, and  
454 materials like clay or-

455 TOM: Well I think any, I mean before, long before  
456 the, Langstroth only discovered the, the, this  
457 moveable frame thing and Bee-space, that was the,  
458 he, he, his big discovery was the Bee-space.

459 IVAN: Mhm.

460 TOM: And that was only like a hundred years ago or  
461 something. So the bees for millions of years have

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462 lived in cavities, I mean, and the Egyptians put them  
463 into their, their pots.

464 IVAN: Yeah.

465 TOM: Uh, and put them on barges going up and down  
466 the river Nile. SO uh, ya they, they lived happily,  
467 stayed happily in natural materials. Use the words  
468 'Natural Materials' I think, which I would, I'd argue  
469 that pottery is almost a natural, it, they use, it's not  
470 manmade, it's just the use of clay or whatever it is  
471 they use and bake and the bees take to that.

472 IVAN: Okay um, and have you ever had any  
473 experience with other hive designs like the Top-Bar  
474 or the Warre?

475 TOM: Uh I've, I, I've been and opened Top-Bar hives  
476 uh, their very common in rural uh, East-Africa uh,  
477 because it's simple and easy to make um, you can  
478 sort of make one with your own locally obtained  
479 materials. So for rural communities that works. Uh,  
480 but it, it doesn't suit commercial beekeeping  
481 because it, it's not, the moveable frame hive, it's  
482 the moveable frame which is the big plus factor,  
483 because in Top-Bar hives uh, the bees will fix it to  
484 the Top-Bar and they may also fix it to the sides, the  
485 sloping sides. But it's not, it's more fragile to, to lift  
486 out. SO it's not nearly so easy to manipulate and look  
487 at so that you can determine the state of the hive,  
488 and whether there's any problems with the brood.  
489 And that's particularly becoming relevant now with  
490 the American Foulbrood in the, in the Cape. That you  
491 gotta be able to closely look and turn the comb  
492 round and it's not easy to do with a top bar hive.

493 IVAN: It's more easy to... break.

494 TOM: The things more likely to fall off. You can't,  
495 you can't, you gotta keep it vertical uh, you should  
496 keep it, a normal frame vertical and lots of people  
497 don't cause it's got wire support in it. Yeah so Top-  
498 Bar hives have a purpose in a rural community but  
499 not as a, in a commercial operation, you know what  
500 I'm saying.

501 IVAN: Okay, and the Warre hive, um?

502 TOM: I'm not familiar with the Warre hive.

503 IVAN: I think the, it's more about the system where  
504 instead of replacing the supers from the top, you  
505 replace from the botTOM and the idea is that the  
506 bees will move the brood downwards, and you will  
507 be able to harvest the supers from the top-

508 TOM: I'm not familiar with that.

509 IVAN: and you keep adding empty ones at the  
510 botTOM.

511 TOM: Oh I, uh that's a, that is a system I'm not  
512 familiar with, I mean I haven't done that. I always  
513 put my supers on the top. Uh, I will sometimes  
514 harvest honey from the brood chamber but,  
515 especially perhaps now, when you're doing your  
516 spring operation if they, you won't find it this year  
517 because it was such a poor year last year, there  
518 could be too much honey in the brood chamber left  
519 over from last year and there's not enough room for  
520 the queen to lay. So you want to give her more space  
521 so you can take out honey from brood frames in a  
522 situation like that and replace them with new  
523 foundation because the queen needs more space. If,  
524 if not new foundation good old empty comb so the  
525 queen can lay and uh, the population of the hive will  
526 start to increase which they need in the early  
527 summer. Plenty of foragers.

528 IVAN: Okay, and in terms of pests and diseases in this  
529 area what would you say are the biggest problems?

530 TOM: Uh, I, I'm not bothered with pests and diseases  
531 in my beekeeping operations, um any beekeepers  
532 will tell you that wax-moths are a problem but that  
533 really is a, it's really directly reflecting the  
534 management, or mismanagement or storage of your  
535 equipment. When you've extracted the honey um, in  
536 the summer there's two wax moths, the smaller one  
537 and the big one. The bigger one, the larvae of the  
538 big one can destroy honey combs very quickly uh, so  
539 you um, that's the biggest problem to me is  
540 controlling the h, the storage of your empty supers  
541 over winter. It's alright In the middle of winter cause  
542 it's very cold, and the wax moths aren't active. Until  
543 the temperature drops you've gotta be very vigilant  
544 in checking, and I use uh, wax moth crystals. Lots of  
545 beekeepers do, uh some people may argue that  
546 that's not good for um, the flow of your honey in the  
547 following year but it's been a practice, it's been

548 going on for over a hundred years and as far as I know  
549 it hasn't had any negative effects on my honey.

550 IVAN: Okay, and um, I know some people say that  
551 it's just better to harvest the wax as well to avoid  
552 that entirely and let the bees reproduce the, the  
553 comb the next year.

554 TOM: Well when you uncap, well when you uh, I  
555 wouldn't agree that to harvest the whole frame, I  
556 mean the, they were talking today about uh, a brood  
557 frame you should use perhaps for up to four years as  
558 long as it's in good shape. But generations of bees  
559 being hatched out of the uh, the cell, each one  
560 leaves behind a uh, a cocoon. It's very, very thin,  
561 but in time that cell will get smaller. So it's good  
562 practice to replace all the brood frames say every  
563 uh, use them for up to four years. But beyond that  
564 so you should have a routine in the spring time like  
565 now, I'll open my hives, which I haven't done yet,  
566 I'll do it around the middle of August. Um, and taking  
567 out two brood frames and replacing them with new  
568 sheets of foundation, or half sheets of foundation,  
569 so the bees, it gives the bees something to do and  
570 uh, then you have decent quality frames which uh,  
571 cause one thing you don't want is crooked frames,  
572 and if you're, if some new beekeepers they, you  
573 should have ten frames in brood trap uh, in a brood  
574 box, you only put nine. The spaces are too big and  
575 then you're likely to get the bees building the comb  
576 across from one frame to another and that makes the  
577 management difficult.

578 IVAN: Impossible.

579 TOM: Difficult. You then have to sort of scrap them  
580 and that's a waste of time and energy on the bees'  
581 behalf. So if you get them nice and straight uh, ten  
582 frames in the hive, and keep them straight then it's  
583 much better.

584 IVAN: Okay.

585 TOM: I inherited a couple of hives and they were a  
586 total disaster cause the guy didn't know what he was  
587 doing. Or maybe his, they may have been vandalised  
588 it may not have been his fault. But there was only  
589 about five frames and there's comb here, there and  
590 everywhere and yes there was a colony of bees but

591 it wasn't manageable. Or not easily manageable and  
592 it was a huge problem.

593 IVAN: Is-

594 TOM: Cause you don't want to waste a lot of time,  
595 you want to be able to do, look quickly and not spend  
596 half an hour trying to sort problems out.

597 IVAN: Is colony, I mean uh, vandalism and theft a big  
598 problem?

599 TOM: Uh, well it is, that's the biggest problem,  
600 vandalism and theft. Um, so I mean I, I got some  
601 hives from a guy that had stopped beekeeping, they  
602 were painted white and you'll see lots of  
603 photographs of beehives painted white but they stick  
604 out like a sore thumb.

605 IVAN: Mhm.

606 TOM: But I, most of my hives are not painted they, I  
607 used to use Creosote but that's now not in favour, so  
608 I use Waxol or paint the hive, paint the hives either  
609 green or brown so they're not visible at a distance.  
610 When some potential vandal, he would see a line of  
611 white ones but he probably won't notice ones that  
612 are the same colour as ground, or in winter the  
613 brown earth.

614 IVAN: Yeah, okay so it's mostly just camouflaged to  
615 prevent it?

616 TOM: Well ya and also you, you put them, if there's  
617 anywhere where you can put them where they were  
618 not visible from passing public is the secret. Um,  
619 fortunately most of my hives are in, on plots of land  
620 which are away from uh, where there's a lot of  
621 people living. SO there isn't, it's uh, fairly secure  
622 land so I haven't experienced problems with  
623 vandalism myself, only minor issues which haven't  
624 been a problem. They big problem I had was honey  
625 badgers. Honey badgers in the Buffelspoort valley,  
626 five hives were trashed there last year and all the,  
627 there were no bees left. The, the frames were  
628 scattered around for about fifty meters away from  
629 where the hives were. The beehives themselves  
630 were okay, but the frames were broken, some of  
631 them I could repair, but the bees were gone. So you  
632 have to, I've now got single pole stands, high up,

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633 there's at least, at least about a meter and a half, I  
634 have to take a little ladder because once you start  
635 putting supers on you can't reach them from  
636 standing on the ground. But you've gotta have a  
637 single pole so the honey badger cannot climb up. So  
638 it has to be more than a meter off the ground.

639 IVAN: Yeah.

640 TOM: So that's what I've done and it seems to work.

641 IVAN: And um, ants? Do you have a problem with  
642 ants?

643 TOM: I've never had a problem with ants um... Oh I  
644 did, on one site, I must tell you about that, on one  
645 site which there was a beehive I was looking after  
646 for somebody else, there was huge ants, big ants and  
647 the hive was on the ground and I went in the spring  
648 about three years ago, and when I got there was no  
649 bees in the hive and I'll not exaggerate but there was  
650 a shovel full of gravel on, in, on the botTOM floor of  
651 the hive which had been taken in by the ants.

652 IVAN: Shees.

653 TOM: No they were big ants, I've actually taken hives  
654 back to that same site three months ago and I put,  
655 put them on four, the two hives on a four legged  
656 stand, and I saw the ants there, big ants, so what I  
657 did was I put the legs into tins with oil in, in the tins  
658 to stop the ants, hopefully, climbing up into the  
659 beehive. But they were on the ground before so they  
660 were vulnerable. But hopefully now I've made them  
661 secure.

662 IVAN: It seems like the moat, the moat of oil is a,  
663 the um, solution for most people.

664 TOM: Ya.

665 IVAN: Okay.

666 TOM: What else can I tell you?

667 IVAN: So you say standardisation is like, the most  
668 important, kind of aspect of hive design?

669 TOM: I think so, and it's no point having lots of new  
670 designs um, when you've got the usage of beehives

671 runs into millions of people, in Africa, all over the  
672 world and it's going to be difficult to bring out a new  
673 design uh, which may have good points about it  
674 which the beekeepers will be in favour of but you're  
675 not going to change something, unless there's  
676 something very obviously better and I cannot  
677 honestly see that you or anybody else can design a  
678 beehive which is gonna be better than, than the  
679 existing ones in use, that is basically the uh, see I'm  
680 getting, my memory is a bit bad, then the uh, the  
681 one we use. The Langstroth hive ya.

682 IVAN: Yeah, well I think the, the aim, the goal is to  
683 make a more accessible hive in terms of cost and  
684 usability and to assist in kind of the initial, or  
685 beginning stages of beekeeping for these people.

686 TOM: Ya, well I think catch hives, well Mike Miles,  
687 the guy that was, was there today, he's got um, a  
688 cheap one, have you seen it?

689 IVAN: The cardboard one?

690 TOM: Ya the cardboard one. Well that is only short  
691 lived thing, it, it's not designed for long term use,  
692 but at least it catches bees and then they can-

693 IVAN: I, I was talking to Edward van Zyl-

694 TOM: Oh Eddie, yeah.

695 IVAN: About, he's quite keen to make one, a more  
696 durable but still cardboard, catch hive. So either  
697 with a plastic, kind of vinyl cover on one side, which  
698 is quite an interesting thing.

699 TOM: Ya well Eddie's, he's a commercial beekeeper  
700 and I mean for years, his brothers the one doing the  
701 talk the other day. Ya so he's a forward thinker  
702 Eddie, but he uses the same hives as everybody else.  
703 If you come up with a design that the beekeepers  
704 think is great you'll become a millionaire.

705 IVAN: Well I'm more in it for the bees than the  
706 money.

707 TOM: (laughs) Well ya, it, it's good to know that the  
708 uh, people are looking at the beekeeping industry  
709 and uh, I mean not only you but other people that  
710 come up with these, these new plastic designs. So

711 something should come positive out of it in the long  
712 run, so I don't quite know what but uh, nothings  
713 perfect and everything can be uh, improved, but I  
714 think you've taken on a difficult task. Good, good  
715 luck.

716 IVAN: (laughs) Yeah, my-

717 TOM showed me his honey processing room and his  
718 garage workshop before I left.

**Appendix E**  
**BK03**

1 Thursday 14<sup>th</sup> August  
2 107 Eerste Laan, Randfontein.  
3 Transcription of interview of Commercial Beekeeper  
4 by Ivan Brown (Industrial Design Student, UJ).  
5 I met BK03 (anonymity requested) at the Southern  
6 Beekeepers Association meeting and he invited me  
7 to come and see his operation. BK03 and his brother  
8 have about 3000 beehives in the Low-veld and High-  
9 veld areas of Gauteng, the North-west and the Free-  
10 state provinces.  
11 We met at 09h00, at BK03s's house. We talked about  
12 beekeeping and hives for about 30 minutes before I  
13 was given a tour of the workshop and honey  
14 processing plant.  
15 BK03: Yeah, good for insulation and things like that,  
16 but I think it's better (speaking about plastic hives).  
17 IVAN: Ya, and a few people have mentioned that um,  
18 there's problems with condensation inside um,  
19 plastic hives.  
20 BK03: Yeah that is normal.  
21 IVAN: And also ya the cost of it.  
22 BK03: Yeah cost, that's a big factor, condensation  
23 you can just put a small opening at the top and it  
24 will come out, that is not a, a big problem.  
25 IVAN: Okay.  
26 BK03: I've got a, I'll show you what I want to do  
27 (cardboard trap hives), but that, that is cheap, but  
28 it's like, it's for, it won't last years and years, it will  
29 last two or three years and then it will, will, will be  
30 finished. I'll show you my trap hives that we use but  
31 I would suggest to you, if you could just stay, don't  
32 reinvent the wheel.  
33 IVAN: Mhm.  
34 BK03: Unless you really have something  
35 revolutionary because there is so many beehives  
36 designed and things and built and everybody's sort  
37 of saying this is the best) and that is the best and  
38 things like that. My honest opinion is it becomes too  
39 expensive to, to uh, uh, reinvent the wheel. Because  
40 you can't get the equipment everywhere, maybe  
41 um, I did, did mention it to you about extractor  
42 machines because that is expensive you know. Ok if  
43 you don't extract it you lose honey, you lose  
44 probably 10 or 15 percent, but maybe it makes up on  
45 the wax.  
46 IVAN: That's if you just sieve and...  
47 BK03: Ya just plain sieve and drain and you put, just  
48 put a normal uh, 70 or 100 watt globe close to it but  
49 not too close, you know so that it just drains it  
50 properly.  
51 IVAN: Okay.  
52 BK03: Not too thick. Then you can get the honey but  
53 then you must mark it, ok you can mark your honey  
54 where you want to, you can either mark it as raw  
55 honey or you can sell it to somebody like me.  
56 IVAN: Okay.  
57 BK03: That will process it further but the uh,  
58 extracting equipment is very expensive.  
59 IVAN: Well um, in Joburg I've spoken to a few people  
60 that have hives in their gardens. Just one or two and  
61 then they have a beekeeper that will come uh, two  
62 or three times a year and swap out the supers for  
63 them and extract the honey and then he charges  
64 them-  
65 BK03: A fee for that. That is in Southern um, there  
66 is quite a few guys that are doing that.  
67 IVAN: Yeah.  
68 BK03: You know but you need to be friends with the  
69 guys.  
70 IVAN: Yeah.  
71 BK03: Cause they, they don't do it for everybody.  
72 But, but you can do that, that is a option but for,  
73 with a, American Foul Brood that's coming I uh,  
74 rather go for cutting the comb and putting the same  
75 frame back. Or a small extractor and extract the  
76 honey there.  
77 IVAN: On the site?  
78 BK03: On the site that you know the, the, the supers  
79 go back on the hive where they came from.  
80 IVAN: Yeah. So you're not swapping-  
81 BK03: But the moment there are three or four or five  
82 separate sets so the possibility is there of spreading  
83 the disease. I spoke to the beekeepers yesterday in  
84 uh, in uh, in the Western Cape uh, some of them  
85 have already destroyed quite a few hundred hives.  
86 IVAN: Shees.  
87 BK03: You know the, the one specific guy I spoke to  
88 yesterday he, he's already destroyed 150 hives and  
89 he says himself it's going to spread because of the  
90 system that is used where you go out and you take a  
91 hundred or seventy supers off, you extracting, you  
92 take it back. So you can, can uh, but it's up to you  
93 what, what you...  
94 IVAN: Yeah. Would you say that the diseases and  
95 bacteria like that is spread as well from moving their  
96 hives around to farms for pollination?  
97 BK03: It can yes, you see what happens is on, on  
98 pollination your bees now normally breaks down to a  
99 very small swarm, and that swarms can be robbed  
100 out. Or what happens is you lose the swarm, you  
101 know you, you whatever the reason is and the, the  
102 hive gets robbed out. Then the, the feral bees in the  
103 other hives and things go into that hive and they rob  
104 the-  
105 IVAN: Take the honey.  
106 BK03: They, ya collect the honey and then you can,  
107 that is definitely a, a project. But I don't think on  
108 urban beekeeping that'll be-  
109 IVAN: Yeah.  
110 BK03: for you. Uh, you must interrupt me if I'm not  
111 understanding or if I'm going in a direction that I  
112 don't think you want to go because urban  
113 beekeeping I c- uh what I can see is maybe five or  
114 ten beehives per person. On some holding or some  
115 open vacant land and farms in, in the city and then  
116 he can collect honey there. He'll never be able to  
117 make a living out of it unless his a real go-getter, you  
118 know, that he can really move around-  
119 IVAN: and have-  
120 BK03: various sites-  
121 IVAN: five or six different hives.  
122 BK03: and things like that. The benefit he will have  
123 is there's always food in the city. There's no, winter  
124 and summer, no there's not really a off season.  
125 IVAN: Okay.  
126 BK03: The other benefit he will have is he won't have  
127 to move his beehives.  
128 (Ed was called away for a moment by one of his  
129 staff).  
130 BK03: Okay shall we start.  
131 IVAN: Um, ya I'll just start off with how long you've  
132 been beekeeping for?  
133 BK03: 35 years.  
134 IVAN: And how many hives do you have at the  
135 moment?  
136 BK03: At the moment uh, I have only 55 now, but I've  
137 given my other hives to my brother that's about a  
138 thousand-four-hundred so he's farming that now.  
139 IVAN: How many hives does he have in total?  
140 BK03: In total he should have close to three-  
141 thousand.  
142 IVAN: Wow.  
143 BK03: So it's quite a big operation.  
144 IVAN: Okay, and are they all kept together?

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145 BK03: No, no, no various sites country, from Tzaneen 180 BK03: Look man I was a young guy, I used to get 220 nice about this is it's trap swarms, small swarms, not 259 Randfontein here just down the road there, there's  
146 to Free-state to North-West. You know you need a 181 about forty to fifty kilos per annum... 221 production swarms. Sorry I must answer that now, 260 a women, the agricultural department approached  
147 hell of a lot of place to put the bees. 182 IVAN: From a single hive? 222 my wife have gone (gets up to answer phone). 261 me I must now help her to, to set up the thing. So I  
148 IVAN: Okay. 183 BK03: From a single hive but in my batches of, of uh, 223 BK03: In everything in life you must just remember, 262 said to her okay lets do this and this, I'll come, this  
149 BK03: There's quite a lot here in the Carletonville 184 a thousand plus beehives so that was very good- 224 with everything in life there is guys that makes it, 263 is what you must do and what you must do here.  
150 area if you want to look at that. 185 IVAN: Wow. 225 guys that live on it and guys that flop off it. Doesn't 264 When you get there again nothing is done, they want  
151 IVAN: A lot of your hives here? 186 BK03: I think it was very good. (coughs) So I made a 226 matter what, it doesn't matter what the only thing I 265 you to do it. Up here just on the other road there,  
152 BK03: Ya look it's my hives his just farming it for him, 187 very good living out of it because I was selling my 227 can say to you is don't think you're going to make it 266 close to the piggeries they've actually sponsored this  
153 so the 55 that I'm doing now is just to keep busy 188 own, own product to a factories and a bottle- uh, to 228 in bees if you're not crazy, the, the passion that you 267 lady, they gave her beehives, they gave her the  
154 again. Cause what happened is I've sold my business 189 the shops and things like that. So I made a very good 229 have for it, you must be willing to well, get divorced. 268 extracting machines, and she's sitting in a site where  
155 and I got a trade restriction on me so I can't really 190 income out of that. With the various diseases and the 230 IVAN: (laughs). 269 she can put about fifteen, twenty beehives that you  
156 sell honey and on small scale I can sell but not, I'm 191 things that came in like the Capensis bees, 231 BK03: For, for your passion- 270 don't have to move, but you know... it's work, it's  
157 may not go into the shops and things like that. 192 etcetera... With the new varieties of, of plants that 232 IVAN: Yeah. 271 work.  
158 IVAN: Okay. 193 they brought in production dropped. I think currently 233 BK03: and it is hard to say that but, that is what 272 IVAN: Yeah.  
159 BK03: So uh, that's why I've got time. Okay. 194 I think you, you'll get about thirty, thirty-five kilos, 234 passion is about and I think a hell of a lot of other 273 BK03: People prefer animals you know, that they can  
160 IVAN: So at the moment you're working on projects 195 if you're a good beekeeper. If you're a good 235 industries it's similar. 274 chase to the kraal, that they can chase out, that type  
161 for bees? 196 beekeeper, that's about it because the citrus is 236 IVAN: Yeah, it was quite interesting, I did a talk at 275 of thing is how they think and bees are not like that,  
162 BK03: Ag just for myself. Specifically yeah, how to 197 basically gone, you get maybe seven kilos, maybe 237 the farming school that they run at the, the campus 276 bees are uh, intensive work when you work. There's  
163 uh limit the spread of, of AFB and how to make a 198 ten kilos because of the poisons and the spray 238 in Soweto. Or I just gave a presentation on what my 277 lots of off sh- uh, off seasons, lots of time off seasons  
164 beehive more profitable. 199 programs that farmers use and new varieties that 239 projects about and I said 'if you're interested come 278 that you can do other things to make your hives  
165 IVAN: Okay. 200 don't need bees, that type of things. 240 up and speak to me afterwards' and like a lot of 279 better and make your project better, I think I've said  
166 BK03: On small scale. That's what I'm looking at. 201 IVAN: So it, it's not worth pollinating citrus? 241 these guys came up to me and they were like 'man I 280 that, but you don't work all the time. But when you  
167 Cause I, myself I just want to, to keep about 200 242 love bees, it's like my dream to have a beehive but 281 need to work with the bees it must be done. Not two  
168 hives and see what the production can be on that. 202 BK03: No for me it's not uh, and also with the 243 I just don't know how to do it, or I don't know where 282 days later, it must be done within the, there is, there  
169 IVAN: And do tests on the- 203 Capensis bees now, you'll go to the citrus, if your 244 to get a hive'. And they, a lot of them said like they, 283 is a limited time cause the flowers don't wait.  
170 BK03: Ya, what, whatever comes along on that uh, 204 bees go Aloes, Citrus, then you'll have to start 245 when they were growing up in Limpopo or Venda 284 IVAN: Okay.  
171 that uh, that I can do on the Varroa's and on the 205 destroying them. 246 they had bees living in like their roof or in the tree 285 BK03: And the swarming season it never waits. Lie  
172 American Foulbrood and- 206 IVAN: Okay. 247 next their house and they were just like fascinated 286 now it's swarming season, your bees must be ready  
173 IVAN: Okay. 207 BK03: You've lost it, and you lose about seventy 248 by it. 287 now, you must, your hives must be ready. But I'll go  
174 BK03: on, on the, but basically what I want to see is 208 percent of your bees there, so it's not worth it to... 249 BK03: Ya. 288 and show you.  
175 what is more, which is the most profitable way to 209 IVAN: To move your hives to the Aloe fields or the 250 IVAN: So. 289 IVAN: Okay.  
176 farm with one beehive. What, what income can I 210 citrus. 251 BK03: There is that, that is, you're beginning to find 290 BK03: Okay.  
177 derive from one beehive. 211 BK03: No, no, Aloe fields may be okay. I'm 252 the guys that, that is not scared for bees, or can live 291 IVAN: That's interesting, um, so you've worked with  
178 IVAN: Typically what kind of income would you say 212 experimenting with that now. I've got bees in the 253 with bees. That, that is your, your beginning that you 292 a lot of beginner beekeepers over the years?  
179 you get from one beehive? 213 Aloes now that uh, uh if you're interested two 254 can. But uh, the problem is people are desperate 293 BK03: I've worked with quite a few.  
214 weeks' time I'll go and check how they, how they've 255 and... 294 IVAN: Do you have uh, any kind of specific things that  
215 done. I've seen, I put them now so uh, I'll see. But 256 IVAN: Mhm. 295 they struggle with that you've noticed?  
216 that's only about thirty-three hives, but it is plainly 257 BK03: And they will grab at any opportunity to, 296 BK03: The, the first thing if people have never been  
217 experimenting to see if I bring them back from, from 258 which they think they can make money. In 297 trained to work with, when I do beekeeping I train  
218 the Aloes to the bl- uh, Blue-gum trees then uh, 298 that person to make a beehive, and there's very few  
219 what, what uh, production wise what will. What is

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299 people that's got that skills, but they can actually	339 work and that doesn't work, it works, it is a good	375 If you put the super on top they go up, but that going	413 IVAN: Okay.
300 buy the beehives, and then after that it is just uh, in	340 size for our bees.	376 down it's not easy to get them to do it.	414 BK03: That's how I've got it.
301 the uh, people must endure you know they must uh,	341 IVAN: Okay.	377 IVAN: Okay.	415 IVAN: And you use queen excluders?
302 how can, how can I put it. They must continue on	342 BK03: Okay.	378 BK03: So I wouldn't, my, my opinion.	416 BK03: No.
303 with the thing, because its night work, I don't work	343 IVAN: The size you're talking about, the frame size	379 IVAN: Okay.	417 IVAN: You don't?
304 with the, especially urban beekeeping you can't	344 and the bee-space.	380 BK03: It doesn't work.	418 BK03: Queen excluders work the problem is uh, a
305 work during the daytime. Its night work and people	345 BK03: The frames size there's obviously controversy	381 IVAN: Part, part of the idea behind it was that you	419 queen excluder nowadays costs about ninety rand
306 don't like it. It's just one of those enterprises that	346 cause our bees is smaller.	382 replacing the brood frames as well to keep	420 and it damage very easy. So uh, just out of a damage
307 people don't, the hours is not conducive to social	347 IVAN: Yeah.	383 refreshing the, the comb and you, you mentioned	421 uh, viewpoint I never use.
308 life, so lose a lot of social life on beekeeping. But	348 BK03: Some people use eleven frames and some guys	384 that you, you just replace two or three frames per	422 IVAN: Is that if the wire get bent?
309 otherwise I don't have any problems with the people	349 use ten frames. I've never used uh, had a problem	385 year...	423 BK03: Ya they get bent or you know people put them
310 of understanding the bees and things like that. That	350 with what size I use the ten or eleven, that's because	386 BK03: Ya I, there's various systems, you were, you've	424 on skew or whatever it is just too much damage and
311 is fairly easy and when it comes down to, to uh,	351 they both work. Uh, but for me it is just uh, the	387 been at that meeting, you see, guys that said to you	425 my viewpoint is also the bigger the swarm the more
312 understand the plants, the seasons of the plants and	352 extracting size, the size of the hive the bees like that	388 put in two.	426 honey you get. Cause the bees when they start
313 things, that is what people don't understand,	353 size of hive, you can expand it to get up, up and	389 IVAN: Yeah.	427 breeding in your supers, when the season starts
314 because they don't understand it's seasonal.	354 down as you need it. It's a practical hive, that's why	390 BK03: For me uh, there were, there were, easiest	428 coming the queen goes up, but a season I normally
315 IVAN: Mhm.	355 I use it.	391 way to work with things is I work from left to right,	429 about a month, maybe two months long and that first
316 BK03: They think it is you take honey off all the time	356 IVAN: Okay, that, the expansion, I asked you about	392 I take one of the frames uh, a good frame I put it on	430 three weeks she might go up to lay eggs and then she
317 and that's not like that, it's seasonal. That is the	357 the Warre hive uh, last week.	393 the side and then I put two frames next to it, empty	431 will, they will force herself down. The uh, the
318 biggest thing to, to teach people.	358 BK03: Uh, what hive?	394 frames. And then I just work it through all the time.	432 disadvantage is you can't use that comb for, for uh,
319 IVAN: Okay.	359 IVAN: The Warre hive, it's the same as the	395 IVAN: Okay.	433 uh comb honey, you must use it for extracting.
320 BK03: For me, that uh, that's a problem that I had.	360 Langstroth-	396 BK03: For me it works because I can remember it, I	434 IVAN: Okay.
321 IVAN: Okay that's interesting. Um, and um, the	361 BK03: Ya, ya.	397 don't have to look at every frame and check every	435 BK03: You must extract that honey because you,
322 beehives that you've used, do you just use the	362 IVAN: It's just you replace the supers from the	398 frame and things like that. Obviously you'll have to	436 because the queen had laid the eggs there-
323 Langstroth hive?	363 bottom.	399 check sometimes for the drone brood cause you	437 IVAN: Cause there's a cocoon.
324 BK03: I've used a uh, up till now I've used the	364 BK03: I've found that our bees, uh I can, if it's still	400 can't have too much drone brood in your hives and	438 BK03: The cocoon and things. But the benefit is the
325 Langstroth hive, now I'm experimenting with quite a	365 here I'll show you, but I've found that when we have	401 if you've transported hives with uh, watch out for	439 strong comb. So but, but for me, never used a queen
326 few things. I use the Top-bar hive, I use the Top-bar	366 bees from the top they don't like working to the	402 breakage cause uh, fresh uh, fresh combs normally	440 excluder.
327 hive with frames, I use it uh, just the hive with just	367 bottom, they like working to the-	403 break but it's just your system that you work with.	441 IVAN: Okay, but wouldn't it be easier for beginners
328 the, call it maar top bar. I'll show you there my	368 IVAN: Upwards?	404 So every beekeeper will work, he'll put two in and	442 to use it or?
329 brother is making cement hives, so for theft and	369 BK03: Upwards, if you're really crowded then you	405 where, wherever he puts them in the hive.	443 BK03: Beginners I can see the benefit, otherwise I
330 things, so, but I prefer to work with uh, with	370 must, it must be er, really a good season before they	406 IVAN: Okay.	444 can't see benefit. Because if your hive is standing
331 Langstroths hives. Because it's, it's easy, you can	371 will start working at the bottom, and that is a	407 BK03: But uh, it makes it, for me the easiest is either	445 still and you have one specific person working with
332 buy it anywhere and it's a general size and you can	372 frustration. Cause what happens a lot is the bees	408 work from left to right or right to left and you know	446 it, but the moment you start working and remember
333 make it yourself it's not difficult.	373 move into a supers, then you have the supers and	409 where you are cause then you just keep on moving	447 when you work commercial you work fast and you
334 IVAN: Standardised?	374 you put it on top of the brood box and then they sit.	410 them, the things in and it takes you about a year	448 work a lot, so you're not very careful when you use
335 BK03: It's standardised, ya.		411 maybe eighteen months then all the combs has been	449 the hive tool. But when you're urban and you have
336 IVAN: Okay.		412 replaced (in the brood).	

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450 ten beehives I can see the benefit of a uh, a uh, 485 BK03: it will be easier, but theft and vandalism will 519 IVAN: Alright. Um, ya um, so are there other, any 553 BK03: And I can't see that that, maybe but not much,  
451 queen excluders. 486 be your, will be you biggest problems. 520 other modifications that you use to prevent pests 554 why will it be different from a composite hive. Okay  
452 IVAN: Okay, um, a lot of people have mentioned that 487 IVAN: Mhm, ya. 521 and diseases? 555 one it's a little bit more plasticity but uh, it's the  
453 theft is quite a big problem, and vandalism? 488 BK03: And they, and they break your hives, that is 522 BK03: Ag, there's many things to trap them with uh, 556 same density and things that you're working with.  
454 BK03: If, we work on a thirty-percent loss per- 489 the problem it's not only, they're really damaged. 523 with uh, hoepels (hoops), metal straps that you put 557 So, and overseas their starting going with that so  
455 annum, some, sometimes more. 490 IVAN: And then the bees are... 524 around. 558 there must be a solution to that uh...  
456 IVAN: From theft and vandalism? 491 BK03: Normally the bees are destroyed (becoming 525 IVAN: Okay. 559 IVAN: Mhm.  
457 BK03: Theft, vandalism, badgers uh, whatever. 492 quite upset) I would say eighty percent of the time 526 BK03: You put chains around and you put uh, screw 560 BK03: To that problem.  
458 IVAN: Pests and diseases. 493 your bees are destroyed because they got no 527 them onto the sides with uh, you can come and see 561 IVAN: Yeah.  
459 BK03: Whatever that is. That is one of the reasons I 494 respect, they break the combs, they break it, they 528 ten methods here. 562 BK03: Uh, that's what I think, okay.  
460 make my own hives and I make my own frames, 495 take it away, they leave the hive open, all that type 529 IVAN: Okay. 563 IVAN: I think that's all for now.  
461 because uh, I'm not, I don't make it perfect 496 of things. So, eighty percent of the time you'll lose 530 BK03: I'll show, I'll show you all the- 564 BK03: Okay ya, that's quick. Okay.  
462 anymore. Cause I'm going to have it for three or four 497 your hives. But once again my brother is doing a 531 IVAN: Alright. 565 IVAN: Um, so next stage is just I'm compiling all the  
463 years and then it's gone in any case. 498 concrete hives, so he's hoping to, that that'll solve 532 BK03: All the things that we do here and nothing 566 research and I'll start doing concept development,  
464 IVAN: Okay. 499 his problems. You can have a look at that. 533 really, it just makes it more difficult but it doesn't 567 and then once I have a few refined concepts then I'll  
465 BK03: But I'll show you, I can go and show you there. 500 IVAN: Okay. 534 prevent anything. 568 probably, if, if you're available I'll come back.  
466 Theft is your biggest, biggest, biggest problem er, 501 BK03: I haven't got, it will work but ey, that stuff 535 IVAN: Okay. 569 BK03: I'll always be available it's just that time, you  
467 and uh, it is vandalism that they break your hives and 502 weighs sixty kilos to carry around. 536 BK03: If they want it they can break it. 570 know normally my Thursdays and Fridays I, um, I'm  
468 theft that they steal your whole beehive and you 503 IVAN: And the boxes already weigh quite a lot when 537 IVAN: Alright. 571 doing a little bit of deliveries and I drink coffee at  
469 have it that other beekeepers come and they load 504 you move them. 538 BK03: So uh, but I'll show you, there's about five, six 572 the coffee shops. No I deliver to restaurants and then  
470 your whole twenty beehives up in ten minutes and 505 BK03: Ya but he puts the bees in the, in the hive. He 539 systems that there are, that we have tried all the 573 we become friends so when you come there...  
471 their gone with it. 506 makes the hive but it weighs sixty, but you can come 540 time, and every time you want to reinvent it and 574 IVAN: You get a coffee.  
472 IVAN: Shees. 507 have a look, maybe it will be a good version for you 541 human beings are funny things. If you do this there's 575 BK03: A koffie or a cappuccino and you chat and  
473 BK03: And that's a fact. 508 to look at. 542 another way that they think how to do that, you're 576 things like that, so, but I think for the, for the, for  
474 IVAN: Piracy. 509 IVAN: Ya, cause I'm interested in, I'm looking at a 543 in engineering so you know what to do. 577 you that Paul Smit will be a uh, interesting guy to  
475 BK03: Theft, and your hives are not really protected 510 few different options- 544 IVAN: Yeah, um, and in terms of material would you 578 talk to, but uh, sorry um. Form your own opinions  
476 cause you're using, because in, in uh, urban 511 BK03: Ya. 545 say that wood is the, the best. 579 and you're going to talk to quite a few beekeepers.  
477 beekeeping you can maybe secure it but in rural 512 IVAN: for the concept direction like ceramic hives, 546 BK03: Wood is the best at the moment. I would say  
478 beekeeping very difficult cause you use this site and 513 I'm also. 547 uh, I haven't tried the composite hive, I would like  
479 you use that site and you use that site. 514 BK03: He might, he's here, I don't know whether it 548 to see, I know the moisture story but I think that can  
480 IVAN: Yeah. 515 was him driving up, but if he's here you can talk to 549 be prevented because in Canada, in and uh, America  
481 BK03: And uh, there's not much protection on a farm 516 him. 550 and in uh, England they started to use these foam  
482 cause the guy gets a gate and he drives in and he 517 IVAN: Okay. 551 hives.  
483 gets your beehives. But you're looking at urban so- 518 BK03: You can see what he's doing here. 552 IVAN: Mhm.  
484 IVAN: Yeah.

THEMATIC ANALYSIS

MATERIAL

Natural  
Low-cost  
Durable  
Wood frames  
Cardboard starter  
Cement permanent  
Available

PROTECTION

Pests  
Diseases  
Theft  
Vandalism  
Fire  
Water  
Wind

THERMOREGULATION

Insulation  
Ventilation  
Cover  
Entrance control  
Floor space control  
Brood orientation  
Air-flow

ADJUSTABILITY

Suited to colony  
Standardised parts  
Standard sizes  
One brood box  
Transfer friendly  
Efficient compatibility

INITIAL CODING

Urban Beekeeping

1. Cities have abundant bee forage.
2. Hives must have water source.
3. Hives must be 5m from boundary.
4. Hives must be 25m from buildings.
5. An barrier around hives to raise Lee's flight path.
6. Site must be clean and maintained.
7. One person can keep up to 40 hives.
8. Inaccessible to children and pets.
9. Four flows per year.
10. Level stand for hive.
11. Accessible for beekeeper.
12. Farmers need pollination
13. Kept in the shade
14. Evening or night inspection.

Sites/Farms

1. Small holdings.
2. Public surroundings.
3. Partially secure facilities.
4. Plant production is low.
5. Some food storage facilities.
6. Part-time subsistence farmers.
7. Full-time farming cooperatives.
8. Presence of local wild swarms.
9. Few materials or tools.
10. Small plots of land.
11. Intensive diverse farming.

Pests & Diseases

1. VFR requires burn treatment.
2. Ants can be stopped by moat.
3. Wives fall off bees to floor.
4. Oil wells for ant prevention.
5. Bees pick up varroa from the floor at the entrance.
6. Adjustable entrance.
7. Bees must be able to carry mess out easily.
8. Mesh floor for varroa removal
9. Entrance must be 40mm from ground

Biomimicry

1. Bee-space
2. Spaces bees to build comb manageably
3. Defensive bee species is aggressive.
4. Bees prefer higher entrances.
5. Bees don't move brood independently.
6. Smaller African bee works with 32mm frames.

Harvesting

1. Comb must be replaced every two years.
2. Queen excluders are unnecessary/costly/time-consuming
3. Keepers with less hives can use excluders.
4. Queen excluders are damaged easily or replaced incorrectly.
5. Putting boxes back correctly is difficult.
6. Bang suppers to get bees out.
7. Harvesting equipment is expensive.
8. Harvesting must be done under hygienic conditions.
9. Interchanging frames and supers is dangerous.
10. Hoffman frame horizontal hives.
11. Wax is as valuable as honey.
12. Wax coated guide ridge can replace foundation.
13. Bottom board must be cleaned annually.
14. Harvesting entire supers or air file frames is easier.

Thermoregulation

1. Good insulation from cold and heat.
2. Good ventilation and air-flow control.
3. Covers and lid manipulation.
4. Adjustable entrance size.
5. Mud and dung are good insulators.
6. Floor space manipulation for seasons.
7. Humidity is controlled by bees.
8. Ideal internal climate is warm and dry.
9. Brood orientation changeable for air protection.
10. Bottom to top air-flow works well.

Manufacturing

1. Mass-manufactured low cost parts (die cut cardboard or injection moulded 3D).
2. Regularly produced batch manufactured parts with machinery.
3. Low-tech community driven manufacturing.
4. Flat-packable to save transportation costs.
5. Low-tech manufacturing tools distributed to community initiatives for implementation.
6. Discarded materials at no cost, will require tools.
7. DIY instruction manual.

Cost

1. Beehives are expensive.
2. Plastic hives are expensive.
3. Wooden hives need machinery and tools to be made.
4. Farmers have spare funds for equipment and low-income.
5. Non-assembled frames are cheaper.
6. Beekeepers can quickly pay off the initial investment.
7. Top-bars are cheaper.

Skills

1. Abundant local interest in bees.
2. Little to no experience.
3. Courses and teachers are available.
4. Low-tech construction skills.
5. Beginners should make their own hive.
6. Aspirations to keep bees.
7. Easy to learn beekeeping through practice.
8. Skills development is important.
9. Associations are interested in second economy development in beekeeping.

Material

1. Bees don't like plastic.
2. Concrete, pine, composites, polystyrene, cardboard, clay and cement are options for hive manufacture.
3. Locally sourced/sustainable materials.
4. Pests lay eggs in holes in/next to wood
5. Wood and PS must be curled/steamed
6. Natural materials are preferred and cheaper.
7. Plastic hives cause condensation problems.
8. Cement generally doesn't create condensation in our climate.
9. Gaps and holes in wooden hives allow pests to enter.

Protection

1. Fire and flood damage
2. Theft and vandalism.
3. Hives must protect bees from damp and wind
4. Boxes must be fastened together.
5. Frames, cages, boxes, chains, combage and strapping are ineffective.
6. Hives should be branded.

Portability

1. Migratory beekeeping is obsolete.
2. Hives must be easily moveable.
3. Landies and stands can aid in moving hives.
4. Permanent colonies become more docile.
5. Permanent hives are easier to secure, maintain and more resistant to pests/diseases.

Adjustability & Standardisation

1. Hives must be adjustable to colony strength.
2. Beekeepers can grow their colonies just by part.
3. One brood chamber for African bees.
4. ITB hives can be divided well but are limited to a maximum size.
5. Parts must be standardised to frame sizes.
6. Beekeepers prefer larger brood hives for compatibility.
7. Helps with colony transfers.
8. Standardisation can cause theft or piracy.

Beginning

1. Cardboard catch hives are hung from trees.
2. Modern hives produce more honey.
3. Low-income user group.
4. Stimulative and supplementary feeding.
5. Hives prevent wild swarms.
6. Government funding and training.
7. Hive hive slow introduction techniques.
8. Cooperative beekeeping/Beekeeper harvest for a fee.
9. Lack personal transportation.

Inspection

1. Frames must be individually removable.
2. Systems are important.
3. Windows for low-impact inspection
4. Bees seal boxes together with propolis
5. Inspection must be delicate and quick.
6. Swarm cells are visible from bottom of the brood.
7. Comfortable working height.
8. Weight of boxes.
9. Easy removal of frames
10. Regular inspection is mandatory.
11. Hives should be numbered to keep records.
12. Removing and adding frames kills bees.
13. Top-bar hives are easier to work with.
14. Top-bar comb can be too delicate to inspect.

MAKING

Batch rapid machined manufacturing  
Low-tech community driven  
Flat packable  
Available tools

MAKING

SITES

Level  
Accessible  
Secluded  
High flight path  
Shade  
Water  
Space saving  
Moveable

SITES

INSPECTION

Frames  
Windows  
Separable  
Gentle  
Brood base visible  
Comfortable height  
Light  
Minimum casualties  
Numbered  
Night work  
Safe

INSPECTION

HARVESTING

Queen excluder  
Mating/repositioning  
Durable/strong  
Horizontal frame hives  
Entire comb: on site  
Low-tech separation  
Entire super/frame (no wax): co-op off site spinning  
Individual frames  
Bee-space

HARVESTING



Appendix G  
Field Diary

Bee Course 30-MAY  
Midrand  
Martin Johansmeir - bee-plant expert.  
Opoltransre - worked at Honeybushes  
- Managed SABIO  
- call after 8pm  
- 90% of bees that are settled don't take to new hives  
- Plant these to save bees  
- picture of flowers for bees.  
- mono-culture  
- melvies wind pollinated  
- people are prepared to invest time & money

1

Gov spent millions over past 3 years on emerging bee and nothing come of it.  
- Main reason people stop is for time (lack) bees require lots.  
- Disappearing bees is American  
- Ideal number of hives to keep is 3 (can split one if one dies)  
- Prevention is better than cure  
- nectar, pollen, propolis & water

2

Colony - bees on a hive swarm - bees outside nectar flow - cracks & fracture  
What bees do in a colony is what needs to be done at a particular time  
- this time of year pros. take bees to abse fields/plats  
- Aloe has most nectar out of any plant known to man.  
- propolis coating on inside of cells can cause bees to abscond/swarm.  
- SWARM from overpopulation

3

Adrian Dutt - University of Pretoria  
- 6 experimental farms  
Bees can fly - 7 miles (not good)  
- 1.5-2km is best.  
Blackburn - lots of nectar  
AEC found that fruit fly was stealing ~~bees~~ nectar.  
• Hives must face outwards & away from each other  
• Drifting = bees are let into other hives if they have food  
• also you work out of flight path of other hives

4

entrance  
- Hives should face rising sun  
- Bee-stings can be toxic & lethal  
- scrape out immediately  
- anti-histamine.  
- can become allergic  
- can medically treat allergy  
- Smell of cut grass & turned soil irritates bees.  
- Strips of wax in brood box  
- full sheets in supers  
- 8 pounds honey = 1 pound wax  
- SAFETY FIRST  
- working at night is better  
- all bees are present  
- can check the hives strength

5

- our bees are most hygienic & cleanest of all species  
- when bees store honey in a box they start furthest from entrance  
- Bee-space (Lorenzo Lionel Lang)  
- gap required for wax  
- 99% of hives are made to Lang specs.  
- Langs are suited to European bees  
- our bees are a bit smaller  
- standard for box is fine  
- standard for ~~the~~ frames must be smaller

6

- Pallet beekeeping 4 per pallet  
- 30mm side bars.  
- Hives need to be redesigned.  
- objectives - make more money  
- make less propolis.  
- Jan Steenkamp: Prof. Bk  
- bees propolise lid closed to close air holes.  
- Use catchment box to get bees with propolis & wax  
- Non-telescopic lid  
- Super  
- Excluder  
Hive  
Hives.  
Brood box  
floor

7

- Catch box is small for initially small hives. colonies.  
- Pine is dipped in hot wax.  
- painting is ~~more~~ less effective  
- strengthen weak hives for winter. 1L bucket over top.  
- Feeding board   
- feed with Puritex or.  
- Mix sugar water 50:50  
- Water must have been boiled  
- Bucket with pin holes in lid.  
- Can empty bucket in 3 days.  
- 3 hives = no wax production.

8

- Bees wax R20-R120 p/kg  
- Propolis R500 p/kg.  
↓  
can only harvest if you have tons of hives.  
- Making a hole in brood box forces bees to close with propolis (propolis wheel).  
- Kim Morgado  
SITES  
- Can put nuts in honey to raise value.  
- Opening boxes is traumatic  
- Inspect once a month & not more than once every 10 days.

9

- Inspect at start of nectar flow.  
- Macadamias <sup>Aloes</sup> Oranges <sup>Highveld Guava</sup> & Vigams  
- Mid honey flow you can remove two brood frames & replace with full wax sheeted ones.  
- Honey doesn't help catch bees  
- 8-10kg per super  
- end frames fill up first  
- If you check a full end one you can remove entire super.

10

- Run Supers on tyre or Super to get bees off  
 - Honey is heated to get impurities out to stop crystallising  
 - put it through a very fine sieve to prolong liquidity  
 - orange honey doesn't crystallise  
 - Heating destroys enzymes that bees add.  
 - Rate of crystallisation depends on floral source.

Pump smoke at entrances wait 2 minutes  
 use hive tool to lift lid remove lid. - blow smoker  
 take out 1 frame keep entrance & exit clear  
 check outer frames  
 10% uncapped in fine frames  
 2 frames with brood 1 super out of 3 full  
 Replace brood frames with last one used as lever.

Put super on dragons and rotate to mate with brood  
 Slide lid on  
 Frame 2 first  
  
 Killing lots of bees  
 Hive jumping around  
 Top bar work away from entrance  
 Resonating 2 bees hang on each others legs to get spacing for cells correct.

Queen excluders  
 - Honey excluders  
 - prevents easy access to deposit honey.  
 Bees store honey at bottom then move up when they need more space.  
 Queen Cells at base of frames means they will swarm  
 Will always find pollen

Make splits.  
 - empty box behind full box  
 - put two brood frames in new box  
 - swap positions  
 - During daytime field bees come back to new hive  
 - looks like parent.  
 Pail Pollination: lots of unethical actors  
 Mpumalanga: avos, lechies, mangoes  
 Honey combs don't work due to spread of AFB.  
 Bees find contaminated honey in dumps.

Processing location phone number  
 Producer Registration  
 Bees cannot see red light  
 They are attracted to white light.  
 Magladerie  
 Kees vandermerwe  
 Plastic hives are more expensive  
 Low Tech (website)  
 PLANTZ AFRICA.COM

1 August 2015  
 IZINDABA FARMING CON.  
 at BOWETO CAMPUS  
 - MACSA: 2.5 Ha Farm  
 - INTERESTED IN BEEKEEPING  
 - Has contact with attracting technology (bulbs for bees)  
 - Different bees 3 types  
 - Beekeeper with 9 hives  
 - How to get raw honey?

INTERVIEW WITH TOM CAW  
 - Start with 10 -> 9  
 - 10 frames then will force bees to form comb correctly  
 Book: BEEKEEPING by March and  
 - Natural Swarms & CCD Benchmarks.

Interview with SAM DUNN  
 - Theft & damage is a big problem  
 - Aloes flowering makes bees aggressive  
 - 39kg per year: 2 hives 4 harvests.

Southern Beekeeping Association Meeting  
 6 August 2015  
 Topic: Spring Maintenance  
 Speakers: Louis Van Zyl  
 Jackie Cowzens  
 ALU-BUBBLE: R2.50 per hive  
 - Lid insulation  
 - African Insulation Methods & Materials  
 - BOOSTER BEE FEED

Appendix G  
Field Diary

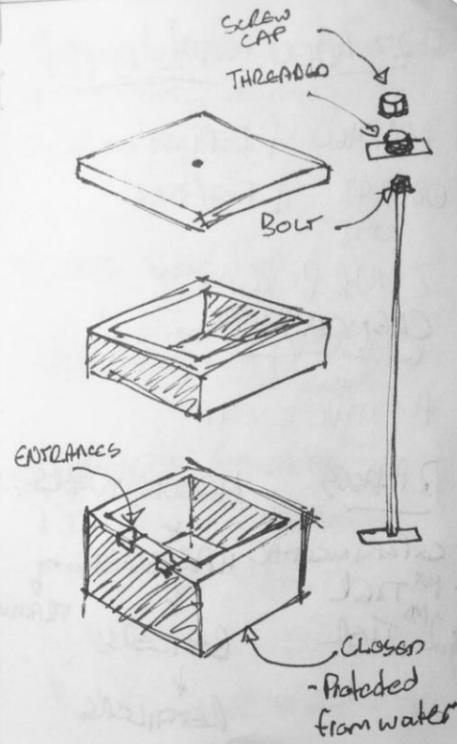
Interview With Edward Van Zyl - 7 August 2015

- Recommendation for further study of the height of the hive entrance & the refusal of bees to move downwards with brood boxes placed beneath
- Concrete hives
  - brood boxes with sealed floor & top entrances
  - square supers
  - flat lid
  - rod to join all boxes together

21

- Use steel covers rather than aluminium to last longer.
- Swarms are worth R1000
- Wax is worth R100/kg
- Hives in cages get burnt
- 30% loss each year from theft, vandalism & diseases/pests.
- Concrete hives coated with bees wax inside
- Concrete hives weigh 210kg & cost R250 to make.

22



23

SITE VISIT

MIDRAND - 28 SEPTEMBER  
HANS STEENPOORT

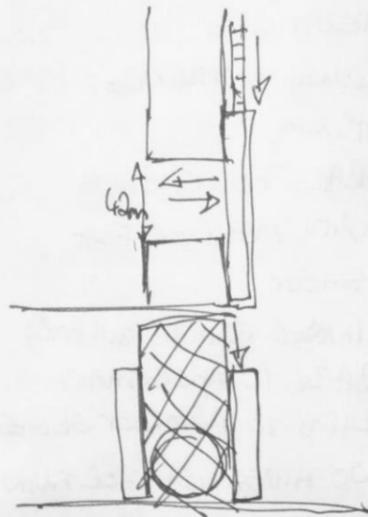
- PLASTIC HIVE
- ELETRO STATIC DISCHARGE PROBLEMS
- CONDENSATION FILLS LID WITH WATER
- BURR COMB & WARPING ON PLASTIC FRAMES
- BEES WILL BOURD COMB ON WOODEN FRAMES FIRST

24

ALTERATIONS

- ROUND ENTRANCES
- 42mm
- RAILS FOR CLOSING WITH MESH OR FLAT SHEET
- INNER FRAME SUPPORT BARS RATHER THAN LIDS TO PROTECT EDGES.
- NO HIVES LARGER THAN 3 BOXES.
- VANDALISM PROBLEMS

25



26

FIELD EXPERIMENTATION

LIVE HIVES - 15 Oct.

Concrete hive

- INNER COVER NOT NEEDED & INTERFERES WITH LOCKING DINGS
- TEMPERATURES
  - 12h00 - 28°C outside
  - 32°C inside
  - 20h00 - 16°C outside
  - 29°C inside.
  - 24h00 - 13°C outside
  - 27°C inside.

27

- BEES USING MAIN ENTRANCE
- NO LANDING PAD
- LAND ON TOP OR BOX SIDE

- HIVE TOOL EASY TO USE.
- FRAMES PROPOLISED TOGETHER NOT TO LID OR FLOOR
- LID CRACKING.

HANDLES

- EASY TO INSERT
- NEED FLAT SURFACE TO PLACE HIVE.

28

- LEGS
- WIGGLING IN HOLES CAUSES CHIPPING & UNSEAL HIVE

29

23 Oct

Piercing holes in lid with top cover reduced temperature from 32°C → 29°C

30

Appendix H  
Initial Concept Posters

beegin

LANGSTROTH

CARDBOARD

R200



HANDLES WILL HELP THIEVES. RAISED ENTRANCE FOR VARROA PROTECTION. SLANTED WALLS INCREASES RAIN PROTECTION.



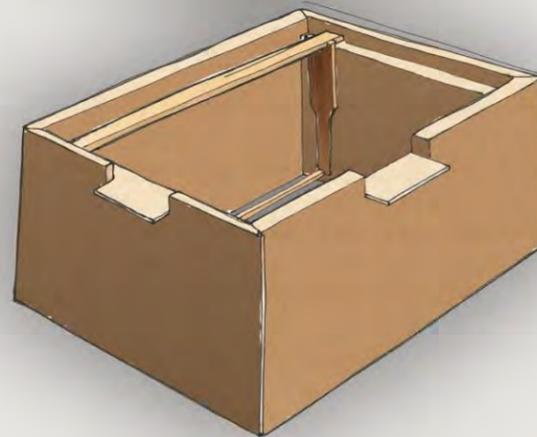
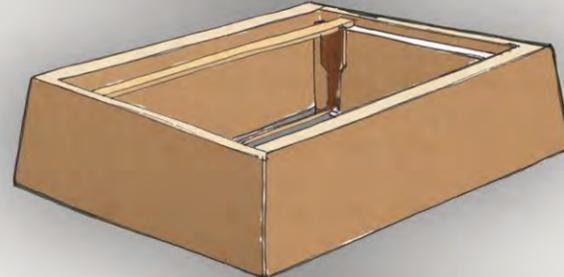
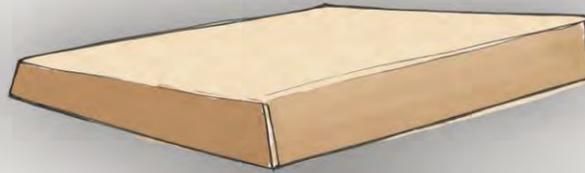
SMALL SUPERS WILL BE CHEAP TO BUY & EASY TO MOUNT, ALTHOUGH FRAMES WILL BE EXPENSIVE.



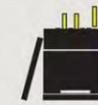
TOP-BARS & WEIGHT MAKE INSPECTION DIFFICULT. FLOOR OPENS TO ALLOW FOR SWARM-CELL CHECKS.



STAND CAN BE SIMPLE AND SMALL. HIVE MUST BE STRAPPED TO THE STAND.



SLANTED INNER SIDE WALLS HELP WITH REMOVING OF TOP-BARS. LIPS TO HELP GRIPPING & LIFTING BOXES.



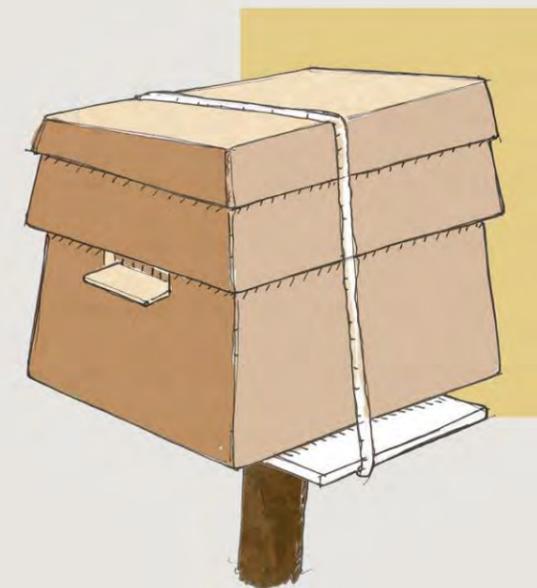
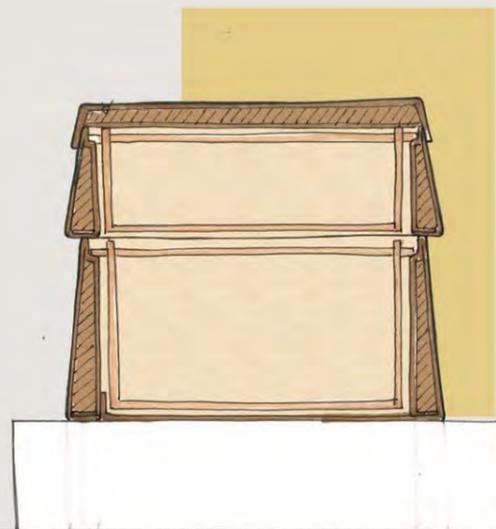
FLOOR IS ATTACHED TO THE BROOD BOX MEANING THERE ARE THREE UNITS..



ALTERNATING ENTRANCES FOR WINTER & SUMMER. INSULATED WALLS & LID.



DOUBLE-WALL CARDBOARD WATERPROOFED ON OUTER SURFACE.



IVAN BROWN

LANGSTROTH

CONCRETE

R400



NO HANDLES TO DETER THIEVES.  
CAN BE CHAINED CLOSED.  
RAISED ENTRANCE FOR VARROA  
PROTECTION.



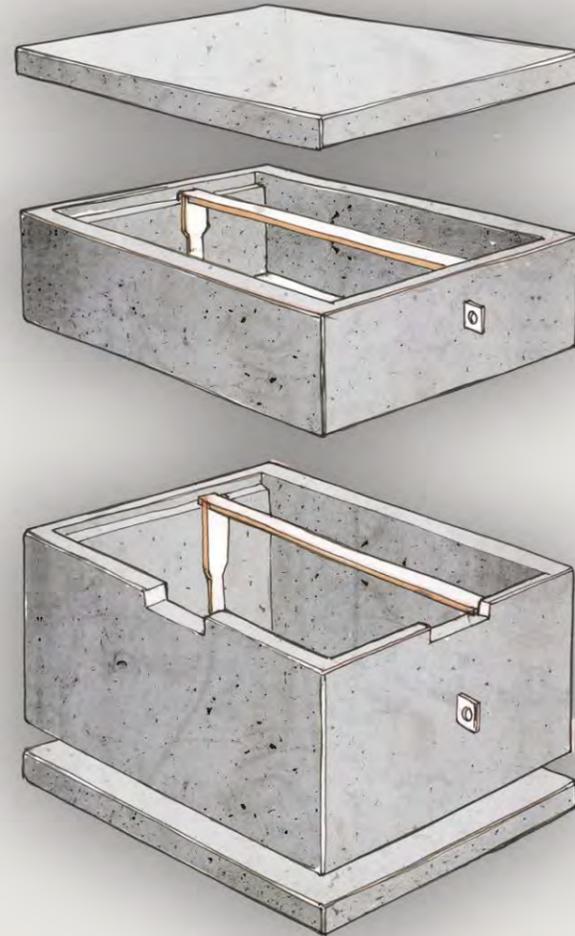
SMALL SUPERS WILL BE  
CHEAP TO BUY & EASY TO MOUNT,  
ALTHOUGH FRAMES WILL BE EXPENSIVE.



SEPARATE FLOOR ALLOWS  
FOR SWARM-CELL CHECKS &  
CLEANING.



BUILT-IN STEEL LEGS CAN BE  
EASILY PLACED IN CANS WITH OIL.



STANDARD FRAMES.  
HEAVY BOXES TO MOVE.



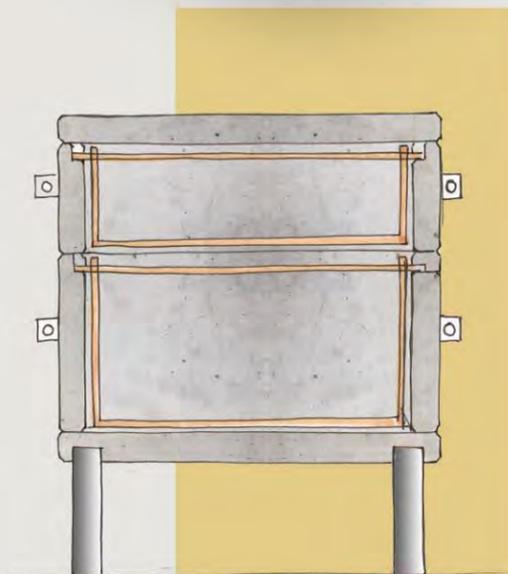
THREE SIMPLE MOULDS REQUIRED.



ALTERNATING ENTRANCES FOR  
WINTER & SUMMER. CONCRETE HAS  
THERMAL MASS. CONDENSATION  
MUST BE PREVENTED.



CONCRETE WITH LIGHTWEIGHT  
AGGREGATES. WOODEN FRAMES.



IVAN BROWN

HORIZONTAL FRAME HIVE

CARDBOARD

R250



MESH FLOOR BELOW THE BROOD SECTION FOR FALLING VARROA, CAN BE CLOSED IN WINTER.



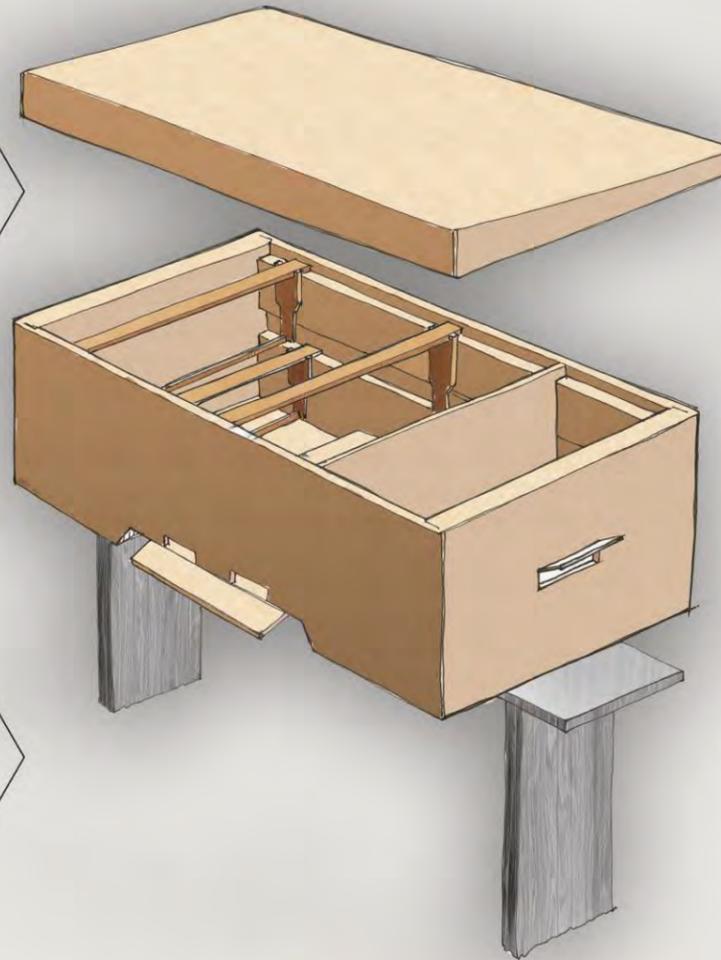
INTERIOR SPACE IS DIVIDED BY TWO SEPARATOR BOARDS. FRAMES CAN BE BOUGHT TWO AT A TIME.



INSPECTION WINDOWS CAN BE ADDED TO THE FRONT WALL. HANDLES ON THE SIDES.



STAND NOT INCLUDED. MUST BE TIED DOWN. PERMANENT SIZE FOR SITE.



WORK DONE FROM ONE HEIGHT. UP TO 24 HONEY FRAMES POSITIONED ON THE SIDES. STANDARD FRAMES.



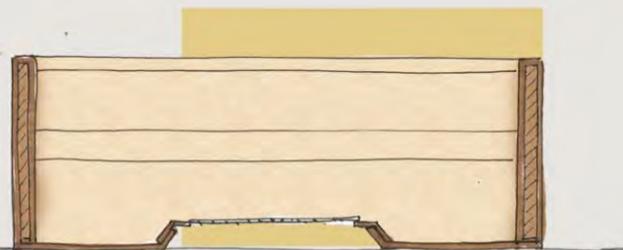
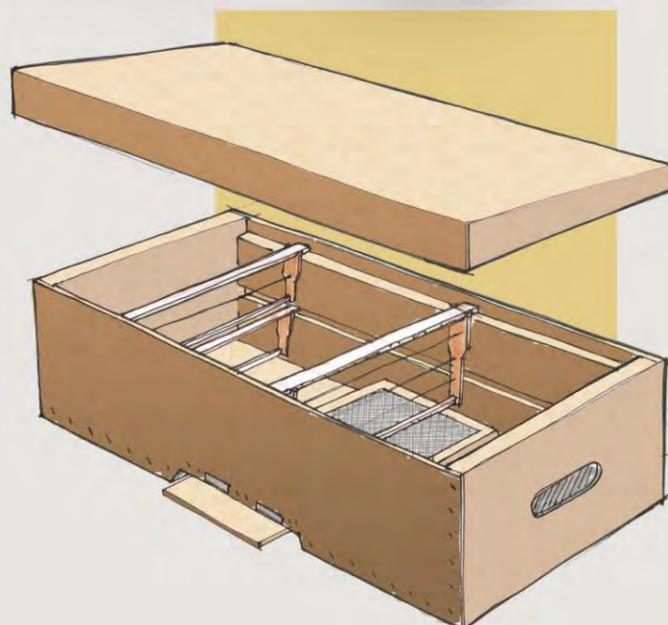
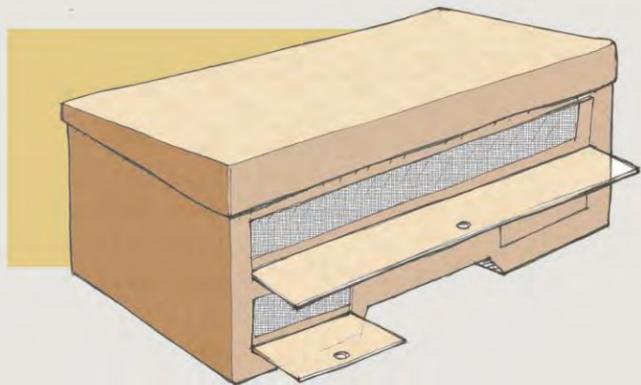
ONE UNIT WITH LESS MOVING PARTS FOR INCREASED DURABILITY. LOW-COST MANUFACTURING.



INSULATED LID AND WALLS. TREATED CARDBOARD WILL PREVENT CONDENSATION.



DOUBLE-WALL CARDBOARD WATERPROOFED ON OUTER SURFACE.



IVAN BROWN

HORIZONTAL FRAME HIVE

CONCRETE

R500



MESH FLOOR BELOW THE BROOD SECTION FOR FALLING VARROA. LIDS CAN BE CHAINED SHUT. NO HANDLES TO DETER THIEVES.



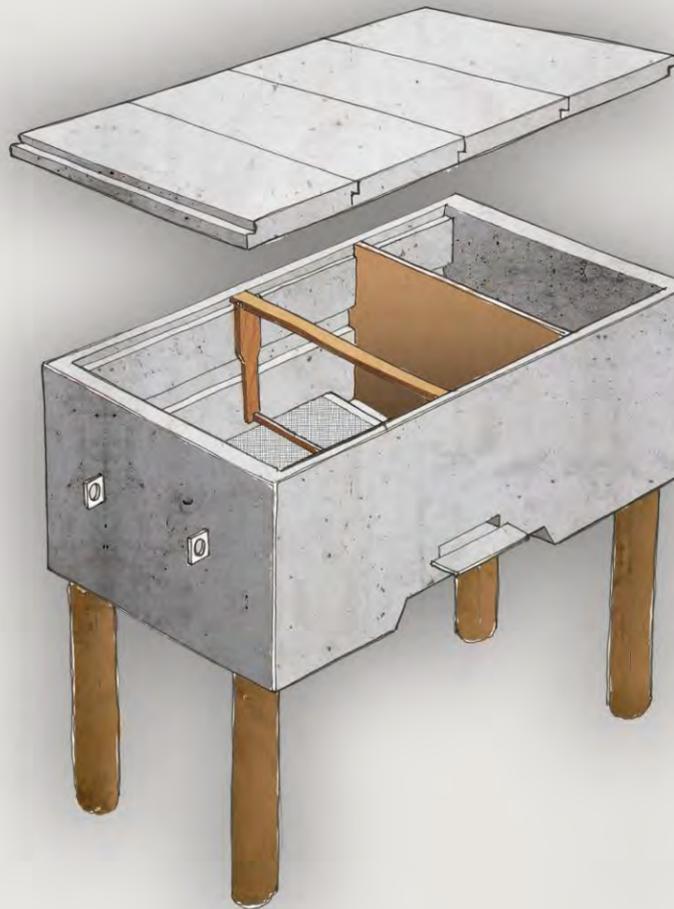
INTERIOR SPACE IS DIVIDED BY TWO SEPARATOR BOARDS. FRAMES CAN BE BOUGHT TWO AT A TIME.



CATCHMENT TRAYS ON THE SIDES, WITH GAPS THAT CAN BE USED TO CHECK FOR SWARM-CELLS.



STAND NOT INCLUDED. PERMANENT SIZE FOR SITE.



WORK DONE FROM ONE HEIGHT. SEPARATE LIDS FOR EASY OPENING & CLOSING. STANDARD FRAMES.



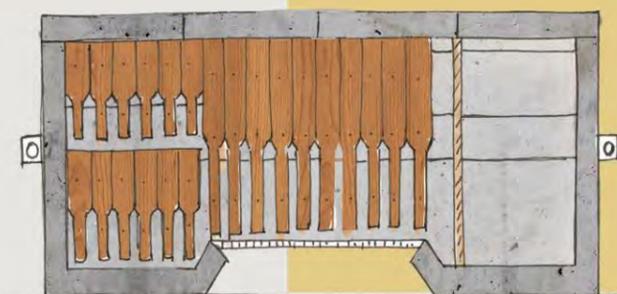
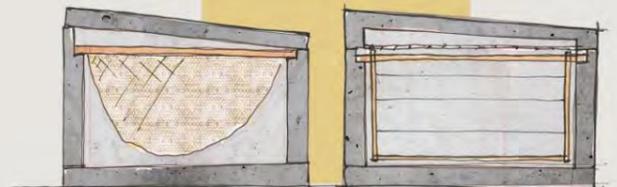
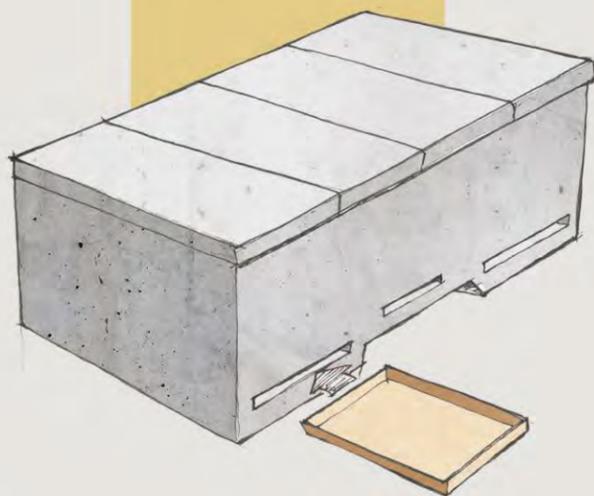
ONLY TWO MOULDS REQUIRED, ALTHOUGH SIZE IS DIFFICULT TO TRANSPORT.



CONCRETE HAS THERMAL MASS. CONDENSATION MUST BE PREVENTED THROUGH VENTILATION HOLES.



CONCRETE WITH LIGHTWEIGHT AGGREGATES. WOODEN FRAMES. WOODEN SPACE DIVIDERS.



VERTICAL TOP-BAR

CARDBOARD

R120



RAISED ENTRANCE FOR VARROA PROTECTION. COMB HARVESTING REDUCES RISK OF DISEASES & PEST PROLIFERATION.



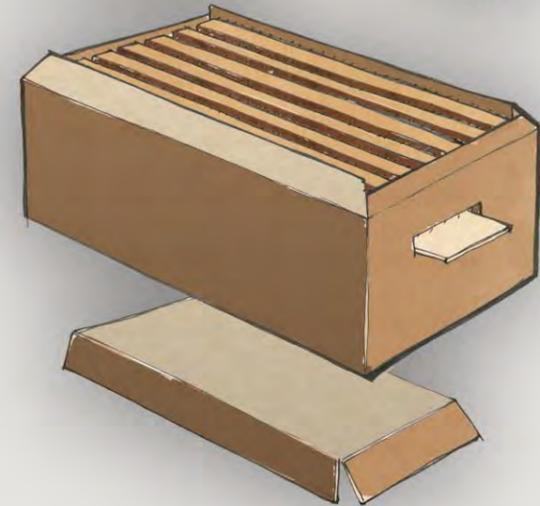
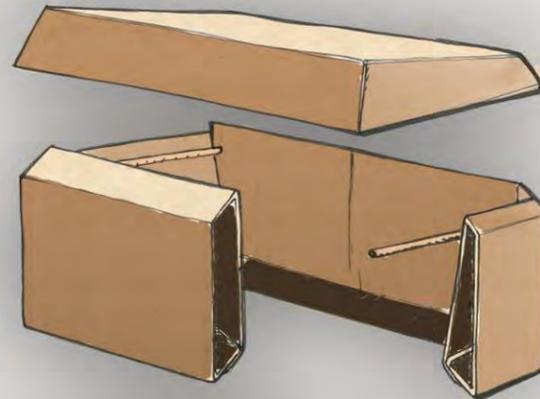
SLANTED LIPS MAKE POSITIONING THE BOXES EASIER. HIVE EXPANDS VERTICALLY.



TOP-BARS MAKE INSPECTION DIFFICULT. ALTHOUGH A VIEWING WINDOW COULD BE INCORPORATED.



SMALL SIZE. CAN BE SUSPENDED FROM A TREE FOR LURING SWARMS.



SLANTED INNER SIDE WALLS HELP WITH REMOVING OF TOP-BARS. STANDARD FRAMES CAN ALSO BE USED.



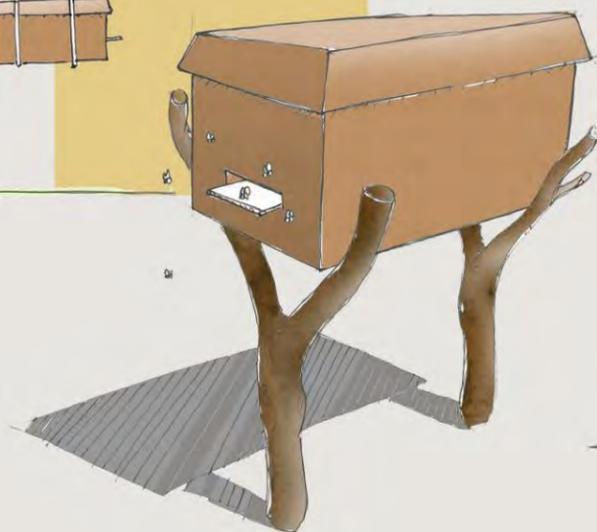
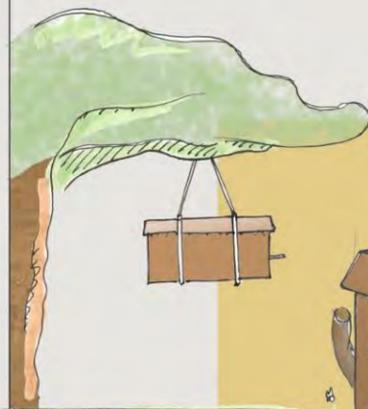
ONE CHAMBER SIZE & ONE LID REDUCES THE OVERALL COST.



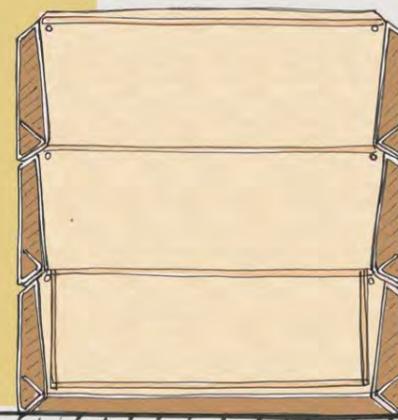
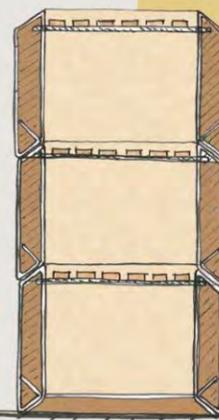
INSULATED WALLS & LID. FLOOR CAN BE REPLACED WITH A MESH SCREEN EASILY.



DOUBLE-WALL CARDBOARD WATERPROOFED ON OUTER SURFACE. DOWEL STICKS TO SUPPORT THE FRAMES.



167mm DEEP



VERTICAL TOP-BAR

CONCRETE

R300



HANDLES WILL HELP THIEVES.  
HIVE CAN BE CHAINED & LOCKED.



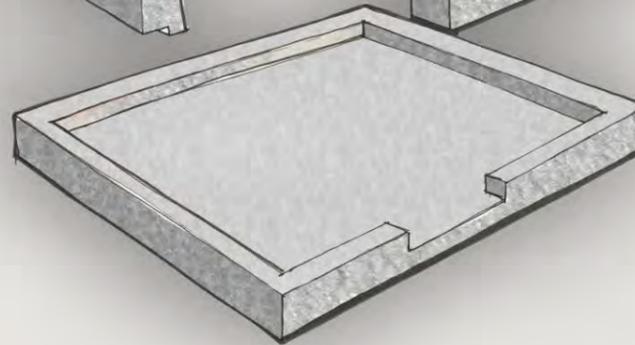
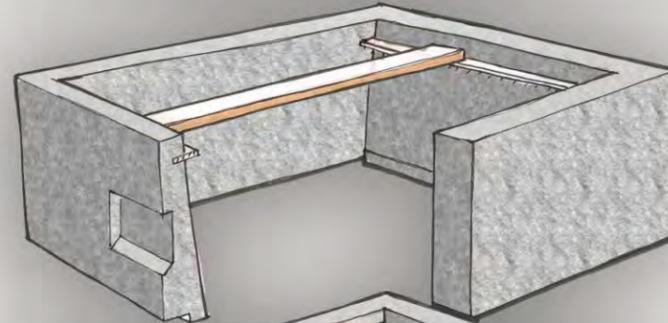
LIP HELPS POSITION THE BOXES  
UPON ONE ANOTHER.



TOP-BARS & WEIGHT MAKE  
INSPECTION DIFFICULT. SEPARATE  
FLOOR ALLOWS FOR SWARM-CELL  
CHECKS.



STAND NOT INCLUDED.  
CAN BE USED TO RAISE WATER  
CONTAINERS OR PROTECT GOODS.



SLANTED INNER SIDE WALLS HELP  
WITH REMOVING OF TOP-BARS.  
HANDLES TO HELP MOVING BOXES.  
STANDARD FRAMES CAN BE USED.



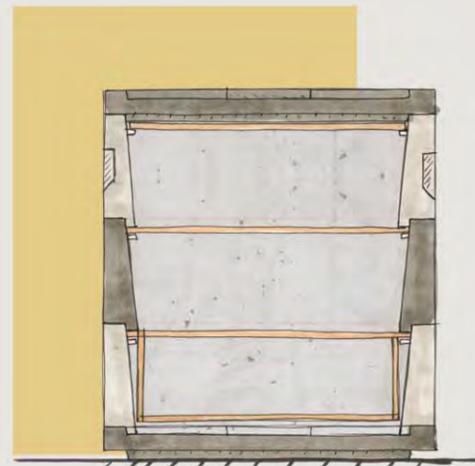
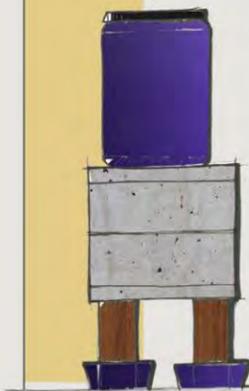
IDENTICAL, LID & FLOOR WITH  
ONE CHAMBER SIZE MEANS ONLY  
TWO MOULDS ARE NEEDED.



BASE CAN BE FLIPPED FOR  
DIFFERENT WINTER & SUMMER  
FLOOR FLOOR DEPTHS.



CONCRETE WITH LIGHTWEIGHT  
AGGREGATES. WOODEN FRAMES.



Appendix K – Entry-level Hive Printed Illustrations Layout Poster



CHAMBER LEFT



CHAMBER FRONT



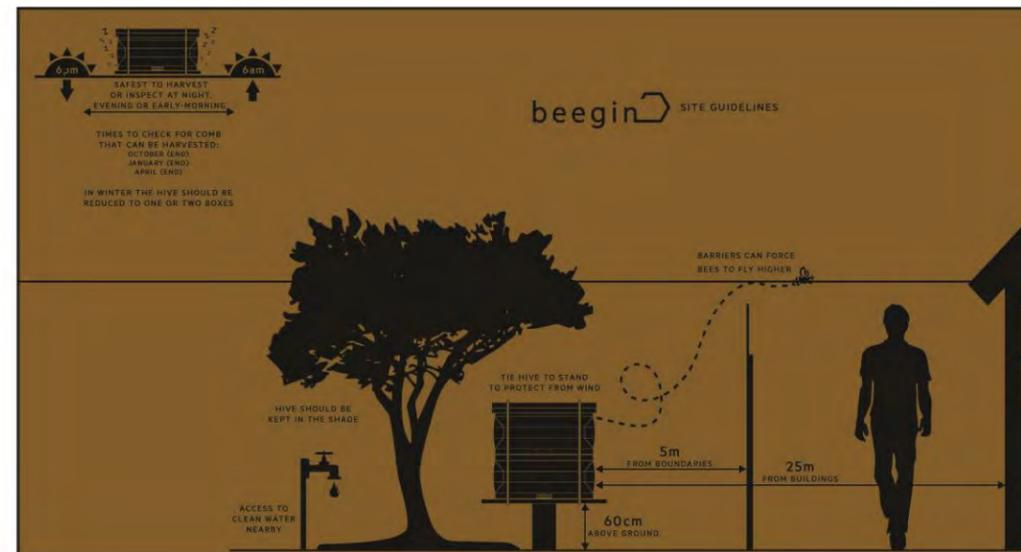
CHAMBER BACK



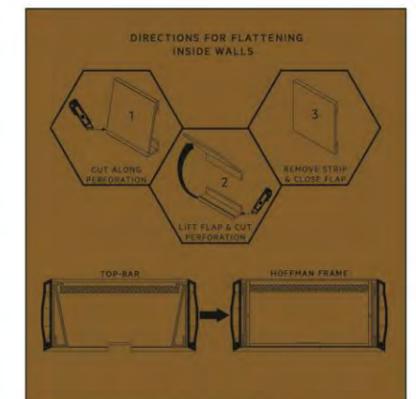
CHAMBER RIGHT



INNER-COVER TOP



LID TOP



INSERT FRONT

**APPENDIX L**  
**TECHNICAL REPORT: MANUFACTURING AND COSTING**

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**1 - INTRODUCTION**

Concrete and cardboard were selected as the materials for producing beehives developed during this study. The focus of the research and testing was determining a suitable process for manufacturing the beehives successfully in accordance with the requirements. This report illustrates the findings of the technical research and testing that was conducted during the design stages of the project.

**2 - ENTRY-LEVEL HIVE**

**2.1 Corrugated Cardboard**

Corrugated cardboard sheeting is used to produce packaging for a variety of products. The material is lightweight, recyclable and cost effective. In recent years beekeepers have started using cardboard catch-hives to lure wild swarms. Colonies of bees can typically be kept in these hives for up to four months before running out of space, however during the rainy season the boxes deteriorate quickly. Existing cardboard catch-hives are not adjustable and are designed to be used once. In order to improve durability, usability and functionality in the cardboard hive it was necessary revise the manufacturing and design approach in order to produce a more successful outcome.

**2.2 Manufacturing**

Corrugated cardboard sheeting is convoluted paper that has been laminated onto flat sheets of paper to produce rigid fluted board. The flute and paper lining is produced in different weights forming different grades (PrimaBox 2015:sp). The direction of the fluting makes the sheets more rigid in one direction and prone to bending along the fluting. To prevent this multiple layers of fluting are laminated onto one another and extra liners can be added between the layers, with the cost increasing in proportion to the grade (PrimaBox 2015:sp). The most common board grades used by packaging manufacturers are:

- Single Face Board (SFK) – 1 liner and 1 layer of fluting
- Single Wall Board (SWB) – 2 liners with 1 layer of fluting
- Double Wall Board (DWB) – 2 -3 liners with 2 layers of fluting
- Triple Wall Board (TWB) – 2-4 liners with 3 layers of fluting

Cardboard products are manufactured in large quantities through die-cutting, a process for cutting, creasing or perforating flat sheet material. The process caters to low-volume production as the tooling is relatively cheap (Thompson 2007:266). A die-cutting tool is made by attaching 'steel-rules' and 'creasing bars' to either a roller or a stamp (Thompson 2007:266). Die-cutting is a fast process with cardboard sheets fed into the tools and up to 4 cut parts ejected every second (Thompson 2007:270). The tool can produce a high number of parts as the blades wear slowly and can be replaced regularly with little added cost (Thompson 2007:267). Manufacturing a rolling-wheel jig or a stamping-board jig depends on the size of the parts and the production speed required, with rolling-dies costing much more but producing parts at a much faster rate. Rollers and presses can also be used to print

ink graphics onto cardboard products (Thompson 2007:400). The cost of the printing and stamp manufacturing is reduced if only black ink is used. Screen printing can also be used for small batch production (Thompson 2007:401).

### 2.3 Characteristics

Cardboard products become weak and lose their form when exposed to water. It is common for packaging manufacturers to use wax impregnation for water proofing, applying a thin layer of molten wax to the surface of the sheet prior to cutting (PrimaBox 2015:sp). The durability of the product is substantially increased through this process, although the cardboard cannot be recycled. Wax impregnation increases the cost of the products substantially (PrimaBox 2015:sp). Other methods such as plastic lamination are also used, however the cost is much higher. Cardboard is a good insulator due to the air-pockets created by the fluting and papers non-conductive properties. Sound and temperature can be reduced significantly by thicker grades of cardboard, however flat surfaces are typically poor diffusers.

### 2.4 Testing

Strength and durability were the main concerns surrounding the entry-level, cardboard hive. Initially DWB and TWB were selected as potential grades. To determine the exact requirements both board grades were used to make full size prototypes that demonstrated the realistic strength. Waterproofing methods were also tested on the prototypes, using wax-based wood sealers as a cost effective alternative to wax-impregnation.

During prototyping it was found that both cardboards were easy to manipulate, however the surface quality of the thinner cardboard was visibly lower. The thicker cardboard also proved to be easier to assemble accurately, where the thinner cardboard was prone to creasing on flat surfaces or tearing at bends. When a coat of wax-sealant was applied to flat sheets the DWB warped severely whereas the TWB only deformed slightly. When the sealant was applied to the prototypes post-assembly deformation only occurred with the thinner cardboard. The prototypes were then sprayed with water, revealing that one coat was not adequate. Through repeated testing it was found that two coats of sealer produced waterproof cardboard, however with the second coat the SWB warped further. The slanted roof design was observed to retain water on the surface due to the rough surface texture of the board. By pitching the roof at the centre this problem was reduced substantially.

Creating a lip fold from the inner walls of the chambers caused assembly complications and reduced the overall strength of the box. Instead a lip was created by adding a cardboard insert to each side of the box, with the added benefit of making the interior space transformation simpler. The faceted form that was designed for the exterior surface of the chambers had the added benefit of reinforcing the flat faces and improving the diffusion of sunlight or sound.

### 2.5 Costing

Based on the following figures a potential production and retail cost for each part was equated:

BILL OF MATERIALS				
MATERIAL	QUANTITY	PRICE	CONVERSION	SOURCE
Waksol Sealant	5l	R140.00	R2.8/0.03ml	Builders Warehouse
Paint Brush	50mm	R26.00	/10 = R2.60	Builders Warehouse
Die Cutting Tools	4	R9500	/500 = R19.00	Sunny Packs Quote
Printing Tool		R6300	/500 = R12.60	Sunny Packs Quote
Full sheet	6 x brood chamber	R43.15 / sheet	R7.20	Sunny Packs Quote
	6 x super chamber		R7.20	
	10 x lid		R4.32	
	12 x inner cover		R3.60	
	12 x floor		R3.60	
18 x insert	R2.40			
Unassembled Brood Frame	1	R9.00	X 6 = R54.00	Beeware Store
Top Bar	1	R3.00	X 6 = R18.00	Beeware Store
Wax Foundation Sheet	1	R18.00	R3.00/strip	Beeware Store
10mm S. Tap. Galv. Screw	1	R0.20	X 6 = R1.20	Builders Warehouse
Wood Glue	5l	R550.00	/5000 = R0.11/ml	Builders Warehouse

ASSEMBLY			
PART	COMPONENTS	TIME	PRODUCTION COST
Brood Chamber	Main Chamber 2 x Inserts Floor Waksol 150ml Wood Glue 30ml Die-tool/500	30min x R0.42	R70.20
Super Chamber	Main Chamber 2 x Inserts Waksol 100ml Wood Glue 30ml Die-tool/500	20min x R0.42	R65.10
Lid	Lid Waksol 80ml Wood Glue 20ml Die-tool/500	10min x R0.42	R43.00
Inner Cover	Inner Cover Die-tool/500	0min x R0.42	R35.20
Brood Frames	Wood Glue 100ml 6 x unassembled Starter strips x 6	15min x R0.42	R79.40
Top Bars	6 x top-bars 24 x screws 6 x starter strip	10min x R0.42	R41.40

### 3 - PERMANENT HIVE

#### 3.1 Concrete

Concrete is a remarkable material, with amazing properties of strength, durability and adaptability (Lefteri 2014:212). There are a range of techniques available to achieve different visual effects and impart a variety of intrinsic qualities based on the requirements of different projects (Owens 2013:5). The practices used in all stages of concrete construction affect both the appearance and structural performance of the concrete.

#### 3.2 Manufacturing

Cement is used to make concrete which consists of aggregate (sand and gravel), water and cement. The proportions of the aggregates used in the mixture affects the properties of the product (Owens 2013:8). When mixed the aggregates form a liquid slurry that undergoes a chemical reaction that causes the mixture to bind and harden. The slurry is generally poured into a cavity that shapes the hardened product using the following methods:

Formwork: Formwork utilises shuttering to create the casting space for the concrete product (Owens 2013:10). The shutters are the surfaces that have contact with the concrete, held in place by external beams and columns. The materials required to cast this way are quite cheap, however there are long set-up times and limited shaping possibilities. Tolerances are difficult to maintain in this process.

Re-usable Moulds: Moulding makes use of a manufactured negative of the product to cast the concrete into (Owens 2013:9). This can be done with a reusable mould or a one-off that is broken or disintegrated during removal. Reusable moulds are usually cast from silicone and fiberglass using a master pattern (Lefteri 2014:212). This means that the design must be releasable. Materials that can be used in casting include plastic, wood, metal and paper. Surfaces that will come into contact with the concrete are lubricated with a substance that will assist in mould release. Aside from commercially produced release agents cooking oil, petroleum jelly and motor oil also work well. The contact surface of the mould creates the surface finish of the concrete casting. Concrete castings are vibrated to removed air bubbles and distribute the slurry into the cavity (Owens 2013:11). Although wetter concrete is easier to pour the excess water reduces the strength of the concrete, therefore plasticizers (chemical additives) are often used to improve the fluidity of the mixture.

#### 3.3 Characteristics

Strength: Concrete has an extremely high compressive strength and a low tensile strength. Steel is commonly used to reinforce concrete, by embedding a support structure within the concrete during casting. Concrete structures are usually reinforced to add strength and absorb stresses and forces. Metal is generally used for its strength and durability. Large flat surfaces can be reinforced by welded steel mesh, and long thin sections such as columns are

reinforced by rebar. Hollow steel sections are sometimes used to decrease the overall weight. External frames are often used to increase the durability of the concrete, where sharp corners and exposed edges may become chipped over time. This involves adding flat steel edges or L-sections during casting, which become permanently affixed to the concrete. Fibres are often added to reduce shrinkage and prevent cracking, they also add tensile strength (Owens 2011:9). Fibres used include polypropylene, nylon, polyvinyl alcohol and alkali resistant glass. Fibre reinforcement can also help absorb impact and contact forces, protecting brittle edges.

Density: The high density of concrete results in heavy products that are thermally conductive. The average density of standard concrete is 2400 kg/m<sup>3</sup> and 1750 kg/m<sup>3</sup> for lightweight concrete (Dorf 1996:22). Lightweight aggregates are added for their insulating properties and can reduce the cost and weight of concrete mixtures. The most common materials are vermiculite, perlite, pumice and polystyrene beads, although the materials should be pre-treated to reduce water absorption (Lefteri 2014:212). Adding lightweight aggregates can reduce the concretes strength, although resistance to temperatures of up to 400 degrees Celsius is produced.

#### 3.4 Testing & Casting

Achieving the desired strength-to-weight ratio relied on finding the correct cement composition. Initially small concrete sections (see Fig. 1) were cast to test the strength and weight of different compositions and thicknesses:

CASTING TEST			
COMPOSITION	THICKNESS	WEIGHT (1-10)	STRENGTH (1-10)
1cement:2sand:2vermiculite	30mm	5	2
	40mm	6	4
1cement:2sand:2stone	30mm	9	8
	40mm	10	10
1cement:2sand:1stone:1vermiculite	30mm	6	4
	40mm	7	6
1cement:1sand:3vermiculite	30mm	3	2
	40mm	4	4
1cement:3vermiculite	30mm	1	2
	40mm	2	4



Figure 1: Test blocks of concrete cast with varying aggregate content, 2015, (produced by author).

It was found that lightweight aggregates could substantially reduce the weight, however the strength would also be diminished. Combining lightweight aggregate with sand or stone did not increase the strength significantly enough to justify the added weight. Through testing it was found that a mixture of cement, vermiculite and water produced a strong and lightweight 40mm concrete sections. However the surface finish was affected by the grade of vermiculite used. The vermiculite was observed to float if too much water was added, while reducing the water content created a denser mixture causing air bubbles to become trapped. The vermiculite was replaced with a fine grade perlite to produce a more homogenous mixture, however the edges were still brittle and prone to chipping. By adding chamfers and polyurethane reinforcement fibres to the second casting the strength of the edges was significantly improved. The fibres also had the added benefit of reducing shrinkage and potential surface cracking. A wooden shutter mould was used to manufacture the first two prototypes (see Fig. 3), however by the third casting the mould had deteriorated substantially. It was decided that a sheet metal shutter mould would be more effective. When casting the prototypes steel mesh was also added for further reinforcement.

For the handles and frame support bars 6, 8 and 10mm steel rods were tested, with 8mm proving the easiest to bend by hand while still providing the required strength. The original legs (see Fig. 2) were designed to fasten to the base. Through testing it was found that the legs were prone to pivoting and cracking the concrete slab at the entry hole. The threaded rod and bolts also added a high cost. The handles and frame support bars were successfully manufactured from 8mm steel bar, using a hammer and table-mounted vice-grip. The low cost of the bar made it a more attractive option for a stand to replace the legs, however the strength was a concern. A prototype stand was manufactured using 10mm and 8mm bar, demonstrating that the 10mm bar was more difficult to bend by hand and that the 8mm bar was strong enough to support the concrete hive.



Figure 2: Prototype of lid/base part with vermiculite aggregate concrete, 2015, (produced by author).



Figure 3: Wooden shutter release mould, 2015, (produced by author).

### 3.5 Costing

BILL OF MATERIALS				
MATERIAL	QUANTITY	PRICE	CONVERSION	SOURCE
Cement	50kg	R63.00	R1.26/kg	Chamberlain
Round Steel Tube 42x2.0	3m	R74.00	R4.05/cm	NJR
Round Steel Bar M8	3m	R10.11	R0.034/cm	NJR
Galv Nut M8	10	R13.12		NJR
Set Screw Bolts M8	10	R35.00		NJR
50mm Steel Mesh	5m x 1.6m	R460.00	R0.00575/cm <sup>3</sup>	Builders Warehouse
Perlite (with fibres)	10kg	R130.00	R13/kg	Stanley
Chamber Mould (incl. fasteners)	1	R1334.00	/100 = R13.34	PBeulich & JKN
Lid Mould (incl. fasteners)	1	R1044.00	/100 = R10.44	PBeulich & JKN
Demoulding Oil	25l	R1000.00	R2.50/100ml	Chamberlain - Sika
Bees Wax	1kg	R240.00	R24/100g	Beeware Shop
Wood Glue	5l	R550.00	R11/100ml	
Unassembled Brood Frame	1	R12.00		Beeware Shop
Labour	Minimum Wage	R25/hour	R0.42/minute	SA
Allububble	1m <sup>2</sup>	R27.15	R0.0027/cm <sup>2</sup>	Allububble SA

ASSEMBLY				
PART	COMPONENTS	COST	TIME	TOTAL
Brood Chamber	Cement 7kg Perlite 2kg Steel Mesh 26x150cm Demoulding Oil 50ml Mould/100 50mm x Steel Tube Bees Wax 50g	R8.82 R1.20 R22.50 R12.00 R13.34 R20.50 R12.00	60min x R0.42 = R25.20	R130.36
Lid/Base	Cement 7kg Perlite 2kg Steel Mesh 58x40cm Demoulding Oil 50ml Mould/100 Bees Wax 25g	R8.82 R26.00 R13.34 R12.00 R10.44 R6.00	60min x R0.42 = R25.20	R107.80
Handles	50cm Steel Bar	R1.70	10min x R0.42	R5.90
Brood Frames	Wood Glue 100ml 10 x unassembled	R11.00 R120.00	45min x R0.42 = R18.90	R149.90
Stand	3m steel bar	R10.11	45min x R0.42 = R18.90	R29.01
Frame Support Bars	40cm steel bar	R1.36	10min x R0.42 = R4.20	R5.56

#### 4 - CONCLUSION

The initial concerns surrounding the materials were overcome by determining the correct manufacturing approach. The production costs and projected retail price of the beehives as compared with existing beehives is shown in the table below:

FINAL COST COMPARISON			
PART	COMPONENTS	PRODUCTION COST	RETAIL PRICE
Beeware Wooden Catch Box	Wooden box and lid 6 brood frames		R275.00
Beequip Cardboard Catch Box	Cardboard box and lid 6 brood frames		R148.00
Beeware Langstroth Hive	Brood Chamber Lid Base 10 x brood frames		R900.00
BEEGIN Entry-level Hive	Brood chamber Inserts x 2 Lid Inner cover Top-bars x 6	R189.8	X 200% = R379.60
BEEGIN Extra Cardboard Chamber	Brood chamber Inserts x 2 Top-bars x 6 Frames x 6	R106.50 R144.5	X 200 % = R213.00 X 200 % = R289.00
BEEGIN Permanent Hive	Brood Chamber Lid/Base x 2 Stand Handles x 2 Frame Support Bars x 2 Brood frames x 10	R558.91	X 200 % = R1127.20
BEEGIN Extra Concrete Chamber	Brood Chamber Frame Support Bars x 10 Brood Frames x 10	R291.38	X 200 % = R 675.24
BEEGIN Permanent Hive Moulds	Lid Mould Chamber Mould Fasteners	R1900	X 200 % = R 3800.00

The retail costs for the beehives are significantly higher than those presented by existing beehives. However the cardboard hive offers features not available in existing catch hives such as adjustability, durability, directions for beginners, top-bar/frame compatibility and improved thermoregulation. The concrete hive also provides the opportunity for community centred manufacturing enterprises without the need for machinery. If the hives could be made available at cost price through organisational funding or subsidies based on sales to commercial beekeepers or hobbyists the cost would then be substantially lower than existing beehives. If the entry-level were also sold flat-packed to be assembled by users the cost could be reduced.

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